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JACARANDA 1
OUTCOMES

HEALTH AND MOVEMENT SCIENCE YEAR 11 | SIXTH EDITION

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JACARANDA

OUTCOMES 1

HEALTH AND MOVEMENT SCIENCE YEAR 11 | SIXTH EDITION

JACARANDA OUTCOMES 1

HEALTH AND MOVEMENT SCIENCE YEAR 11 | SIXTH EDITION

HAYLEY DEAN

JADE HUNT

ERINN McMAHON

WADE RICHARDSON

CLARE WARREN

RON RUSKIN

KIM HARPER

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resource.

The publisher acknowledges ongoing discussions related to
gender-based population data. At the time of publishing, there
was insufficient data available to allow for the meaningful
analysis of trends and patterns to broaden our discussion of
demographics beyond male and female gender identification.

Contents

Learning with learnON

JACARANDA
OUTCOMES 1 HEALTH AND MOVEMENT SCIENCE
YEAR 11 | SIXTH EDITION

Developed by teachers for students

Tried, tested and trusted. The completely revised and updated sixth edition of *Jacaranda Outcomes 1 Health and Movement Science Year 11* continues to focus on helping teachers achieve learning success for every student — ensuring no student is left behind and no student held back.

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Reading content and rich media including embedded videos and interactivities

learn**on** Outcomes 1 Health and Movement Science Year 11 6e

3.6 The determinants of health | 3.6 teachON | 3.6 Ex 1

3.6 The determinants of health

⊙ Syllabus: Discuss the range of determinants (broad features of society, environmental factors, socioeconomic characteristics, health behaviours and biomedical factors) that influence the health and wellbeing of Australians

Including:
- how do the determinants interact to affect the health of population groups?
- what are the sociological causes of risky health behaviours?
- where do inequities exist and what can we do about them?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

FIGURE 3.19 The determinants of health are divided into groups with the main direction of influence from left to right.

Source: Adapted from: *Australian Institute of Health and Welfare (2018)* Australia's health 2018, Australia's health series no. 16. AUS 221. Canberra: AIHW. Figure 1.1.1, p. 6.

3.5 SOCIAL JUSTICE PRINCIPLES

3.6 Exercis

SELECT YOUR

ALL

Test your kr
Q1

Discuss the how the s
determine the health

SAMPLE RESPONS

Q2

Using table 3.3, expla
improve the health of

TABLE 3.3 Physical

National Physical Ac

	Childre to 5 ye
Physical activity	

STUDENT RESULTS &

powerful learning tool, learnON

Differentiated question sets

Teacher and student views

Textbook questions

Answers and sample responses

Digital documents

Video eLessons

Interactivities

Exam question booklet

Enhanced teaching support resources

Interactive questions with immediate feedback

SHARE | Teacher | Student | No Class | Help

3.6 Ex 2 | 3.6 TBQ | 1

RESOURCES

Topic PDF 1
Sample responses 1
Digital documents 3
Video eLessons 1
Interactivities 7
Weblinks 13
Exam question booklet 1
TEACHER Digital documents 2

Topic 3 Teacher advice and answers
Download teacher notes and suggested answers to the activities in this topic.
doc-41514

Work program — Topic 3
Download the work program for this topic.
doc-34753

3.8

Topic 3 test
Download a customisable topic test.
doc-41526

Topic 3 test solutions
Download a customisable topic test with solutions.
doc-41535

se

R PATHWAY

LEVEL 1	LEVEL 2	LEVEL 3
Questions: 1, 2	Questions: 3, 4, 5, 6, 8	Questions: 7, 9

nowledge

socioeconomic characteristics and health behaviours interrelate to of an individual.

0 Word(s)

1 mark(s)

ain how the physical activity and sedentary behaviour guidelines would f children and young people.

activity and sedentary behaviour guidelines

activity and Sedentary Behaviour Guidelines

ren (birth ears)	Children and young people (5–17 years)	Adults (18–64 years)	Older Australians (65+)
Birth–1 year: 30	Accumulating 60 minutes or	Doing some physical	Do some form of

MARKING

3.7 SAMPLE EXAM QUESTION RESPONSE

Online, these new editions are the complete package

Trusted Jacaranda theory, plus tools to support teaching and make learning more engaging, personalised and visible.

Each topic is linked to content points from the Health and Movement Science 11–12 Syllabus

Interactive glossary terms help develop and support literacy.

3.3 The dynamic nature of health

Syllabus: Explain the dynamic nature of health by exploring the interactions between the dimensions of health, the concept of good health, the health continuum, how health changes over time, and how an individual's circumstances affect their health

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Health can be classified as dynamic, because it is constantly changing. Over the course of a week, a month or years, your health has the ability to fluctuate as you may suffer an injury, catch a cold or suffer from a debilitating illness; but if you correctly rehabilitate your injury or take some medication for your cold, along with rest, you may shift from a state of poor health back to good health.

We can explain the dynamic nature of health by:
- considering the interactions
- understanding the concept of good health
- using the health continuum

FIGURE 3.2 Physical fitness is an aspect of physical health.

Physical health

Physical health relates to the efficient functioning of the body and its systems, giving people the capacity to carry out everyday activities and be free from illness. It is the most visible dimension of health.

3.2 MEANINGS OF HEALTH

3.4 MEASURING HEALTH STATUS

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1 Collaborative investigation

1.1 Phase 1 — Group and research question formation

1.1.1 Investigation introduction

Understanding what a collaborative investigation is and what its benefits are

The collaborative investigation is a mandatory component of the Year 11 course. It gives you the opportunity to work collaboratively in groups of up to four, to investigate an agreed topic that aligns with either Focus area 1: Health for individuals and communities or Focus area 2: The body and mind in motion. The purpose of the investigation is:
- to build and extend your subject knowledge
- to develop a range of skills to apply your knowledge and understanding.

FIGURE 1.1 The process to complete your collaborative investigation

1.2 PHASE 2 - FORMING A HYPOTHESIS

RESOURCES

Topic PDF

Digital documents

Weblinks

NESA Health and Movement Science 11–12 Syllabus
Learn more about the latest NESA syllabus.
web-5085

National Statement on Ethical Conduct in Human Research
Learn more about the National Statement on Ethical Conduct in Human Research.
web-5086

Australian Institute of Aboriginal and Torres Strait Islander Studies
Learn more about the Australian Institute of Aboriginal and Torres Strait Islander Studies.
web-5087

UNSW research guidelines
Learn more about UNSW research guidelines.
web-5088

APA Style 7th Edition Reference Guide
Download the APA Style 7th Edition Reference Guide.
web-5089

onResources link to targeted digital resources including video eLessons and weblinks.

Tables and images break down content, allowing students to understand complex concepts.

Depth study boxes link depth study ideas to the topic.

Differentiated question sets, with immediate feedback in every lesson, enable students to challenge themselves at their own level.

Each topic has a modelled exam question response to help build skills.
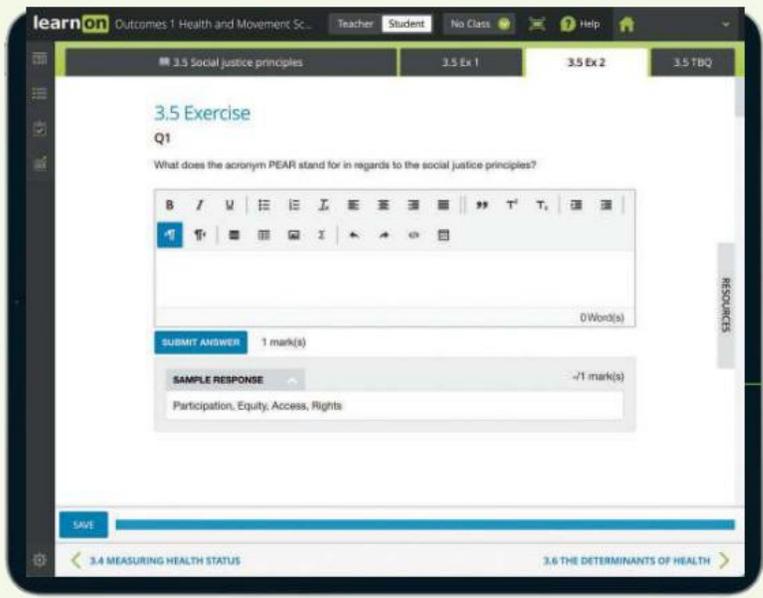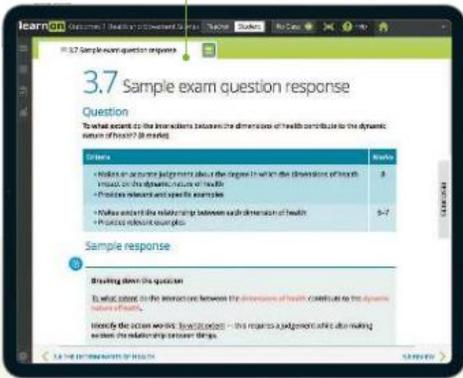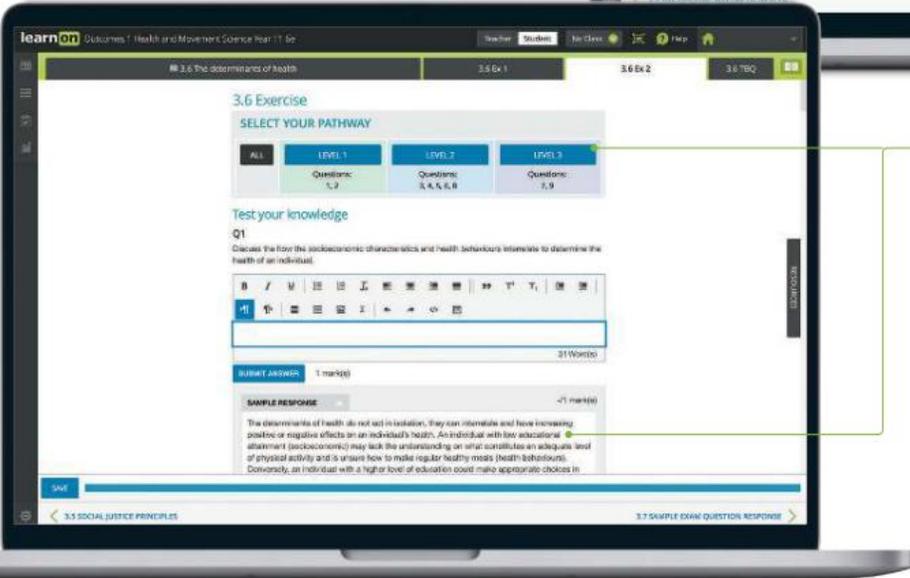
- Online and offline question sets contain practice questions, with exemplary responses.
- Every question has immediate feedback to help students to overcome misconceptions as they occur and to study independently — in class and at home.

Topic reviews

Topic reviews include summaries and topic-level review exercises that cover multiple concepts.

3.8 Review

3.8.1 Topic summary

3.2 Meanings of health
- Health is diverse and means different things to different people.
- In the past health was defined as being free from disease or illness. However, the World Health Organization now defines health as 'a resource for everyday life, not the objective of living. Health is a positive concept emphasising social and personal resources, as well as physical capacities'.

3.3 The dynamic nature of health
- Health is continually changing; that is, it is dynamic.
- At an individual level, health depends on the interaction of five dimensions — physical, social, mental, emotional and spiritual.
- Interactions between each dimension of health have the potential to result in positive health outcomes as well as negative health outcomes.
- A health continuum can be used to record an individual's current health status, as well as to track their health status over time.
- The concept of good health is individual and can be highly subjective, as people see health in different ways, have different perceptions about what is optimal or 'normal' and define the extremes of the continuum differently.
- An individual's health will constantly change from birth, to childhood and adolescence, through adulthood and into their elderly years.
- The personal circumstances of each individual will determine their own level of health.

3.4 Measuring health status
- Epidemiology provides data and information about disease, injury, illness and death. It indicates the risk factors for and apparent determinants of disease.

3.7 SAMPLE EXAM QUESTION RESPONSE

4.1 LEARNING SEQUENCE

Get exam-ready!

Topic-level review questions are structured just like the exams — with multiple choice, short answer and extended response questions.

3.8 Exam questions

Q1

Which of the following determinants of health are considered socioeconomic factors?

A Educational attainment, genetics, disability

B Culture, community safety and blood pressure

C Social networks, employment status and social expectations

D Cultural background, employment status and educational attainment

SUBMIT ANSWER   1 mark(s)

Q2

3.7 SAMPLE EXAM QUESTION RESPONSE

4.1 LEARNING SEQUENCE

Exam question booklet

Focus Area 1 ▶ Topic 2 ▶ Subtopic 2.2 Self-assessed health status and life expectancy

To answer questions online and to receive **immediate feedback** and **sample responses** for every question, go to your learnON title at **www.jacplus.com.au**.

Source: HSC 2020 PDHPE Exam, Section 1, Part B, Q 2 © NESA

Question 1
Briefly **outline** two indicators that are used to measure the health status of populations.   **4 marks**

Source: HSC 2018 PDHPE Exam, Section 1, Part A, Q 4 © NESA

Question 2
Define life expectancy.   **1 mark**

Customisable practice exam question booklets are available in every topic to build student competence and confidence.

Expert advice for collaborative investigations and depth studies

Two complete topics step students through collaborative investigations and depth studies. Content includes templates, checklists and practical advice.

Collaborative investigation and depth studies

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- teaching advice and additional activities
- quarantined topic tests (with solutions)
- custom exam-builder with Focus area and question filters

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A testmaker enables you to create custom tests from the complete bank of thousands of questions.
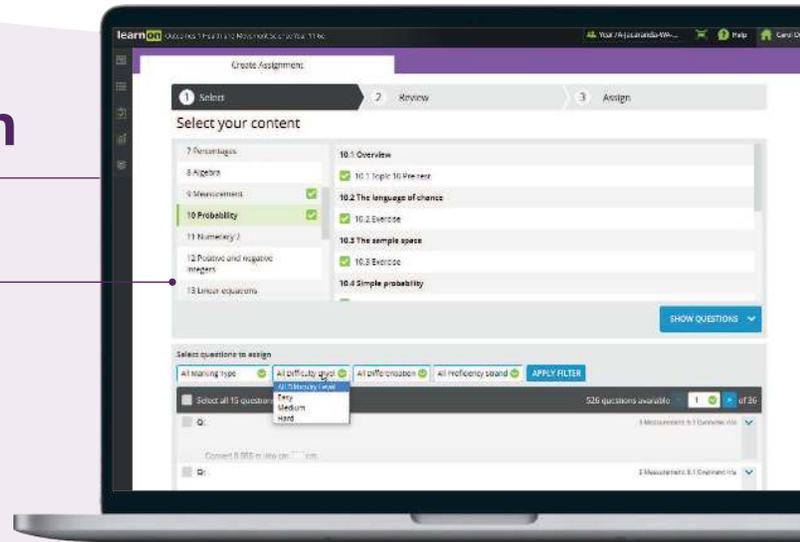
Reports and results

Data analytics and instant reports provide data-driven insights into performance across the entire course.

Show students (and their parents or carers) their own assessment data in fine detail. You can filter their results to identify areas of strength and weakness.
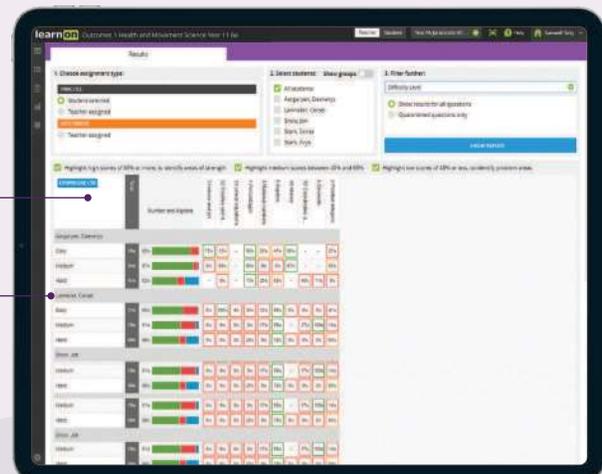
Meet our author team

Hayley Dean is a Principal Education Officer (PEO) at the NSW Department of Education, where she oversees policy and professional learning and provides project support to the office of the Executive Director. Previously a Senior Curriculum Officer at the NSW Education Standards Authority (NESA), Hayley led curriculum teams, drove reform and notably spearheaded the two-year development of the Health and Movement Science Stage 6 syllabus. Her commitment extends to advocacy, evident in her roles as a presenter at network, state and national levels. She has also volunteered as both Vice President and Board member of ACHPER NSW. She combines executive leadership, curriculum expertise and a passion for research to have a positive impact on education in New South Wales. She is currently completing her doctoral thesis at UNSW, focusing on cognitive science and the impact of teaching practices on student motivation, engagement and achievement.

Jade Hunt has fifteen years' experience as a Personal Development, Health and Physical Education teacher in secondary schools in New South Wales. For the past decade, she has been the Head of PDHPE at Amity College. In addition to her wealth of classroom experience, Jade is also a current HSC Senior Marker. With a passion for pedagogy, she has written a number of units of work and workbooks spanning a broad range of PDHPE topics. Moreover, Jade is a sought-after author of HSC PDHPE Trial papers that are used by numerous schools throughout New South Wales, further cementing her reputation as an accomplished education professional.

Erinn McMahon has fifteen years' experience as a PDHPE educator. She is a PDHPE teacher and Head of House at Loreto Normanhurst, Sydney. Erinn completed a Bachelor of Health Science (PDHPE) at the University of Western Sydney and a Graduate Diploma in Education (Secondary) at the Australian Catholic University. She also has her Certificate III in Fitness. Erinn is on the executive committee for the PDHPE Teachers Association, is a member of the writing teams for HSC PDHPE Trial papers for multiple organisations, has marked HSC papers for PDHPE and has been part of the writing teams for PDHPE Stage 4–6 texts within Jacaranda.

Wade Richardson has fourteen years' experience as a PDHPE teacher in primary and secondary settings in government and independent schools in New South Wales. He is currently in the role of Head of PDHPE and has engaged in syllabus writing for NESA, as well as having written teacher resources for *Jacaranda Active Outcomes* textbooks and Preliminary and HSC exams for the NSW PDHPE Teachers' Association. Wade has also co-authored the *Jacaranda Health and Physical Education* textbooks for Years 7 & 8 and Years 9 & 10 for the Australian curriculum, and is an experienced HSC marker for PDHPE.

Clare Warren is a passionate educator with over 15 years' experience teaching PDHPE in New South Wales at HSC level. Having completed post-graduate qualifications in a Masters of Education and Innovative Learning Design, she has a strong pedagogical approach that is informed by current educational research. Clare is a Deputy Principal Teaching and Learning and has led PDHPE faculties, designed and resourced curriculum that meets the diverse needs of students, and equipped teachers to help students succeed in their academic endeavours.

Ron Ruskin is an established and respected PDHPE teacher and has had several active roles and qualifications in sports coaching and examining. He was formerly the Head Teacher of PDHPE at Northmead High School, but is now retired. Ron maintains a particular interest in basketball, touch football, golf and aquatics (as a former examiner for the Royal Lifesaving Society — Australia). He has also been a Senior Marker of the HSC for the NSW Board of Studies and has worked on the HSC advice line. Ron is a contributing author to the *Jacaranda Outcomes* and *Jacaranda Active Outcomes* series for senior and junior high-school students in New South Wales.

Kim Harper is an ACHPER Board member and Deputy Principal, Student Wellbeing Initiatives NSW Department of Education. Kim currently leads a team responsible for the state-wide implementation of a mental health and suicide prevention programs in NSW government high schools. An experienced PDHPE teacher and head teacher, Kim has taught at several schools and has worked as a drug education consultant and relief PDHPE Curriculum Advisor. Kim is passionate about PDHPE and its impact on the lives of students.

Acknowledgements

The authors and publisher would like to thank the following copyright holders, organisations and individuals for their assistance and for permission to reproduce copyright material in this book.

Syllabus key words

The following key words may appear in syllabus outcomes statements and in HSC examination questions. By becoming familiar with the key words and their meanings, students will better understand the types of responses required.

Key words in exam questions

Account	Account for: state reasons for, report on. Give an account of: narrate a series of events or transactions
Analyse	Identify components and the relationship between them; draw out and relate implications
Apply	Use, utilise, employ in a particular situation
Appreciate	Make a judgement about the value of
Assess	Make a judgement of value, quality, outcomes, results or size
Calculate	Ascertain/determine from given facts, figures or information
Clarify	Make clear or plain
Classify	Arrange or include in classes/categories
Compare	Show how things are similar or different
Construct	Make; build; put together items or arguments
Contrast	Show how things are different or opposite
Critically (analyse/evaluate)	Add a degree or level of accuracy, depth, knowledge and understanding, logic, questioning, reflection and quality to (analysis/evaluation)
Deduce	Draw conclusions
Define	State meaning and identify essential qualities
Demonstrate	Show by example
Describe	Provide characteristics and features
Discuss	Identify issues and provide points for and/or against
Distinguish	Recognise or note/indicate as being distinct or different from; to note differences between
Evaluate	Make a judgement based on criteria; determine the value of
Examine	Inquire into
Explain	Relate cause and effect; make the relationships between things evident; provide why and/or how

Extract	Choose relevant and/or appropriate details
Extrapolate	Infer from what is known
Identify	Recognise and name
Interpret	Draw meaning from
Investigate	Plan, inquire into and draw conclusions about
Justify	Support an argument or conclusion
Outline	Sketch in general terms; indicate the main features of
Predict	Suggest what may happen based on available information
Propose	Put forward (for example, a point of view, idea, argument, suggestion) for consideration or action
Recall	Present remembered ideas, facts or experiences
Recommend	Provide reasons in favour
Recount	Retell a series of events
Summarise	Express, concisely, the relevant details
Synthesise	Put together various elements to make a whole

Collaborative investigation and depth studies

OUTCOMES

- interprets meanings, measures and patterns of health experienced by Australians HM-11-01
- analyses methods and resources to improve and advocate for the health of young Australians HM-11-02
- analyses the systems of the body in relation to movement HM-11-03
- investigates movement skills and psychology to improve participation and performance HM-11-04
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

Teacher note: Outcome HM-11-05 must be assessed. Other outcomes are selected based on the group's investigation topic.
Source: *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Skill	Definition
Collaboration	Collaboration involves working together to achieve a common purpose or goal. This may include: • allocating resources and responsibilities to optimise all group members' strengths • recognising and supporting diverse perspectives; and • using personal and social skills to positively interact with and influence others.
Analysis	Analysis involves identifying components, the relationships between them, and drawing out and relating implications. This may include: • examining each element individually • explaining the relationships between the elements and the implications; and • identifying alternative ideas or solutions and their validity.
Communication	Communication involves effectively exchanging information. This may include: • actively listening and responding • creating and sharing information; and • selecting and using communication modes appropriate to the audience, purpose and context. *Note:* Communication may be verbal, non-verbal, or both.
Creative thinking	Creative thinking involves students generating and applying new ideas in specific contexts, interpreting existing situations in a new way, identifying alternative explanations, or making new links that generate a positive outcome. This may include: • synthesising and analysing information to make inferences • assessing the relevance and significance of ideas to the context • sharing and evaluating new ideas; and • applying dispositions such as inquisitiveness, and a flexibility to try new ways of doing things.
Problem-solving	Problem-solving involves using cognitive processes to develop solutions. This may include: • identifying and defining the problem • generating new ideas to solve the problem; and • evaluating the effectiveness of a solution.
Research	Research is an ongoing, adaptive and systematic process with an aim to increase knowledge and understanding. This may include: • defining the research area or question • planning or designing the research approach • locating and selecting relevant information from a range of sources and perspectives; and • integrating research with prior knowledge to critically analyse the information and make a judgement.

Source: *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

1 Collaborative investigation

LEARNING SEQUENCE

1.1 Phase 1 — Group and research question formation

1.1.1 Investigation introduction

Understanding what a collaborative investigation is and what its benefits are

The collaborative investigation is a mandatory component of the Year 11 course. It gives you the opportunity to work collaboratively in groups of up to four, to investigate an agreed topic that aligns with either Focus area 1: Health for individuals and communities or Focus area 2: The body and mind in motion. The purpose of the investigation is:

- to build and extend your subject knowledge
- to develop a range of skills to apply your knowledge and understanding.

The group investigation may be practical or theoretical. The requirements for the collaborative investigation include:

- a total of 20 hours course time
- the research question must focus on a concept and further your understanding in the course. It must not overlap significantly with an investigation or research being done in another Year 11–12 course. This includes not overlapping with a Depth Study in the Health and Movement Science course.
- assessment of knowledge, understanding and skill outcomes, including HM-11-05 *Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts.*
- assessment of the process and findings
- a total mark that includes a group and an individual mark.

There are five steps to completing your collaborative investigation:

- Phase 1: Group and research question formation
- Phase 2: Forming a hypothesis
- Phase 3: Methods
- Phase 4: Data collection, presentation and analysis
- Phase 5: Findings and conclusions.

The steps within each phase are explained in this topic, along with checkpoints to support assessment and feedback.

The five steps outlined above for completing your collaborative investigation should be captured in your portfolio. Your portfolio is a document of the research process and helps you keep accurate records of your work. For more information on creating a portfolio and its structure, see section 1.5.3.

FIGURE 1.1 The process to complete your collaborative investigation

Phase 1: Group and research question formation

1. Decide on a topic

2. Form a group

3. Narrow the topic

4. Preliminary research

5. Choose a research question

Phase 2: Forming a hypothesis

6. Background research

7. Propose a hypothesis

Phase 3: Methods

8. Decide on your research methods

9. Check your ethics

Phase 4: Data collection, presentation and analysis

10. Collect, present and analyse your data

Phase 5: Documenting the collaborative investigation

11. Record group findings and conclusions

12. Present your investigation

Read about your topic/review the literature. Compile your portfolio.

1.1.2 Topic proposal

▶ **Syllabus:** How to design and refine a useful research question

Deciding on a topic is your first step when planning your collaborative investigation. You may develop a preference for either Focus area 1 or Focus area 2 content, and this will then influence the topic chosen to investigate further. Use the questions in figure 1.2 to help you choose your topic. The mind maps for Focus area 1 (figure 1.3 and figure 1.5) will also help with this process, and spending time on why this matters to you will help you develop a context for your research.

> 1. Decide on a topic

Developing a research question requires time not only to learn about the concepts and topics in the focus areas, but also to think more deeply about how it might apply to another context, be it your community or a particular sport or physical activity, for example.

As concepts are taught throughout the focus areas, there are opportunities in the content for exploring concepts more deeply; for example, in Focus area 1 you might explore the question *What further research questions could be explored to build understanding and advocacy?*, while in Focus area you might examine, *What further research questions can be proposed to further understand skill development*. It is a good idea to jot down 'I wonder' questions throughout the teaching and learning of both focus areas. This could take place individually or as a class, resulting in a bank of research questions that can later be refined for the collaborative investigation.

FIGURE 1.2 Choosing your topic
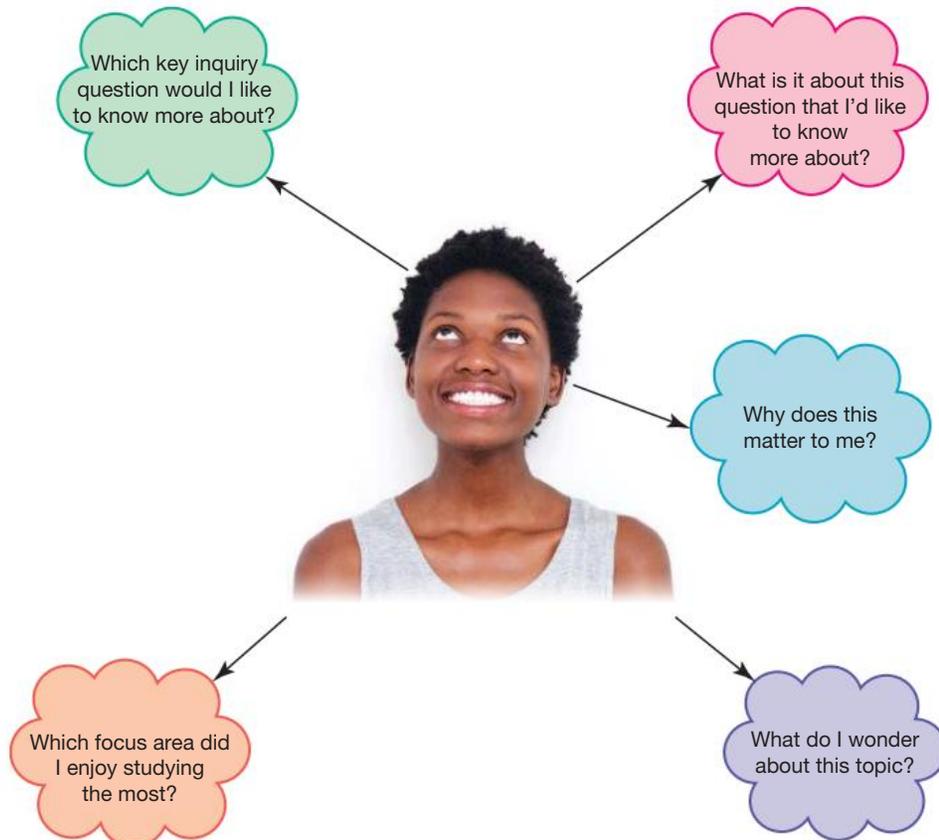
Focus area 1 includes the health sciences that draw on epidemiology, dimensions and determinants of health and social justice principles. This gives you opportunities to think critically and creatively about the equity, access and sustainability of health for individuals and communities. In this focus area you will explore health promotion, including the Sustainable Development Goals (SDGs) as a way to improve the health of individuals and communities.

FIGURE 1.3 Developing a research question: Syllabus Focus area 1

How do we understand and measure Australia's health?
• Meanings of health
• Dynamic nature of health
• Health status of Australians
• Social justice principles (SJPs)
• Determinants of health and wellbeing

What are young people's meanings of health?
• Young people over time — similarities and differences
• Meanings of health for young people — investigation

Focus area 1: Health for individuals and communities

What key issues affect the health of young people and how can they protect and promote good health?
• Health status of young people, including Aboriginal and Torres Strait Island young people
• Health-related issues for young people
• Skills for strengthening and sustaining the individual
• Personal health and healthy behaviours

What are the opportunities for improving and promoting young people's health?
• How young people advocate for their own and others' health
• Organisations and communities advocating for the health of young people
• Health promotion in Australia
• SDGs for improving health

FIGURE 1.4 You may find you have a preference for Focus area 1 with its health focus, or Focus area 2 with its movement focus.

Focus area 2 includes information about why and how your body moves, including the interrelationships between anatomy, physiology, biomechanics, psychology, sociology, nutrition, skill acquisition, injury prevention and rehabilitation.

FIGURE 1.5 Developing a research question: Syllabus Focus area 2

How do the systems of the body influence and respond to movement?
- Skeletal and muscular systems and movement
- Respiratory and circulatory systems and movement
- Digestive and endocrine systems and movement
- Nervous system and movement
- Body systems and movement
- Biomechanical principles
- First aid and movement

What factors influence movement and performance?
- Energy systems
- Nutrition and macro- and micronutrients
- Aerobic and anaerobic training for individuals and group sports
- Training program based on FITT
- Immediate physiological responses to training
- Physiological responses to training — Investigation
- Physical fitness testing

Focus area 2:
The body and mind in motion

How are movement skills acquired, developed and improved?
- Movement skills for recreational and elite athletes
- Movement skills in sport

What is the relationship between psychology, movement and performance?
- Psychology, movement and performance for individuals and groups
- Communities of exercise

1.1 ACTIVITY 1

1. Use the mind maps in figures 1.3 and 1.5 to unpack as much as you know about each key inquiry question and concepts studied. Consider setting a time limit for this task. If time allows, swap your list with a peer and discuss the similarities and differences.
2. Using the two mind maps for Focus areas 1 and 2 (figures 1.3 and 1.5), highlight the concepts that really interest you and that you would like to know more about.
3. Identify the focus area that had the most highlighted concepts that were of interest to you.
4. Using this focus area, list the top 3 concepts or topics that you would like to learn more about. Compare your list with that of a peer and justify why you selected those concepts.

1.1.3 Collaboration group formation

Collaborative learning involves working together to achieve a common goal. In a collaborative group, you learn from the other members of your group, and they learn from you.

2. Form a group

Section 1.1.2 helps you choose a topic you are interested in, but you also need to consider the skills you can bring to a group.

Outcome HM-11-05 in the syllabus focuses on the skill of collaboration. Your personal statement of learning (discussed in depth later) requires you to link your own skills to these syllabus skills. It is therefore important that you reflect on these collaboration skills in relation to your own skills in your group work. Collaboration involves:
- dividing resources and responsibilities to make use of the strengths of all group members
- recognising and supporting the different views that exist in the group
- using your social and personal skills to interact positively with others and have an influence on the group.

FIGURE 1.6 Working in a group can make the most of everyone's strengths.

There are particular features that support collaborative learning. These include:
- that the group is diverse in character and skills, ideally with a good range of skills across the group
- that students are given specific roles and responsibilities within the group
- that your teacher continues to monitor and support you and your group
- that you are aware of your own contribution and how you interact with others, making sure the group culture is productive and everyone feels valued.

1.1 ACTIVITY 2

Collaborative learning

1. Following a group work activity, discuss class norms for collaborative learning. What class culture do you need to be able to positively contribute to group work to get the most out of the collaborative investigation? For example, actively listening, asking questions, being on time, being open to different or diverse perspectives, and using divergent thinking to explore ideas before making a decision. All students should contribute to the class brainstorm to create a set of class norms that can be referenced throughout the collaborative investigation process. ▶

2. Complete the following skills checklist, identifying your individual and group strengths.
3. Swap your skills checklist with another student for peer feedback and discuss:
   - whether your interpretations of your strengths are accurate
   - how you might use your strengths in a group
   - how you might develop some of the areas that are not your strengths.
4. As a group, use the skills checklist to allocate tasks in the plan. You can find a downloadable Word version (doc-34898) in the Resources panel.
5. Throughout the collaborative investigation process, report back to the class on your progress using key points and visuals. Each member of the group should contribute to the feedback process. This is good practice for your group presentation at the end. This is also an opportunity to learn from other groups.

Skills checklist

Name:				
Individual skills			**Group skills**	
Self-management skills I am:	**Tick**		**Interpersonal skills** I am:	**Tick**
• curious and questioning • self-motivated and persistent • honest • reliable • agile and flexible • committed • aware and reflective of my learning (metacognition) • optimistic • a problem-solver • solution-focused • on time • organised • able to ask for help • Other: _____			• an effective communicator • an active listener • good at connecting with others • willing to share my ideas • able to reflect and adapt my ideas based on feedback • able to express my thoughts and feelings respectfully • able to give and receive feedback • able to negotiate respectfully • assertive • respectful of other's opinions • respectful of other's strengths and weaknesses • respectful of other's contributions • understanding of other's views • able to influence others • able to motivate others • committed to the outcomes of the team • Other: _____	
Practical skills I can:	**Tick**			
• search for information using a database • record information/data accurately • analyse data • produce graphs and tables • use Google Docs or similar • use video conferencing programs, for example Microsoft Teams or Zoom • use applications (list): _____ • use PowerPoint • create visual presentations • create a video • create a website • confidently perform public speaking • confidently perform movement skills • Other: _____				

Note: Other — additional items can be added individually or collectively as a group or class; think about what is missing from the list that you consider to be an important skill.

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📄 **Digital document** Skills checklist (doc-34898)

Refining the research topic

Once you have chosen a general topic to explore further and formed a group, the next step is to narrow the topic. The research process makes this easier, providing information on the amount of data available on the topic and, as a result, helping you make a decision on whether the topic is too broad or too narrow, and interesting enough to sustain further research. Thinking about the context of the topic includes making it relatable to you. Consider why this topic matters to you. Does this topic impact a group or environment that you are familiar with?

<div style="float:right">

3. Narrow the topic

</div>

Start by reading some general articles and gathering broad information about your chosen topic. This will give you a sense of what is known already and where there might be gaps. Some examples are shown in table 1.1.

TABLE 1.1 Refining your research topic requires starting with a broad topic and then narrowing and contextualising the topic following a review of the literature.

Broad topic	Narrow topic	Contextualise topic	Research question
Gambling and young people	Sports betting and young people	Sports betting and male youth	To what extent is there a connection between the sports betting sponsorship of football teams and the gambling rates in male youth?
Technology	Social media and young people	Social media and body image of female youth	How does the use of social media affect the personal body image of female youth?
Anaerobic training	High Intensity Interval Training (HIIT)	HIIT training and football	How does HIIT training affect anaerobic fitness and football performance after a 6-week program?
Communities of exercise	Parkrun and physical activity participation	Parkrun and physical activity participation levels in my community	How has parkrun affected physical activity levels in Australia?

A topic can become too difficult to research if it is:
- *too contextual* — research questions that are refined to a particular community or cultural group may result in limited secondary sources of information. For example, the question 'What impact has parkrun had on the physical activity levels of the people from Wollongong?' may be difficult to answer without collecting primary data and interviewing.
- *recent* — the contemporary nature of some topics can make them interesting to investigate; however, it can also mean that there is limited research available, restricting available information to sources such as newspaper or online articles.
- *interdisciplinary* — covering too many aspects in a research question can make answering it overwhelming. Make sure your research question is not multiple questions rolled into one. For example, the question 'How do the determinants of health influence the health, wellbeing and safety of elderly Australians?' would be difficult to answer because it is so broad.

Using generative AI

Refer to your school procedures and teacher's guidance about the use of generative AI (for example, ChatGPT). Remember that, if you are permitted to use AI technology, it should never be the only source of information. It can, however, be a useful tool to help synthesise your research findings and collaborative work, create personalised content, and provide targeted and instantaneous feedback.

1.1.4 Preliminary research — justification for research in this area

How to become familiar with the topic in enough detail to design a research question

Conducting a preliminary review of the research is important to develop a deeper understanding of the topic. This means:

4. Preliminary research

- finding out what is known
- finding out what is still unknown or where there are gaps in the research
- establishing previous methods used to research your chosen area or topic.

Taking notes on each source and compiling a reference list as you go will make it easier to complete your portfolio and the presentation of your investigation.

Figure 1.7 illustrates strategies in conducting preliminary research on a topic. Your preliminary review of the research should enable you to answer the questions below. You will revisit these questions in more depth when conducting background research in phase 2 of your collaborative investigation.

A preliminary review of the literature should answer the following:
- What do we already know?
- What are the existing theories?
- Where are the gaps in our knowledge and understanding?
- Why study the research problem?
- What research design or methods should or shouldn't be used?

Organising your notes during your preliminary and background review of the literature is important. It will help you show the sequence of how you developed your research problem for your portfolio. Consider keeping electronic copies of your notes and scaffolding your work with key headings.

FIGURE 1.7 Finding information on my topic

Google Scholar search on my topic

Search for publications and reports on NSW and Australian government service provider/community organisation websites, e.g. NSW Health, AIHW, Mission Australia

Talk to librarian about my topic

Use research database to search topics

Talk to my teacher

Search for publications and reports on international websites, e.g. WHO, UNESCO

FIGURE 1.8 Using online research publications, databases and library catalogues will help locate appropriate information.

1.1 ACTIVITY 4

Database searching

Choose one of these activities to help start your research.

1. Your teacher will provide a peer-reviewed journal article. Read the article either as a whole class or individually and then discuss the following in a class group to explore the key aspects. What journal was the article published in? Who is the publisher? Who are the authors? What date was the article published? What is the article about (in 1 or 2 sentences), and where can we quickly find this information? What methods were used? What were the findings? What theories or frameworks underpinned the study? What gaps or opportunities for further research were identified?
2. As a class, choose a topic and conduct a Google Scholar search. Practice these research skills:
   - search terms; for example, use of synonyms to cater for terms with the same meaning, such as 'young people' and 'teenagers'
   - ways to narrow a search, by adding additional words or refining the search; for example, Boolean searches (use of quotation marks and using AND, OR, NOT)
   - filters; for example, by year by adding dates
   - saving favourite searches.
3. As a class, choose a topic. Individually or in pairs, complete the activities above, then in groups discuss the process you took. Was the search effective? Give feedback to the other group members.
4. Engage in a think–pair–share activity on 'my topic/question is significant because…'. Draft a response, then share with a peer, before discussing in groups or as a class. This process of talking about your topic will enable you to better think and talk about your research.

1.1.5 Research question

What makes a good question?

Good questions call for **higher-order thinking** and cannot be answered with recall alone, instead requiring application. A good research question cannot be answered with a yes or no; it should be an 'open' question that uses sub-questions to answer it.

5. Choose a research question

FIGURE 1.9 Higher-order research questions allowing for application of knowledge use the adverbs 'how', 'why' or 'to what extent' rather than adverbs such as 'who', 'what', 'where' or 'when', which focus more on recall of information.

higher-order thinking requires greater cognitive processing than lower-order thinking. Learners use higher-order thinking skills when they engage in learning activities that require them to arrive at new meanings and understandings. Some examples of higher-order thinking include synthesising, analysing, application, evaluation and making a judgement.

An example of an open research question is:

How successful are the Sustainable Development Goals (SDGs) in improving the health status of Australians?

To answer this question, you would need to research what initiatives have been put in place using the SDGs to improve the health status of Australians, and assess the data collected on the impact these initiatives have had on the health status of individuals and groups. Sub-questions will help define the question and provide a starting point for the steps in your research. For example:

How successful are the Sustainable Development Goals in improving the health status of Australians?
- *What health initiatives based on the SDGs are in place in Australia?*
- *What were the objectives/aims of the initiatives that have been put in place, and have these been achieved?*
- *What impact have these health initiatives had on the health status of individuals and groups?*

FIGURE 1.10 Creating a good question — step 1
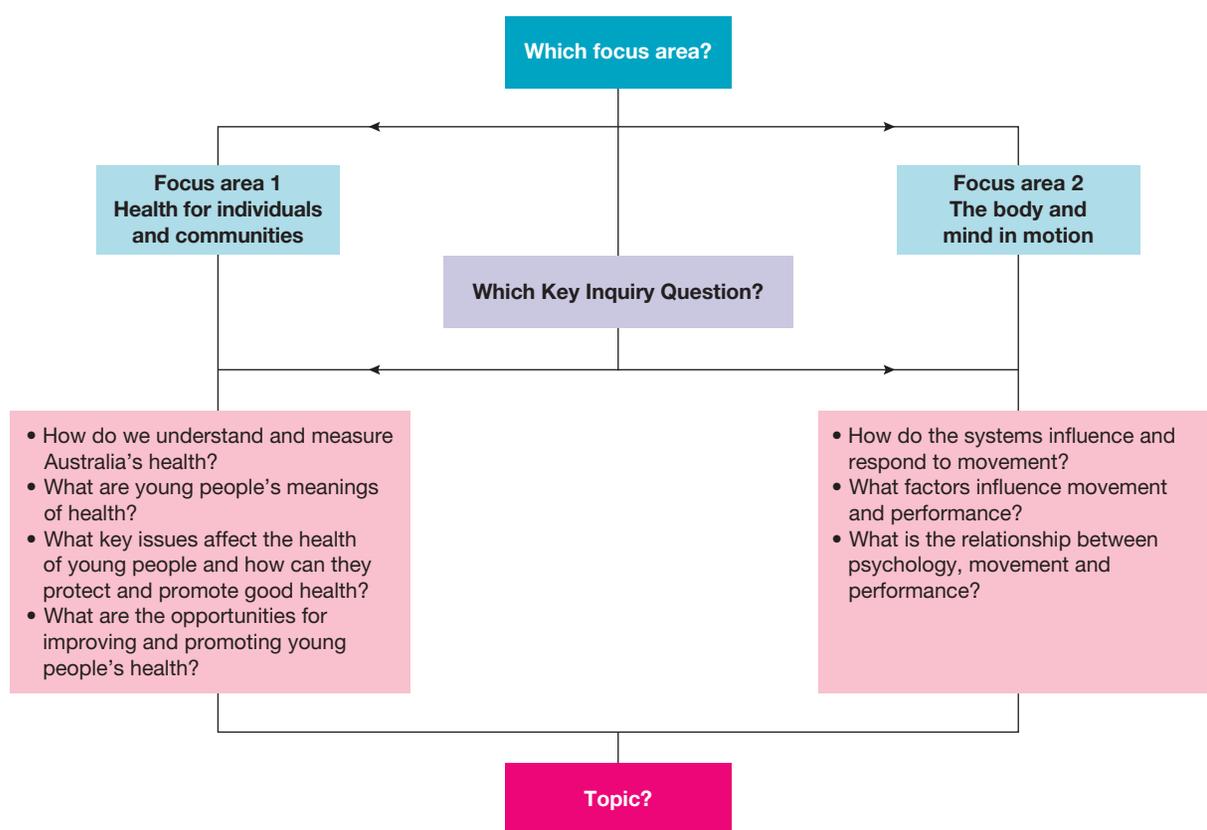
You may decide as a group to use sub-questions to provide direction for your research question.

A good question has the following characteristics:
- there is no obvious answer and it cannot be solved with a single search
- it is timeless
- it requires critical and continual rethinking
- it inspires meaningful thinking, discussion and debate
- it is clear and focused
- it is researchable and meaningful for the real world
- the individual or group is engaged through personal connection.

FIGURE 1.11 Creating a good question — step 2

Topic:
_____

Why does this matter to me ?
_____
_____

What do I wonder about this topic?
Ask a question. Start with 'how', 'why', or 'to what extent' or ask a closed question that requires application of knowledge to justify yes/no answers.
I wonder..

Refining my question
• Is my topic too broad?
Yes = Narrow the topic
• Do I need to contextualise the topic?
Yes = Review why this matters to me

My research questions:
_____
_____

1.1.6 Checkpoint 1: feedback on collaborative practice and research question approval

1.1 ACTIVITY 5

1. Complete the **Checkpoint 1 template: feedback on collaborative practice and research question approval** document (doc-41286) from the Resources panel.
2. Use the **Checkpoint 1 learning matrix** to reflect on your learning and demonstration of the skill outcomes. The matrix can be completed online and saved to your results, or downloaded from the Resources panel (doc-41287) to complete offline.
   Step 1: Evaluate your confidence level for each of the learning intentions (aligned to the outcomes you will be assessed on) as you progress through this topic.
   Step 2: Complete the comment boxes for each learning intention, to provide self-assessment evidence on how you are demonstrating achievement towards the skill outcomes.

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Digital documents Checkpoint 1 template: feedback on collaborative practice and research question approval (doc-41286)
Checkpoint 1 learning matrix (doc-41287)

1.2 Phase 2 — Forming a hypothesis

How to conduct background research or a review of the literature to help you identify the understandings that are critical to the investigation

1.2.1 Background research

Background research or conducting a review of the literature helps you to define key terms in your research question and analyse other studies linked to your question and the aims of your study. However, it does not just involve a summary of the research that has previously been conducted; it is more an argument outlining the leading thinkers in the field, the opposing perspectives and your views on the strengths and weaknesses of the research you have reviewed. This process should help you start to draft a **hypothesis**, a statement that predicts the outcome of your research question.

6. Background research

1.2.2 Reviewing the literature

Reading or reviewing the literature on your given topic is an ongoing process, as represented in figure 1.12. Ongoing reading enables you to deepen your knowledge and understanding of the topic, which helps further critical and creative thinking.

Four important outcomes of conducting a review of literature are:
- understanding the current state of research on a topic
- identifying the experts on a specific topic
- identifying gaps in the research
- understanding methodologies used in previous studies.

hypothesis (plural: hypotheses) an idea or explanation for something that is yet to be proven. A hypothesis can be a basis for further investigation.

FIGURE 1.12 There are four main outcomes of a review of the literature or conducting preliminary and background research.
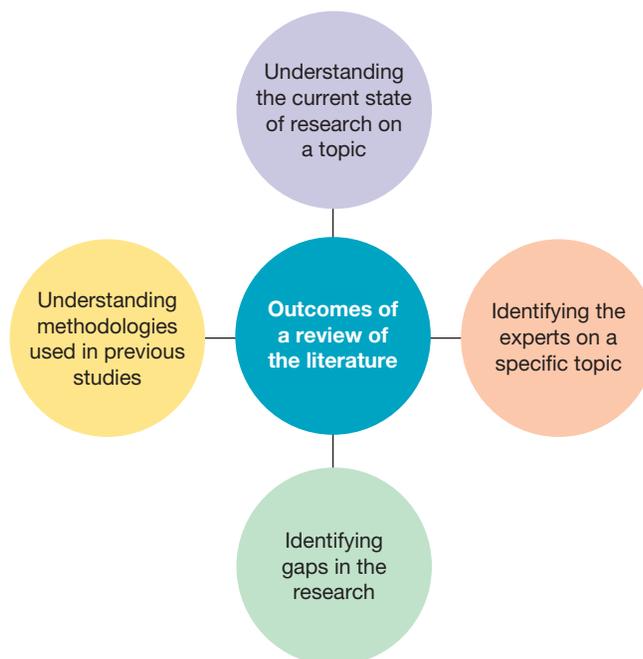
A review of the literature provides a researcher with confidence in their knowledge and understanding on a topic. Should questions arise while conducting research, knowing who the experts are on the topic enables you to seek answers more quickly.

A review of the literature should answer the following:
- What do we already know?
- What are the existing theories?
- Where are the gaps in our knowledge and understanding?
- What views need to be researched/tested further?
- Why study the research problem?
- What contribution can this research make?
- What research design or methods should/should not be used?

Guide to recording your review of the literature

The steps in a literature review are outlined in figure 1.13 and described in more detail below. Following these steps will help you demonstrate how your thinking developed as you learned more about your research problem and question.

The review could also be added to your portfolio. This will help demonstrate the process you took and provide further evidence of the knowledge, understanding and skill outcomes you have demonstrated through the process.

1. *Identify your research topic*. This will help you read widely to begin with to increase the breadth of your knowledge.
2. *Decide the scope of your study by refining your research question*. The scope of your study is likely to be refined once you start to review the literature and identify key questions that have yet to be answered. Create a list of synonyms for the words in your research question. Use this list to help you with your search terms, as different contexts will use different words for concepts with the same meaning.
3. *Find relevant information*. Use the library catalogue and online databases to find relevant journal articles, books or other texts. Google Scholar is an online database that is freely accessible and provides links to many referencing software applications. Searching the internet will provide access to the websites of large organisations and their publications; for example, Australian organisations such as NSW Health, Australian Institute of Health and Welfare (AIHW) and Mission Australia, and international organisations such as the Organisation for Economic Co-operation and Development (OECD), the World Health Organization (WHO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). These organisations do their own research and publish evidence-based reports and publications on their websites. These reports or reviews often include a review of the literature that can save you time or provide references for you to access.
4. *Sort your readings*. Finding research on a given topic can sometimes become overwhelming, so it is important to be strategic when identifying relevant information. Read the introduction or abstract of articles to determine whether they align with your research question. Often this will be enough to determine whether the reading is suitable. Sometimes it may also be beneficial to read the conclusion for articles on primary research.

FIGURE 1.13 The steps in a literature review

1. Identify your research topic

2. Decide the scope of your study by refining your research question

3. Find relevant information

4. Sort your readings

5. Analyse, evaluate and summarise

6. Structure and write your review of the literature
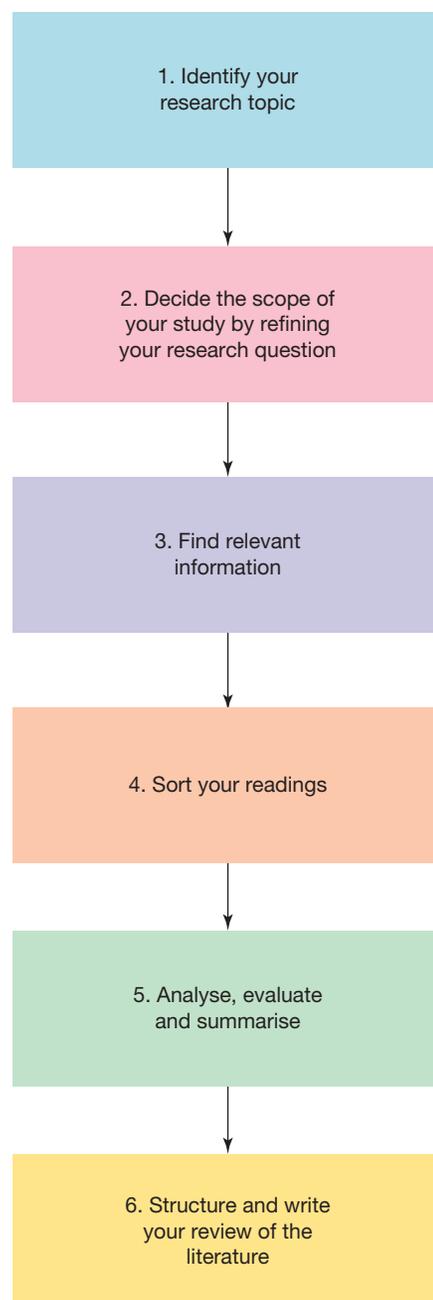
5. *Analyse, evaluate and summarise*. You may choose to print your readings or read them electronically. Either way, consider completing an annotated bibliography as you go. An annotated bibliography provides a brief summary and a short analysis or evaluation. It can be as short as one sentence; however, a standard annotated bibliography consists of the citation followed by a short paragraph of approximately 100–200 words. This is extremely helpful when you come to write your literature review to save you re-reading publications. Think of it as a structured and purposeful way to take notes as you read. Whether you print or read electronically, be sure to store and organise your readings, preferably in themes to be able to reference later on. Talk with your teacher about your ideas for your research to ensure that you will have the time and resources to make this possible.
6. *Structure and write your review of the literature.*
    a. *Introduction* — identify your research question and define your topic, establish the purpose for the review, explain the key themes and signpost the structure of your review.
    b. *Body* — organise this part into your identified themes and consider including key headings. Provide a discussion or argument of the various perspectives and how they relate to and create the space for your research.
    c. *Conclusion* — summarise important findings, identify limitations of previous studies and identify gaps in the research, explaining the link to your study.

1.2 ACTIVITY 1

Use the steps given for writing your literature review to conduct your background research on your topic. This will inform your hypothesis and research methods. Use the strengths in your group to distribute the work involved in searching for relevant information, readings or papers; sorting the reading; and analysing, evaluating and summarising the information.

The following tools may assist you in this process:
- OneNote — this software can be used to organise and collaborate on your notes.
- R Discovery — this is an AI-based literature discovery app. Once you have set up your area of interest, the app finds the top reads and provides them in a daily feed. When you feed in key terms, the app searches the topics and offers articles, which you can sort by recency or relevance. It also helps you to find similar papers and bookmark important research papers.
- Microsoft Word or Mendeley — these programs can assist with organising your reference list and formatting in-text citations. Mendeley imports and organises references in a systematic manner. Mendeley also integrates with R Discovery.

1.2.3 Propose a hypothesis

As discussed, conducting background research on your topic should help you to develop a hypothesis for your study. A hypothesis is a statement that can be tested by scientific research. It can be seen as your prediction of the outcome of your research or an untested answer to your research question.

7. Propose a hypothesis

However, your hypothesis should not be a guess; it needs to be based on existing theories and knowledge. It also has to be testable. This means that your research methods (experiments, observations, statistical data analysis) should let you either support or refute the hypothesis. This will be explained in subtopic 1.3.

1.2.4 Checkpoint 2: approval of research proposal

1. Complete the **Checkpoint 2 template:** a**pproval of research proposal** document (doc-41288) in the Resources panel.
2. Use the **Checkpoint 2 learning matrix** to reflect on your learning and demonstration of the skill outcomes. The matrix can be completed online and saved to your results, or downloaded from the Resources panel (doc-41289) to complete offline.
   Step 1: Evaluate your confidence level for each of the learning intentions (aligned to the outcomes you will be assessed on) as you progress through this topic.
   Step 2: Complete the comment boxes for each learning intention, to provide self-assessment evidence on how you are demonstrating achievement towards the skill outcomes.

on Resources

Digital documents Checkpoint 2 template: approval of research proposal (doc-41288)
Checkpoint 2 learning matrix (doc-41289)

1.3 Phase 3 — Methods

How to design your research and understanding the different types of research methods

1.3.1 Research methodology

Research methodology means how you will do your research and what techniques you will use. Research methodology includes any theories or **theoretical models** on which you are basing your research, the different parts of the research and quantitative and qualitative techniques.

Your research planning should involve:
- outlining how you will conduct your research
- identifying the methods your group will use to achieve the project aims
- demonstrating that the investigation is feasible in terms of time and resources.

The methods chosen will depend on the topic and the type of research you wish to conduct. Research methods can be categorised into quantitative and qualitative methods. Reading other studies on your topic will provide insights into the type of research methods and tools used. You may even be able to use the same research tool and use it in a different context, for example using survey questions from another study with participants in your local area/school.

8. Decide on your research methods

research methodology refers to how you will do your research and what techniques you will use. Research methodology includes any theories or theoretical models on which you are basing your research, the different parts of the research, and quantitative and qualitative techniques.

theoretical model a written or visual representation used to understand the way in which a process or system works

FIGURE 1.14 Choosing your research methods

```
                    ┌─────────────────┐
                    │  Type of study  │
                    └────────┬────────┘
         ┌───────────────────┼───────────────────┐
┌─────────────────┐ ┌─────────────────┐ ┌─────────────────┐
│   Quantitative  │ │  Mixed methods  │ │   Qualitative   │
├─────────────────┤ ├─────────────────┤ ├─────────────────┤
│ Focuses on      │ │ A combination   │ │ Focuses on      │
│ 'what' and      │ │ of quantitative │ │ 'why' and 'how' │
│ 'how many'      │ │ and qualitative │ │                 │
└────────┬────────┘ └────────┬────────┘ └────────┬────────┘
         └───────────────────┼───────────────────┘
                    ┌────────────────────────┐
                    │ Data collection tools  │
                    └───────────┬────────────┘
         ┌──────────────────────┴──────────────────────┐
```

- Experiment
- Survey (closed questions)
- Statistical analysis
- Observation
- Review

- Interviews
- In-depth, semi-structured, unstructured
- Focus groups
- Surveys (open)
- Conversational analysis
- Participant observation and field notes
- Video analysis

A mixed-methods approach includes using both quantitative and qualitative methods to collect data; for example, when measuring the impact of using the FITT principle on the fitness levels of sedentary young people. You may decide to use quantitative methods in the form of the RPE scale to assess 'rate of perceived exertion' for individuals, along with a heart rate monitor to assess working heart rate and resting heart rate throughout the duration of the research. An additional qualitative method in the form of interviews may help to provide greater insight into individual feelings and any other factors that may have influenced recorded RPE and heart rate throughout the study. The qualitative data helps to provide the story behind the statistical data.

FIGURE 1.15 Personal technology devices can be used to provide data on an individual's performance and physiological responses.

Quantitative research methods

Quantitative research involves inquiry into an identified issue, testing a theory, measuring in numbers and analysing using statistical techniques. The results achieved from this type of research are statistical, logical and unbiased. The goal of quantitative research is to determine whether predictions based on a theory are true.

Statistical data can be collected using a specific target group, then across multiple groups to enable a comparative analysis. This type of data collection enables large samples of data to be collected. For example, the annual Mission Australian Youth Survey questions young people aged 15 to 19 years throughout Australia on what they consider to be the most important issues in Australia at the time. A total of 19 501 young people participated in the survey in 2023, enabling comparisons to be made between young people in major cities and young people in regional areas.

The most common types of quantitative methods include experiments and surveys (closed). Other tools that can be used include statistical analysis (for example, analysing the statistics of a game of tennis), a review, or an observation.

Experiments

This type of method uses one or more hypothesis (your prediction about what will happen) and tests them to determine whether the hypotheses are true, false or inconclusive. For example, testing to conclude if the use of augmented feedback has performance benefits for tennis players at the autonomous stage of skill acquisition would use augmented feedback with one group of tennis players and not use augmented feedback with a second group of tennis players (control group for comparison of results), and compare the results.

FIGURE 1.16 Statistics of a game could include tennis service speed.

Surveys (closed questions)

Surveys may be conducted using questionnaires or interviews for data collection, in order to make generalisations for a large population based on a smaller sample from that population. Surveys can take place online or offline, with examples including written questionnaires, online polls and online surveys. There are many different software applications to help you create a survey online, share links with research participants and collate data when the data collection period has closed. Survey results are often presented as percentages. Results tend to be more accurate when a broad section of the population is surveyed.

FIGURE 1.17 Online surveys are an efficient way to collect and analyse survey data.

Variables

When conducting quantitative data collection, **variables** need to be considered. Variables include any factor that can be controlled, changed or measured in an experiment.

> **variable** includes any factor that can be controlled, changed or measured in an experiment

- An *independent* variable is something the researcher changes or controls.
- A *dependent* variable is something the researcher observes and measures.

If there are any other variables, be sure to write these down as you go to minimise the chances that research bias will affect your results.

Following are examples of different variables.
- Daily exposure to social media leads to increased levels of depression among young people.
  In this example, the independent variable is social media — the assumed cause. The dependent variable is the level of depression — the assumed effect.
- Explicit instruction leads to increased skill development for beginner football players.
  In this example, the independent variable is explicit instruction — the assumed cause. The dependent variable is skill development — the assumed effect.
- Walking 10 000 steps per day increases weight loss.
  In this example, the independent variable is walking — the assumed cause. The dependent variable is a person's weight — the assumed effect. Other possible variables could include food and fluid intake/nutrition.

Qualitative research methods

The type of qualitative method selected will depend on the issue or topic of research, available resources, the skills and training of the researcher, and the audience for the research. The sample size (number of participants) for qualitative research is usually quite small due to the depth and richness of the data collected. When reviewing the literature, take note of sample sizes used in other studies. The number of case studies will depend on the amount of available time for data collection and data analysis.

Interpretation and analysis of data is based on the researcher identifying patterns, themes or relationships.

Qualitative research helps us to find out what people think and feel about an issue. Data collection tools for qualitative methods include:

- interviews — in-depth, semi-structured or unstructured
- focus groups
- conversational analysis
- participant observations and field notes
- video analysis.

The data collected is subjective, based on the researcher's interpretations and views. It is also based on the context it was collected in; for example, data collected from one community or group could look very different from that collected in another community or group. Interpretation and analysis of data is based on the researcher identifying patterns, themes or relationships.

FIGURE 1.18 Focus groups are a qualitative data collection tool that enable the researcher to collect data from more than one participant at a time in a relaxed context.

Ethical considerations

When we think of ethics (or morals), we think of rules for distinguishing right from wrong. Considering the ethics of your research must take place at the beginning. This includes planning, protecting collected information and a responsibility to protect the participants.

9. Check your ethics

- *Planning*. Ensures that your research questions are acceptable, and that your methodology will follow ethical procedures and will not lead to misleading results. Ethical research promotes the aims of research, including knowledge and truth. This means that the methods used to collect, analyse and interpret data are appropriate for the research question. Planning with the support of your teacher will help make sure your methodology enables you to accurately collect, analyse and represent your findings. Your planning should include information about how you will protect participants involved in your study

FIGURE 1.19 Ethics affect all social settings in our lives.

and the data collected. A sample ethics checklist is provided for you to discuss with your teacher before you proceed with your research (see table 1.2). Planning also helps avoid plagiarism, by referencing sources to acknowledge the original ideas and work of others that is not your own (see section 1.5.6 for more information on this).

- *Protecting collected information*. It is important that all information collected during the research is recorded and stored in a place that is not publicly accessible and is protected. This may be in an online location that is password-protected, such as Google Drive, One Drive or in Microsoft Teams files. Talk with your teacher about how to best store your data.
- *Responsibility to protect the participants*. When conducting research involving participants, it is essential to obtain consent prior to the study. This is usually in written form, but may also be audio or video recorded. Participants should not be subjected to harm in any way, and respect for their privacy and dignity should be provided at all times. Participant confidentiality and anonymity needs to be maintained. This may include using another name and not providing personal details when referencing an individual or group in your results, discussion or conclusions.

The weblinks in the Resources panel provide some guidance on ethical research. The *National Statement on Ethical Conduct in Human Research*, published by the Australian government, is a valuable resource and is used by universities to guide their research ethics. The **Australian Institute of Aboriginal and Torres Strait Islander Studies** provides guidelines for ethical research in Aboriginal and Torres Strait Islander subjects. University websites such as **UNSW** provide guidelines for human research as another point of reference.

TABLE 1.2 Ethics checklist for conducting primary research

Health and Movement Science collaborative investigation ethics checklist	
Instructions	
This form is designed to be completed electronically and sent with your research plan to your teacher. This checklist and the plan for your research should be discussed with your teacher and signed before you commence data collection.	
Low-risk research — according to the *National Statement on Ethical Conduct in Human Research 2023*, 'low risk' is where the only foreseeable risk is one of discomfort. Examples of discomfort include some fatigue from exercise or anxiety caused by being interviewed. The collaborative investigation should not include risk more serious than discomfort.	
PART A: Does your research involve the following?	**Y/N**
Aboriginal and Torres Strait Islander Peoples (NS 4.7)	
People whose primary language is not English (NS 4.8)	
Children and young people (younger than 18 years) (NS 4.2)	
Comment:	
PART B: Research where there is risk of harm **Is there a possibility that any of the research activities have the potential to cause the following?**	**Y/N**
Physical harm: including injury, illness or pain (NS 2.1)	
Psychological harm: including feelings of worthlessness, distress, guilt, anger or fear related, for example, to disclosing sensitive or embarrassing information (NS 2.1)	
Devaluation of personal worth: including being treated disrespectfully or unjustly (NS 2.1)	
Social harm: including damage to relationships with others (NS 2.1)	
Economic harm: including any direct or indirect costs to participants (NS 2.1)	
Note: If you have answered yes to any of the above statements, the level of risk involved in your research is considered to be more than low risk (discomfort). Your research plan will need to be discussed and reviewed with your teacher to remove this level of risk.	
PART C: Project details	
Project title:	
Group members:	
Project description (up to 200 words):	
Have you attached a copy of your research plan?	**Y/N**

PART D: Declaration By submitting this form, we, student investigators, declare that we:	
understand that we cannot commence data collection until our research plan and ethics have been approved by the teacher	☑
accept responsibility for the accuracy of the information provided in this checklist	☑
will seek approval for modifications to the research prior to implementation.	☑
PART E: Research plan and ethics approval meeting **This checklist and your research plan should be discussed with your teacher.**	
Meeting date and time:	
Meeting discussion/comments:	
Modification required? Comment:	**Y/N**
Teacher signature: Date:	

Note: NS refers to the relevant section in the *National Statement on Ethical Conduct in Human Research 2023*.

1.3 ACTIVITY 1

Research summary and ethics

1. Draft a short research summary or 'elevator pitch' for potential participants in which you explain who you are, what you are doing and how you see their role in your study.
2. Consider your topic of research and, as a group, brainstorm the possible ethical issues to be considered.
3. In groups, create a plan for how you will collect and store the information in your study. Share your group plan with the class.

See the sample **Participant information** and **Consent form** templates in the Resources panel.

on Resources

📄 **Digital documents**	Ethics checklist (doc-34896) Participant information (doc-36159) Consent form (doc-36160)
🔗 **Weblinks**	National Statement on Ethical Conduct in Human Research Australian Institute of Aboriginal and Torres Strait Islander Studies UNSW research guidelines

1.3.2 Checkpoint 3: feedback on collaborative practice and method approval

1.3 ACTIVITY 2

1. Complete the **Checkpoint 3 template: feedback on collaborative practice and method approval** (doc-41290) in the Resources panel.
2. Use the **Checkpoint 3 learning matrix** learning matrix to reflect on your learning and demonstration of the skill outcomes.
   The matrix can be completed online and saved to your results, or downloaded from the Resources panel (doc-41289) to complete offline.
   Step 1: Evaluate your confidence level for each of the learning intentions (aligned to the outcomes you will be assessed on) as you progress through this topic.
   Step 2: Complete the comment boxes for each learning intention, to provide self-assessment evidence on how you are demonstrating achievement towards the skill outcomes.

1.4 Phase 4 — Data collection, presentation and analysis

How to collect, record, analyse and interpret the results of quantitative and/or qualitative data you collect

1.4.1 Quantitative data collection, presentation and analysis

Analysing data collected through quantitative methods, such as experiments, includes recording raw data in a table. From the raw data (data you actually measured) you may work out other data using mathematical formulas (called derived data); for example, finding the average speed recorded or the overall improvement in speed over a period of time. Both the raw data and the derived data can be shown visually by using drawings, graphs or infographics. Graphs let you analyse relationships between variables. This means that the increase or decrease in one variable will result in a corresponding increase or decrease in the other variable.

> 10. Collect, present and analyse your data

To work out a relationship, you need to have enough data points and the range of your data points should be as large as possible.
- For linear relationships, six data points is generally considered adequate.
- For non-linear relationships (for example, a dramatic drop in heart rate when exercise ceases as opposed to a few minutes later), more data points are needed.

There are many different types of graphs so it is important to use the right graph for what you are trying to communicate. Some common graph options are listed in table 1.3.

TABLE 1.3 Types of graphs and their function

Strength of the graph	Type of graph	Example
To show a relationship between variables	Line graph Scatter graph	The relationship between speed and heart rate
To show how one continuous variable will affect the other	Line graph	The independent variable may be the intensity the athlete was running at, and the dependent variable may be the average speed, heart rate or stride length of the runner during each kilometre of a marathon.
To measure groups of things	Column or bar graph	Measuring the number of times each participant participated in organised physical activity during the month

The next step after analysing your results is to interpret them. This means showing the relationship between your research question or hypothesis and your results, and will form the basis of your discussion and conclusion. It is important when writing your discussion that you show a clear alignment between what you were aiming to find and what you actually did discover. In other words, do your results support your hypothesis?

It is not enough to say that the experiment did not work or the hypothesis was not supported. Your review of the literature should enable you to think critically about why the results of your experiment turned out the way they did. It could be that the model or theory you were using did not match your hypothesis, or that there was human or technical error in recording the results.

1.4.2 Qualitative data collection, presentation and analysis

Data collected through qualitative methods refers to information that may be in the form of interview transcripts, observation field notes, voice recordings of an interview or focus group discussion, or survey responses. The format of your raw data will determine how you analyse and look for themes, patterns or relationships, deriving further data. Analysing qualitative data can be done using data analysis software or manually looking for themes. You should talk with your teacher about how you will analyse your data, including the following steps.

Step 1 — Developing and applying codes

A code can be a word or phrase that represents an idea or theme. It is important to use meaningful codes when coding non-quantifiable things, such as:

- human behaviours
- activities
- events.

TABLE 1.4 Example of analysing qualitative data using codes

Research title	Element to be coded	Codes
The impacts of technology on the wellbeing of teens	Wellbeing indicators	Psychological
		Social
		Physical

Step 2 — Identifying themes, patterns and relationships

Unlike quantitative data analysis, there is no universally comparable technique for generating findings. This is where the researcher is required to use critical and creative thinking to draw out themes, patterns and relationships from the data. Ways to do this include:

- looking for word or phrase repetition
- comparing your primary data with findings from your review of the literature
- identifying information that was not given by participants and how this may be interesting
- identifying how findings are similar or different.

Step 3 — Summarising the data

Interpretation of your data comes back to your research questions, and what your research aim or objective was. If you have used sub-questions, your analysis will be focused on answering these questions. When writing your discussion, you can use quotations from your raw data to highlight major themes within your findings.

Extract 1 — Data analysis

Extract 1 provides an example of the coding process that could draw out themes when conducting research on the impact of social media on the wellbeing of teens. Identifying the impacts on wellbeing by coding the wellbeing indicators in participant responses is part of the analysis that could take place with this data. Further analysis could also identify when, why and how this impact is occurring.

Extract 1

Interview question: How do you feel about yourself during and after spending time using social media?

Coding for wellbeing indicators: psychological[1], social[2], physical[3]

Participant 1

I use Facebook to see what my friends are up to and check out what they're doing. It seems like everyone is always having a great time, which makes me feel like my life isn't so great[1]. Some of my friends love to post the perfect selfie, and I never feel like the photos I take of myself are good enough to share[1]. I don't catch up with some of my friends, because I don't want photos of me up on Facebook all the time[2]. It makes me feel sick[3] just thinking about it.

Participant 2

I use Instagram all the time to stay connected with people. It's a chance for me to feel like I'm still connected[2], even when I can't catch up with friends and hang out. I can still see what people are up to, and sometimes that motivates me to do things, like stay active[3]. Sometimes I do feel down when I feel like I'm missing out on stuff. I'd rather not know sometimes[1], rather than having FOMO.

Extract 2 — Data collection and analysis: what do I think?

Extract 2 provides an example of the link between data collection and data analysis for a qualitative study. The data was collected through observations and field notes. Analysis of this data included writing up the field notes, identifying the key themes related to the research question (including immigration and documentation status), then analysing the field notes for key words or phrases related to this theme. The researchers identified that this happened 13 times throughout the observations. They were also able to identify who raised these themes and when through their analysis process.

Extract 2

1.4.2 4. Methods

4.4. Data collection

We conducted 51 observations, approximately 95 min each, during the 2016–2017 academic year.[1] For each of three academic units at the beginning, middle, and end of the year, we visited the class at least six times per unit and observed for the entire period while taking detailed field notes and audio- and video-recording. Outside of these visits, we observed the class at least once a week while continuing to record and take field notes. This observation schedule enabled us to maintain a level of specificity in our fieldnotes within the scope of our research questions and keep presence in the classroom to ensure, as much as possible, that we did not miss significant interactions during the year. When participants. used Spanish in their interactions, we marked the occurrence(s) and had Mr. Stringfellow translate them into English.[2]

5. Data analysis

To begin our analysis, we read through all field note write-ups and identified every instance in which any students mentioned the topics of immigration or documentation status. This happened 13 times over the course of the school year. Upon closer examination, we noted that José, Kayla, Olga, and Marisol were the main participants in all of these conversations. We identified three of the 13 conversations in particular where the participants themselves broached the topic of their documentation statuses: two in January during a unit on immigration, and one in June as the students were working on their final project for the class, which for the participants also pertained to immigration.

[1] We also conducted teacher and student interviews and focus groups, but used only the interviews for both context and **triangulation** for this study.

[2] English and Spanish were the only two languages used in the conversations under analysis.

triangulation using several data collection techniques in order to validate findings

Source: Hemmler, V. L., & Kibler, A. (2019). 'You ARE Immigrant... but Not Like Us': A discourse analysis of immigrant students' positioning of undocumented immigrants in a CLD classroom. *Linguistics and Education*, 54, Article 100763. pp. 1–17.

1.5 Phase 5 — Documenting the collaborative investigation

How to document your collaborative work, create your portfolio and create a personal statement of learning

1.5.1 Findings and conclusions

Sharing your findings and conclusions is an important part of any research project. This helps you to add to the body of knowledge. The findings of a study would typically be found in the discussion section. In discussing your findings, you should link back to your research question(s) and to previous research on the topic.

This section should make links between the findings of your study and the literature, not just summarise your findings/results. This section contains your contribution to research in this field.

This part of your research is in many ways the most creative, as you impose order and meaning to your data. The main function of your findings is to reach your conclusions. The data collected in your study is used as evidence for your argument.

FIGURE 1.20 The main function of your findings is to reach a conclusion, using the data collected in your study as evidence for your argument.

The questions are the main focus of your introduction. The answers become the main focus of your conclusion.

Structure

The following provides a typical structure for writing your findings and conclusions:

1. *Background information* — revisit the theoretical background to set the scene
2. *Statement of results* — stronger results may be presented first
3. *Expected (or unexpected) outcome* — comment on whether the results were expected, or surprising
4. *Refer to previous research* — compare your results/findings to those of other studies
5. *Explanation* — suggest reasons for surprising or unexpected results/findings
6. *Deduction and hypothesis* — make claims about your results/findings. This is where 'hedging' needs to be considered in terms of the language used; this means you should be careful and consider using language that acknowledges the uncertainty or potential limitations of your conclusions.

Making claims

It is important when making claims in your conclusions that you are cautious in these statements. *Hedging* softens the language to make the claims or conclusions less absolute. This involves using words or phrases that convey a level of caution, such as 'it is possible that,' 'it appears that,' or 'there is some evidence to suggest'.

You may also identify 'knowledge deficits' or what is still not known. This may be communicated as generalisations, implications, limitations and recommendations for areas of further research.

Hedges are linguistic devices that express ambiguity, uncertainty, probability or politeness in academic writing. Demonstrating a conservative and cautious attitude by softening claims provides room for further discussion, helps to avoid criticism for being overly radical or overconfident and is respectful in the academic world.

Weaker		Stronger
Might result in	May result in	Will result in
It is possible that	It is very likely/probably that	It is certain that
Would seem that	Seem to have	Have
May have contributed to	Contributed to	Caused
Suggests	Indicates	Shows

Some other verbs that you may consider using to help make knowledge claims include: suggest, imply, infer, interpret, assume, appear, lead, seem to and support.

1.5 ACTIVITY 1

1. Individually, write down all the things you know now that you did not know when you started the research. Use one sentence for each.
2. Share and combine this list in a group.
3. Sort these sentences into some sort of grouping.
4. Give headings to each group of sentences. This will help to provide a framework for the writing-up of your findings. The structure you use should guide the reader through to your conclusions.
5. Now brainstorm a tentative list of conclusions. These should relate back to your research question(s) and aims.
6. Read the conclusion section of 2 or 3 academic papers and, using a highlighter, identify hedging. Comment on the style of writing and level of cautiousness or confidence used by the researcher. Discuss in pairs or in your group.
7. Brainstorm the following individually and as a group, and share as a class (perhaps in a gallery walk): My significant contribution is … Sharing your research contributions could culminate in a 'research showcase' celebration afternoon or evening at your school, showcasing to students, staff and parents/carers the contributions made to the field and the skills developed throughout the collaborative process.

1.5.2 Evaluation

It is important to evaluate your research design to identify strengths, limitations and areas for further improvement. This process will help you if you do future research in this area, and will be a useful skill more broadly.

Step 1: Reflect on each phase of the collaborative investigation. You may wish to consider your role in each phase, as well as the work and collaboration of the group.

Step 2: Provide comments following the analysis about whether this part of the investigation was a strength, if there were limitations and/or if this was an area of improvement.

Step 3: If you identify limitations, include these in your evaluation to help with future research in this area. For example, if you identified a limitation in your athlete survey, a comment for future studies might be to use coach surveys to help better understand findings. Use the **Reflective framework** document (doc-41508) in the Resources panel as a template.

TABLE 1.5 Reflective framework

Phases	Reflective statements	Analysis	Comments
Phase 1	• The research question was clear, focused, researchable and meaningful.	☐ Strength ☐ Limitation ☐ Area of improvement	
Phase 2	• The hypothesis was based on thorough background research, building on previous studies.	☐ Strength ☐ Limitation ☐ Area of improvement	
Phase 3	• The methods used for data collection were aligned with the research question, hypothesis and resources available. • The ethical considerations and risk assessment were thorough and appropriate for the study.	☐ Strength ☐ Limitation ☐ Area of improvement ☐ Strength ☐ Limitation ☐ Area of improvement	
Phase 4	• Data collection methods (e.g. quantitative, qualitative, mixed methods) were aligned with the research question, hypothesis and resources available. • Data was presented in a logical format according to the type of data collected (e.g. quantitative or qualitative) and the findings. • Data was processed appropriately (e.g. quantitative data analysis identified mean, median and correlations; qualitative data analysis identified themes).	☐ Strength ☐ Limitation ☐ Area of improvement ☐ Strength ☐ Limitation ☐ Area of improvement ☐ Strength ☐ Limitation ☐ Area of improvement	
Phase 5	• Presentation logically and coherently covered the following: research question, background research, methodology, data collected, data analysis, conclusion and evaluation.	☐ Strength ☐ Limitation ☐ Area of improvement	

on Resources

📄 **Digital document** Reflective framework (doc-41508)

1.5.3 Creating a portfolio

Portfolio design

It is important to document the research process and keep accurate records of the secondary and primary data that is collected and analysed (review of the literature, meetings, discussions, testing) and the processes used to ensure the validity, reliability and accuracy of the research. For this task you will use a portfolio.

> 11. Record group findings and conclusions

A portfolio is a collection of work over a period of time, demonstrating evidence of learning progress and accomplishment. The portfolio should include:
- a research design, including an overview of the methods used
- evidence of sequential development of the research problem
- a record of discussions with peers, teachers and other stakeholders
- a record of the major decisions made during the investigation
- cumulative self, peer and teacher reflection/evaluation of the investigation
- draft responses to the focus or research question
- personal statement of learning.

A good way to keep accurate records of all the information and data collected and discussed during the investigation is to record it using an online storage service such as Google Drive or OneDrive/SharePoint that each team member has access to. You may also choose to record personal ideas, sketches and notes in a sectioned notebook and then transfer online so that your records are all in one location.

Set up online folders to help organise different types of information; for example:
- Research design/methodology
- Review of the literature
- Team meetings
- External meetings
- Reflections
- Results
- Discussion/conclusions
- Presentation
- Personal statement of learning.

Online meetings, via Teams or Zoom, can be recorded and stored with meeting minutes. Microsoft Teams can also provides a transcript of recorded meetings; however, this would need to be checked for accuracy.

There are lots of online applications that can be used to create a portfolio. Where possible, choose an application that is linked to your storage of information; for example, Microsoft Sway or Google Sites.

FIGURE 1.21 Google Drive folders are an example of an online storage service that provides live and accessible storage of information.
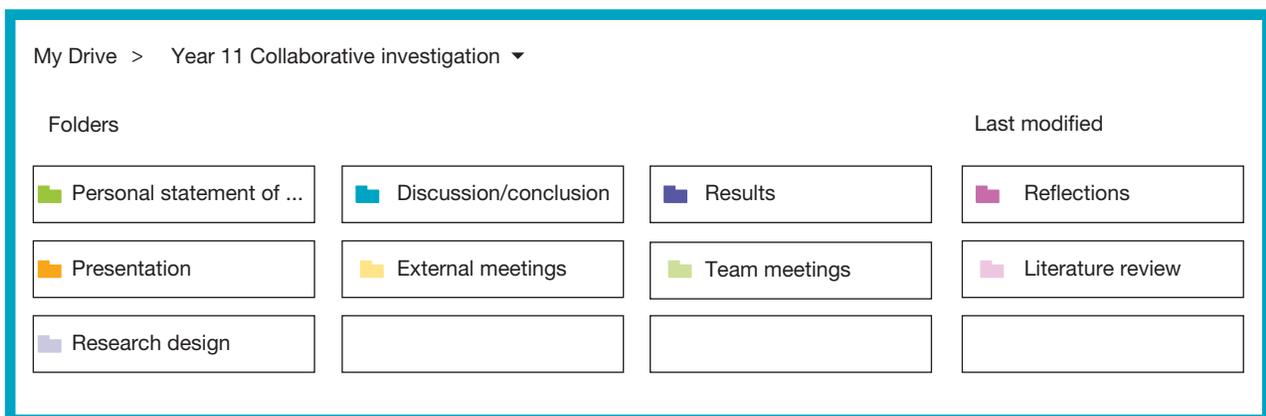
Recording conversations and reflections

Your portfolio should include records of your group discussions and any other discussions you have with your teacher or stakeholders, including research participants and experts on the topic you are researching. Self, peer and teacher reflections should also be included in your portfolio.

How you record conversations will depend on the type of conversation, whether it is formal or informal, and who the meeting is with. As with all meetings, it is important to always be prepared, recognise that other people's time is precious, be respectful of other's opinions and thank those you meet with. Some examples of the types of conversations or meetings and ways to record these include the following.

- *Team meetings*. Team meetings should be held regularly and structured to make sure the meeting is productive and timely. Have a simple meeting agenda, which may include recording who is in attendance at the meeting, any apologies (team members absent), team member updates on progress, team milestones for the next meeting and any general business (items for discussion).

FIGURE 1.22 A meeting minutes template provides clear structure for conducting and recording team meetings.

Meeting protocols
- Only one team member speaks at a time.
- All team members contribute to the meeting.
- Meeting chair to keep the meeting to schedule.
- Minute taker to record attendance and apologies for the meeting.
- If meeting online, only the speaker has the microphone on, other to mute their microphones.

Date	Record the date.
Chair (person)	Record the name of the group member leading the meeting.
Minutes (person)	Record the name of the group member taking the meeting minutes.
Attendance	Record the name of the group members in attendance for this meeting.
Apologies	Record the names of the group members absent from this meeting.
Actions from previous meeting: use the minutes from the last meeting to go through the actions from the previous meeting. Team members responsible for each action to provide an update on the progress.	Read over the previous meeting minutes as a group and check for accuracy. Make any necessary corrections, then one group member should move to accept the meeting minutes, with another to second this. Mover: Seconder:
Team updates	Name: Name: Name:
Actions (or milestones) for next meeting	
General business	Group members raise items for discussion.
Close of meeting	Record the time that the meeting finished.

on Resources

Digital document   Meeting minutes template (doc-34897)

- *Progress meetings with your teacher*. It is important to have checkpoints or regular meetings as a group with your teacher to discuss your progress, ideas and questions, seek feedback and ensure that you are on the right track. Your teacher will be able to provide advice and encourage you to think critically and creatively about your decisions throughout the process. These meetings may be planned or unplanned, but either way it is important to record notes on what was talked about for future reference. A group member may choose to record handwritten notes and later upload to an online folder, or record dot points in a Word document that can be saved and stored.
- *Meetings with research participants*. Initial meetings with research participants to discuss your research plan and consent to be involved in the study may be in person, via phone or online using video technology.

It is important to record the dates of these meetings and some brief notes about the purpose of the meeting, format, outcomes and anything to follow up. This can be shared in your team meetings to make sure everyone has the same information.

- *Meetings with topic experts.* Technology has made it much easier to contact individuals or organisations anywhere in the world to seek information or advice on a topic. This may include academics, government or non-government organisations, athletes, trainers or coaches. Contact with topic experts might be via social media, phone or email. Let the person you are talking with know about your collaborative investigation, plan your message or your questions before making contact, and record the main points of the discussion in a way that works during or after the conversation. If you are having a conversation with a topic expert, it may be beneficial to send your questions through before you meet to discuss, to enable the person time to consider their responses.

Writing a personal statement of learning

A personal statement of learning is a chance for you to reflect on what you have learned and to evaluate your contributions to the collaborative process. Your statement should be written in first person (for example, 'I have', 'I am', 'my') and should be an honest reflection, including examples. It is recommended that you record personal reflections throughout the duration of the collaborative investigation and draw on these reflections when writing your personal statement of learning, rather than try to write it at the end. When writing your personal statement of learning, consider the following:

- How did I feel about the collaborative process and the outcome of our investigation?
- How did I allocate resources and responsibilities to build on the strength of all group members?
- To what extent did I recognise and support different perspectives in the group?
- How did I use my personal and social skills to positively interact and influence others?
- To what extent did I develop new knowledge and skills?
- How can I transfer what I have learned about the investigative process to my depth studies in Year 12?

1.5 ACTIVITY 2

Documenting the collaborative investigation

1. As a group, choose an online application to use for your group meetings, then find a short video on how to use the application.
2. In your group, trial an online meeting and then discuss what worked well and what could be improved for next time. Consider functionality of the technology, inclusivity and connection of group members in the meeting, time management and decision-making processes. This process will help build your confidence to conduct an online meeting with an expert or participant in your research.
3. Record a personal statement of learning following the online meeting. Consider how you contributed to the meeting, what you learned and how you could best contribute to future team meetings.

1.5.4 Checkpoint 4: feedback on collaborative practice and review of findings

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1.5 ACTIVITY 3

Use the **Checkpoint 4 learning matrix** to reflect on your learning and demonstration of the skill outcomes.

The matrix can be completed online and saved to your results, or downloaded from the Resources panel (doc-41292) to complete offline.

Step 1: Evaluate your confidence level for each of the learning intentions (aligned to the outcomes you will be assessed on) as you progress through this topic.

Step 2: Complete the comment boxes for each learning intention, to provide self-assessment evidence on how you are demonstrating achievement towards the skill outcomes.

1.5.5 Presentation of findings — oral, written and multimodal presentations

Your findings can be given in the form of an oral presentation, a written response or a multimodal presentation.

12. Present your investigation

FIGURE 1.23 There are various ways to present your findings.

Oral presentation

Ways to present findings

Multimodal presentation

Written response
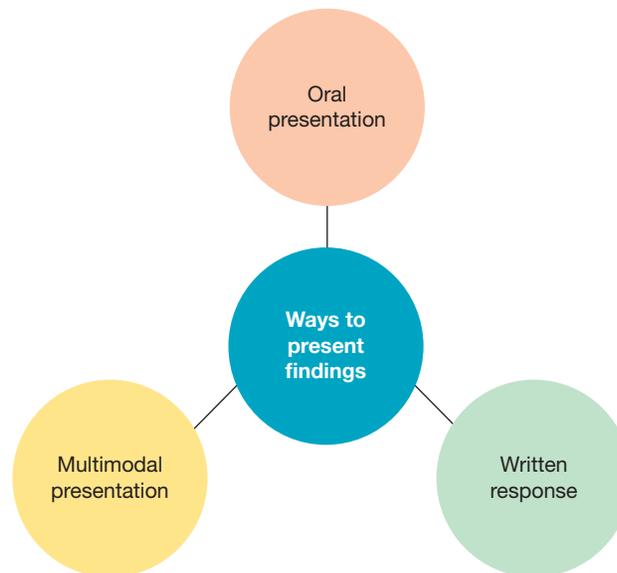
Oral presentation

If you are considering an oral presentation, make sure you include a summary of your research findings with supporting evidence and acknowledgement of the sources. Your teacher may ask you to submit your oral presentation notes as part of your assessment. Remember that a guide of 3 minutes has been provided, so try to stick to this length. However, remember that you are not being assessed on the length of your presentation, but on the outcomes.

It is also important to represent a number of perspectives in your presentation, in addition to the group's view or conclusion. Other perspectives

FIGURE 1.24 You might choose to communicate the findings of your collaborative investigation as an oral presentation.

will come from your review of the literature, recognising the key researchers on your topic and their contributions to the existing research. When preparing for your oral presentation:

- *consider the role of each group member* — whether each group member will speak, and how you will include group members if they are not speaking
- *consider your audience and the context* — your audience and the setting for your presentation will determine your introduction and the language you use throughout your presentation. Individuals in the audience should feel that you are talking personally to them through your verbal and non-verbal communication, so carefully plan what you will say and how you will say it, including the pacing, your stance, tone of voice, gestures and eye contact.
- *share your research story* — take your audience on a journey from where your research started with your research question(s), highlighting how your group worked collaboratively using the chosen methodology to gather and analyse your findings and to draw conclusions
- *prepare and use your note*s — use palm cards or perhaps your device. Very few people can memorise a speech, and often public speaking can make people nervous, so use your notes to help you relax and ensure you follow your plan.

Written response

If the thought of public speaking makes you nervous, perhaps you are considering a written response. The suggested word limit is 750 words, which is a summary of the research findings providing a range of perspectives, evidence and acknowledgement of sources or references. Images or graphs can be included in the appendix if these add value to your findings. Your summary should provide a clear link between the research question(s), methodology, results, discussion and conclusion. Some suggested headings for your written response or report include:

- *Introduction* — this should include background information and your research question(s). The background information tells the reader why you did the investigation and the research question(s) provides the shape for the report.
- *Background research* — this will acknowledge a range of perspectives on your topic and helps the reader to understand what has shaped the design of your study, and perhaps the refinement of your research question(s).
- *Methodology* — summarises what you did and how you did it. This includes whether you conducted qualitative and/or quantitative research and how you collected and analysed your data.
- *Results and data*
- *Evaluation* and/or *Conclusio*n.

Multimodal presentation

The different ways, or modes, in which we engage with a text include reading, writing, listening, speaking and viewing. A multimodal presentation is one that uses two or more modes of communication, such as written language, spoken language, visual, audio, gestures and spatial communication.

The suggested requirement in terms of length is two-thirds that of the other presentations, as you are combining modes; for example, two minutes for any recordings and 500 words for any written text. This is not long, so you will need to consider writing a mini essay and practicing it in relation to the suggested duration.

Your presentation should include a summary of the research findings, providing a range of perspectives, evidence and acknowledgement of sources or references. Your summary of your literature review will demonstrate **research perspectives** that are different to those of your group. Your summary should provide a clear link between the research question(s), methodology, results, discussion and conclusion.

research perspectives (or theoretical perspectives) a set of assumptions about reality that inform the questions we ask and the kinds of answers we arrive at. It can be thought of as a frame that focuses what we look at; one researcher's frame for their research may be different to the next. A review of the literature will help identify other research or theoretical perspectives on a topic that can guide your own research.

Multimodal presentations can take many different forms, depending on the modes of communication chosen. A simple example is a speech with some sort of visual aid, such as a slideshow or a handout. PowerPoint is one of the most user-friendly applications for producing such a presentation. PowerPoint enables the use of images, video and sound, along with text. Sound clips can be imported or you can even create your own voice-overs. Templates enable animation and tutorial videos help with production. This software is also very user-friendly for editing.

Technology is changing all the time, so it is important to find a software application that performs the functions you are looking for, watch tutorial videos on how to use the features, and most importantly spend time experimenting and creating.

No matter which style of presentation you choose as a group, it is important to practice and provide/seek critical feedback that will lead to a presentation that best represents your findings, your collaborative practice and your knowledge, understanding and skills in relation to the outcomes selected by your teacher.
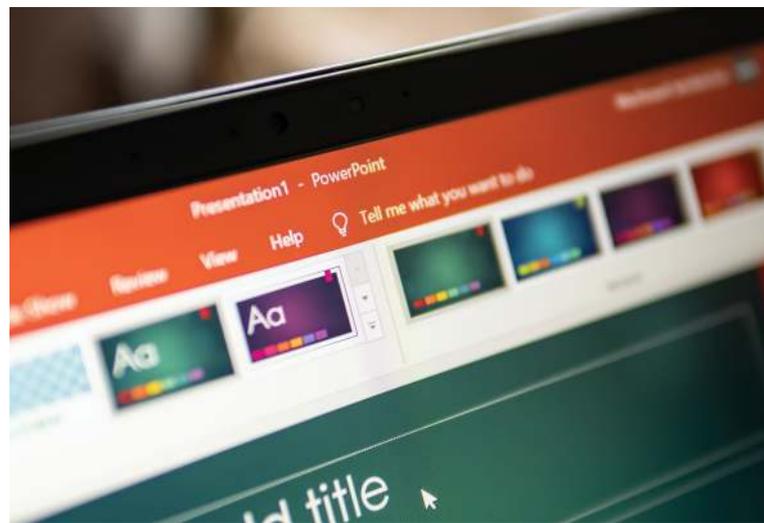
1.5.6 Referencing

The purpose of referencing is to acknowledge the original ideas and work of others that are not the author's own. Referencing includes in-text citation (referencing used throughout the text to reference a specific idea, phrase or concept that was originally someone else's) and a complete reference list providing the full details of each source referred to in the document.

Common author–date referencing styles includes APA (American Psychological Association) and Harvard. The APA style of referencing uses an author–date style format, meaning you use the surnames of the authors and the date of the publication in text, and the reference list is in alphabetical order.

If you are writing using software applications such as Microsoft Word or EndNote, or using referencing software such as Mendeley, in-text citations will automatically generate a reference list that can be included at the end of the paper.

on Resources

   🔗 **Weblink** APA Style 7th Edition Reference Guide

1.5 ACTIVITY 4

Communicating content understanding

1. At the end of a key inquiry question, the teacher records the topics or concepts from the syllabus on individual strips of paper and puts them into a box. Each student chooses a topic (strip of paper) from the box. In small groups, take turns to speak about your topic for one minute. Group members can provide feedback to the speaker on demonstrated knowledge and understanding of the topic, use of **subject-specific vocabulary**, clarity and engagement.
2. Choose a syllabus dot point you have studied and create a written summary, aligning the depth of your summary to the verb used in the content statement (dot point). For example, if the dot point uses the verb 'analyse', then you would need to identify the components and the relationship between them in your written summary. Swap your written summary with another student for peer feedback.
3. Choose a syllabus dot point that you have studied and create a digital multimodal representation of your notes as a summary; for example, a video, an infographic, or a storyboard.

subject-specific vocabulary
refers to the specialised words and terms associated with a particular academic discipline or subject area

1.6 Review

1.6.1 Topic summary

1.1 Phase 1 — Group and research question formation

Investigation introduction
- The elements of the collaborative investigation include research design, documentation via a portfolio, presentation of findings and your reference list.
- The group investigation may be practical or theoretical.
- The process for completion of the collaborative investigation includes 12 suggested steps:
    1. Decide on a topic
    2. Form a group
    3. Narrow the topic
    4. Preliminary research
    5. Choose a research question
    6. Background research
    7. Propose a hypothesis
    8. Decide on your research methods
    9. Check your ethics
    10. Collect, present and analyse your data
    11. Record group findings and conclusions
    12. Present your investigation

    Reviewing the literature or reading about your topic and compiling your portfolio should happen throughout the process.

Topic proposal
- Deciding on a topic is the first step when designing a research question. Developing a research question requires time to learn about the concepts and topics in the focus areas, and time to think more deeply about how it might apply in another context.
- It is important to use opportunities embedded in the content and take time to develop 'I wonder' questions while studying Focus areas 1 and 2.

Collaboration group formation
- Groupings for the collaborative investigation should be based on research interest in Focus area 1 or 2.
- Talk to other students in your class about your content/topic interests and your skill set.
- It is valuable to work in a group with students who have different strengths to yours, so that you can learn from each other, and feel valued for your strengths and contributions.
- Your teacher will decide how groups are formed for the collaborative investigation.

Refining the research topic
- When a topic has been chosen for research, the next steps involve narrowing the topic, contextualising the topic, then formulating a research question.
- It is important that the research question is not too contextual, too recent, or interdisciplinary.

Research question
- Good questions require higher-order thinking and application and cannot be answered just through recall.
- The adverbs 'how', 'why' and 'to what extent' create open-ended questions, requiring higher-order thinking and demonstration of understanding to answer.
- Sub-questions can be used to help provide direction in order to answer a research question.

1.2 Phase 2 — Forming a hypothesis

Background research

- Background research should identify the leading researchers on the topic, the limitations of previous research, and gaps for future research.
- A review of the literature involves investigating existing research by conducting a database search, varying search terms and refining your research question as a result of your findings.
- A hypothesis is a statement that can be tested by scientific research. It is an untested answer to your research question.

1.3 Phase 3 — Methods

Research methodology

- Research methodology is the strategy that includes the way in which the research will be done and the methods that will be used.
- Methodology includes any theories or theoretical models that underpin the research, phases of the research and quantitative and/or qualitative techniques.
- Your research planning should involve outlining how you will conduct your research, identifying the methods and confirming that the investigation is feasible in terms of time and resources.
- Research methods can be categorised into quantitative and qualitative methods, with significant differences in their underlying assumptions, data collection and analysis procedures.

Quantitative research methods

- Quantitative methods involve inquiry into an identified issue, testing a theory, measuring in numbers and analysing using statistical techniques.
- The results using this type of method are statistical, logical and unbiased.
- The goal of quantitative research is to identify whether predictions based on a theory are true.
- The most common types of quantitative methods include experiments and surveys (closed).

Qualitative research methods

- Qualitative methods have the goal of exploring human experiences in order to understand the reasons behind behaviours and meanings behind those experiences.
- The type of qualitative method selected will depend on the topic of research, available resources, the skills and training of the researcher, and the audience for the research.
- The sample size for qualitative research is usually quite small due to the depth and richness of the data collected.
- Data collection tools may include interviews, focus groups, conversational analysis, participant observation and field notes, video analysis and surveys.

Ethical considerations

- It is essential when doing research to think about and plan for ethical considerations to ensure the welfare, rights, dignity, and safety of your research participants. This will allow you to conduct legitimate research that is valid, reliable and accurate.
- Ethics should be considered during your research planning, collected information should be protected, and you should always consider your responsibility to protect participants.

1.4 Phase 4 — Data collection, presentation and analysis

Quantitative data collection, presentation and analysis

- Analysing data collected through quantitative methods, such as experiments, includes recording raw data in a table.
- From the raw data (data you actually measured) you may derive other data using mathematical formulas.
- Both raw data and derived data can be used to show relationships between variables.
- It is important to use the most appropriate graph to communicate your findings.

- Interpreting your results means showing the relationship between your research question or hypothesis and your results. This will form your discussion and conclusion.
- If your findings do not support your hypothesis, you need to explain why.

Qualitative data collection, presentation and analysis
- Data collected through qualitative methods refers to information that may be in the form of interview transcripts, observation field notes, voice recordings of an interview or focus group discussion, or survey responses.
- Analysing qualitative data can be done using data analysis software or manually, looking for themes, patterns or relationships.
- The steps involved in analysing qualitative data include developing and applying codes, identifying themes, patterns and relationships, and summarising the data.

1.5 Phase 5 — Documenting the collaborative investigation
Creating a portfolio
- A portfolio is a collection of work over a period of time, demonstrating evidence of learning progress and accomplishment.
- An online storage service such as Google Drive or OneDrive/Sharepoint is a good way to keep accurate records of all the information collected and discussed during the investigation, while enabling access and collaboration for team members.

Recording conversations and reflections
- Your portfolio should include records of your group discussions and any other discussions you have with your teacher or stakeholders, including research participants and experts on the topic you are researching.
- Self, peer and teacher reflections should be included in your portfolio.
- How you record conversations will depend on the type of conversation, whether it is formal or informal, and who the meeting is with.

Writing a personal statement of learning
- A personal statement of learning enables you to reflect on what you have learned and to evaluate your contributions to the collaborative process.
- Your personal statement of learning should be written in first person.
- You should record personal reflections throughout the collaborative investigation process and draw on these when writing your personal statement of learning.

Presentation of findings — oral, written and multimodal presentations
- Your findings can be given in the form of an oral presentation, a written response or a multimodal presentation.
- Your presentation will be assessed on the outcomes chosen by your teacher for the collaborative investigation.
- Your group should choose a presentation mode that will best represent your findings and demonstrate the strengths of the members in the group.
- Your presentation should include a summary of your research findings with supporting evidence and acknowledgement of the sources. It should also represent a number of perspectives; these should include the group's perspective as well as those from your review of the literature.

Referencing
- Referencing is an essential part of academic writing.
- The purpose of referencing is to acknowledge the original ideas and work of others that is not the author's own. Referencing includes in-text citation and a complete reference list providing the full details of each source referred to in the document.
- Common author–date referencing styles includes APA (American Psychological Association) and Harvard.

1.6.2 Key terms

higher-order thinking requires greater cognitive processing than lower-order thinking. Learners use higher-order thinking skills when they engage in learning activities that require them to arrive at new meanings and understandings. Some examples of higher-order thinking include synthesising, analysing, application, evaluation and making a judgement.

hypothesis (plural: hypotheses) an idea or explanation for something that is yet to be proven. A hypothesis can be a basis for further investigation.

research methodology refers to how you will do your research and what techniques you will use. Research methodology includes any theories or theoretical models on which you are basing your research, the different parts of the research, and quantitative and qualitative techniques.

research perspectives (or theoretical perspectives) a set of assumptions about reality that inform the questions we ask and the kinds of answers we arrive at. It can be thought of as a frame that focuses what we look at; one researcher's frame for their research may be different to the next. A review of the literature will help identify other research or theoretical perspectives on a topic that can guide your own research.

subject-specific vocabulary refers to the specialised words and terms associated with a particular academic discipline or subject area

theoretical model a written or visual representation used to understand the way in which a process or system works

triangulation using several data collection techniques in order to validate findings

variable includes any factor that can be controlled, changed or measured in an experiment

on Resources

Digital documents Topic 1 summary (doc-35904)
Key terms glossary (doc-36170)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

1.1 Collaborative investigation (tpdf-2176) ☐

Digital documents

1.1 Skills checklist (doc-34898) ☐
Checkpoint 1 template: Feedback on collaborative practice and research question approval (doc-41286) ☐
Checkpoint 1 learning matrix (doc-41287) ☐
1.2 Checkpoint 2 template: Approval of research proposal (doc-41288) ☐
Checkpoint 2 learning matrix (doc-41289) ☐
1.3 Ethics checklist (doc-34896) ☐
Participant information (doc-36159) ☐
Consent form (doc-36160) ☐
Checkpoint 3 template: Feedback on collaborative practice and method approval (doc-41290) ☐
Checkpoint 3 learning matrix (doc-41291) ☐
1.5 Reflective framework (doc-41508) ☐
Meeting minutes template (doc-34897) ☐
Checkpoint 4 learning matrix (doc-41292) ☐
1.6 Topic 1 summary (doc-35904) ☐
Key terms glossary (doc-36170) ☐

🔗 Weblinks

1.1 NESA ☐
1.3 National Statement on Ethical Conduct in Human Research ☐
Australian Institute of Aboriginal and Torres Strait Islander Studies ☐
UNSW research guidelines ☐
1.5 APA Style 7th Edition Reference Guide ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

2 Preparing for your depth studies

LEARNING SEQUENCE

2.1 Overview

What a depth study is and the types of depth study pathways

Depth studies provide opportunities for you to personalise your learning. This means planning to spend more time learning about topics that are of interest to you in order to improve your knowledge and understanding in these areas.

Depth studies help to:
- consolidate your learning (strengthen your knowledge)
- practically apply knowledge to a real-world context (apply your knowledge and develop your understanding and skills)
- deepen your understanding about a topic (deepen your knowledge and understanding and develop your skills).

2.2 Depth studies

2.2.1 How to use this topic on depth studies

The following content will guide you in how to choose topics, the type of depth study and how much time to allocate. The amount of time you allocate per depth study will depend on the topic and the type of depth study you choose; that might involve reviewing content or concepts, or conducting a primary or secondary investigation. It is suggested that you allocate more time to a **primary investigation** to allow for the collection and analysis of primary data. Depth studies can be conducted individually or in groups.

primary investigation a research methodology in which the researcher directly collects data, rather than relying on data collected from previous studies

An investigation is not complete until it has been communicated. In subtopic 2.6 you can read about various ways to communicate the findings of your depth study, with activities to build your knowledge, understanding and skills in using these communication methods. Once you have chosen the way you will communicate your findings based on the purpose and the audience, you can complete the appropriate activities. Complete the activities only for the communication method you have chosen in order to inform your presentation and so that you feel confident in the steps to take.

2.2.2 Types of depth studies

Depth studies can be divided into three broad categories:
1. Consolidating knowledge
2. Applying knowledge and skills — secondary investigation
3. Deepening knowledge — primary investigation

FIGURE 2.1 How to use this topic on depth studies

For my depth study I wish to…

Consolidate my knowledge
- Spend more time learning/ understanding a concept and communicating my understanding

Go to:
2.3.1 Depth study plan: Consolidating knowledge
2.6 Communicating your understanding

Apply my knowledge and skills
- Apply knowledge and skills through practical application of concepts

Go to:
2.2.3 Secondary investigations
2.3.2 Depth study plan: Applying knowledge and skills — secondary investigation
2.6 Communicating your understanding

Deepen my knowledge
- Develop a deeper understanding, connect concepts and/or apply to real-world concepts

Go to:
2.2.4 Primary investigations
2.3.3 Depth study plan: Deepening knowledge — primary investigation
2.4 Data reliability, validity and accuracy
2.5 Analysing and interpreting your data
2.6 Communicating your understanding

FIGURE 2.2 Type of research-based depth study
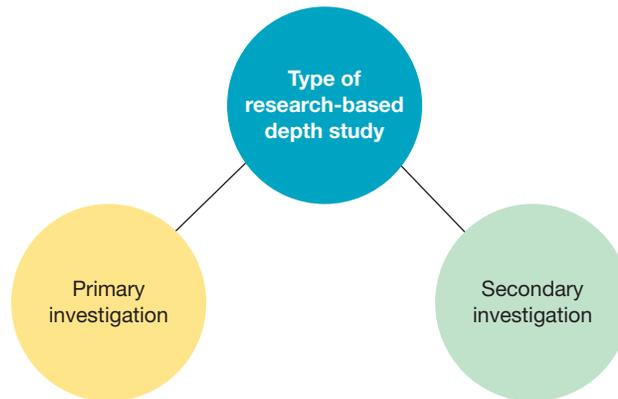
2.2.3 Applying knowledge and skills — secondary investigation

Secondary research involves the summary, collation (collection and organisation) and synthesis (combining in a meaningful way) of existing research. Where primary research generates data, secondary research uses primary research as a source of data for analysis. Secondary investigations can include:

- writing a blog, op-ed, essay or journal article based on evidence, analysis of data or fieldwork observations
- conducting a review of the literature
- developing a plan, for example a training plan, injury management plan or health promotion plan
- investigating emerging technology in the field of health or movement
- analysing a health or movement science-based video or text.

FIGURE 2.3 Investigating emerging health technology such as 24-hour access to health experts is a type of secondary investigation.

FIGURE 2.4 Ideas for your secondary investigation
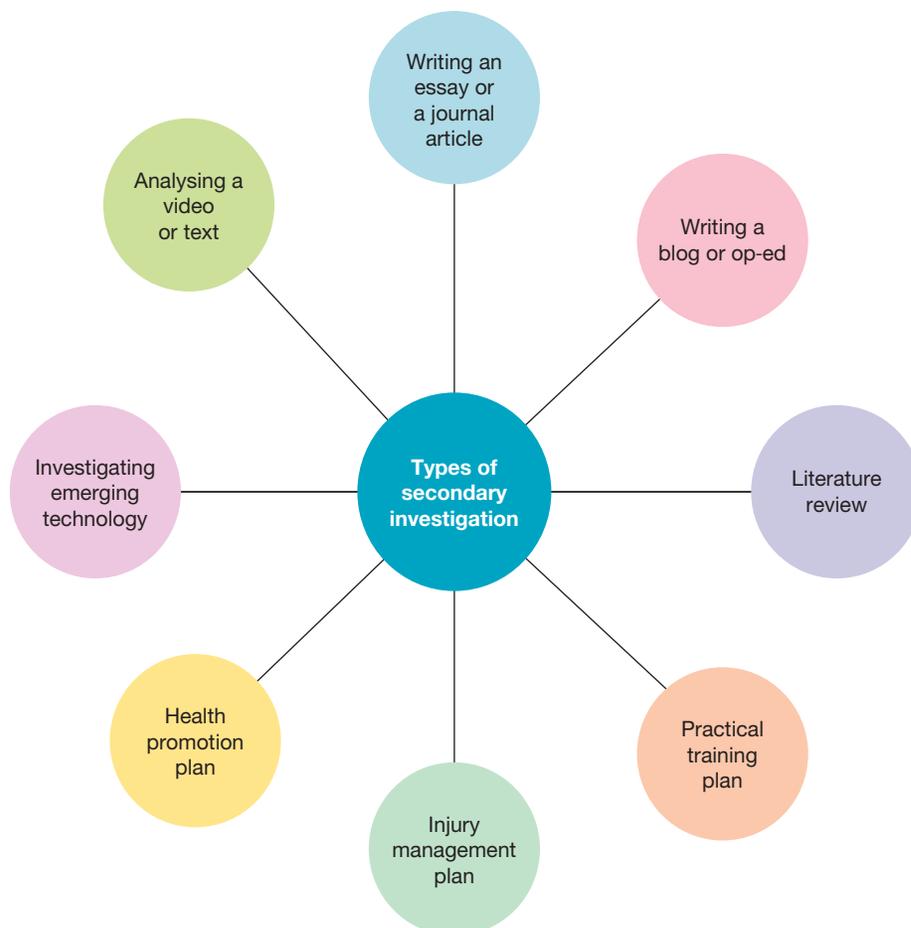
All depth studies require the analysis of information or data, either primary information that you collect yourself or secondary data that you investigate, synthesise, analyse and interpret.

2.2.4 Deepening knowledge — primary investigation

Conducting first-hand research requires a deep knowledge and understanding of content and concepts to enable critical and creative thinking and problem-solving. Throughout each focus area, you will know the concepts and content areas you are confident in to enable primary research if that is what you choose. This should be discussed with your teacher. Primary research aims to fill a research space or gap, generating new data.

Primary investigations to collect first-hand information can include:

- *experiments* — for example, assessing physiological responses to training, types of training, energy systems, stages of learning/skill acquisition, practice methods, types of feedback, or types of motivation
- *fieldwork observations* — at school, home or in the community; engaging with experts in the field, with athletes or with recreational participants
- *creation and testing of a model or application* — for example, a new training method, equipment to improve participation and performance, or a health or sports computer application.

FIGURE 2.5 An experiment assessing individual performance based on changes in hydration is an example of primary investigation.

FIGURE 2.6 Types of primary investigations

Experiment

Understanding methodologies used in previous studies

Types of primary investigations

Identifying the experts on a specific topic

Fieldwork observations

Create and test model or application

2.3 Planning for your depth studies

Planning a depth study using a template

Once you have decided on the topic of your depth study, you need to consider the resources you have access to and the amount of time that you will require. This will determine the type of depth study you conduct. Conducting a primary investigation will require more time to be able to collect and analyse data.

You may want to work individually or in a group for your depth study. If you decide to work in a group, it is important to consider the skill set of individuals in your group. Working with students who have different strengths to your own will provide opportunities for greater collaboration and learning. Further information on forming groups is provided in section 1.1.2.

FIGURE 2.7 When working in a group, brainstorming is a great way to start planning your depth study.

Designing a plan at the beginning of your depth study will enable you to make sure you have allocated enough time, as well as providing the chance to think about the resources you will need and the steps you will need to take.

2.3.1 Depth study plan: Consolidating knowledge

It is important that, as you work your way through the content, you use the syllabus and the text to carry out pulse checks, reflecting upon and highlighting your level of understanding. The 2.2 Activity will support you in doing this; the 'I see, I think, I wonder' process can help you identify content or concepts to focus on if you are choosing a depth study to consolidate your understanding.

For example, following step 1 of the activity, you might highlight the following syllabus dot point:
- Examine how the United Nations' Sustainable Development Goals (SDGs) are being used to improve health

This suggests that you recognise the need to consolidate your understanding. Following discussion with your teacher, individually or in a small group, you may choose to review your notes and classwork on this content, and engage in further research on one or more of the content points listed below, through websites of organisations such as UNESCO, World Health Organization or Healthy Cities Illawarra.
- What are the SDGs?
- How has the World Health Organization applied a health lens to the SDGs?
- How are the SDGs being used in Australia?
- How could the SDGs be used to promote the health of young people in a local community?

Consolidation of your knowledge will occur through the reading (reviewing your notes and engaging in further reading on the topic) and writing (presenting the information in your own words) cycle. Subtopic 2.6 provides suggestions as to how you may choose to present your understanding. You might choose to present it verbally, or share with peers to support deeper understanding through the need to explain it to others and respond to questions.

FIGURE 2.8 Pathways for your depth study: consolidate your knowledge

Consolidate your knowledge → go to: → Subtopic 2.6 Communicating your understanding
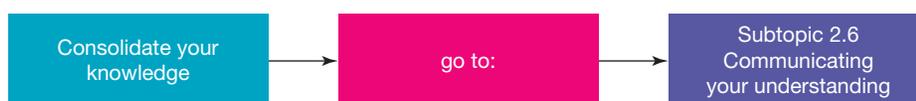
TABLE 2.1 A guide for planning a primary or secondary investigation

Primary-source investigation	Secondary-source investigation
What data do you need?	What information do you need to collect?
Will you need resources to do this, and what type?	What sources can you use to get this information?
How, where and when will the data be gathered?	How, where and when will the information be found?
What task will each group member do (if working in groups)?	What task will each group member do (if working in groups)?
Who is responsible for gathering the data?	Who is responsible for finding what information?
Who will keep records?	Who will keep records? What method will you use to avoid plagiarism?
How will you analyse the data?	How will you analyse the information?
What referencing method will you use for your sources and where will you collect them?	Which referencing format will you use for your sources?

2.3.2 Depth study plan: Applying knowledge and skills — secondary investigation

TABLE 2.2 Depth study plan for secondary research

Depth study elements	Description
Researcher(s)	List the individual or members of the group conducting the study.
Title	Choose a title for your depth study.
Rationale	Explain why you choose this topic for your research. What benefits will this study have for yourself and others?
Type of depth study	Decide on the type of depth study; for example, developing a training plan, injury management plan or health promotion plan; investigating emerging technologies; or analysing a video or text.
Communicating your understanding	How will you communicate your understanding? For example, this could be in the form of an essay, a viva voce, journal article, portfolio of evidence or multimedia presentation.
Timeline	**Phase**
Insert time periods, e.g. Week 1–2 and/or hours	**Planning phase** Review the literature; refine your research question or hypothesis; assess the risks and ethical issues; plan valid, reliable and accurate methods for collecting and analysing the data; select appropriate materials and technologies; plan experimental controls and how to measure them.
	Conduct investigation and record data Collect, organise and record your data
	Communicate/present data Plan and present your understanding using a mode or modes of communication

TABLE 2.3 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 1 content

Depth study elements	Description
Researcher	Name of student
Title	How did the NSW government use data to inform response activities to the novel coronavirus (COVID-19) outbreak in 2020? *Sub-questions:* • What organisations or professionals were involved in providing data to the government? • What data sources were used? • What response activities were put in place?
Rationale	The COVID-19 pandemic was an unprecedented time for health in NSW, Australia and the world, having profound social, economic and health implications for individuals and communities. The NSW government used data and expertise from government, academia and non-government organisations to inform the advice and response activities used to protect the health, safety and wellbeing of citizens, with an aim to reduce morbidity and mortality rates.
Type of depth study	Secondary investigation on Focus area 1 content, investigating the impact of data on the NSW government's response to the COVID-19 outbreak
Communicating your understanding	An essay will be written to highlight the impact that government response had during a time of COVID-19 and provide a perspective on this.

(continued)

TABLE 2.3 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 1 content *(continued)*

Timeline (10 hours)	Phase
1 hour	**Planning phase** • Plan the research question and sub-questions. • Assess any risks involved in this research; for example, providing creditable evidence to justify opinion, citing references accurately, commenting on decisions made by experts in the field. • Plan how the research will be conducted. • Plan how the research will be communicated.
6 hours	**Conduct investigation** • Review the literature on COVID-19, NSW Health policies for COVID-19, NSW health promotion initiatives and Australian government policies for COVID-19 • Review how to write an essay and complete the activities in this text.
3 hours	**Communicate/present data** • Plan essay structure and argument. • Draft essay using a word-processing application (such as Word). • Share for peer feedback • Edit essay based on any feedback. • Submit essay.

TABLE 2.4 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 2 content

Depth study elements	Description
Researcher	Name of student
Title	How can I create a training plan incorporating High Intensity Interval Training (HIIT) to improve my physiological responses to training and my overall physical fitness? *Sub-questions:* • What is HIIT training and how is it implemented to improve individual sporting performance? • What are the elements of a training plan? • What physiological responses would be affected by a HIIT plan?
Rationale	High Intensity Interval Training (HIIT) is a contemporary form of interval training that has received attention for improving athletic capacity and condition. There is no universal session duration, but the workouts typically last for less than 30 minutes. This type of training has high potential for senior students to manage personal physical fitness levels and study workload.
Type of depth study	Secondary investigation — developing a training plan
Communicating your understanding	A training plan based on HIIT training will be produced, justifying the frequency, intensity, type and time allocations for training, based on readings that will inform the plan.
Timeline (10 hours)	**Phase**
Weeks 1–2 (2 hours)	**Planning phase** • Plan the research question and sub-questions. • Assess any risks involved in this research; for example, producing a safe training plan. • Plan how the research will be conducted. • Plan how the research will be communicated.

Weeks 3–6 (4 hours)	**Conduct investigation** • Review the literature on HIIT training. • Research how to create a training plan. • Create a training plan template.
Weeks 6–10 (4 hours)	**Communicate/present data** • Plan and draft training plan. • Share training plan for peer feedback. • Edit training plan and justify key elements of the plan based on the FITT principle. • Submit training plan.

FIGURE 2.9 Pathways for your depth study: apply your knowledge and skills
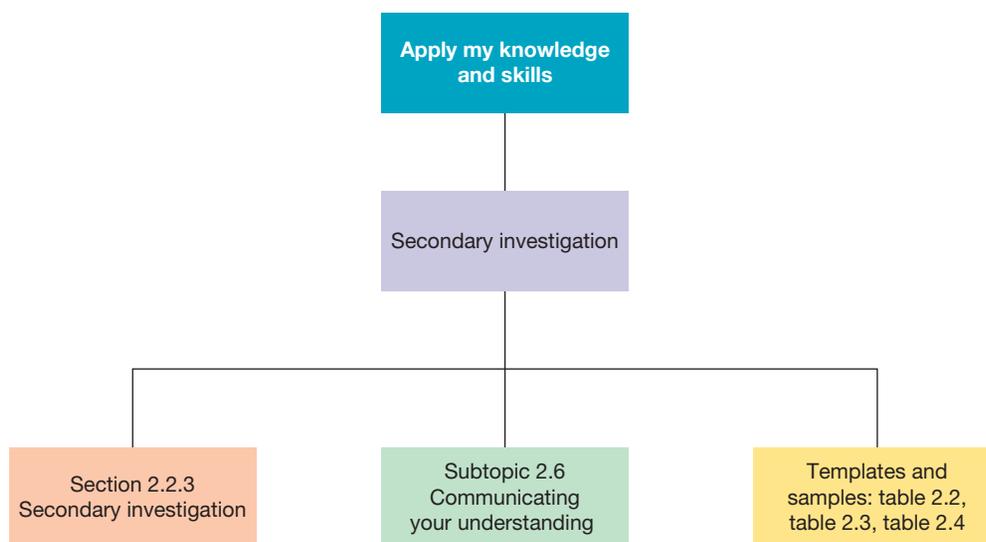
on Resources

📄 **Digital document** Depth study plan template: secondary research (doc-34895)

2.3.3 Depth study plan: Deepening knowledge — primary investigation

FIGURE 2.10 Pathways for your depth study: deepen your knowledge
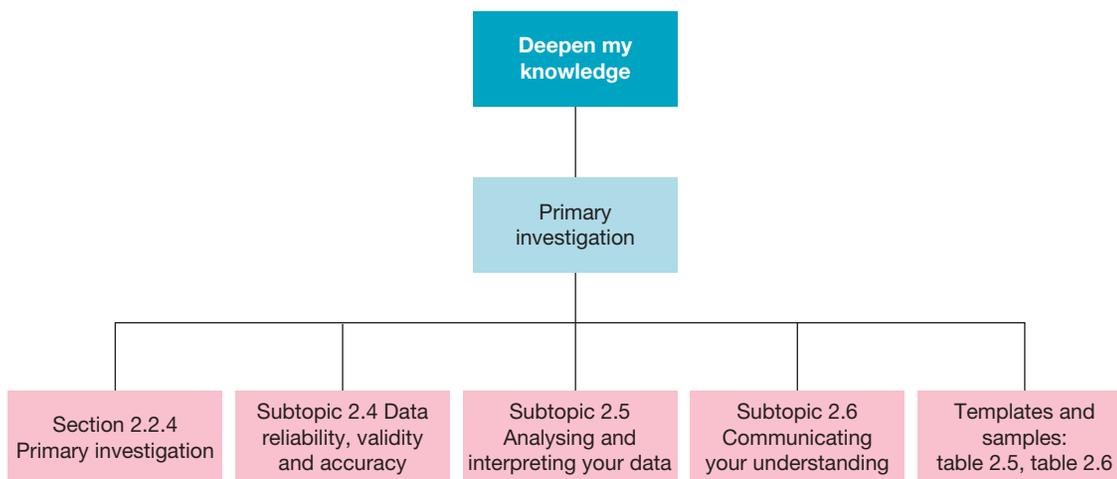
TABLE 2.5 Depth study plan for primary research

Depth study elements	Description
Research question or hypothesis	State your research question or hypothesis.
Key search terms	List the key words and synonyms you will use to locate relevant information.
Rationale	Explain why you choose this topic for your research. What benefits will this study have for yourself and others?
Type of depth study	Decide on the type of depth study; for example, designing and conducting an experiment, observational fieldwork, creating or testing a model or application. Include any theoretical models you are using for your research.
Leading researchers	Who are the leading researchers on this topic? Complete this once you have reviewed the literature.
Communicate your understanding	How will you communicate the process and findings of your investigation? For example, this could be an oral or written response, or a multimodal presentation.
Timeline	**Phase**
Insert time periods, e.g. Week 1–2	**Planning phase** Review the literature; refine your research question or hypothesis; assess the risks and ethical issues; plan valid, reliable and accurate methods for collecting and analysing the data; select appropriate materials and technologies; plan experimental controls and how to measure them.
	Conduct investigation and record data Safely conduct the investigation; collect accurate data; organise, record and process data as you go.
	Analyse and interpret data Summarise and code the data; look for trends, patterns or mathematical relationships in the data.
	Communicate your understanding Plan and present your findings. Explain the relevance of your research; present the various perspectives on the topic; use appropriate terminology; demonstrate the link between the research question, findings and conclusions; acknowledge your sources.

TABLE 2.6 Example plan — depth study conducting primary research

Depth study elements	Description
Research question or hypothesis	How do teenagers use social media to communicate? *Sub-questions:* • What social media are teenagers using to communicate? • How much time do teenagers spend using social media to communicate? • In what ways are teenagers communicating via social media?
Key search terms	Teenagers, young people, adolescents, social media, Facebook, digital technology, communicate, Instagram, TikTok, Snapchat
Rationale	The way in which teenagers communicate has changed with developments in technology over time. Young people now communicate largely through a device, and this seems to have implications on their health, wellbeing and safety. It is important to discover how young people are communicating.
Type of depth study	Primary investigation, quantitative study

	Leading researchers	Lenhart, A., Madden, M., Macgill, A.R., & Smith, A. (2007) Vanden Abeele, M.M.P. & van Rooij, A.J. (2016) Lenhart, A. & Pew Research Centre (2015) Orben, A. (2020) Oyovwe-Tinuoye Ogheneghatowho, G. & Adomi, Esharenana E. (2021)

Communicate your understanding	Viva voce presentation in Week 10	

Timeline	Phase	Who
Week 1–4	**Planning phase** • Review of the literature and defining the topic • Draft research plan — including methodology • Draft email and Google form to identify participants for survey (email and Google Form) • Create database of participants (Google Form) • Draft survey (closed questions) • Create electronic survey. — consider instruments and scale used in previous studies • Draft ethics checklist and consent form • Submit research plan and ethics checklist to teacher • Ethics and plan meeting and approval with teacher • Send email to participants to inform them about receiving the survey via email the following week	All Michael, Lucy All/John John All Michael Lucy, Alexis Alexis, John All Alexis
Week 5	**Conduct investigation and record data** • Send electronic survey to participants. • Send reminder emails to complete survey. • Close survey.	 John Alexis John
Weeks 6–7	**Analyse and interpret data** • The data will be manually coded, looking for trends and relationships that can be drawn out and additional calculations that can be made (derived data). • Discuss findings and how to represent these. • Create visual representations of the data.	Alexis, Lucy All John, Michael
Weeks 8–9 Week 10	**Communicate your understanding** • Write discussion and conclusion. • Prepare presentation. • Communicate research process and findings by conducting a viva voce with the class.	Lucy, Michael All/Alexis and John All

For information on types of research methods, see subtopic 1.3 Phase 3 — Methods.

on Resources

Digital documents	Depth study plan template: primary research (doc-34894) Ethics checklist (doc-34896) Participant information (doc-36159) Consent form (doc-36160)
▶ **Video eLesson**	Planning for your depth studies (eles-5013)

2.4 Data reliability, validity and accuracy

The different types of variables, and how to make sure your data is reliable, valid and accurate

Primary Investigation

2.4.1 Data points and variables

When planning your experiment, you need to consider how many **data points** you will collect. Data points are the points in time that you record data; for example, recording heart rate every minute until it returns to resting heart rate after a period of exercise, or recording resting heart rate three times a day over a period of 2–4 weeks. Generally, it is better to have more data points than fewer. However, time and resources will affect the amount of data you are able to collect and analyse to ensure the **accuracy**, **reliability** and **validity** of the data. A minimum of 6–10 data points is usually required to establish a relationship between **variables**, if the relationship is linear. A linear relationship means that an increase or decrease in one variable will result in a corresponding increase or decrease in the other variable, resulting in a straight line when graphing the data points. When conducting experiments, you need to decide the variables you wish to change, what you will measure, and the variables that you will control. It may be easier to control some variables than others.

data point a single piece of information or data

accuracy refers to how close a measurement or calculation is to the standard or correct value, which is set by previous reliable studies

reliability the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same

validity refers to how accurately a test or an experiment measures what it says it will measure. Results need to be valid to be able to draw conclusions from the research.

variable includes any factor that can be controlled, changed or measured in an experiment

independent variable the factor that is changed or controlled in an experiment; it represents the cause or reason for an outcome

dependent variable the variable being tested in an experiment; as change is made to the independent variable, the effect on the dependent variable is observed and measured

FIGURE 2.11 There are three types of variables.
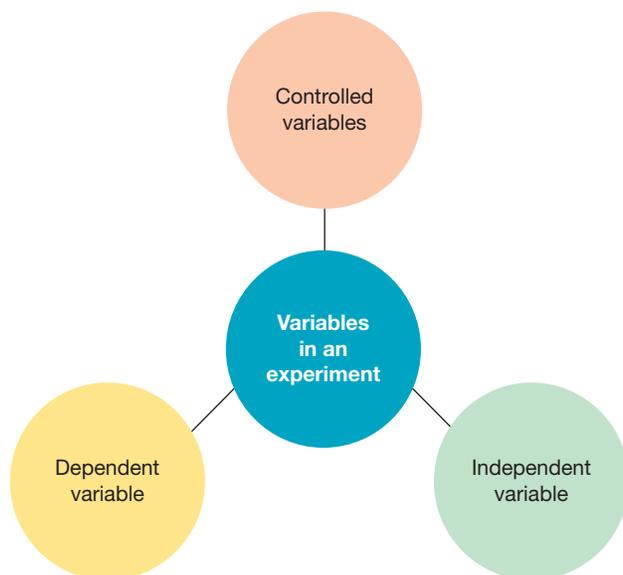
Typically, an experiment will have three types of variables:
- *independent variable* — this is the variable being tested, and therefore will be purposefully changed
- *dependent variable* — this is the variable that is measured. This changes as a result of changing the independent variable. As the names suggests, this variable is dependent on another variable.
- *controlled variables* — these variables are kept the same so they do not interfere with the results.

For example, if you were testing to see which playing surface was faster for returning play in tennis, the variables would be as follows:
- *independent variable* — the playing surface; for example, grass versus clay court
- *dependent variable* — speed of the play (this is what you are recording)
- *controlled variables* — tennis players, rackets and ball, weather conditions; these would need to stay the same.

If you do not expect the relationship to be linear, aim to collect more data in the range where you think the dependent variable will be changing more quickly. For example, if you are measuring how quickly heart rate returns to resting rate after intensive exercise, you should collect more data as soon as exercise ceases when the drop in heart rate is more rapid.

As a researcher, you have a responsibility to ensure you present accurate findings based on a thorough review of the literature and careful planning to collect, record and analyse data. There are steps you can implement to help ensure the reliability, validity and accuracy of your findings and conclusions when conducting research. These are presented in table 2.7.

TABLE 2.7 Summary of reliability, validity and accuracy

	Definition	Steps to take
Reliability	Reliability is the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same.	• Review the literature, including the method used for similar studies, to guide your method. Use peer-reviewed studies as a trustworthy source. • Repeat measurements and observations to ensure the same results are obtained, while maintaining the same conditions. A reliable experiment will provide the same results on multiple occasions.
Validity	Validity refers to how accurately a test or an experiment measures what it says it will measure. Results need to be valid to be able to draw conclusions from the research.	• Identify variables that need to be kept constant; for example, weather conditions during shuttle run tests. • Implement strategies to ensure variables are kept constant; for example, record shuttle run tests indoors (closed environment). • Demonstrate the use of a control; for example, remove any external motivation to see whether a different result is obtained without it. • Use appropriate data collection techniques; for example, consistent use of electronic stopwatch, timer and recording method. • Trial procedures and repeat them, checking that the results can be repeated. • An investigation is valid if factors that may vary during the experiment are held constant to ensure a fair test.
Accuracy	Accuracy refers to how close a measurement or calculation is to the standard or correct value. The standard is that set by previous reliable studies.	• The accuracy refers to the methodology used and the result. • The accuracy of the methodology or the procedures used in the experiment can be improved by using precise measuring instruments, avoiding human error where possible, and conducting repeat trials. • The accuracy of the results or the data generated is a measure of how close the result is to the expected value recorded in previous (peer-reviewed) studies.

2.5 Analysing and interpreting your data

How to analyse and interpret the results of both quantitative and qualitative data

Primary Investigation

The next step after collecting your data is to analyse it. The analysis of your results will be different for data gathered through quantitative methods as opposed to data collected through qualitative methods. For more information on types of research methods, see subtopic 1.3 Phase 3 — Methods.

2.5.1 Analysing and interpreting quantitative data

Analysing data collected through quantitative methods, such as experiments, includes recording raw data in a table. From the raw data (data you actually measured) you may work out other data using mathematical formulas (called derived data); for example, finding the average speed recorded or the overall improvement in speed over a period of time. Both the raw data and the derived data can be shown visually by using drawings, graphs or infographics. Graphs let you analyse relationships between variables. This means that the increase or decrease in one variable will result in a corresponding increase or decrease in the other variable.

To work out a relationship, you need to have enough data points and the range of your data points should be as large as possible.
- For linear relationships, six data points is generally considered adequate.
- For non-linear relationships (for example, a dramatic drop in heart rate when exercise ceases as opposed to a few minutes later), more data points are needed.

There are many different types of graphs so it is important to use the right graph for what you are trying to communicate. Some common graph options are listed in table 2.8.

TABLE 2.8 Types of graphs and their function

Strength of the graph	Type of graph	Example
To show a relationship between variables	Line graph Scatter graph	The relationship between speed and heart rate
To show how one continuous variable will affect the other	Line graph	The independent variable may be the intensity the athlete was running at, and the dependent variable may be the average speed, heart rate or stride length of the runner during each kilometre of a marathon.
To measure groups of things	Column or bar graph	Measuring the number of times each participant participated in organised physical activity during the month

The next step after analysing your results is to interpret them. This means showing the relationship between your research question or hypothesis and your results, and will form the basis of your discussion and conclusion. It is important when writing your discussion that you show a clear alignment between what you were aiming to find and what you actually did discover. In other words, do your results support your hypothesis?

It is not enough to say that the experiment did not work or the hypothesis was not supported. Your review of the literature should enable you to think critically about why the results of your experiment turned out the way they did. It could be that the model or theory you were using did not match your hypothesis, or that there was human or technical error in recording the results.

2.5.2 Analysing and interpreting qualitative data

Data collected through qualitative methods refers to information that may be in the form of interview transcripts, observation field notes, voice recordings of an interview or focus group discussion, or survey responses. The format of your raw data will determine how you analyse and look for themes, patterns or relationships, deriving further data. Analysing qualitative data can be done using data analysis software or manually looking for themes. You should talk with your teacher about how you will analyse your data, including the following steps.

Step 1 — Developing and applying codes

A code can be a word or phrase that represents an idea or theme. It is important to use meaningful codes when coding non-quantifiable things, such as human behaviours, activities and events.

TABLE 2.9 Example of analysing qualitative data using codes

Research title	Element to be coded	Codes
The impacts of technology on the wellbeing of teens	Wellbeing indicators	Psychological
		Social
		Physical

Step 2 — Identifying themes, patterns and relationships

Unlike quantitative data analysis, there is no universally comparable technique for generating findings. This is where the researcher is required to use critical and creative thinking to draw out themes, patterns and relationships from the data. Ways to do this include:
- looking for word or phrase repetition
- comparing your primary data with findings from your review of the literature
- identifying information that was not given by participants and how this may be interesting
- identifying how findings are similar or different.

Step 3 — Summarising the data

Interpretation of your data comes back to your research questions, and what your research aim or objective was. If you have used sub-questions, your analysis will be focused on answering these questions. When writing your discussion, you can use quotations from your raw data to highlight major themes within your findings.

Extract 1 — Data analysis

Extract 1 provides an example of the coding process that could draw out themes when conducting research on the impact of social media on the wellbeing of teens. Identifying the impacts on wellbeing by coding the wellbeing indicators in participant responses is part of the analysis that could take place with this data. Further analysis could also identify when, why and how this impact is occurring.

Extract 1

Interview question: How do you feel about yourself during and after spending time using social media?

Coding for wellbeing indicators: psychological[1], social[2], physical[3]

Participant 1

I use Facebook to see what my friends are up to and check out what they're doing. It seems like everyone is always having a great time, which makes me feel like my life isn't so great[1]. Some of my friends love to post the perfect selfie, and I never feel like the photos I take of myself are good enough to share[1]. I don't catch up with

some of my friends, because I don't want photos of me up on Facebook all the time[2]. It makes me feel sick[3] just thinking about it.

Participant 2

I use Instagram all the time to stay connected with people. It's a chance for me to feel like I'm still connected[2], even when I can't catch up with friends and hang out. I can still see what people are up to, and sometimes that motivates me to do things, like stay active[3]. Sometimes I do feel down when I feel like I'm missing out on stuff. I'd rather not know sometimes[1], rather than having FOMO.

Extract 2 — Data collection and analysis: what do I think?

Extract 2 provides an example of the link between data collection and data analysis for a qualitative study. The data was collected through observations and field notes. Analysis of this data included writing up the field notes, identifying the key themes related to the research question (including immigration and documentation status), then analysing the field notes for key words or phrases related to this theme. The researchers identified that this happened 13 times throughout the observations. They were also able to identify who raised these themes and when through their analysis process.

Extract 2

4. Methods

4.4. Data collection

We conducted 51 observations, approximately 95 min each, during the 2016–2017 academic year.[1] For each of three academic units at the beginning, middle, and end of the year, we visited the class at least six times per unit and observed for the entire period while taking detailed field notes and audio- and video-recording. Outside of these visits, we observed the class at least once a week while continuing to record and take field notes. This observation schedule enabled us to maintain a level of specificity in our fieldnotes within the scope of our research questions and keep presence in the classroom to ensure, as much as possible, that we did not miss significant interactions during the year. When participants. used Spanish in their interactions, we marked the occurrence(s) and had Mr. Stringfellow translate them into English.[2]

5. Data analysis

To begin our analysis, we read through all field note write-ups and identified every instance in which any students mentioned the topics of immigration or documentation status. This happened 13 times over the course of the school year. Upon closer examination, we noted that José, Kayla, Olga, and Marisol were the main participants in all of these conversations. We identified three of the 13 conversations in particular where the participants themselves broached the topic of their documentation statuses: two in January during a unit on immigration, and one in June as the students were working on their final project for the class, which for the participants also pertained to immigration.

[1] We also conducted teacher and student interviews and focus groups, but used only the interviews for both context and **triangulation** for this study.

triangulation using several data collection techniques in order to validate findings

[2] English and Spanish were the only two languages used in the conversations under analysis.

Source: Hemmler, V. L., & Kibler, A. (2019). 'You ARE Immigrant... but Not Like Us': A discourse analysis of immigrant students' positioning of undocumented immigrants in a CLD classroom. *Linguistics and Education*, 54, Article 100763. pp. 1–17.

2.6 Communicating your understanding

The different ways of communicating your depth study include portfolio of evidence, essay, viva voce, multimodal presentation or video, journal article or unseen timed response

Primary and Secondary Investigation

2.6.1 How to create a portfolio of evidence

A portfolio of evidence is a purposefully selected compilation of your work. It can cover a single content focus or include curated (carefully chosen) evidence over an entire course, focus area or key inquiry question. In this case, you can use the portfolio of evidence to demonstrate evidence of learning in relation to course knowledge and skill outcomes.

This means that it becomes evidence for these outcomes:
- Knowledge outcome: interprets meanings, measures and patterns of health experienced by Australians (HM-11-01)
- Skill outcome: Communication: communicating health concepts to audiences and contexts, using a variety of modes (HM-11-07).

Your portfolio of evidence can include your work samples over a period of time (for example, a school term), with personal reflections and annotations, peer feedback or teacher feedback. The portfolio of evidence may also be a resource that you can share with your family to showcase your learning and achievement.

As portfolios are created over a period of time, it is important you consider the ICT application you will use in the planning stage. You will need to share access with your teacher so they can view your work and personal reflections in real time. This will allow them to support you with feedback throughout your learning journey.

Some ICT applications that you may wish to consider can be accessed using the following weblinks in your Resources panel: **Microsoft PowerPoint — My learning portfolio**, **Microsoft PowerPoint — My learning journal**, **Microsoft Word — Learning log**, **Microsoft OneNote**, **Google Slides – My learning portfolio**, **Google Slides – My learning journal** or **Google Sites**. Make sure you are logged into your Microsoft or Google account when accessing these templates.

on Resources

  Weblinks Microsoft PowerPoint — My learning portfolio
               Microsoft PowerPoint — My learning journal
               Microsoft Word —Learning log
               Microsoft OneNote
               Google Slides – My learning portfolio
               Google Slides – My learning journal
               Google Sites

Using generative AI

Refer to your school procedures and teacher's guidance regarding the use of generative AI (for example, ChatGPT). Remember that, if you are permitted to use AI technology, it should never be the only source of information. It can, however, be a useful tool to help synthesise your research findings and collaborative work, create personalised content, and provide targeted and instantaneous feedback.

2.6.2 How to write an essay

An academic essay is a presentation method in which the writer seeks to persuade the reader to agree with an idea, based on the evidence provided. It should include an introduction, body and conclusion.

An academic essay should do three things:

- answer a question
- present an argument or closely related points by reasoning
- provide supporting evidence or examples.

FIGURE 2.12 Suggested steps for writing an essay.

1. Analyse the research question and define key terms

2. Establish a point of view

3. Research the topic

4. Take notes

5. Develop an essay plan

6. Develop your first draft

7. Seek feedback on your draft

8. Apply feedback by editing your draft

9. Include a reference list and finalise citations

10. Publish your final draft

2.6.3 How to prepare for a viva voce

A viva voce is a form of oral assessment. It helps to develop effective communication and presentation skills.

A viva voce is defined as a formal academic assessment in which students are required to verbally present and discuss their research, knowledge or a specific topic, often to a teacher panel, typically as part of their academic evaluation.

The assessment of a viva voce can include multiple assessors and questions between the student and the assessors. The assessment can focus on factual recall, applied knowledge, ability to synthesise information and communication skills.

This type of presentation or assessment requires you to think on your feet and enables you to demonstrate your ability to think critically at a point in time.

Recording a viva voce can be helpful in gaining further feedback on your communication and presentation skills.

2.6.4 How to write a journal article

When writing a journal article, it is important to know the purpose and the audience you are writing for. Think about the contribution your article will make and how you will convince the reader.

Like other forms of writing, journals use a standard format for articles, with slight variation depending on the type of journal. This style of writing requires the writer to use 'signposting' for the reader, guiding the reader through the article and letting them know what is coming next.

Researching the journal you intend to write for is very important to familiarise yourself with the sorts of things they publish. Each journal has a certain style. Your review of the journal should also inform you about the journal guidelines for structure, formatting, word length and referencing style.

It is also important to have conducted a thorough review of the literature to ensure the research you are citing is current and that you are making an original contribution in some way. The list below outlines the standard format for a journal article that you need to follow if you choose this form. Even though your article will not appear in a real journal, you should model the structure of published articles.

The standard format of an article

- *Title* — this should accurately describe the content of your paper and may also indicate the results. Consider the terms that researchers would use when searching for papers (articles) on your topic.
- *Authors* — usually listed by maximum contribution first, followed by others who have contributed.
- *Abstract* — this is a short summary of your article and your findings. Many readers only read this section when deciding whether to read the article or not, so it needs to be short (maximum 300 words) and summarise the research questions or statement, methods, results and discussion.
- *Introduction* — this should set the context for the paper, summarising the existing research in the field and justifying why your research is necessary.
- *Materials and methods* — this section describes the resources and processes that were used to conduct the research. Tables, diagrams and flowcharts may be used to visually represent some of this information.
- *Results* — here you share the results of the primary research conducted. If graphs or tables are used, they should be numbered and titled appropriately.
- *Discussion and conclusion* — these sections demonstrate how the results answer the research questions and contribute to research in the field. As a researcher, you are expected to be humble in your finding and contributions, identifying how the research could be improved.
- *References* — these are an essential part of academic writing. The purpose of referencing is to acknowledge the original ideas and work of others that are not your own. Referencing includes in-text citation (referencing used throughout the text to reference a specific idea, phrase or concept that was originally someone else's) and a complete reference list providing the full details of each source referred to in the document. Journals indicate the referencing system and style that should be used. Common author–date referencing styles include APA (American Psychological Association) and Harvard. If writing your journal article using programs such as Microsoft Word, using referencing software such as can help to automatically generate a reference list that can be included at the end of the paper.

2.6 ACTIVITY 4

Planning your journal article

The following tasks should be completed if you are considering choosing a journal article to communicate your understanding.

1. Investigate three types of journals in the health or movement science field and compare article structure, formatting, word length and referencing style.
2. Use the standard structural headings listed above to create a plan for your journal article.

2.6.5 How to create a multimodal presentation

A multimodal presentation is one that uses two or more modes of communication to present content. These may include text, audio, images, animations, video and interactive content. The benefit of a multimodal presentation is that it provides you with the opportunity to demonstrate your knowledge, understanding and skills in a range of ways, using your strengths to better showcase what you know, understand and can do. This type of presentation provides you with the skills to be able to communicate in an increasingly multimodal world.

For more information on creating a multimodal presentation, see section 1.5.5 in topic 1.

2.6.6 How to prepare for an unseen timed response

This type of presentation can include a seen or unseen stimulus that requires a written or verbal response in a set timeframe. The stimulus may include a graph, image, video, text or display. The response is assessed according to knowledge or concepts identified in the stimulus and the skill(s) required to provide the response; for example, communication or analysis.

on Resources

🔗 **Weblink** Sports Science Development at the AIS

2.6.7 How to write a literature review

A review of the literature is the basis for research in most academic fields, including health and movement sciences. A literature review is essential for conducting primary research to understand the current state of research on a topic; if your depth study is a secondary study, then the literature review may be the investigation itself. For information on how to write a literature review, see section 1.2.2 and the related Activity questions in topic 1.

2.6.8 How to write a blog

A blog is an opportunity for people to communicate information online. A blog can be used to practice writing and to communicate research findings and build understanding and discussion around particular topics or disciplines. It is a style of writing that can be highly influential. A well-written blog is a great way to connect with your intended audience, as it requires regular updates and provides readers with the opportunity to comment and voice their opinions.

The key to writing polished blogs that others want to read and share is reading other evidence-based or academic blogs and taking the time to consider the style that you like to read. This should then influence the style of your own writing. Regular blog posts will also help you to connect with your audience.

Most blogs include a basic structure and features. These may include:

- a header with a menu or navigation bar
- a main content area with blog posts and dates
- a sidebar with recent posts and social media profile
- a footer with contact information, links to a disclaimer and privacy policy, and a space for readers to reply or make comment.

FIGURE 2.13 Writing a blog is a different way to share your research findings and your perspectives on a topic.

The benefits of blogging include the following:

- *Being succinct in your writing*. Most blogs are short in nature, so it requires you as the writer to get to the point quickly. To cater for being concise, bloggers use short paragraphs and even bullet points. The art of being succinct is beneficial not only for blogging, but also for summarising your classwork to create study notes and for writing examination style responses.
- *Writing for your audience*. Reading a blog is optional. Keeping readers engaged relies on you as the writer creating interest and maintaining that interest for the duration of the blog. It is important to consider what the audience needs and wants to know. Including links and images also help to maintain a reader's interest.
- *Finding your voice*. Writing a blog enables you to experiment with various textual approaches, including syntax, genre and vocabulary. The way you choose to structure your sentences and word choice helps you to define your 'voice' as a writer.
- *Becoming a confident writer*. The art of writing well, like any other skill, requires practice. The more you blog, using the concepts and language of the syllabus, the more confident and relaxed you will become in your knowledge and understanding, and in your ability to answer responses to examination questions.
- *Developing deep understanding*. The process of planning and writing a blog, including reviewing your class notes, conducting further reading on the topic and planning and writing a succinct yet engaging blog, really help to consolidate knowledge and develop deep understanding. We know that teaching others leads to a greater understanding for ourselves.

2.6 ACTIVITY 7

Planning your blog

If you are considering choosing a blog to communicate your understanding, complete the following questions. These examples of communicating your understanding will be used for both collaborative investigations and depth studies.

1. Investigate three evidence-based blogs and compare the platform, structure and features of each. What is similar and what is different?
2. Compare writing styles for the three blogs chosen and discuss the writing style that most attracts you as the reader.
3. Watch a tutorial video for the platform on which you will create your blog.
4. Plan the design and name of your blog.
5. Discuss your plan with a peer student and seek feedback.

2.6.9 How to write an op-ed

You may well be wondering what an op-ed is – it stands for 'opposite the editorial page' and is typically published by a newspaper or magazine expressing the opinion of an author usually not linked to the publication's editorial board. Op-eds are not the same as an editorial or a letter to the editor. They are known as an opinion story, giving the writer an effective channel for direct communication with the public. Op-eds provide a forum for providing health or scientific information and/or viewpoints on a particular issue, or to advocate for a particular policy or health promotion.

When writing an op-ed:

- *have a goal in mind* — what is your point? Is it important to make this in the first paragraph of your op-ed. This piece of writing is a chance to provide your perspective on an important issue; but to ensure that this is clear, focus on one major point. Clearly state one point with a strong perspective for maximum impact.
- *abide by the word limit* — different newspapers and magazines have different word limits on opinion stories; the limit tends to range from 250 to 750 words.
- *include your contact details* — newspapers and magazines require writers to provide their name, address and a contact number with a submission.

2.6 ACTIVITY 8

Writing an op-ed

The following questions should be completed if you are considering choosing an op-ed to communicate your understanding.

1. Use the ***Los Angeles Times* Op-Ed: How to make high schools better for students** weblink in the Resources panel to read the opinion piece, then complete the following questions.
   a. What is the point of the article?
   b. Is the writer's opinion clear throughout the article? Provide examples.
   c. Assess the word length of the article.
2. Read two or three op-eds from different sources to learn how to frame complex issues. Sources where you might find op-eds include the websites of *The New York Times*, *The Sydney Morning Herald*, *The Australian Financial Review* and *The Washington Times*.
3. Use your class notes on a topic that would interest the public and write an op-ed of around 250 words. Share with a peer student for feedback.
4. Seek readings in addition to your class notes on a topic that would be of interest to the public and write an op-ed of 400–500 words. Share with someone who is not familiar with the content for their feedback on your writing structure, style and influence of the article.

2.7 Review

2.7.1 Topic summary

2.2 Depth studies

How to use this topic on depth studies
- Your learning goals should guide your planning for your depth studies.
- Depth studies can be undertaken individually or in groups.
- The syllabus requires a minimum of two depth studies in Year 11 and a total of 20 hours in-class time allocated to Focus area 1 and/or Focus area 2.

Types of depth studies
- Depth studies can fall into one of three categories: consolidating your knowledge through revising or reviewing content or concepts; applying your knowledge and skills in a secondary investigation; or deepening your knowledge and understanding and developing your skills through a primary investigation.

Applying knowledge and skills — secondary investigation
- Secondary research involves the summary, collation and synthesis of existing research. Where primary research generates data, secondary research uses primary research as a source of data for analysis.
- Examples of secondary investigations include a portfolio of evidence, an essay, a viva voce, an unseen timed response, conducting a literature review, writing a blog, op-ed or journal article based on evidence, analysis of data or fieldwork observations, developing a plan, investigating emerging technology, or analysing a health or movement science-based video or text.

Deepening knowledge — primary investigation
- Primary investigations require a deep knowledge and understanding of syllabus content and concepts to be able to apply it to a new context.
- Primary investigations provide the researcher with first-hand information.
- Examples include experiments, fieldwork observations and the creation and testing of a model or application.

2.3 Planning for your depth studies

- Your access to resources, including time, will determine the type of depth study you conduct.
- Conducting a primary investigation requires more time to be able to collect and analyse data.
- You can work individually or in groups for your depth studies.
- Thorough planning at the beginning will support time-management and effective decision-making throughout your depth study.

2.4 Data reliability, validity and accuracy

- When planning your experiment, you need to consider how many data points you will collect.
- Time and resources will impact the amount of data you are able to collect and analyse to ensure the accuracy, reliability and validity of the data.
- When conducting experiments, you need to decide which variables you wish to change, what you will measure, and the variables that you will control. It may be easier to control some variables than others.
- Typically, an experiment will have three types of variables: an independent variable, a dependent variable and controlled variables.
- As a researcher you have a responsibility to ensure you present accurate findings based on a thorough review of the literature and careful planning to collect, record and analyse data.
- There are steps you can implement to help ensure the reliability, validity and accuracy of your findings and conclusions when conducting research.

2.5 Analysing and interpreting your data

Analysing and interpreting quantitative data

- Analysing data collected through quantitative methods, such as experiments, includes recording raw data in a table.
- From the raw data (data you actually measured), you may derive other data using mathematical formulas. Both the raw data and the derived data can be used to show relationships between variables.
- It is important to use the most appropriate graph to communicate your findings.
- Interpreting your results means showing the relationship between your research question or hypothesis and your results. This will form your discussion and conclusion.
- If your findings do not support your hypothesis, you need to explain why.

Analysing and interpreting qualitative data

- Data collected through qualitative methods refers to information that may be in the form of interview transcripts, observation field notes, voice recordings of an interview or focus group discussion, or survey responses.
- Analysing qualitative data can be done using data analysis software or manually looking for themes, patterns or relationships.
- The steps involved in analysing qualitative data include developing and applying codes, identifying themes, patterns and relationships, and summarising the data.

2.6 Communicating your understanding

How to create a portfolio of evidence

- A portfolio of evidence is a purposefully selected compilation of your work.
- It can cover a single content focus or include curated (carefully chosen) evidence over an entire course, focus area or key inquiry question. In this case, you can use the portfolio of evidence to demonstrate evidence of learning in relation to course knowledge and skill outcomes.
- Your portfolio of evidence can include your work samples over a period of time (for example, a school term), with personal reflections and annotations, peer feedback or teacher feedback.
- Some ICT applications you may wish to consider using can be accessed using the weblinks in your Resources panel.

How to write an essay

- An academic essay is a method where the writer tries to persuade the reader to agree with an idea, based on the evidence provided. It should include an introduction, body and conclusion.

How to prepare for a viva voce

- A viva voce is a form of oral assessment. Students are required to verbally present and discuss their research, knowledge, or a specific topic, often to a teacher panel.

How to write a journal article

- A journal article is considered one of the best mediums for publishing the findings of academic research to other researchers in the field.
- It is an opportunity to show how your findings contribute to existing research on the topic.
- It is important to write with a clear understanding of your purpose and audience.
- The standard format of an article includes: title, authors, abstract, introduction, materials and methods, results, discussion and conclusion, and references.

How to create a multimodal presentation

- A multimodal presentation is one that uses two or more modes of communication, such as written language and spoken language as well as forms that are visual, audio, gestural, tactile and spatial.
- The benefit of a multimodal presentation is that it provides you with the opportunity to demonstrate your knowledge, understanding and skills in a range of ways, using your strengths to showcase what you know, understand and can do.

How to prepare for an unseen timed response
- This can include a seen or unseen stimulus that requires a written or verbal response in a set timeframe. The stimulus might be in the form of a graph, image, video, text or display.

How to write a literature review
- A literature review is an examination of the research that has taken place in a particular field of study.
- The review itself is not merely a summary of the research that has previously been conducted, but more an argument outlining the leading thinkers in the field, the opposing perspectives and your views on the strengths and weaknesses of the research being reviewed.
- The important outcomes of conducting a literature review include understanding the current state of research on a topic, identifying the experts on a specific topic, identifying gaps in the research, and understanding methodologies used in previous studies.

How to write a blog
- A blog is a way to communicate research findings and build understanding and discussion around particular topics or disciplines.
- It is a style of writing that can be highly influential.
- The key to writing polished blogs that others want to read and share is reading other evidence-based or academic blogs and taking the time to consider the style that you like to read.
- Most blogs include a basic structure and features.

How to write an op-ed
- Op-ed stands for 'opposite the editorial page' and is typically published by a newspaper or magazine expressing the opinion of an author usually not linked to the publication's editorial board.
- Op-eds are known as an opinion story, giving the writer an effective channel for direct communication with the public.
- Op-eds provide a forum for providing health or scientific information and/or viewpoints on a particular issue, or to advocate for a particular policy or health promotion.
- When writing an op-ed you should have a goal in mind, abide by the word limit, and include your contact details for feedback.

2.7.2 Key terms

accuracy refers to how close a measurement or calculation is to the standard or correct value, which is set by previous reliable studies

data point a single piece of information or data

dependent variable the variable being tested in an experiment; as change is made to the independent variable, the effect on the dependent variable is observed and measured

independent variable the factor that is changed or controlled in an experiment; it represents the cause or reason for an outcome

primary investigation a research methodology in which the researcher directly collects data, rather than relying on data collected from previous studies

reliability the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same

triangulation using several data collection techniques in order to validate findings

validity refers to how accurately a test or an experiment measures what it says it will measure. Results need to be valid to be able to draw conclusions from the research.

variable includes any factor that can be controlled, changed or measured in an experiment

on Resources

Digital documents Topic 2 summary (doc-41464)
Key terms glossary (doc-41465)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

2.1   Preparing for your depth studies (tpdf-4025)   ☐

📄 Digital documents

2.3   Depth study template: primary research plan
      (doc-34894)   ☐
      Depth study template: secondary research plan
      (doc-34895)   ☐
      Ethics checklist (doc-34896)   ☐
      Participant information (doc-36159)   ☐
      Consent form (doc-36160)   ☐
2.7   Topic 2 summary (doc-41464)   ☐
      Key terms glossary (doc-41465)   ☐

▶ Video eLessons

2.3   Planning for your depth studies (eles-5013)   ☐

🔗 Weblinks

2.6   Microsoft PowerPoint — My learning portfolio   ☐
      Microsoft PowerPoint — My learning journal   ☐
      Microsoft Word —Learning log   ☐
      Microsoft OneNote   ☐
      Google Slides – My learning portfolio   ☐
      Google Slides – My learning journal   ☐
      Google Sites   ☐
      Sports Science Development at the AIS
      Los Angeles Times Op-Ed: How to make high schools
      better for students   ☐

Teacher resources

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1 Health for individuals and communities

OUTCOMES

- interprets meanings, measures and patterns of health experienced by Australians HM-11-01
- analyses methods and resources to improve and advocate for the health of young Australians HM-11-02
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

3 How do we understand and measure Australia's health?

LEARNING SEQUENCE

3.1 Overview

Key inquiry question

How do we understand and measure Australia's health?

Syllabus

	Syllabus content	Subtopic
○	■ Compare meanings of health, using various sources, including the World Health Organization's (WHO) definition, and explain why people give different meanings to health	**3.2**
○	■ Explain the dynamic nature of health by exploring the interactions between the dimensions of health, the concept of good health, the health continuum, how health changes over time, and how an individual's circumstances affect their health	**3.3**
○	■ Discuss the use of epidemiology, mortality, infant mortality, morbidity, incidence and prevalence to explain the health status of Australians using tables and graphs from *Australia's Health* and other health reports	**3.4**
○	■ Investigate the role of social justice principles, participation, equity, access and rights, in promoting an individual and community's health status	**3.5**
○	■ Discuss the range of determinants (broad features of society, environmental factors, socioeconomic characteristics, health behaviours and biomedical factors), that influence the health and wellbeing of Australians **Including:** • how do the determinants interact to affect the health of population groups? • what are the sociological causes of risky health behaviours? • where do inequities exist and what can we do about them?	**3.6**

Source: *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Outcomes

• interprets meanings, measures and patterns of health experienced by Australians HM-11-01
• Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
• Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents   Topic 3 summary (doc-35905)
Key terms glossary (doc-36171)
Revision quiz (doc-34732)

3.2 Meanings of health

3.2.1 What does health mean?

People give different meanings to the term 'health'. In order to understand issues related to health, it is first important to understand what is meant by the term 'health' as it applies to individuals and the community.

The concept of health is diverse and means different things to different people for many reasons including their age, gender, cultural background or lived experience. This diversity can be recognised by considering the different meanings of health that have developed over time.

Early meanings of 'health'

In the past the term 'health' was closely associated with how well a person's body functioned physically, and in particular with their capacity and ability to perform physical activity. Prior to World War II, health was viewed as the opposite of illness. If there was no evidence of disease or physical illness we were considered healthy, and any breakdown in the body system meant that it was not healthy. This view of health suggested that if you were ill, medicine, drugs and doctors were able to return you to a healthy state.

FIGURE 3.1 Health can mean many things to people.

This early definition of health was recognised as being too narrow and one-dimensional in its perception of what was involved in a person's health. Its failure to consider an individual's mental, social, emotional or spiritual

health meant that the definition had severe limitations. For example, a person might not be suffering from a physical illness, but may be experiencing depression or emotional stress, which according to the definition above would mean that they are 'healthy'. Without appropriate recognition and treatment of such conditions, a person's mental health could be affected, potentially leading to a significant impact on their everyday lives and overall level of health.

A changing definition of 'health'

In 1948, the **World Health Organization (WHO)** developed a definition of health which defined it as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'. This definition gave a more holistic concept of health by recognising the whole person and focusing on more than the physical aspect of health and the absence of disease or illness.

Consider the two following individuals. Yousef, a teenage male, is currently in a state of good **physical health**; however, he is managing a diagnosis of anxiety, which often has an adverse impact on his relationships with his friends. Gretta, an elderly female, is managing osteoporosis and diabetes, has an active social life and enjoys participating in group Tai Chi.

The WHO's definition suggests that Yousef and Gretta cannot be considered truly healthy unless they have *complete* physical, mental or social wellbeing. However, it is plausible that, if interviewed, Yousef and Gretta could describe themselves as healthy individuals, which leads us to think about why people give different meanings to health.

In 1986, the WHO clarified their definition of health as 'a resource for everyday life, not the objective of living. Health is a positive concept emphasising social and personal resources, as well as physical capacities'. With this in mind, the definition of health becomes more inclusive and more achievable. The focus on personal resources and physical capacities means that health is dependent on an individual's own situation. A person can be considered healthy even if they do not have 'complete' wellbeing in the dimensions of physical, social and mental health.

World Health Organization (WHO) a specialised agency of the United Nations that acts as the coordinating authority on international public health issues

physical health refers to the efficient functioning of the body and its systems, allowing people to carry out everyday activities and to be free from illness

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DEPTH STUDY IDEA

Using the open-ended question approach, create a range of survey questions asking individuals to give their own meaning of health. Survey findings could be collected via forms or video-recorded vox pops. Analyse the results as a class, noting any variance in the meanings provided based on age, gender or other factors. Present the findings as a presentation, video or poster to better inform the school population about the meaning of health.

3.2 ACTIVITY

What does health mean to me?

1. Create a collage containing at least six images that show what the term 'health' means to you.
2. Share with a partner and discuss reasons for choosing the images included in your collage. Note similarities and differences between what the term 'health' means to you and your partner.
3. As a class, discuss the types of images that were selected and the reasons people gave for the images chosen. What do the different responses tell you about people's understanding of the term 'health'?

on Resources

🔗 **Weblinks** What does being healthy mean to you? Children's perspective
What does being healthy mean to you? Youth perspective
What does being healthy mean to you? Global perspective

3.2 Exercises

3.2 Quick quiz **on**	3.2 Exercise

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Revise your knowledge

1. Why is the definition of health no longer limited to a focus on 'absence of disease or illness'?
2. What is the WHO's current definition of health?
3. Why do people give different meanings to health?

Apply your knowledge

4. Devise your own definition of health. Share your answer with a partner.
5. Using your understanding of health, identify some of the key factors that constitute a healthy lifestyle.
6. Using your understanding of health, identify some of the key factors that constitute an unhealthy lifestyle.
7. Explain why a teenager might have a different meaning of health compared to an elderly person.
8. Is it possible for someone with a permanent disability to lead a healthy lifestyle? Discuss.

3.3 The dynamic nature of health

> ▶ **Syllabus:** Explain the dynamic nature of health by exploring the interactions between the dimensions of health, the concept of good health, the health continuum, how health changes over time, and how an individual's circumstances affect their health
>
> **Source:** *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Health can be classified as **dynamic**, because it is constantly changing. Over the course of a week, a month or years, your health has the ability to fluctuate as you may suffer an injury, catch a cold or suffer from a debilitating illness; but if you correctly rehabilitate your injury or take some medication for your cold, along with rest, you may shift from a state of poor health back to good health.

dynamic health refers to the constant changes that occur in our level of health

health continuum a scale on which an individual's health can be measured or assessed; usually includes categories such as very poor, poor, fair, good and very good

We can explain the dynamic nature of health by:
- considering the interactions between the dimensions
- understanding the concept of good health
- using the **health continuum**
- understanding that health changes over time
- knowing how an individual's circumstances affect their health.

3.3.1 How do the dimensions of health interact?

There are five dimensions of health. These include physical, mental, emotional, spiritual and social. A person's level of health is the result of interaction between these different dimensions, and a balance between all five dimensions is essential to produce general wellbeing and satisfaction.

Physical health

Physical health relates to the efficient functioning of the body and its systems, giving people the capacity to carry out everyday activities and be free from illness. It is the most visible dimension of health.

Physical health is supported by factors such as regular physical activity, eating a balanced diet, having enough rest/sleep, maintaining an ideal body weight, adequate energy levels and the absence of illness, disease or injury. A person who is able to have a balance between all of these factors would be considered to have good physical health.

Your physical health may change over time due to short-term factors that could include:
- an injury such as a sprain, strain or fracture
- a female being diagnosed with gestational diabetes during their pregnancy.

It could also be affected by to chronic illness or permanent disabilities such as:
- being diagnosed with cancer, heart disease or Alzheimer's disease
- being paralysed as a result of an accident.

Physical health can be impacted by the other dimensions in the following ways:
- *Social.* Recovering from a short-term injury or illness and being welcomed back into your social circles will have a positive impact on the individual.
- *Mental and emotional.* Being diagnosed with a life-threatening illness can affect the thoughts and feelings of an individual as they can begin to question their mortality.
- *Spiritual.* Often people experiencing adversity find a new sense of direction or strong purpose in life, such as advocating for improved conditions for people with a disability.

FIGURE 3.2 Physical fitness is an aspect of physical health.

social health refers to our interactions with other people as well as the social and communication skills and abilities we display

Social health

Social health refers to our interactions with other people (such as family, friends, peers or co-workers), as well as the social and communication skills and abilities we display. Good social health means we feel a sense of connection and belonging to various people, and to the wider community in which we live. We can interact effectively with people in an interdependent, appropriate and cooperative way. Positive social health means we can form and maintain positive relationships that provide us with a network of support, and appropriately manage situations where relationships may break down.

FIGURE 3.3 Going to a party and enjoying yourself can have positive benefits to your social health.

Like all dimensions of health, social health and wellbeing is dynamic. An individual can have a network of friends and a supportive family until their life circumstances change, such as moving away from home for work or to attend school or university. In a new environment social interaction can become more difficult, and an individual's social health can suffer. However, the act of making friends and engaging with new people within their new environment can restore the individual's social health.

Social health can be impacted by the other dimensions in the following ways:

- *Physical.* Going through a serious relationship breakdown may cause problems with a person's physical health due to the increased emotional pressure.
- *Mental and emotional.* Graduating from high school may lead to feelings of success and satisfaction in achieving a goal.
- *Spiritual.* Forming new friendships may allow people to feel like they have a greater connection to those around them and the community to which they belong.

Emotional health

Emotional health is related to how we think and feel, and how we cope with our thoughts and feelings. Having strong emotional health does not mean that you are always happy; it refers to your ability to recognise your own emotions, and those of others, to respond accordingly in a given situation. It also includes the ability to show resilience, or to 'bounce back' from difficult stages in life such as the loss of a loved one or a relationship breakdown. The emotional health of an individual is heavily linked to their self-esteem and self-concept.

emotional health a state of health related to how we think and feel, and how we cope with our thoughts and feelings

mental health a state of mental wellbeing that enables people to cope with the stresses of life, realise their abilities, learn well and work well, and contribute to their community

Emotional health can be considered dynamic due to the range of emotions one is likely to experience over the course of a day, weeks, months or years. In a short period of time someone could experience the jubilation of securing a new job and later suffer from a relationship breakdown.

Emotional health can be impacted by the other dimensions in the following ways:

- *Physical.* Participation in physical activity can lead to improvements in your emotional health.
- *Social.* Volunteering at a charity event may lead to positive social interactions with various community members.
- *Spiritual.* The loss of a loved one could affect how people see the world, which may have an impact on their faith.

Mental health

The term '**mental health**' is often misconstrued to mean what is going wrong, when in fact it is used to determine what is going well in a person's life. According to the World Health Organization, mental health is 'a state of mental well-being that enables people to cope with the stresses of life, realise their abilities, learn well and work well, and contribute to their community'. As you move throughout the various stages in life your mental health will be challenged frequently. This can be due to gaining more responsibilities or experiencing new stressors due to your greater sense of independence. Building a strong mental health 'toolkit' will help young people to recognise these challenging moments and feel confident in returning a balance to their lives.

FIGURE 3.4 Relationship breakdowns can be detrimental to your mental and emotional health.

Mental health can be impacted by the other dimensions in the following ways:

- *Physical.* Changes in your brain function can lead to conditions such as Alzheimer's disease and dementia.
- *Social.* Dealing with depression or anxiety may lead to an individual withdrawing themselves from friendship groups, resulting in isolation and loneliness.
- *Spiritual.* Achieving a set goal such as completing a half-marathon may lead to strong feelings of satisfaction.

Spiritual health

Spiritual health relates to feeling a sense of purpose and meaning in our life. Good spiritual health helps us to feel connected with others such as family members, peers, our community, or to a religion, a culture or the environment. Beliefs, values and the ethics we hold are factors that influence our spiritual health. Our level of spiritual health can be influenced by an awareness and understanding of ourselves. It can also relate to our ability to do things such as set realistic goals, appreciate the needs and feelings of others, and have ambitions and aspirations.

FIGURE 3.5 Engaging in cultural practices can improve your spiritual health by giving you a sense of belonging.

The dynamic nature of health is also evident in the spiritual dimension of health — person's sense of purpose and meaning is likely to change as they age, due to a range of factors including life experience and newly gained knowledge.

Spiritual health can also be impacted by the other dimensions in the following ways:
- *Physical.* Setting time aside to look after your wellbeing may allow you to make appointments with health professionals to look after your own health.
- *Social.* Spending long hours at work could result in less time being spent with those you love and care for.
- *Mental and emotional.* Completing an act of goodwill for someone else may result in strong feelings of personal satisfaction.

spiritual health feeling a sense of purpose and meaning in one's life

TABLE 3.1 The interactions between the dimensions of health

Dimension	Dynamic nature of the dimension	Negative interactions between dimensions	Positive interactions between dimensions
Physical	Your physical health may change over time due to short-term factors such as: • an injury such as a sprain, strain or fracture • a female being diagnosed with gestational diabetes during their pregnancy. It could also be affected due to chronic illness or permanent disabilities such as: • being diagnosed with cancer, heart disease or Alzheimer's disease • being paralysed as a result of an accident.	*Social*: A short-term injury or illness may cause you to miss school, work or leisure activities, meaning you may miss out on social events and catching up with friends. *Mental and emotional*: Being diagnosed with a life-threatening illness can affect the thoughts and feelings of an individual as they can begin to question their mortality. *Spiritual*: Individuals may begin to question their purpose or the meaning of life when suffering from a physical health issue.	*Social*: Recovering from a short-term injury or illness and being welcomed back into your social circles will have a positive impact you. *Mental and emotional:* Achieving a state of relatively good health while suffering from a chronic illness can have a large impact on the emotional state of the individual. *Spiritual*: Often people experiencing adversity find a new sense of direction or strong purpose in life such as advocating for improved conditions for people with a disability.

(continued)

TABLE 3.1 The interactions between the dimensions of health *(continued)*

Dimension	Dynamic nature of the dimension	Negative interactions between dimensions	Positive interactions between dimensions
Social	Your social health changes due to life events such as: • forming new friendships • joining a new team or workplace • relationship breakdowns • moving to a new town/city/country • graduating high school or university.	*Physical:* Going through a serious relationship breakdown may cause problems with a person's physical health due to the increased emotional toll. *Mental and emotional:* Graduating high school may lead to a loss of a positive social outlet which can lead to feelings of sadness and loneliness. *Spiritual:* Individuals who move to a new city may lose contact with friendship groups and therefore their connectedness with a part of themselves.	*Physical:* Joining a new sports team and finding a new social circle can have benefits for your cardiorespiratory system. *Mental and emotional:* Graduating from high school may lead to feelings of success and satisfaction in achieving a goal. *Spiritual:* Forming new friendships may allow people to feel like they have a greater connection to those around them and the community of which they are a part.
Mental and emotional	Your mental and emotional health can be impacted by factors such as: • changes in your brain function • participation in physical activity or leisure activities • suffering a loss such as a family member, friend or pet • achieving a goal that you have set • moving from adolescence to adulthood • living with depression or anxiety • volunteering.	*Physical:* Changes in your brain function can lead to diseases such as Alzheimer's disease and dementia. *Social:* Dealing with depression or anxiety may lead to an individual withdrawing themselves from friendship groups, resulting in isolation and loneliness. *Spiritual:* The loss of a loved one could affect how people see the world, which may have an impact on their faith.	*Physical:* Participation in physical activity can lead to improvements in your mental health. *Social:* Volunteering at a charity event may lead to positive social interactions with various community members. *Spiritual:* Achieving a set goal such as completing a half-marathon may lead to strong feelings of satisfaction.

Dimension	Dynamic nature of the dimension	Negative interactions between dimensions	Positive interactions between dimensions
Spiritual	Your spiritual health can be altered due to factors such as: • completing an act of goodwill or service for someone else • setting time aside to look after your own wellbeing • spending long hours at your workplace • finding comfort in a new social group, e.g. religious, cultural or sporting.	*Physical*: Spending long hours at your workplace could lead to you feeling physically drained and exhausted. *Social*: Spending long hours at work could also result in less time being spent with those you love and care for. *Mental and emotional*: Not finding time to look after your own wellbeing by participating in things you enjoy could lead to feelings of sadness or anger.	*Physical*: Setting time aside to look after your wellbeing may allow you to make appointments with health professionals to look after your own health. *Social*: Connecting with cultural groups may result in the formation of new friendships and contacts. *Mental and emotional*: Completing an act of goodwill for someone else may result in strong feelings of personal satisfaction.

3.3.2 The health continuum and the concept of good health

A common way to measure one's health is by a continuum with excellent health at one end and poor health at the other end. On any given day you may rate your own health at various points along the continuum based on how you are feeling within each health dimension.

FIGURE 3.6 A health continuum

Poor   Fair   Good   Very good   Excellent

In order for an individual to record their health on a health continuum, they would first need to define their own concept of 'good health'. This can be highly subjective, as people see health in different ways, have different perceptions about what is optimal or 'normal' and define the extremes of the continuum differently. Further, when assessing their level of health people consider their past and current circumstances, as well as comparing themselves to others. For example, if we compare our physical health to that of an Olympic athlete we may not believe ourselves to be very healthy in comparison.

3.3.3 How health changes over time

From the time we are born we are constantly going through changes that influence our health. In childhood, health is determined by your genetics and is also strongly influenced by how you are raised by your parents. Vaccinations, regular check-ups, providing a balanced and nutritious diet and opportunities for exercise, as well as maintaining hygiene, are just some of the responsibilities parents have when it comes to raising children.

During adolescence, you increasingly gain more independence and may begin to make your own health choices. The beliefs and values that you form about health behaviours in these formative years have the greatest impact on your lifestyle choices later in life.

During adulthood you may gain more responsibilities and trying to balance your own health and wellbeing on top of work, social and family life can be challenging. Taking control of your health through these years

is essential to promote healthy ageing by reducing the likelihood of developing a chronic illness or disease. Additionally, as we age, our definition and meaning of health changes to reflect our changing experiences, expectations and beliefs about what good health looks and feels like. If we consider someone who has turned 80, their opinion on what constitutes good health could be as simple as being able to move independently around their house, and being able to cook and clean for themselves.

FIGURE 3.7 Your health status will change over the course of your lifespan.

3.3.4 How an individual's circumstances affect their health

We should now recognise that an individual's health across their lifetime will be influenced by a range of circumstances and that no two people experience the same health at the same points in time. For example, some children are born with hearing or vision impairments, or develop chronic conditions, such as diabetes, some of which are hereditary.

A number of factors are likely to play a role in determining our personal circumstances, including:
- socioeconomic status
- geographic location
- cultural background
- gender
- age
- level of education
- community values and expectations.

All these factors influence our understanding of what good health involves. This includes the expectations we form about our health potential and the health-related choices we make. Recognising the differences in personal circumstances between individuals and through different stage of life also means that our understanding of health will continue to change over time.

CASE STUDY

Bradley

By Bradley, 18

Depression can strike anyone at any time. Take me for example. I was a typical teenager at high school. I had good grades and got on well with people and I was a prefect. Then, as fate would have it, I lost a dear friend of mine in a car accident. At that moment, my life went into a rapid downward spiral, but I forced myself to carry on. I refused to admit I had a problem or seek help.

…

As the time went by, my relationship with my then girlfriend became shaky, my grades began to fall and day to day life became a burden. Soon enough, I learnt that my then girlfriend had cheated on me with my then best mate. I then knew it was time to turn this thing around. I began to think, my life is nowhere near as bad in comparison to some people. This little epiphany changed my view on my own situation. I made an appointment with the school social worker who referred me to a local GP who diagnosed me with depression. From there on I had a few appointments with the GP and I continued to speak with the school social worker on a twice a week basis. We used cognitive behavioural therapy and I began to conquer my dark passenger. I knew there were people around school who felt similar to me or who were heading down the same dark road, so I decided I needed to address this issue. I arranged with my principal to allow me to make a formal presentation to the whole school. I stood up in front of the whole school and told them my story. It was the hardest thing I ever had to do. But looking back, I realise it was the best thing I could do.

The next day I was told that my speech has inspired one person to seek help. It may have been only one person who received my message, but that is one person I know I have helped. I could lie and say that the journey to recovery was simple, but it wasn't. There were times I fell. But the thing is, you can never just lie down. Depression is [an illness] and you need to fight it with everything. Trust me, the journey may be tough but you will overcome the darkness.

My message is simple; there is always hope. I want people to know that it doesn't matter who you are or where you come from, depression can strike anyone. Nobody is perfect. I hope my story is enough to show that anyone can suffer with depression. I urge anyone who feels even slightly like they may have depression to seek help. Better to have a false alarm than to leave it too late. Remember, you are not alone!

Source: www.youthbeyondblue.com/get-involved-and-help-others/connect-with-others/personal-stories/story/bradley.

Case study questions

1. Describe how the various dimensions of Bradley's health were affected by different circumstances in his life and discuss the possible interactions that occurred between the following dimensions:
   - physical health
   - emotional health
   - social health
   - spiritual health.
2. Identify the events described by Bradley that have:
   a. positively affected his health and wellbeing
   b. negatively affected his health and wellbeing.
3. Draw a health continuum similar to the one shown below.

Poor   Fair   Good   Very good   Excellent

Use the health continuum to rate Bradley's health at the following times in his life. Place each letter (a) to (e) at the relevant place on the continuum.
a. After the loss of his friend in a car accident
b. After finding out his girlfriend cheated on him
c. After being diagnosed with depression
d. After seeing his GP and social worker on a regular basis
e. After delivering the formal presentation to his school

DEPTH STUDY IDEA

Develop a common health continuum as a class group. Complete the health continuum individually as a check-in check-out procedure at the beginning and end of each school day, focusing on the mental and emotional dimensions of health. After a four-week period, create a report to analyse the trends in the data to identify any individual circumstances that may have affected your health positively or negatively. Suggest strategies that will promote positive mental and emotional health.

3.3 ACTIVITIES

1. Dimensions of health

Recall a time in your life when one dimension of your health was poor; for example, when you experienced a relationship breakdown or loss. Consider how other dimensions of your health were also affected during this time. Draw a mind map or a flow chart to illustrate your ideas.

2. Conduct a polarised debate

Conduct a debate to explore the relative nature of health and the different interpretations that people have of the concept of good health. Questions for debate could include the following:
1. Is it possible for a person who requires regular medication to be considered healthy?
2. Can you be healthy without being physically active?
3. Can elderly people achieve the same level of health as young people?

A polarised debate is set up by dividing the class into two sides, one supporting the affirmative and the other side the negative. The debate begins with a comment from the affirmative and proceeds with a comment in turn from each side. If a comment reaffirms their side's position, the student remains on that side. If a student speaks against their side's position, they 'cross the floor' and move to the other side. The debate is concluded when there is no movement from either side or there are no further comments.

Evaluate the arguments presented by members of your class at the conclusion of the debate.

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on Resources

🔗 **Weblink** Mental health continuum

3.3 Exercises

3.3 Quick quiz **on**	3.3 Exercise

Learning pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
2, 3, 9	1, 4, 5, 6, 8	7, 10

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Revise your knowledge

1. Describe how health can be considered 'dynamic'. Use examples.
2. What are the five dimensions of health?
3. Differentiate between mental and emotional health.
4. How can the physical and social dimensions of health interact with each other to determine someone's health status?
5. Discuss how an individual's health might change from childhood to middle age.
6. Explain how personal circumstances may influence an individual's health.

Apply your knowledge

7. Design an infographic poster focused on one dimension of health and justify the importance of this dimension. Include instances of when this dimension of health interrelates with the other four. Display these posters in prominent locations (for example near the canteen, on bathroom walls, near bubblers) to increase the understanding of health for younger students in your school.
8. Create a visual timeline presentation of how an individual's health will change from birth to when they are elderly. Conduct a class discussion based on each individual's timeline.

9. Divide the class into small groups and assign each group a factor that will affect an individual's health. Examples include, but are not limited to: socioeconomic status, geographic location, cultural background, gender, age and level of education. Each group will brainstorm all the ways these factors could have an impact on the health of individuals. Participate in a gallery walk for each group to observe the other groups' responses and to add an additional two of their own.

10. Read the following scenarios and rate each individual's health on a continuum. Justify your answer to the rest of the class with reference to the dimensions of health.

$$\longleftarrow \text{Poor} \qquad \text{Fair} \qquad \text{Good} \qquad \text{Very good} \qquad \text{Excellent} \longrightarrow$$

a. Lionel, 76 years old. Plays croquet weekly, is a great-grandfather of a close-knit family, is a moderate drinker and non-smoker who has not seen a doctor in the past five years.
b. Siobhan, 43 years old. Happily married, averages four drinks per day, does not exercise regularly and is slightly overweight.
c. Mumeet, 30 years old. Smoker, recently made redundant from work and is of average weight.
d. Nella, 25 years old. Works a 70-hour week in an executive position, meditates, exercises daily and is a vegetarian.
e. Billy, 17 years old. Plays sport at weekends, attends dance parties, non-smoker, social drinker and eats takeaway food four times a week.

3.4 Measuring health status

> **Syllabus:** Discuss the use of epidemiology, mortality, infant mortality, morbidity, incidence and prevalence to explain the health status of Australians using tables and graphs from *Australia's Health* and other health reports
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

3.4.1 The role of epidemiology

Epidemiology involves studying how often diseases occur in different groups or populations and why. Through epidemiology we can collect a range of data and information to create an accurate and comprehensive picture of the health status of Australians.

Epidemiology is used by governments and health-related organisations to:
- obtain a picture of the health status of a population
- identify the patterns of health and disease
- analyse how health services and facilities are being used.

Epidemiology considers the patterns of disease in terms of:
- **prevalence** (the number of cases of disease in a population at a specific time)
- **incidence** (the number of new cases of disease occurring in a population)
- **distribution** (the extent)
- apparent causes (determinants and indicators).

Observations and statistics help researchers and health authorities to:
- describe and compare the patterns of health of groups, communities and populations
- identify health needs and allocate healthcare resources accordingly
- evaluate health behaviours and strategies to control and prevent disease
- identify and promote behaviours that can improve the health status of the overall population, such as eating less fat and more fibre.

epidemiology the study of the patterns, causes and effects of health-related states or events (including disease) in a population, through the collection and analysis of data; the goal is to prevent and control health problems by identifying and understanding the causes

prevalence the number or proportion (of e.g. cases or instances) in a population at a given time

incidence the number of new cases (of e.g. an illness or event) occurring during a given period

distribution the extent within a population

Data collected through the epidemiological process focuses on quantifiable and direct measures of ill health (or the lack of good health), such as patterns of illness, injury and death, rather than on the positive qualities of health and wellbeing. Figure 3.8 shows the wide variety of sources used to collect data for epidemiological studies. Epidemiology commonly uses statistics on:

- births
- deaths
- disease incidence
- disease prevalence
- contact with healthcare providers
- hospital use (treatment received in hospitals for medical problems)
- injury incidence
- work days lost
- money spent on healthcare.

Limitations of epidemiology

Epidemiology has proven to be an effective approach to measure health status, but it has some limitations. For example, epidemiological statistics:

- do not always show the significant variations in the health status among population subgroups (for example, between Aboriginal and Torres Strait Islander Peoples and other Australians)
- might not accurately indicate quality of life in terms of people's level of distress, impairment (loss or abnormality of body structure or of a physiological or psychological function), disability or handicap
- tell us little about the degree and impact of illness
- cannot provide the whole health picture; data on some areas, such as mental health, are incomplete or non-existent
- fail to explain *why* health inequities persist
- do not account for health determinants — the broad features of society, environmental factors, socioeconomic characteristics, health behaviours and biomedical factors.

FIGURE 3.8 The epidemiological process revealing Australia's health status

Health status
(groups, communities,
populations, nation)

Collection bodies (examples of)

National Health and Medical Research Council	Australian Bureau of Statistics	Australian Institute of Health and Welfare	Department of Health	Safe Work Australia	The Heart Foundation	National Injury Surveillance Unit
Collection, observation, analysis, reporting, dissemination, comparisons						

Information/statistics

Vital statistics	*Population surveys*	*Surveillance*	*Health outcomes*
• Life expectancy • Disease incidence and prevalence • Hospital utilisation • Cost of healthcare • Morbidity • Mortality	• Baselines • Indicators • Self-reporting • Monitoring	• Database • Monitoring • Reporting	• Changes — declines, increases in rates • Procedures • Interventions

Epidemiology emphasises controlled measurement based on disease and associated risk factors, with limited consideration of other contributing factors to health. Statistics also have limitations due to:

- the varying reliability of data
- the numerous sources of information
- imprecise methods of data collection
- surveys not always using standard instruments (methods or devices for recording, measuring or controlling), definitions and classifications.

For example, the National Health Survey conducted by the Australian Bureau of Statistics collects data through surveying one adult and one child from each sample dwelling to gain a picture of the health status of Australians. This type of data collection gives fairly reliable data on illnesses such as asthma and colds, but unreliable data on illnesses such as **cancer**. To achieve an accurate picture of the health status of Australians, data would also need to be collected from places such as hospitals and nursing homes using strict privacy guidelines.

FIGURE 3.9 Data for epidemiological studies are gathered from many sources, including the information collected by doctors and other health professionals, health surveys by government departments and health-related organisations, and the register of births and deaths.

Broadening the framework of epidemiology

Despite its limitations, epidemiology provides valuable scientific information about disease and associated risk factors. It has been useful in providing a basis for investigating issues such as the impact of social, cultural and economic factors that support health or cause disease.

Recently, health authorities have acknowledged the need to adopt a measurement approach that focuses on the health of populations more than the diseases of individuals. To address inequities in health we must go beyond the disease and its risk factors to the environmental and social frameworks in which individuals live. The epidemiological measurement process must include a social perspective to identify and combat the leading causes of sickness and death in Australia, and to reduce inequities in health. The higher rates of morbidity and mortality in rural and remote populations, for example, are directly related to the social and environmental context of these communities.

To reduce health inequities, factors such as poor access to health services, low socioeconomic status, attitudes to illness and health promotion, limited education about self-care and health practices must be addressed.

3.4.2 Measures of epidemiology

The common indicators of the health of a community include measures of mortality (deaths), infant mortality and morbidity (ill health).

Mortality

Mortality is the number of deaths in a group of people over a specific time period, usually one year. An objective and often easily determined measure of health status, data on mortality can be used to compare health status across population groups and between years.

By observing epidemiological data over time, we can recognise trends that show whether the health of Australians is improving or not. The most current statistics in regard to the health of Australians should be sought from the Australian Institute of Health and Welfare (AIHW) or the Australian Bureau of Statistics (ABS) websites. Use the **ABS** and **AIHW** weblinks in the Resources panel to access these sites.

cancer a group of diseases characterised by abnormal cell growth which has the potential to spread throughout the body

mortality number or rate of deaths in a population during a given time period

FIGURE 3.10 Leading underlying causes of death in Australia, by sex, 2021

Male:

Rank	Cause	Value
1	Coronary heart disease	10 371
2	Dementia including Alzheimer's disease	5664
3	Lung cancer	4968
4	Cerebrovascular disease	4180
5	Chronic obstructive pulmonary disease	3713

Female:

Rank	Cause	Value
1	Dementia including Alzheimer's disease	10 276
2	Coronary heart disease	6960
3	Cerebrovascular disease	5620
4	Lung cancer	3706
5	Chronic obstructive pulmonary disease	3305

Source: AIHW National Mortality Database, Table S3.1.

FIGURE 3.11 Leading underlying causes of death in Australia, by age group, 2019–2021

Age group (years)	1st	2nd	3rd	4th	5th
Under 1	Perinatal and congenital conditions	Other ill-defined causes	Sudden infant death syndrome	Selected metabolic disorders	Accidental threats to breathing
1–14	Land transport accidents	Perinatal and congenital conditions	Brain cancer	Other ill-defined causes	Suicide
15–24	Suicide	Land transport accidents	Accidental poisoning	Other ill-defined causes	Assault
25–44	Suicide	Accidental poisoning	Land transport accidents	Coronary heart disease	Other ill-defined causes
45–64	Coronary heart disease	Lung cancer	Suicide	Colorectal cancer	Liver disease
65–74	Lung cancer	Coronary heart disease	Chronic obstructive pulmonary disease	Colorectal cancer	Cerebrovascular disease
75–84	Coronary heart disease	Dementia incl. Alzheimer's disease	Lung cancer	Cerebrovascular disease	Chronic obstructive pulmonary disease
85–94	Dementia incl. Alzheimer's disease	Coronary heart disease	Cerebrovascular disease	Chronic obstructive pulmonary disease	Diabetes
95+	Dementia incl. Alzheimer's disease	Coronary heart disease	Cerebrovascular disease	Heart failure	Influenza and pneumonia

Rank is shown across the top: 1st, 2nd, 3rd, 4th, 5th.

Source: AIHW National Mortality Database, Table S3.2.

Infant mortality

The **infant mortality** rate is the number of infant deaths in the first year of life per 1000 live births. This measure is considered to be the most important indicator of the health status of a nation, and can also predict adult life expectancy.

Infant mortality can be divided into:
- neonatal (deaths in the first 28 days of life)
- post-neonatal (deaths in the remainder of the first year of life).

The former is influenced by the quality of maternal and neonatal care.

The infant mortality rate in New South Wales and Australia has declined steadily over the past few decades (see figure 3.12). The infant mortality rate in Australia was 2 infant deaths per 1000 live births in 2022.

> **infant mortality** the number of deaths among children aged under 1 year in a given period, per 1000 live births in the same period

FIGURE 3.12 Infant mortality rate, Australia, 1917—2022

Infant mortality rate 1917 to 2022
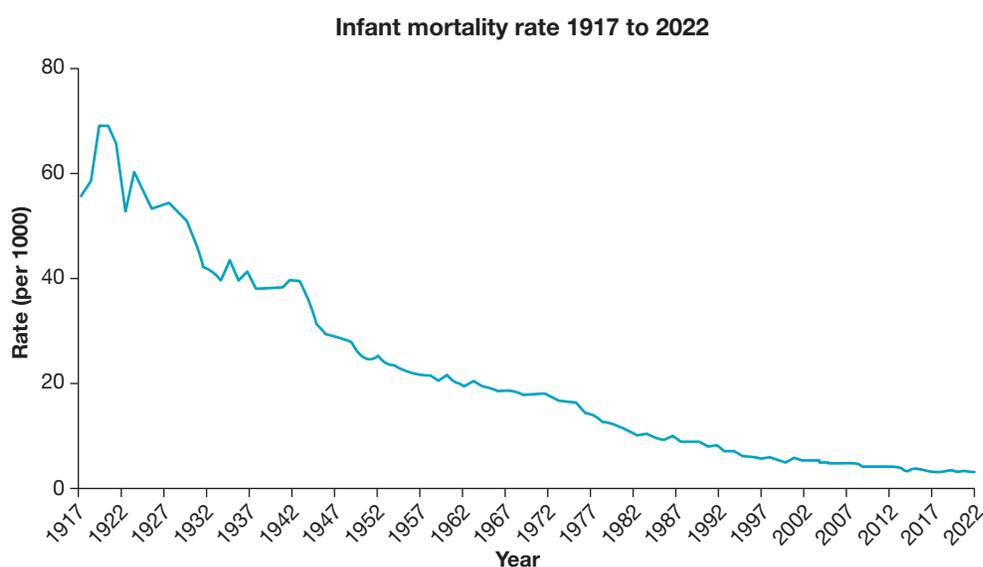
Source: Australian Bureau of Statistics, Deaths, Australia 2022.

Although there have been substantial improvements in the infant mortality rate over time, it still remains higher in the Aboriginal and Torres Strait Islander population. A summary of findings from the Australian child death statistics (2020) showed that infant mortality rates for Aboriginal and Torres Strait Islander infants were 1.5 to 3.9 times higher than those for non-Indigenous infants.

FIGURE 3.13 A health worker checks an infant at a Northern Territory health clinic while his mother looks on.

Morbidity

Morbidity (sickness) refers to the ill health of an individual in a population or group. Illness, disease and injury are all conditions that reduce our quality of life, either temporarily or permanently. Information about the incidence and prevalence of these conditions in the total population gives us a broader perspective on the nation's health than that provided by mortality statistics.

morbidity the ill health of an individual and levels of ill health in a population or group

Medicare Australia's government-funded health scheme that subsidises the cost of medical services for all Australians

Rates of coronary heart disease have steadily declined for both males and females between 1980 and 2020 (see figure 3.14). Coronary heart disease occurs when there is a narrowing or blockage in the blood vessels that supply blood to the heart. The decline in morbidity over time has been linked to reductions in risk factors including tobacco smoking, better treatment and care, and improved secondary prevention. Despite these health gains at a population level, coronary heart disease still remains the leading single cause of disease burden in Australia.

FIGURE 3.14 Incidence of coronary heart disease, by sex, 1980–2020
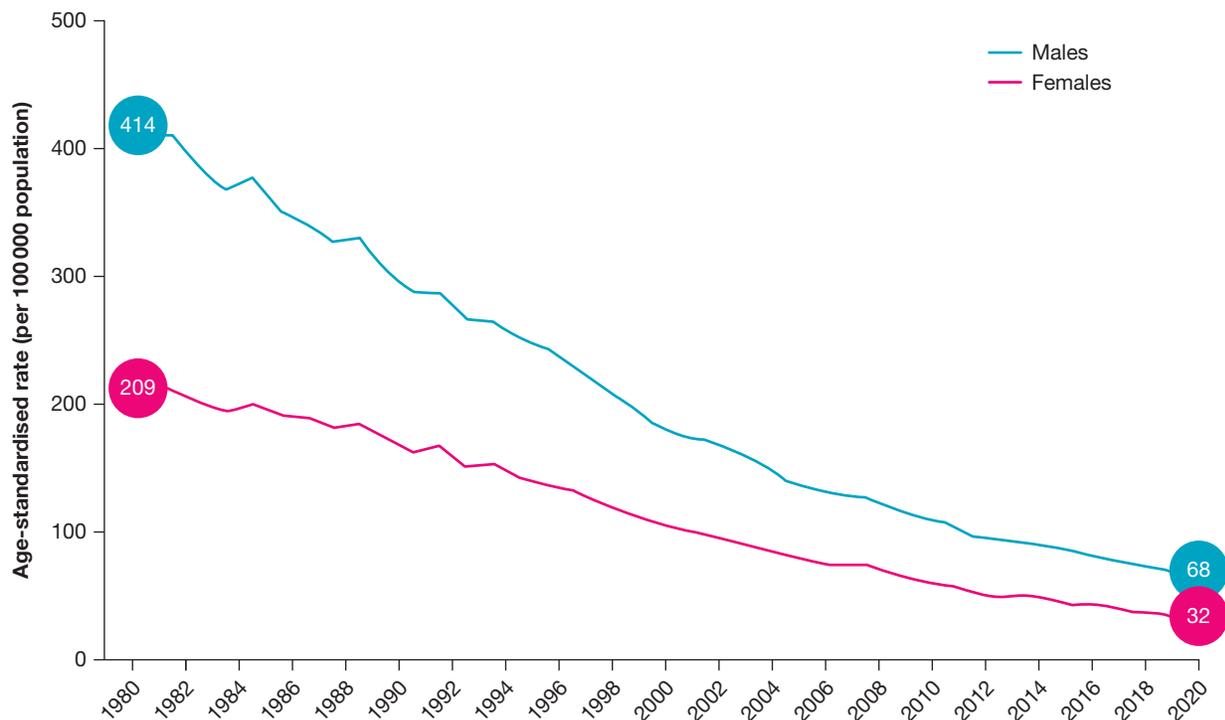
Source: Australian Institute of Health and Welfare.

Morbidity measures and indicators include:
- *hospital use* (the cause and number of admissions to hospital). These statistics provide some measure of the rates of illness (acute rather than chronic) and accidents in the community. The causes of hospital use indicate the major reasons for our ill health as a nation.
- *doctor visits and Medicare statistics*. **Medicare** statistics (services claimed on Medicare) indicate the reasons for and number of doctor visits. They also provide the number of days absent from work as a result of sickness.
- *health surveys and reports*. National health and other surveys can provide a range of key health indicators and bring together an extensive range of health information. Health surveys often depend on self-reporting, so individual perceptions of health and illness affect the information gathered to varying degrees.

FIGURE 3.15 The extent of hospital use is one of the measures of morbidity (illness, disease or injury).
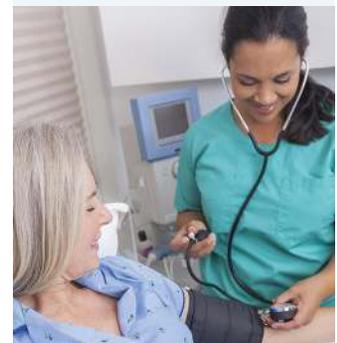
- *disability and handicap*. The incidence of disease or accident can lead to impairment, disability and handicap. A person incurring injury in an accident, for example, could be impaired. The resulting abnormal function or loss of physical or mental capacities could cause disability by disturbing the individual's normal activity or performance. Disability can be in terms of self-care, mobility, verbal communication, schooling and/or employment.

Incidence and prevalence

Incidence and prevalence are two measures used to present morbidity data. Incidence refers to the number of new cases (of an illness or event, for example) occurring during a given period (usually 12 months). Prevalence refers to the number or proportion of cases or instances in a population at a given time. For example, in relation to cancer, prevalence refers to the number of people alive who had been diagnosed with cancer in a prescribed period (usually 1, 5, 10 or 25 years). Both incidence and prevalence data can be shown as the total number or the rate (often expressed per 1000 or per 100 000 population).

Incidence data are useful for identifying which conditions are increasing in diagnosis and which are decreasing. This can assist the government and health organisations in allocating resources and taking action to improve the health status of Australia's youth. Incidence and prevalence (see figure 3.16) provide two ways to look at how many people experience particular conditions. New cases add to the overall prevalence of a condition, while those who are cured or die from it reduce the number.

FIGURE 3.16 Morbidity includes both incidence and prevalence rates.

Incidence

Prevalence

Cure / Death
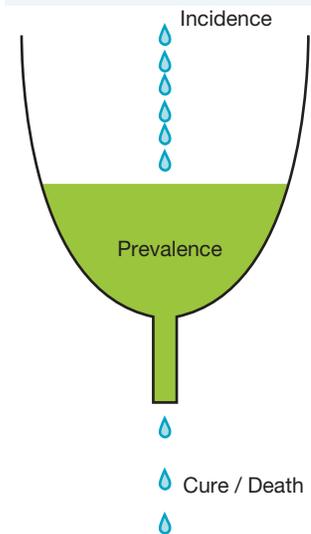
3.4 ACTIVITIES

1. Epidemiology

Read the statements below and identify if each is something that epidemiological data can or cannot determine.
- The incidence of lung cancer cases related to smoking within a population
- The number of people not reporting a COVID-19 infection
- How each individual will respond to a particular treatment or medical intervention
- The number of patients in a hospital and the length of their stay
- The estimated monetary costs of a health issue such as coronary heart disease
- The emotional cost to a person's wellbeing as the result of a chronic health issue
- The coverage rates of vaccinations within a population
- The specific barriers individuals face in accessing healthcare services

2. Class discussion

Refer to figures 3.10 and 3.11 as stimuli to conduct a class discussion. Develop a range of open-ended questions that encourage the sharing of thoughts and opinions. Examples might include:
- Why is suicide more prevalent in younger populations?
- Why are dementia and Alzheimer's disease more prevalent in females?

During a discussion it is important to respond to each other, ask follow-up questions, and share your own perspectives.

DEPTH STUDY IDEA

In groups, select a leading cause of mortality and morbidity. Using a secondary-sourced investigation approach, research the nature of the disease, trends, the incidence and prevalence, possibilities for early intervention and treatment options. Present the information in a visual or multimodal presentation.

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on Resources

🔗 **Weblinks** ABS
AIHW

3.4 Exercises

3.4 Quick quiz on	**3.4 Exercise**

Learning pathway

■ **LEVEL 1**	■ **LEVEL 2**	■ **LEVEL 3**
1, 2, 4, 7	3, 6	5, 8

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Revise your knowledge

1. Discuss the benefits and limitations of the use of epidemiology.
2. Identify the four measures of epidemiology.
3. Distinguish between the terms 'incidence' and 'prevalence'.
4. View figure 3.10 and compare the leading causes of death for males and females in 2021.

Apply your knowledge

5. Examine figure 3.12 and, using research, propose reasons for the declining trend in infant mortality during the time shown.
6. Explain how asthma can have a higher prevalence in males aged 10–14, but anxiety and depression have a higher incidence.
7. In small groups, use the **ABS** and **AIHW** weblinks in the Resources panel to find the current incidence and prevalence rates for the following types of cancer:
   a. breast cancer
   b. lung cancer
   c. prostate cancer
   d. bowel cancer.
8. Compare the prevalence of diabetes and depression in Aboriginal and Torres Strait Islander Peoples and in the total Australian population. Use the **ABS** and **AIHW** weblinks in the Resources panel to help you research current epidemiological data and statistics.

3.5 Social justice principles

3.5.1 Social justice principles

The adoption of **social justice principles** is fundamental to improving the health status of individuals and the community. These principles seek to ensure that individuals and communities who are identified as being the most disadvantaged (and therefore most likely to experience poor health) are provided with sufficient resources and support to empower them to improve their health. On occasions this can see significantly more resources being allocated to particular groups compared to the general population, in an effort to narrow the gap that exists and improve the health of the whole population. The principles of social justice include the ability to participate in decision-making, the promotion of equity, providing appropriate access to healthcare facilities and services, and ensuring an adherence to the rights of both individuals and communities to lead healthy lives.

social justice principles
principles that aim to reduce or eliminate inequality, foster inclusivity and diversity, and create supportive environments for all individuals

FIGURE 3.17 Social justice principles

Participation

Equity

Access

Rights

Participation

The principle of participation enables individuals to participate in decisions which affect their lives. By allowing individuals and community members to be involved in the decision-making process, it achieves better outcomes and provides opportunities for power imbalances to be overcome. If individuals are educated and equipped with the skills and health literacy to make informed decisions, they may be able to improve their own health status. For instance, someone who identifies that they lead a sedentary lifestyle and are approaching 50 years of age may visit their GP to seek advice to reduce the likelihood of developing a form of cardiovascular disease. The formation of the National Aboriginal Community Controlled Health Organisation (NACCHO) aimed to increase the participation of Aboriginal and Torres Strait Islander Peoples in decisions regarding their own health. This was in response to experiences of racism in mainstream health services and an unmet need for culturally safe healthcare. By addressing these health inequities, local Aboriginal Community Controlled Health Organisations have improved participation in health education. This has led to equal, if not better, outcomes in the management of chronic disease compared to general practices.

Equity

Equity means taking action to achieve fairness. In health, this is done by allocating resources and entitlements, including power, fairly across the population. The needs of individuals and communities have to be carefully considered to ensure all citizens have access to the same opportunities for achieving optimal health. People experiencing extreme disadvantage, such as those suffering poor health, living in poverty or in very remote locations, need to be allocated more resources if their health outcomes are to change. For example, each year the Commonwealth Government and universities provide equity scholarships to students from low socioeconomic backgrounds to provide assistance with their higher education needs.

FIGURE 3.18 The principles of social justice include the need to make health services equal for all population groups.

Access

Ensuring all people can access treatments and services regardless of their age, gender or ethnicity allows for improved health outcomes. Throughout Australia, access to health facilities and services can be limited due to geographic location, cultural background or education level. For example, access to healthcare can be improved for Aboriginal and Torres Strait Islander Peoples through:

equity the fair distribution of resources based on the needs of individuals and populations, with the aim of achieving equitable outcomes

- *equitable distribution of healthcare resources* — distributing resources, facilities and services in a way that addresses the unique needs of Aboriginal and Torres Strait Islander communities can include ensuring that healthcare services, including Aboriginal Community Controlled Health Services (ACCHS), are located in or near these communities to reduce geographical barriers
- *culturally appropriate care* — Aboriginal and Torres Strait Islander Peoples have distinct cultural practices and healthcare beliefs. Ensuring that healthcare services and practitioners are culturally sensitive and respectful can improve the likelihood that individuals will seek and engage with healthcare.

Additional strategies that can be implemented in order to improve access include:
- mobile health services such as the BreastScreen van and the Hear Our Heart Ear Bus Project.
- health information delivered in various languages at medical centres
- cultural or linguistically diverse health professionals in public hospitals
- the Royal Flying Doctor Service (RFDS), which helps people in rural and remote locations.

Rights

In order to maintain a just society, everyone's rights must be protected. These may include civil, political, economic, cultural and social rights. The rights of individuals and groups can be upheld through:
- legislation and policy reforms such as anti-discrimination laws
- public awareness and education through school curricula to foster respect and understanding
- supporting and advocating for marginalised groups including Aboriginal and Torres Strait Islander Peoples, LGBTQIA+ people and refugee populations.

An example of the social justice principle of rights in action can be seen in the population group of people with disabilities. People with disabilities are more likely to live in poverty, have poorer health and have lower levels of education than other Australians. The Disability Discrimination Act (1992) protects Australians from unfair treatment by making sure they have reasonable accommodations made within schools and workplaces to provide them with equal access and opportunities. The Australian Human Rights Commission is able to assist those affected to resolve complaints of unfair treatment.

For effective progress to be made in achieving equitable health outcomes across population subgroups in Australia, it is important that all of these social justice principles are applied in an interconnected way. This will produce the greatest benefit, as opposed to an ad-hoc approach which treats each principle in isolation.

Identifying ear problems crucial

By John Ryan June 14, 2018

Wade Miller, 17, is a leader at Dubbo College's South Campus and has a bright future ahead of him, but without intervention from the Hear our Heart project, life could have been far different for him.

Suffering ongoing ear infections from his earliest days, Wade endured years of physical pain and suffering as well as falling further and further behind at school, unable to hear well enough to understand his teachers…

'I had a lot of trouble in class, I struggled to hear other people talking.

'It was pretty hard because when in class there's so much noise, and it's very hard to learn when you can't hear the teacher and they're explaining things — the background noise made it hard,' Wade explained.

He also suffered teasing and bullying because he couldn't understand much of what was happening. Then, during Year 4, after all those years of school, he came to the notice of Donna Rees and Rachel Mills and their Hear our Heart initiative.

This saw Wade diagnosed after years of ongoing issues, so he's had to play catch-up for years and still struggles after such a poor start — but he's over the moon he now understands the root of his health and learning problems.

Donna Rees, who with fellow Hearing Support teacher Rachel Mills founded the project, says things could have been far worse for Wade if he hadn't been properly diagnosed…

'Up to five kids a year in Australia still die from ear-related infections; the infection gets so chronic that it can actually get into the mastoid area and cause tumours. Wade was one of those kids that was very, very ill, but if these things are picked up they can be prevented.

'Wade's mum and dad were devastated because they'd already been to the doctor so many times since he was a little baby, an infant, and were often told it's alright, he'll grow out of it, just wash his ears and use these drops, he'll be fine, so as parents they thought they were doing the right thing,' she said.

Mrs Rees says Dr Ridha, a local Ear, Nose and Throat specialist, has been a huge support for the kids they've identified as needing intervention.

'Wade's a community-raised child, so to speak — as well as his parents there's a five-way partnership between the Hear our Heart bus project, the education department/private schools, the Hearing Support teachers, Australian Hearing and the ENT specialist,' Mrs Rees explained…

He's also embraced the fact that being able to hear, he's been able to properly connect to and appreciate his Aboriginal heritage — being an oral language, when he couldn't hear, it was like being blind and trying to read.

'If Rachel and Donna weren't here, I don't know where I'd be now,' Wade said.

Source: https://www.dubbophotonews.com.au/news/general-news/top-stories/item/5028-identifying-ear-problems-crucial.

Case study questions

1. Outline the negative impact that Wade's hearing ability had on him when he was younger.
2. Describe the positive benefits that arose after Wade was visited by the Hear Our Heart Project.
3. Justify which social justice principles are targeted by the Hear Our Heart Project.
4. Using the **Hear Our Heart** weblinks in the Resources panel, determine the impact this initiative has had on the health of individuals and communities in Central West NSW.

DEPTH STUDY IDEA

Using a secondary-sources investigation approach, research the health inequities experienced by Aboriginal and Torres Strait Islander Peoples. Create a multimodal presentation which includes possible strategies to overcome these inequities.

on Resources

🔗 **Weblinks** Hear Our Heart
Hear Our Heart video
NACCHO
TOOTH program
NDIS

3.5 Exercises

3.5 Quick quiz **on**	**3.5 Exercise**

Learning pathway

■ **LEVEL 1**	■ **LEVEL 2**	■ **LEVEL 3**
1, 2, 3	5, 6	4, 7

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Revise your knowledge

1. What does the acronym PEAR stand for in terms of the social justice principles?
2. Define each social justice principle.
3. Read the following scenarios and identify the most relevant social justice principles.
   a. A mobile dental van travels to rural and isolated locations to provide check-ups and follow-up appointments for school students.
   b. Greater resources are provided to address the gaps in health between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians.
   c. Students with disability must have the same opportunity as those without disability to attend their local school.
   d. Individuals and groups are given the opportunity to voice their opinions on the health needs of their own community.

Apply your knowledge

4. The Outback Oral Treatment and Health (TOOTH) program, developed by the Royal Flying Doctor Service, provides fly-in fly-out mobile dental services to remote and rural Australians who cannot access regular dental care. Only 45 per cent of adults in remote areas visit a dentist every year, compare to 63 per cent in cities. Funding is provided by state governments, donor funds or private investments. It removes a barrier to dental care by coming to remote communities rather than people having to miss school or work. For example, instead of a 5-hour trip to Dubbo and an overnight stay just to see a dentist, children in Bourke can have the dentist come to them, so they do not have to miss school or their parents miss work. Use the **TOOTH program** weblink in the Resources panel to learn more about this program.
   a. Justify which principles of social justice apply to this initiative.
   b. Using further research, evaluate the impact this program has had on the individuals and community of Bourke.

5. Using Google Maps, search for a range of health facilities (for example, GP, hospital, physiotherapist, dentist) in the locations listed below. Take screenshots to create a visual display to show the comparison.
   - Newcastle
   - Batemans Bay
   - Boorowa
   - Cobar
   - Tamworth

   Using the information you have gathered, explain the differences between locations in terms of the social justice principles of access and equity and the potential impact this may have on the citizens living there.

6. The National Disability Insurance Scheme (NDIS) is a national scheme for people with disability. It provides funding directly to individuals who can choose what support they need. Use the **NDIS** weblink in the Resources panel to help you evaluate how this aims to implement the principles of social justice.

3.6 The determinants of health

> **Syllabus:** Discuss the range of determinants (broad features of society, environmental factors, socioeconomic characteristics, health behaviours and biomedical factors) that influence the health and wellbeing of Australians
>
> **Including:**
> - how do the determinants interact to affect the health of population groups?
> - what are the sociological causes of risky health behaviours?
> - where do inequities exist and what can we do about them?
>
> *Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).*

FIGURE 3.19 The **determinants of health** are divided into groups with the main direction of influence from left to right.

Broad features of society	Socioeconomic factors	Health behaviours	Biomedical factors	
Culture Affluence Social cohesion Social inclusion Political structures Media and language **Environmental factors** Geographic location Quality of air and water Safe workplaces Community safety Access to physical resources within a community	Socioeconomic status Educational attainment Employment status Cultural background Disability Social networks Social expectations and attitudes Cultural traditions Media	Individual beliefs and actions (such as tobacco use, alcohol consumption, physical activity, dietary behaviour, drug use, sexual practices)	Genetics Blood pressure Blood glucose levels Cholesterol levels Physical impairment	**Health and wellbeing over time**

Individual physical and psychological make-up

Source: Adapted from Australia's health 2018 (fig.1.1.1, p.6) and Australia's health 2022, Australia's health series no.16 & no.18. AUS 221 & AUS 241. Australian Institute of Health and Welfare, Canberra.

determinants of health the range of factors, as identified by the AIHW, that determine the health status of individuals and populations

3.6.1 Broad features of society

The **broad features of society** include culture, affluence, social cohesion, social inclusion, political structures, media and language. It is becoming better understood that these broader determinants of health, which are the conditions individuals are born into and then grow and live within, shape future health possibilities.

> **broad features of society**
> determinants of health that include culture, affluence, social cohesion, social inclusion, political structures, the media and language

Culture

Cultural beliefs and practices can influence health behaviours. For example, dietary choices, traditional remedies and attitudes toward seeking medical care may vary based on cultural background. In Spanish, Italian and Greek cultures, people consume what is known as a Mediterranean diet. This includes the consumption of fruits, vegetables, whole grains, seafood, nuts, legumes and olive oil. This cultural dietary choice has been linked to lower rates of cardiovascular disease. In contrast, high levels of saturated fats, refined sugars, and processed foods have become part of modern Australia's cultural diet, and are associated with an increased risk of cardiovascular disease.

FIGURE 3.20 The Mediterranean diet is linked with lower rates of cardiovascular disease.

When it comes to seeking medical care, it is important that healthcare is culturally competent and safe. Understanding and respecting diverse cultural perspectives can lead to better healthcare outcomes. A strong connection to culture is a protective factor for Aboriginal and Torres Strait Islander Peoples' health. Engaging with First Nations communities and involving them in the design and implementation of health programs and initiatives leads to better healthcare outcomes. This approach respects the community's cultural perspectives and empowers them to take ownership of their health.

For example, a healthcare initiative aimed at addressing a specific health issue, like diabetes prevention, may collaborate with local Aboriginal or Torres Strait Islander Elders and community members to develop culturally relevant educational materials and workshops. By involving the community and respecting their cultural insights, the initiative is more likely to be successful and have a lasting impact on health outcomes.

Affluence

Higher affluence, meaning to have access to relatively more money and wealth than other people, is often linked to better health due to improved access to healthcare, education and overall living conditions. It can result in lower rates of chronic diseases such as cardiovascular disease. For instance, higher-income individuals may have access to private healthcare services, which often leads to shorter wait times for surgeries and more personalised care.

FIGURE 3.21 Income equality can result in poorer health outcomes for socioeconomically disadvantaged groups.

Income inequality is on the rise in Australia and it can also lead to greater health disparities. Those with lower incomes may face barriers to accessing quality healthcare and experience more health-related stressors from insecurities associated with finance, housing, food and work. An example is the association between income inequality and higher rates of mental health issues in socioeconomically disadvantaged communities.

Social cohesion

Strong social cohesion contributes to mental health and overall wellbeing. Supportive communities can mitigate the negative impact of stressors on health. For instance, close-knit communities that organise support groups, such as mothers' groups, can provide a crucial lifeline for individuals dealing with the challenges of daily life.

Social cohesion also fosters resilience during crises, such as natural disasters or health emergencies, through collective support and response. Communities coming together to support recovery efforts after a natural disaster is a prime example of how social cohesion can enhance resilience and promote wellbeing for individuals and communities.

FIGURE 3.22 Mothers' groups enhance social cohesion by allowing each person to share their personal experience and receive or offer support in a safe environment.

Social inclusion

Inclusive policies and practices promote equitable access to resources, opportunities and healthcare services. Socially inclusive societies reduce discrimination and health disparities. For example, policies and scholarships have been implemented in Australia to increase the number of Aboriginal and Torres Strait Islander people in educational institutions (schools, TAFE and universities) and the workforce to ensure they have equal opportunities in education and employment. These initiatives aim to reduce the gap in educational attainment and employment between Aboriginal and Torres Strait Islander Peoples and other Australians.

Socially included individuals have a stronger sense of belonging, which positively influences mental health and overall life satisfaction. For example, inclusive school environments that embrace diversity create a sense of belonging among students with various cultural backgrounds and physical or intellectual abilities. As a result, these individuals have an increased opportunity to enhance their social, mental and spiritual health.

Political structures

Political structures influence healthcare accessibility, affordability and quality. Universal healthcare programs, public health initiatives and health regulations impact the population's health. An example of this is Australia's Medicare system, which provides universal healthcare coverage for all citizens. This includes free treatment within public hospitals, covering the cost of doctor's fees, accommodation and other expenses so that individuals do not have to face significant financial burdens as a result of requiring medical treatment.

FIGURE 3.23 Medicare aims to increase equity in the healthcare system within Australia.

Government policies on education, housing and employment can either mitigate or worsen health inequalities based on socioeconomic status. For instance, policies that invest in education and job training programs, such as the NSW Fee Free initiative, can lead to improved employment opportunities and better health for disadvantaged populations. In contrast, disparities in education funding can lead to outdated resources and facilities and decreased opportunities for extracurricular involvement for students in low socioeconomic communities.

Media

The media has the capacity to shape public perception of health issues. Accurate, evidence-based reporting improves health literacy, while sensationalism or misinformation can lead to misconceptions or unnecessary anxiety. An example is the role of the media in communicating information about vaccine safety and efficacy, which can influence vaccination rates and public health outcomes. Media campaigns and public health messages communicated through media channels can change behaviours and attitudes related to health, such as vaccination uptake. For instance, public health campaigns using a wide variety of media platforms played a significant role in raising awareness about the importance of protective health behaviours during the COVID-19 pandemic.

FIGURE 3.24 The media plays a significant role in communicating reliable health information, including the health benefits of a national vaccination program.

Language

Language barriers can hinder access to healthcare. Ensuring that healthcare services are available in multiple languages is essential for diverse communities. For example, providing healthcare information and services in a variety of languages can improve healthcare access for people of different cultural backgrounds in Australia.

Promoting health literacy in various languages also enhances understanding of health information, treatment options and preventative measures, leading to better health decision-making. An example is the availability of multilingual health education materials in hospitals and clinics, enabling patients to make informed choices about their healthcare.

What are the sociological causes of risky health behaviours?

Individuals in Australia that share white-European cultural backgrounds are more likely to experience social cohesion and inclusion and see themselves reflected in the broad media landscape. Those individuals that belong to other ethnic and cultural groups, which do not reflect the dominant culture of Australian society, are more likely to experience ill health through social isolation, harassment and racism. If an individual from an Aboriginal or Torres Strait Islander or non-European migrant background is unable to see themselves reflected in their society, whether that is in prominent media roles or through representation in politics, it may reduce their ability to see a place for themselves in society. This can negatively affect their social, emotional and spiritual health and may lead to adverse health outcomes through the adoption of risky health behaviours. Through no fault of the individual, the broad features of society can have a significant impact on their health status. Some groups will experience worse outcomes than others; however, there are strategies and interventions that can help overcome these barriers and which aim to promote positive health and wellbeing among all Australians.

Where do inequities exist and what can we do about them?

Equality aims to ensure that all different groups receive the same treatment, whereas equity allows for resources to be allocated based on the needs of individuals and populations to achieve equality of outcomes. Where inequities exist, certain groups may need to receive additional support in order to reach the same point as other members of society (see figure 3.25).

FIGURE 3.25 Equity means that resources are allocated in accordance with the needs of individuals or groups to achieve equality of outcomes.

Equality   **Equity**
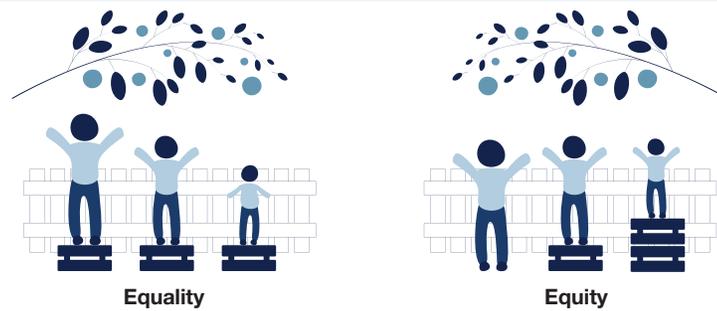
When it comes to the broad features of society, the following groups experience inequities.

Aboriginal and Torres Strait Islander Peoples

Many Aboriginal and Torres Strait Islander Peoples and their communities are strong and rich in their culture. However, the effects of colonisation and disruption to culture, the Stolen Generations, systematic discrimination and racism, and intergenerational trauma have been linked to poorer health outcomes, particularly mental health disorders (for example, anxiety) and risky health behaviours. Cultural factors can lead to avoidance of healthcare. These include language barriers, lack of trust in the health provider and experiences of discrimination. Avoiding healthcare can increase the duration and severity of ill health and disease.

Work is being done across the health sector to help Aboriginal and Torres Strait Islanders Peoples improve their health outcomes. Targeted campaigns and programs to improve specific health issues include The Aboriginal and Torres Strait Islander Lived Experience Centre, aimed at mental health, and the Back on Track campaign by Diabetes Australia and the National Diabetes Services Scheme.

Some examples of progress that has been made include:
- in the five years to 2021, 62 per cent of First Nations Australians had at least one culturally specific health check
- Aboriginal and/or Torres Strait Islander primary healthcare organisations provided 4 million 'episodes of care' in 2021–22
- of First Nations Australian youth aged 15 to 17, 85 per cent have never smoked
- from 2003 to 2018, there was a 16 per cent decrease in the gap between Aboriginal and Torres Strait Islanders Peoples' burden of disease compared to that of other Australians.

In 2013, the NSW Department of Education implemented community-driven Aboriginal language and culture 'nests' to bind nearby schools together through traditional languages. Programs have been initiated on Wiradjuri, Gumbaynggirr, Bundjalung, Gamilaraay/Yuwaalaraay/Yuwaalayaay and Paakantji land that enable Aboriginal and non-Aboriginal students to gain a greater understanding and appreciation of the history, cultural identity and pride in one of the world's oldest living cultures. When these programs have been implemented, performances of Aboriginal and Torres Strait Islander students have been found to be comparatively better than those in other schools.

Migrants and refugees

Non-European migrants and refugees may experience high rates of racism due to a lack of acceptance of their culture or language. The strict eligibility criteria to enter this country and the need for enough financial resources to afford the cost of moving to another country in the first place mean migrants who can afford the costs of relocation may have higher levels of affluence, creating disparities with those who cannot. In comparison, refugees who are seeking asylum may have used all of their savings and lost many or all of their possessions in order to arrive in Australia, and are already starting their lives over from a very difficult position. Time spent in detention centres awaiting approval for asylum can also increase their own trauma, which can result in higher cases of mental health related problems and illnesses.

3.6.2 Environmental factors

Environmental factors consider the built and natural environments that have an impact on health; for example, geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community. Approximately 71 per cent of the Australian population live in major cities and only 1 in 10 live in small towns with populations of fewer than 10 000 people. However, the number of people living in small towns and major cities has been growing — with different population groups. In small towns, there is a greater proportion of people aged 50 and over, perhaps due to the decreased cost of living in small towns compared to major cities. In contrast, major cities may offer greater educational and employment opportunities for those under the age of 50.

> **environmental factors**
> determinants of health that include geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community

Geographic location

Studies into Australia's health have found that people who live in rural and remote parts of Australia have poorer health outcomes than people living in major cities. They have:

- lower life expectancy
- higher rates of illness and injury
- higher levels of health risk factors such as smoking, being physically inactive, drinking excessive amounts of alcohol and being overweight or obese.

Differences in the health status of people living in rural areas compared with those living in urban and regional areas are complex and likely to be closely linked to other determinants of health, including socioeconomic factors and sociocultural factors. However, a number of factors specific to rural and remote environments play significant roles in determining the health of people living in these areas.

Quality of air and water

Living in cities and large built-up areas can affect a person's level of health. High levels of air pollution are far more likely in major cities where there are more motor vehicles and industrial complexes. Poor air quality resulting from the production and release of emissions from vehicles and heavy industry increases the risk of respiratory infections, asthma, bronchitis and cardiovascular conditions. Smoke from bushfires and the burning of fossil fuels also decreases air quality. People living in particular areas may face greater risks; for example, those living near major roads or industrial areas are likely to experience higher levels of air pollution, as well as more noise pollution and higher levels of traffic congestion.

FIGURE 3.26 Air pollution affects the health of people living in major cities.

People who live in cities and regional areas in most states and territories in Australia are more likely to be supplied with fluoridated tap water. The Australian Institute of Health and Welfare estimates that 80 per cent of localities in major cities have water supplies with adequate fluoridation, compared with 30–40 per cent of locations in regional areas. This percentage declines further in more remote locations. Studies have highlighted significant differences in the oral health of children living in major cities compared to those in regional and remote areas, with the number experiencing tooth decay, missing teeth and filled teeth being substantially higher in regional and remote areas.

Safe workplaces

People living in rural and remote areas often have to travel long distances for work, household-related purposes and socialising. This can place them at greater risk of injury due to the dangers involved in travelling on country roads, which include long distances, poor road quality and factors such as speed, fatigue from driving long distances and animals on the road.

They are more likely to face harsh living and working conditions and experience severe climatic conditions such as extreme heat, drought and floods that have the potential to negatively affect both physical and emotional health. Injury, disease, emotional distress and financial hardship are some of the health risks that can result from experiencing these weather conditions. The remoteness of communities and the distances between people may make it harder to create or maintain social support networks. The sense of isolation and difficulties finding emotional support when geographically isolated may contribute to poor mental health and depression.

FIGURE 3.27 Driving in rural and remote areas involves dangers.

Community safety

Safe communities, where people feel protected from harm within their home, workplace and community, are important for physical and mental wellbeing. Feeling safe is an indicator of how an individual perceives their community; those who feel safe are able to live a better quality and healthier life and are more likely to engage in the community, and the community as a whole face a lower incidence of, and costs from, injuries and violence.

While the majority of Aboriginal and Torres Strait Islander Peoples feel safe in their communities and do not experience negative outcomes, as a population group they tend to experience greater rates of hospitalisation and death as a result of violence than the non-Aboriginal population.

- In 2020–21, Aboriginal and Torres Strait Islander Peoples were 15 times more likely to be hospitalised for assault compared to other Australians.
- In 2020–21, Aboriginal and Torres Strait Islander females were 27 times more likely to be hospitalised for assault compared to non-Aboriginal females.
- Over the period 2010–11 to 2020–21, there was a 37 per cent increase in the rate of family violence-related assaults for Aboriginal and Torres Strait Islander Peoples.

Access to physical resources within a community

The physical resources offered within major cities and regional areas may also determine a person's health. Physical resources refers to buildings and spaces that are constructed within communities. These include houses, shopping centres, public buildings, roads, railways, footpaths and recreational areas such as parks.

FIGURE 3.28 Having parks and walking paths near where people live can improve health.

Communities can promote health through careful planning and good design to ensure environments contain appropriate housing, transport infrastructure and facilities that encourage recreation and social interaction. The construction of cycleways and footpaths, along with the provision of adequate lighting, playgrounds, parks and other recreational facilities, encourages physical and community activity. Adequate public transport also supports access to essential services, such as healthcare, while reducing the number of private vehicles on the road, thereby decreasing pollution levels, crashes and traffic congestion.

FIGURE 3.29 The majority of Australians live on the east coast and in major cities.

Remoteness areas

Very remote
Remote
Outer regional
Inner regional
Major cities
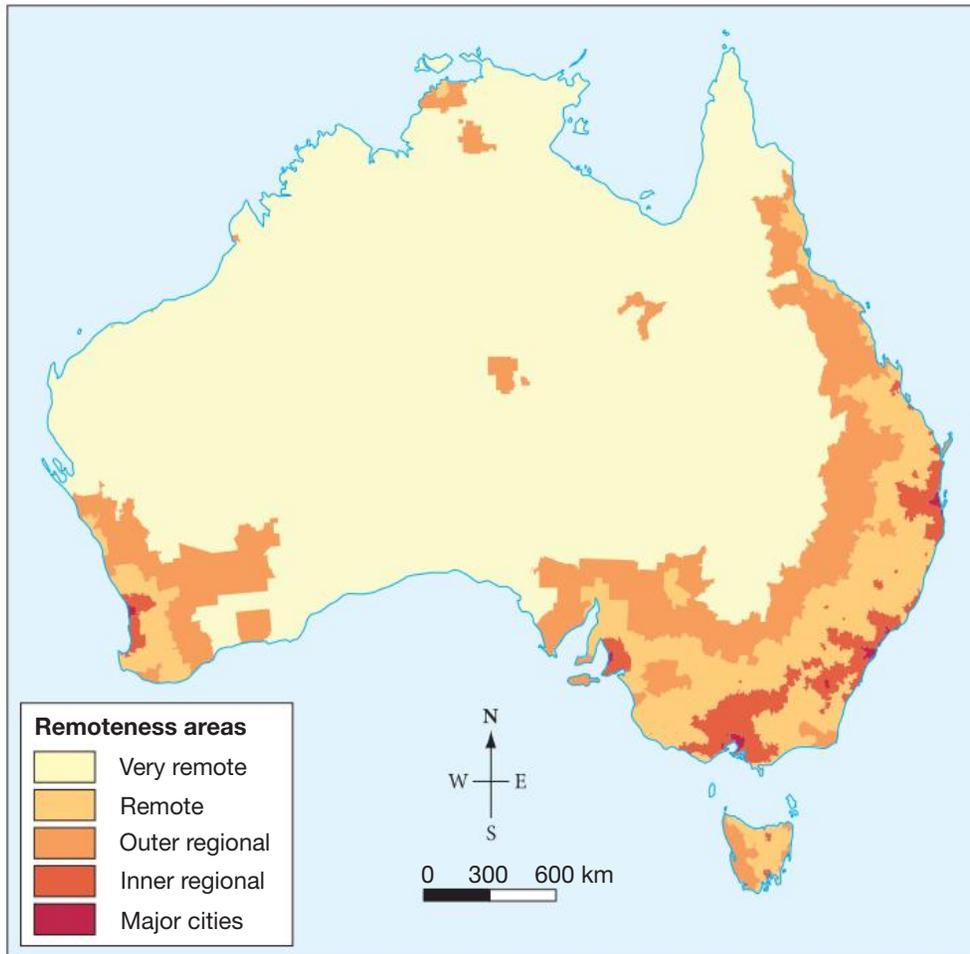
Source: Australian Bureau of Statistics (2016).

What are the sociological causes of risky health behaviours?

The built and natural environments in which we live have an immense impact on our current and future health status. In urban areas with larger populations, such as Sydney and Newcastle, where there are significantly higher levels of motor vehicle–based transport, there is a decrease in air quality which can in some cases lead to respiratory disease. Another factor that can result from heavily built-up environments is access to physical resources. In large cities, residents may have reduced opportunity for exercise due to less green space, greater fast-food availability and a lack of social connection arising from the sheer size of the suburb or city. However, there are also advantages to living in major cities, such as a greater selection of health professionals to suit your individual needs and improved access to life-saving medical technologies.

FIGURE 3.30 People living in larger cities may experience a lack of social connection due to mobility issues and declining community participation.

When we compare these urban environments to regional centres (for example, Coffs Harbour or Tamworth) or rural areas, such as Peak Hill or West Wyalong, we can observe reduced transport-based pollution, reduced light pollution and more accessible green spaces due to the relative openness of the environment in the regional and rural areas. This can have a positive impact on the physical and social dimensions of health by encouraging individuals to be active outdoors.

In remote NSW towns such as Bourke, Walgett and Menindee, although the opportunity for improved social connection can be high due to the familiarity of people and a strong sense of community, there can be downsides that are less likely to be experienced in larger centres or urban areas. Once such issue is that of water accessibility and availability in severe drought. A lack of rain can result in green spaces turning brown or to dust, which can significantly affect the mental and emotional health of people in those areas as once-beautiful community spaces deteriorate. Furthermore, the reduced rainfall can lead to an inability to produce valuable crops in farming communities, which could result in less business being generated in the town due

FIGURE 3.31 Small regional towns can offer improved social connection through a strong sense of community.

to a reduction in disposable income. This can lead to people relocating and businesses closing down, reducing the numbers in school communities and sporting teams and resulting in the loss of social outlets for those remaining. In worst-case scenarios, when rivers and dams run dry people's physical health may be affected by a lack of quality drinking water for the community to consume, or water supply to the town may stop completely.

Where do inequities exist and what can we do about them?

When we compare mortality rates to levels of remoteness, there are many noticeable similarities and differences (see figure 3.33):

- very remote populations are 4 times more likely to die from diabetes and land transport accidents and 2–3 times more likely to die from suicide and chronic obstructive pulmonary disease than those living in major cities
- remote populations have similar mortality rates due to dementia and Alzheimer's disease and cerebrovascular disease compared to those in major cities
- suicide mortality rates increase with level of remoteness
- deaths from influenza and pneumonia are more common in major cities.

FIGURE 3.32 Family and domestic violence is a major national health and welfare issue in Australia

According to current research into **family and domestic violence**, and sexual violence, people living outside major cities were 1.4 times more likely to have experienced partner violence than those living in major cities. Additionally, people living in remote and very remote areas were 24 times more likely to be hospitalised for domestic violence as those in major cities.

family and domestic violence violent or aggressive behaviour towards family members that may occur within the home

FIGURE 3.33 Leading cause of death by geographic location, with comparison mortality rates with Australia overall, 2017–21

	Major cities	Inner regional	Outer regional	Remote	Very remote
1	Coronary heart disease	Coronary heart disease	Coronary heart disease	Coronary heart disease	Coronary heart disease
2	Dementia including Alzheimer disease	Dementia including Alzheimer disease	Dementia including Alzheimer disease	Lung cancer	Diabetes
3	Cerebrovascular disease	Cerebrovascular disease	Lung cancer	Chronic obstructive pulmonary disease	Lung cancer
4	Lung cancer	Lung cancer	Chronic obstructive pulmonary disease	Dementia including Alzheimer disease	Chronic obstructive pulmonary disease
5	Chronic obstructive pulmonary disease	Chronic obstructive pulmonary disease	Cerebrovascular disease	Cerebrovascular disease	Suicide
6	Colorectal cancer	Colorectal cancer	Colorectal cancer	Diabetes	Cerebrovascular disease
7	Diabetes	Diabetes	Diabetes	Suicide	Dementia including Alzheimer disease
8	Accidental falls	Prostate cancer	Prostate cancer	Colorectal cancer	Land transport accidents
9	Heart failure	Heart failure	Suicide	Land transport accidents	Kidney failure
10	Prostate cancer	Cancer of unknown or ill-defined primary site	Cancer of unknown or ill-defined primary site	Prostate cancer	Other ill-defined causes primary site

Rate ratio (compared with all Australia)

≤ 1.0	1.1–1.24	1.25–1.49	1.5–1.9	2.0–2.9	3.0–4.0

Notes:
1. Australian standard population.
2. Leading causes of death are listed in order of number of deaths in each remoteness area from 2017–2021.
3. Boxes are coloured based on rate ratio comparing each region to Australia overall.

Source: AIHW 2023.

The Rural Doctors Association of Australia (RDAA) has identified that, when it comes to inequities experienced by those in rural and remote areas, the most important issue is access — to healthcare and to other services and opportunities. In 2018, the RDAA made a range of policy recommendations to the federal government in order to try to reduce the inequities experienced by those living in areas with higher levels of remoteness. The recommendations included:
- investing in models of care that provide critical services in local communities, including expanding renal dialysis services
- allocating sufficient funding to develop the National Rural Generalist Pathway to ensure rural and remote people have access to doctors with the advanced skills they need
- working with rural doctors to identify effective support mechanisms for general practices as providers of health services, employers and contributors to local economies

- developing specific agreements on rural hospital funding through the Council of Australian Governments national health agreements process, directed to maintaining rural hospital services and providing incentives for increasing services
- establishing funding models that support sustainable health services and health workforce retention.

As most of these challenges are largely non-modifiable for individuals, in order for positive health gains to occur in this area it is important that collaboration occurs between all levels of government and in consultation with each community to ensure their specific needs are met.

3.6.3 Socioeconomic factors

Socioeconomic factors include educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media. A combination of all these factors is referred to as an individual or group's socioeconomic status. Generally, people in lower socioeconomic groups are at greater risk of poor health, have higher rates of illness and death, and have a lower life expectancy than people from higher socioeconomic groups. The higher a person's socioeconomic status, the healthier they tend to be.

> **socioeconomic factors** determinants of health that include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media

Socioeconomic status

When discussing socioeconomic status, we are often referring to an individual's level of income or wealth. The income and wealth of an individual or family can determine the type of neighbourhood in which a young person grows up and the kind of school they attend. The quality of these settings is an important factor in determining healthy behaviours and young people's health status.

For young people living in the family home and undertaking full-time education, parental income is often directly related to the amount of money they have to spend on essentials, such as food, education, transport and healthcare, as well as recreation, including dining out, music lessons and an internet connection. These resources can assist people in maintaining a healthy body weight, staying socially connected and accessing healthcare when required, which can improve health status by reducing morbidity and mortality rates.

FIGURE 3.34 Participating in sport and physical activity as a child is essential to achieving positive health outcomes later in life.

Having adequate access to resources for life's essentials and recreation promotes the dimensions of social and mental health. Feeling a sense of belonging is very important to young people, and often this involves attending social events that require a financial commitment. Belonging to sports clubs can be expensive, and it is the family income that is likely to determine which activities young people are able to participate in.

Educational attainment

Many young people spend a significant amount of time in formal educational settings. Through education in schools and higher education institutions, such as universities and TAFE colleges, young people are provided with the opportunities to gain knowledge and skills that enable them to enter the workforce. Educational institutions are also places where young people can form relationships and challenge themselves, which can lead to enhanced social, emotional and mental health. The quality of education a young person receives can be affected by the resources an educational institution has at its disposal. For example, having access to advanced digital technology resources, such as 3D printing or classes in coding, can increase the opportunities available to young people in the future.

FIGURE 3.35 Education has strong links to improved health status.

Employment status

Being able to secure satisfying, meaningful and regular employment is a protective factor for our health. Reports on the health of Australians have estimated that mortality rates are significantly higher for unemployed Australians than for those who are employed. Employment provides opportunities to be active, develop a positive sense of identity, interact with others and feel a sense of control over our lives, as well as ensuring a degree of financial security. Unemployment has been linked to stress, loss of confidence, limited social contact, and feelings of depression and disempowerment, all of which significantly affect a person's emotional and social health. Rates of self-harm, attempted suicide and suicide have been found to be higher in people unable to find work, particularly following extended periods of unemployment, while higher incidence of cardiovascular disease and lung cancer have also been linked with unemployment.

The type of occupation a person has can also determine their health. Jobs involving manual labour, such as trades or transport jobs, have higher rates of injury and death than clerical, managerial or professional occupations. The latter group, however, may be less physically active at work as their job involves large amounts of time sitting doing computer-based work. Long working hours can contribute to stress, reduce the time available for physical activity and make it hard to find a work–life balance, all of which affect a person's health and wellbeing. Employment in certain jobs is also likely to result in exposure to high levels of pollution or increase the risk of coming into contact with harmful substances such as asbestos, chemicals or radiation.

FIGURE 3.36 Your job can provide satisfaction and help develop a positive sense of identity.

Cultural background and traditions

Cultural background and traditions play a significant role in influencing the health and wellbeing of Australians. Australia is a diverse and multicultural society, with a vast array of cultural backgrounds, traditions and beliefs. These factors can impact health outcomes in various ways.

Health beliefs and practices

Different cultural backgrounds often come with distinct health beliefs and practices; for example, traditional Chinese medicine, Aboriginal bush medicine, or Ayurvedic medicine from the Indian subcontinent. These beliefs can influence how individuals perceive health, illness, and treatment options.

Access to healthcare

Cultural background can affect access to healthcare services. Language barriers, limited understanding of the healthcare system, and concerns about discrimination can hinder some individuals from seeking medical care. Conversely, implementing culturally sensitive healthcare services can help overcome these barriers.

Diet and nutrition

Cultural traditions significantly impact dietary habits. Traditional foods and cooking methods can either contribute to or detract from overall health. For instance, some cultures have diets rich in fruits and vegetables, such as the Mediterranean diet, which is a protective factor against the development of cardiovascular disease. Others may have diets high in processed or high-sugar foods, leading to poorer health outcomes such as an increased risk of developing type 2 diabetes.

Racism and discrimination

Experiencing racism and discrimination can have profound negative effects on the health and wellbeing of individuals from diverse cultural backgrounds. These experiences can be traumatic and can lead to stress, mental health issues and physical health problems.

FIGURE 3.37 Many Australians were born overseas.

In 2022, the most common overseas countries of birth were:

England
3.7% (961,000)

India
2.9% (753,000)

China
2.3% (597,000)

New Zealand
2.3% (586,000)

- Over 300 languages are spoken in Australia.
- Over 1 in 5 (22%) people speak a non-English language at home
- The language with the highest number of speakers was Mandarin, followed by Arabic.
- 3.4% of the population spoke English not well or not at all.

Source: ABS 2022.

Source: ABS 2023.

Research shows that overseas-born Australian populations are often healthier than Australia-born populations due to what is known as the 'healthy migrant effect'. As Australia, and many other nations, require health screenings before migration occurs, this means that migrants are more likely to have a higher health and wealth status on arrival and show evidence of lower mortality rates compared to the Australian-born population (see figure 3.38). It is important to recognise that the 'healthy migrant effect' can disappear after people have lived in Australia for a period of ten years or more.

FIGURE 3.38 Age-standardised all-cause mortality rate, by country of birth, 2016

Country of birth	Mortality rate (deaths per 100 000 population)
Scotland	701
Australia	608
Germany	562
Italy	533
England	532
New Zealand	530
Greece	457
India	415
Sri Lanka	393
South Africa	393
Philippines	353
Vietnam	328
China	313
Malaysia	305
South Korea	305
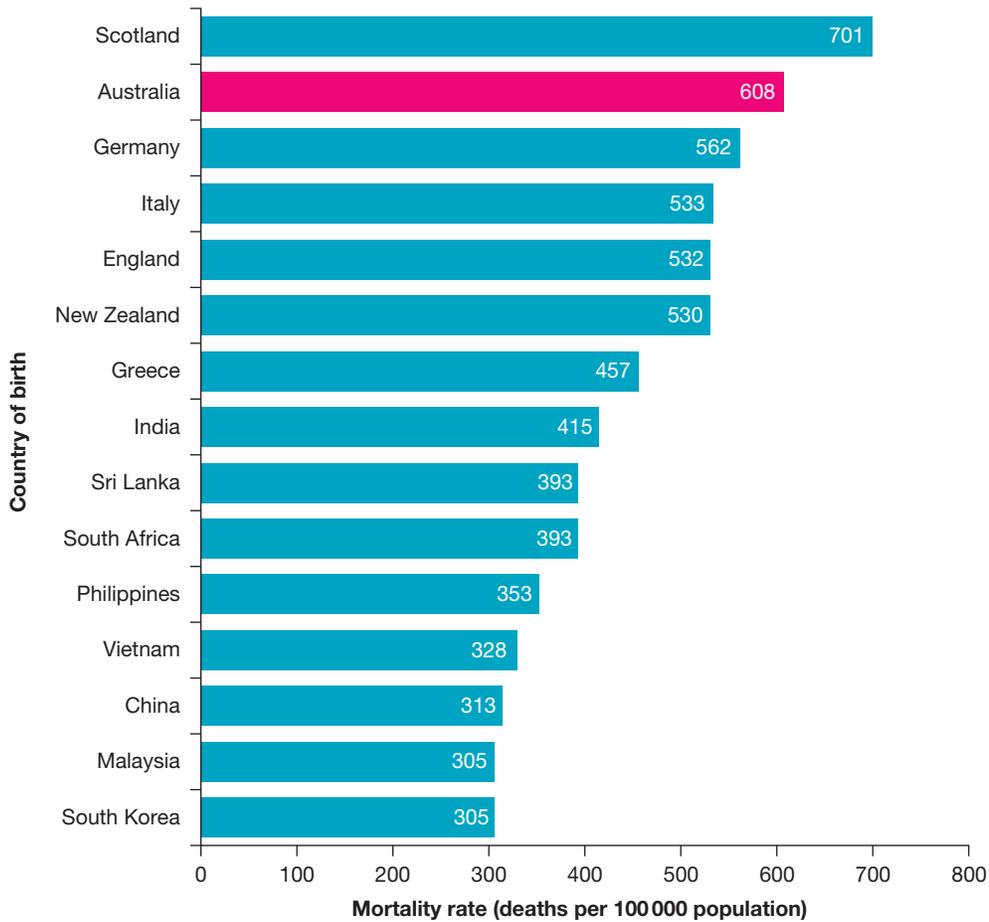
Source: National Mortality Database; Table S5.3.2.

Disability

Individuals with disabilities often face unique challenges in accessing healthcare, education and employment opportunities, which can be made worse by their socioeconomic status. Lower-income individuals with disabilities may encounter financial barriers to accessing assistive devices, specialised medical care and necessary support services. Additionally, limited educational and employment prospects for people with disabilities can result in economic hardship and reduced access to healthcare and social support systems. The combined impact of disability and lower socioeconomic status can lead to a higher risk of health disparities, reduced quality of life and increased vulnerability.

Social inclusion is another crucial aspect influenced by disability. Stigmatisation, discrimination and societal attitudes can isolate individuals with disabilities, leading to feelings of exclusion and low self-esteem. This exclusion can have detrimental effects on mental health, contributing to conditions such as depression and anxiety.

FIGURE 3.39 An inclusive society values diversity and promotes the wellbeing and full participation of all Australians, regardless of their abilities.

It is crucial to acknowledge that individuals with disabilities bring a wealth of unique strengths and perspectives to society. In Australia, people with disabilities have contributed significantly to arts, sports, business and advocacy. They can possess resilience, adaptability and a depth of life experiences that enrich our communities. By recognising and harnessing these strengths, we can create a more inclusive society that values diversity and promotes the wellbeing and full participation of all Australians, regardless of their abilities.

Social networks

Social networks, both online and offline, have a substantial influence on the health and wellbeing of Australians. These networks play a crucial role in shaping behaviours, attitudes and access to support systems, ultimately impacting the overall health status of individuals in the country.

Social networks provide a vital source of emotional and psychological support. In Australia, the presence of strong social networks can contribute to improved mental health outcomes. Friends, family and close-knit communities can offer a support system for individuals facing mental health challenges, reducing feelings of isolation and promoting early intervention and treatment. Volunteering, participation in local events, or collaborating on community projects can also play a pivotal role in enhancing the health and vitality of individuals and communities.

Health behaviours can be significantly influenced by social networks. Friends and family can either encourage or discourage healthy habits such as exercise, nutrition and substance use. For example, participating in group fitness activities or engaging in healthy eating practices with friends can positively affect an individual's health.

Social networks are essential for communicating health information. Australians increasingly rely on their social connections to learn about health-related issues, treatments and preventative measures. In the digital age, social media platforms have become powerful sources of health information, but they also pose risks as they can spread misinformation.

FIGURE 3.40 Volunteering your time to assist the community can have a positive effect on all health dimensions for yourself and others.

Social expectations and attitudes

There is a strong link between social expectations and attitudes, with a person's personal experience likely to influence the attitudes they develop and the way they behave. For example, someone who has respectful attitudes towards women is less likely to be violent or excuse disrespectful and aggressive behaviour towards girls and women, and more likely to have positive, healthy relationships. The attitudes we hold are influenced by families, peers, education, the media, our culture and the communities in which we live. Our sense of self-efficacy also has an influence on our attitudes and whether we feel capable of making lifestyle changes that may improve our health.

People's attitudes towards certain health behaviours, their willingness to seek help to address health concerns and the value they place on positive health all play a part in determining their health. Research into the factors that affect young people's willingness to seek help for mental health issues has identified a number of key barriers to accessing help. These include:
- feelings of embarrassment
- a preference for managing problems without help
- concerns about opening up to people they do not know (for example, counsellors) who are potential sources of help.

On the other hand, those who hold positive attitudes towards health professionals are more likely to seek help. Knowledge about the type of help available and where this help can be found also serves to encourage help-seeking behaviour.

Media

The media can be seen as a socioeconomic characteristic in terms of health in several ways.

Access to health information and media literacy

Socioeconomic status often determines access to different forms of media. People with higher incomes and education levels typically have better access to a variety of media channels, including social media, television, the internet and print media. Individuals with higher levels of education and socioeconomic status are also more likely to possess the skills to critically analyse health-related information in the media, which can help them make informed healthcare decisions.

FIGURE 3.41 Those with higher education levels often have a better ability to critically evaluate health information.

Health education and promotion

The media plays a crucial role in communicating health education and promotion campaigns. These campaigns can vary in effectiveness depending on the media channels used and the socioeconomic groups they reach. Those with higher socioeconomic status may have more exposure to health information and public health campaigns, leading to greater awareness and healthier behaviours.

Representation of health issues

The media's portrayal of health issues can vary based on socioeconomic characteristics. Issues that affect lower socioeconomic groups more, such as access to healthcare, affordable housing or food insecurity, may receive less attention in the media compared to issues that are more common in higher socioeconomic groups.

To address the influence of the media as a socioeconomic characteristic in health, it is essential to promote media literacy, provide equitable access to health information, and encourage balanced and accurate reporting on health issues. Additionally, public health campaigns and interventions should be designed to reach and resonate with diverse socioeconomic groups to reduce health disparities.

What are the sociological causes of risky health behaviours?

Each of the socioeconomic characteristics interrelate and can have a compounding effect on an individual's health behaviours in both the positive and negative sense. For instance, a young person born into a family with a high socioeconomic status is more likely to achieve higher levels of educational attainment such as completing their HSC or completing tertiary education. If both parents have stable employment status, they will be better able to access healthcare services due to their ability to afford the associated costs.

Comparatively, a young person of low socioeconomic status, with parents unable to secure stable employment, may have additional barriers to accessing appropriate healthcare when required. As a child, these non-modifiable factors can be of great benefit or a potential barrier to future levels of health. These factors need to be recognised in order to shape future policy decisions in order to ensure all Australians have the opportunity to achieve a positive level of health and wellbeing.

Where do inequities exist and what can we do about them?

Within each socioeconomic characteristic there are a range of inequities that affect different population subgroups. These include the following.

Low socioeconomic status

People with higher levels of education are also more likely to secure better-paid jobs, which can lead to lower levels of stress and more income to pay for private health insurance and nutritious food, reducing rates of morbidity from conditions such as obesity and mental health disorders. Compared with low-poverty neighbourhoods, high-poverty neighbourhoods have fewer high-quality public and private services, such as community centres, schools, healthcare providers and support services. High-poverty neighbourhoods are also more likely to have more crime and street violence, and a greater exposure to negative peer influences.

Age

In Australia, income inequality has continued to rise over time, with the unemployed, single parents, people born overseas in non-English speaking backgrounds and people living in regional, rural or remote areas suffering the most. Recent statistics show that wealth inequality increased most strongly in people aged 35 and under. If wealth inequality continues to rise it could have long-term impacts on the health outcomes of future generations.

According to data from the Australian Bureau of Statistics, the number of young people aged 15–24 who were involved in part-time work was higher than those in engaged in full-time work (see figure 3.42). This has changed dramatically since 1990, when the rates of young people in full-time work were three times higher than those in part-time work. The major reason for this trend is due to the higher rates of young people staying at school to complete Year 12. More young people are also undertaking further study after high school, as jobs are increasingly requiring higher skills or qualifications. In turn, this is increasing the demand for a more educated and qualified workforce.

int-8605

FIGURE 3.42 Number of young people employed in either full- or part-time work, 1990–2018
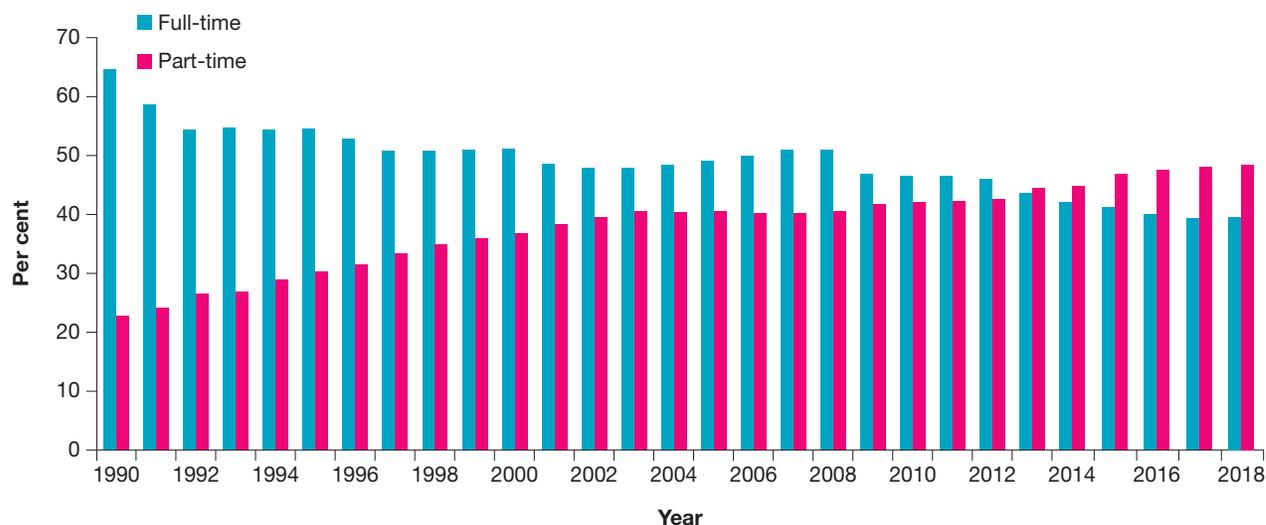
Note: Data are annual averages of monthly employment labour force figures (based on ABS 'original series' estimates), using the labour force population aged 15–24 as the denominator.
Source: AIHW analysis of ABS 2018 data.

Geographic location

The increasingly global nature of the economy, as well as constant technological advances, affect Australian society and will influence the type of occupations individuals will have in the future. Studies show that increased automation and technological advancement could result in up to 5 million jobs (almost 40 per cent of Australian jobs) having a moderate to high chance of disappearing in 10–15 years. These job losses will impact those in rural and regional areas at higher levels, with job losses predicted to be at over 60 per cent in these locations.

The higher your level of remoteness, the less access you have to health services. Recent data from the AIHW shows that the overall rate of medical practitioners, including specialists, was 253 per 100 000 population in rural and remote areas, compared with 409 per 100 000 population in major cities. The number of GP services provided per person in very remote areas was about half that of major cities.

Cultural background and traditions

There is diversity of cultural backgrounds in people who have migrated or sought asylum in Australia over a number of generations. Many of these groups experience higher rates of inequities. Individuals and families from non-English speaking backgrounds are more likely to experience difficulty accessing health services that are culturally and linguistically appropriate. They may also be reluctant to use available health services due to cultural differences, perceived racism or misunderstandings of the facilities.

Migration can be a very traumatic experience, particularly for refugees, and this can affect their health. Refugees have been found to have higher rates of mental health problems such as post-traumatic stress disorder, depression and anxiety than the general population. On top of this, many refugees tend to have lower levels of health literacy than the rest of the population, which means they are less likely to know how or where to seek professional help.

Those on temporary visas who may be working or studying in Australian are ineligible for Medicare and therefore must have private health insurance, which means that money can also be a barrier to accessing healthcare.

There are many avenues to overcoming these inequities and it can be achieved through government initiatives, non-government organisations and even individuals and communities. Government initiatives such as the Active Kids program in New South Wales provide vouchers for parents, guardians and carers to use towards sport and recreation costs, and increase the opportunity for young people of low socioeconomic status to engage in physical activity, which can help achieve equitable health outcomes.

The Asylum Seeker Resource Centre (ASRC) is a non-government organisation that has an enormous impact on overcoming inequities experienced by new arrivals to Australia. This organisation provides assistance through food and material aid, healthcare, education and training as well as support services and legal aid. During the 2020 lockdown in Melbourne caused by the COVID-19 pandemic, the ASRC was able to coordinate food banks to allow individuals and families to have improved **food security** while they were restricted to their places of residence for many months. They were also able to translate the constantly updated health advice to ensure that people from all language backgrounds could know and understand their rights.

food security when all people, at all times, have access to sufficient safe and nutritious food to meet their dietary needs for an active and healthy lifestyle

CASE STUDY
New Australians feel abandoned as they battle social isolation, struggle to find employment

By Rachel Riga

16 October, 2019

Anas Barbaree was a qualified pharmacist working overseas, but has never been able to work in Australia in his chosen field.

He's not alone, with refugees and migrants facing significant barriers to skilled employment which is causing impacts to mental wellbeing.

Social isolation among new Australians is so severe that some are asking how to return to refugee camps, and some live without necessities like power, a South-East Queensland refugee and migrant service has warned.

Mr Barbaree fled war-torn Iraq with his family when Islamic State militants invaded the city of Mosul in 2014.

'Christians, Shia Muslims, Yazidis had to leave the city — or we had three options — be killed, pay tribute, or convert to Islam,' he said.

'We had to leave everything behind, and we were searched at checkpoints for valuables like mobile phones.'

At the time, the 31-year-old had been working as a pharmacist at a government-run hospital in Makhmour, Iraq, as part of his two-year regional placement after he completed a Bachelor of Pharmaceutical Science.

Mr Barbaree, his wife Maryam and their first-born daughter Maram were among 12,000 asylum seekers granted visas in Australia under a special humanitarian intake of Syrians and Iraqis, fleeing terrorism and civil war.

Since arriving in Australia in 2016, Mr Barbaree has taken the required steps to become a registered pharmacist in Australia.

He has been assessed by the Australian Pharmacy Council, taken part in a knowledge and English exam and submitted an application to the Australian Health Practitioner Regulation Agency (AHPRA).

He is waiting for his application to be approved by AHPRA, but they require one document — his evidence of registration from the Federal Government of Iraq.

'It's a document that says I've been registered as a pharmacist in Iraq and I have a clean record,' he said.

'I've tried through the [Iraq] Ministry of Health and the Iraqi Pharmacists Syndicate to get it but the situation in Iraq is getting worse ... I'm waiting for it to be more stable.

'I will keep trying, I've spent too much time trying — I am waiting for one document.'

Mr Barbaree said he is grateful to have secured work as a full-time technician at an oncology compounding centre.

'Finding a job is hard here because it depends on your Australian experience, which of course you don't have.'

The Australia Talks National Survey revealed 68 per cent of recent migrants are unhappy with their jobs, compared with 38 per cent of more settled migrants and 41 per cent of people born in Australia.

Source: https://www.abc.net.au/news/2019-10-16/social-isolation-refugee-immigration/11586114.

Case study questions

1. What caused Mr Barbaree to flee his home in 2014?
2. What impact do you think leaving their home would have had on this family's short-term and long-term health?
3. What barriers to health do migrants face upon arrival in Australia?
4. To what extent does having a meaningful job affect a person's mental, emotional and spiritual health?

3.6.4 Health behaviours

The health of an individual can be influenced by their individual beliefs and actions. These beliefs and actions can be sorted into protective factors, which help individuals reduce the chances of injury or illness; and risk factors, which increase the likelihood of developing an injury or illness (see table 3.2).

TABLE 3.2 Protective and risk factors

Protective factors	Risk factors
Non-smoker	Smoker
Balanced diet	Poor nutrition
Responsible or no consumption of alcohol	Consumption of alcohol at risky levels
Engaging in regular physical activity	Sedentary lifestyle and workplace
Responsible use of prescription drugs	Abuse of prescription and/or illicit drugs

Over the past two decades a number of trends have emerged in terms of the health behaviours of Australians. These include the following.

Individual beliefs and actions

Tobacco smoking

Australia has one of the lowest rates of smoking in adults among all OECD (Organisation for Economic Cooperation and Development) countries. Since 2001, the rates of smoking for Australians aged 15 and over have fallen by 36 per cent. Recent data collected from the National Drug Strategy Household Survey shows that over 85 per cent of the Australian population aged 18 and over are not daily smokers, and 60 per cent of this age group have never smoked in their lives.

E-cigarette use

While rates of e-cigarette use or vaping among young people (aged 18–24) is still quite low, rates have increased between 2016 and 2022. Of those young people who have tried e-cigarettes, the vast majority did so out of curiosity. Research shows a strong association between the use of e-cigarettes by non-smoking youth and future smoking. Although vaping is a relatively new form of smoking, health experts stress that there is increasing evidence of health harm consistent with normal cigarette smoking.

FIGURE 3.43 Although Australians are smoking less than previous generations, it still remains the leading cause of disease burden.

Dietary behaviour

Data collected in 2022 showed that 96 per cent of men and 87 per cent of women do not eat the daily recommended serves of vegetables. Although slight improvements were seen in fruit consumption, still 59 per cent of men and 52 per cent of women aged 19–50 did not eat enough fruit. Although almost 72 per cent of children (aged 5–14) ate the recommended amount of fruit, only 4.4 per cent ate the recommended amount of vegetables. With the link between healthy eating and adequate hydration resulting in improved health outcomes, it is essential that individuals from all backgrounds make an active effort to improve their daily nutritional habits.

Alcohol consumption

The consumption of alcohol is widespread within Australia and associated with many social and cultural activities. Despite social attitudes towards alcohol consumption, recent trends show an increasing number of young people are abstaining from alcohol use (see figure 3.44). However, this age group are still more likely than any other to consume alcohol in a way that exceeds single occasion risk (binge drinking). Young people are also more likely to be victims of alcohol-related harm.

int-9277

FIGURE 3.44 Alcohol use status for young people aged 14–24, by age and sex, 2019
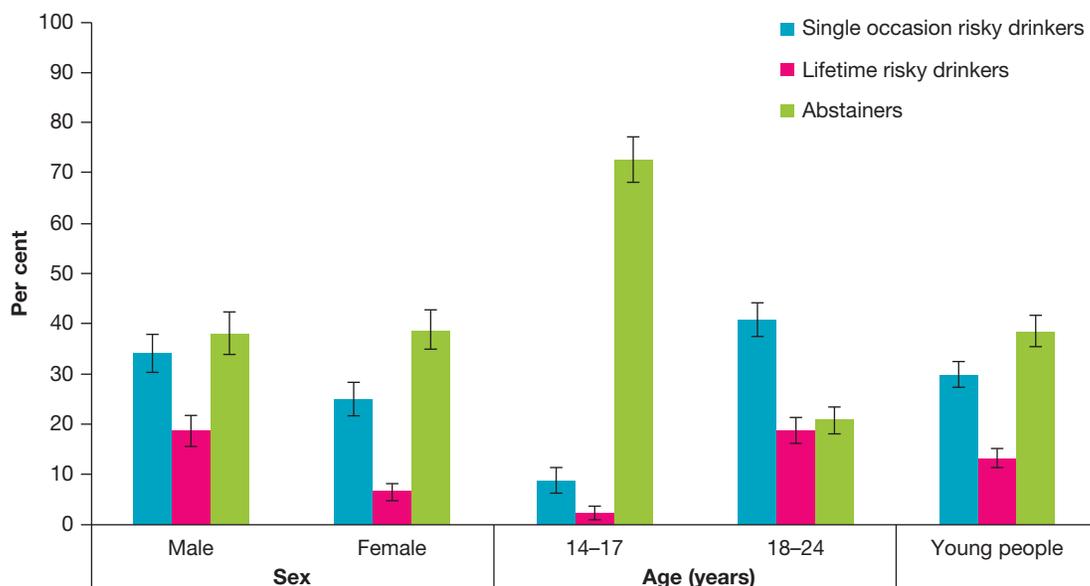
Physical activity

Regular physical activity is important for optimal health and wellbeing. It can improve a person's mental health and physical health by reducing disease risk factors such as overweight and obesity. Current data shows that more than 1 in 2 (55 per cent) of Australian adults and 2 in 3 (70 per cent) children aged 2–17 did not meet the recommended physical activity and sedentary behaviour guidelines (see table 3.3). Physical inactivity is also shown to increase as people age.

TABLE 3.3 National Physical Activity and Sedentary Behaviour Guidelines

	Children (birth to 5 years)	Children and young people (5–17 years)	Adults (18–64 years)	Older Australians (65+ years)
Physical activity guidelines	• Birth–1 year: 30 minutes of tummy time, reaching, grasping, clasping, pushing and pulling, and crawling • 1–2 years: at least 180 minutes a day doing a variety of physical activities (running, jumping, twirling) • 3–5 years: at least 180 minutes a day, of which 60 minutes is energetic	• Accumulating 60 minutes or more of moderate to vigorous physical activity per day involving mainly aerobic activities • Activities that strengthen muscle and bone at least 3 days per week	• Doing some physical activity is better than none. Start by doing some, then gradually build up to the recommended amount. • Be active on most, if not all, days of the week • Accumulate 150–300 minutes of moderate-intensity physical activity or 70–150 minutes of vigorous-intensity physical activity each week • Muscle-strengthening activities on at least 2 days per week	• Do some form of physical activity no matter their age, weight, health problems or abilities • Participate in range of activities including fitness, strength, balance and flexibility • Accumulate at least 30 minutes of moderate intensity physical activity on most, preferably all, days of the week
Sedentary behaviour guidelines	• Should not be restrained for more than one hour at a time (stroller, car seat, high chair) • Activities such as reading, singing, puzzles and story time should make up sedentary behaviour time • Restrict TV time to 1 hour in a 24-hour period – less is better	• Break up long periods of sitting as much as possible • Limit sedentary recreational screen time to less than 2 hours – less is better • Engage in positive use of electronic media	• Minimise the amount of time spent in prolonged sitting • Break up long periods of sitting as much as possible	• Minimise the amount of time spent in prolonged sitting • Break up long periods of sitting as much as possible

Source: Australia's Physical Activity and Sedentary Behaviour Guidelines and the Australian 24-Hour Movement Guidelines. Department of Health, 2019.

Drug use

Illicit drug use affects individuals, families and the broader Australian community. These harms are numerous and include health impacts (burden of disease, death and hospitalisation) and social impacts (violence, crime and trauma). Cannabis remains the most commonly used illicit drug; however, use of cannabis among 18–24 year olds has declined since 2001. The use of stimulants such as cocaine and ecstasy has increased significantly since 2016, and deaths due to non-medical use of pharmaceutical drugs such as benzodiazepines and opioids also grew significantly.

FIGURE 3.45 Deaths associated with pharmaceutical drugs such as opioids and benzodiazepines are of growing concern in Australia.

Sexual practices

Recent data shows that more Australians hold stronger expectations of sexual exclusivity in relationships. Reports indicate that the number of sexual partners women have over the course of their lifetime is becoming more similar to that of men, which suggests a reduction in the traditional 'double standard' (where women were expected to have fewer sexual partners than men). Condom use has become more common in the last decade, which suggests that people are more careful to use protection against sexually transmitted infections and unwanted pregnancy. Over the past decade, HIV and hepatitis C incidence has declined; however, rates of chlamydia and gonorrhoea have steadily increased. Unfortunately, rates of sexual coercion remain steady, which suggests improvement needs to be made in this area.

What are the sociological causes of risky health behaviours?

Within society there are a range of diverse and complex processes that influence people's behaviour in risk taking. In relation to the health behaviours above, there are a range of reasons why one individual may experience positive health while another may be more likely to experience negative health outcomes. For instance, if an individual has developed strong family connections and has a supportive network of friends, they may encourage each other to make positive health choices such as avoiding smoking and vaping and increasing the amount of daily physical activity they engage in. In contrast, if an individual has no strong role models in their lives and has a friendship group that engages in peer-pressuring behaviours, they may be more likely to initiate the use of illicit drugs or engage in unsafe or harmful use of alcohol.

Where do inequities exist and what can we do about them?

Across the Australian population, inequities exist for a range of population subgroups in regard to health behaviours.

Aboriginal and Torres Strait Islander Peoples

Current data shows that Aboriginal and Torres Strait Islander children are almost three times more likely than other children to smoke. However, they are more likely to meet the physical activity guidelines.

Geographic location

As an individual's level of remoteness increases, they are more likely to smoke, to suffer from alcohol-related disease, and to have less favourable dietary habits and higher levels of obesity. Use of cocaine and ecstasy are more common in major cities, whereas use of methamphetamine is higher in remote or very remote areas.

Socioeconomic status

Those of low socioeconomic background are more likely to smoke, to consume alcohol daily and to expose themselves to lifetime or single occasion risk. There is little difference in time spent being sedentary (11 hours for children) regardless on one's socioeconomic status; however, the cause of these behaviours does vary. Low socioeconomic populations are more likely to have higher rates of screen time, whereas those of high socioeconomic status are more likely to be completing homework, reading or school-related activities.

Lesbian, gay, bisexual, transgender, queer, intersex, asexual (LGBTQIA+) community

Within the LGBTQIA+ community, some studies show that illicit drug use is more common and individuals are more likely to have a greater number of sexual partners across the course of their lifetime.

Through the use of epidemiological data, it is possible to identify where these inequities exist. However, to make health improvements a number of key stakeholders need to be engaged. An example of this is the Quit B Fit program, which aims to improve the life expectancy of Aboriginal and Torres Strait Islander Peoples by reducing tobacco use. This program is funded by the federal government and implemented by Aboriginal Community Controlled Health Organisations with the assistance of community members and high-profile ambassadors such as musicians and sports stars to deliver education on the effects of smoking and second-hand smoking.

FIGURE 3.46 Quit B Fit is a program that can enact positive change to reduce health inequities.

3.6.5 Biomedical factors

Biomedical factors are bodily states that have an impact on a person's risk of disease. They include **genetics**, blood pressure, **blood glucose** levels, cholesterol levels and physical impairment. Through a range of lifestyle behaviours, individuals can control the level to which these factors affect their health. However, an individual's heredity can predispose them to certain conditions such as hypertension, diabetes or physical impairments over which they have limited control.

Genetics

Our potential to achieve a certain level of health may be significantly influenced by genetics. A number of genetic disorders, such as muscular dystrophy and cystic fibrosis, lead to chronic ill health and decreased life expectancy. These diseases are caused by genetic information passed on by parents at conception. Other disorders such as Down syndrome, which can affect physical development and intellectual functioning, are the result of chromosomal abnormalities that occur during pregnancy.

Genetics can also play an important role in a person's susceptibility to certain diseases or health problems. People with fair skin, which is a genetically inherited trait, are at greater risk of developing skin cancer as their skin burns more easily and more quickly following exposure to the sun. Research has identified that diseases such as breast cancer, asthma, heart disease, diabetes and some mental illnesses have a genetic link, making those with a family history of these diseases more susceptible to developing the disease themselves.

biomedical factors determinants of health that include genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment

genetics refers to characteristics, features or hereditary diseases that are genetically linked and passed on within a family

blood glucose also referred to as blood sugar; a form of stored energy within the blood cells generated from the breakdown of carbohydrates

FIGURE 3.47 Our skin type is an inherited trait, making certain groups more predisposed to skin cancer.

The genetic information that we inherit can also positively influence our health, as it can provide us with potential in terms of intellectual capacity, physical abilities and life expectancy. For example, hereditary factors have an effect on how fast we can run, how coordinated we are and how well suited we are for particular sports. Hereditary factors therefore have an influence on our sporting abilities and likelihood of successful participation.

However, while genetics influences our health potential, there is no degree of certainty that we will inherit all of the health conditions of our parents or grandparents. Many genetic disorders are complex and do not follow a clear-cut pattern of inheritance. Lifestyle and environment also play a part, meaning that if people make positive adjustments to how they live they can reduce their risk of ill health and maximise their potential. Similarly, even though we may have inherited superior genes for both physical and intellectual growth and development, a poor physical and sociocultural environment can negatively affect our level of health, reducing our potential.

Blood pressure

Global comparisons by the WHO show that the rate of high blood pressure (hypertension) among all Australians is below average compared to the 36 OECD countries. Within Australia, there has been no significant change in the prevalence of uncontrolled high blood pressure since 2011–12. Although these figures seem promising, uncontrolled high blood pressure remains a major disease burden, with about 1 in 3 people (34 per cent) aged 18 and over currently living with high blood pressure.

FIGURE 3.48 Regular checkups are required to monitor blood pressure.

Blood glucose levels

When carbohydrates are consumed, the resulting glucose is absorbed into our bloodstream; when blood glucose levels rise, insulin is released from the pancreas to allow the glucose to be used for energy. Impaired glucose regulation is a precursor to the development of **type 2 diabetes** and this condition is currently the fastest growing form of chronic disease in Australia. Individuals and population groups who display the risk factors associated with impaired glucose regulation experience higher rates of **cardiovascular disease** and type 2 diabetes. These conditions can contribute to significant differences in health status, such as higher rates of heart attack, stroke, kidney disease and premature death.

Cholesterol levels

Cholesterol is a fatty substance produced by the liver and carried by the blood to supply material for cell walls and hormones. There are two types of cholesterol, **low density lipoprotein (LDL)** and **high density lipoprotein (HDL)**. LDL or 'bad' cholesterol increases atherosclerosis (the build-up of fatty deposits in your arteries), whereas HDL or 'good' cholesterol may protect your body against coronary heart disease (see table 3.4 for sources of LDL and HDL cholesterol). **Triglycerides** play an important role in metabolism as an energy source and in helping to transfer dietary fat throughout the body.

type 2 diabetes a condition in which the body develops a resistance to insulin or does not produce enough insulin

cardiovascular disease refers to disease that affects the heart or blood vessels

low density lipoprotein (LDL) referred to as 'bad' cholesterol as it transports excess cholesterol to the blood vessel walls

high density lipoprotein (HDL) referred to as 'good' cholesterol as it assists in the removal of other forms of cholesterol from your blood

triglycerides a type of fat found in the blood

TABLE 3.4 Sources of cholesterol in foods

Sources of LDL ('bad') cholesterol	Sources of HDL ('good') cholesterol
Fried foods Fast food Processed meats Desserts	Eggs Cheese Shellfish Sardines Full-fat yoghurt

When abnormal amounts of cholesterol and triglycerides are found in the blood, it is known as **dyslipidaemia**. The prevalence of dyslipidaemia increases with age. This condition is common among both men and women, with rates over 50 per cent for all age groups except those aged 18–24. Due to the increasing rates of overweight and obesity, on top of Australia's poor dietary and physical activity habits, the incidence of dyslipidaemia is likely to increase unless there are improvements within these areas. Interestingly, in Australia the proportion of the population with dyslipidaemia is relatively similar across geographic areas and socioeconomic groups.

dyslipidaemia a condition characterised by an abnormal amount of blood lipids

FIGURE 3.49 How insulin acts on glucose

When foods are eaten, carbohydrates are broken down into glucose.

The glucose molecules are absorbed into the bloodstream through the small intestine. This increase in blood glucose levels triggers the release of insulin into the bloodstream from the pancreas.

Stomach

Pancreas

Carbohydrate

Pancreas

Insulin

To cells

Bloodstream

Insulin is like a key that opens a part of the cell that allows glucose in to be used for energy. Without insulin, the glucose is 'locked out' and remains in the bloodstream.

Physical impairment

Physical impairment as a biomedical factor can significantly influence the health and wellbeing of Australians in several ways. Physical impairments can lead to functional limitations, making it challenging for individuals to perform everyday tasks. This can affect their independence, mobility and overall quality of life. For example, paralysis or amputation can hinder an individual's ability to walk or perform self-care activities. Physical impairments can be emotionally and psychologically challenging, potentially leading to mental health problems. Individuals with physical disabilities may experience depression, anxiety and reduced self-esteem due to the limitations they face. Addressing the mental health of people with physical impairments is crucial for overall wellbeing.

Addressing the health and wellbeing of Australians with physical impairments requires a comprehensive approach that includes medical care, mental health support, accessibility and social inclusion. It is also essential to promote awareness, reduce stigma and create an inclusive society that values the contributions of individuals with physical disabilities.

What are the sociological causes of risky health behaviours?

An individual's biomedical factors can be linked to many factors within our society. There are increasing opportunities for sedentary behaviours, such as higher levels of automation in the workplace and more opportunities to engage in non-physically active recreation time through the use of smartphones, computers, gaming and streaming services. An increase in sedentary behaviours, along with reduced physical activity levels (both planned and incidental), is a risk factor for the development of hypertension, high cholesterol, type 2 diabetes and obesity. Each individual has a responsibility to incorporate planned physical activity into their daily lives to reduce their chances of developing these conditions.

Where do inequities exist and what can we do about them?

The following inequities exist in Australia regarding biomedical factors.

Biological sex

According to recent research, men are more likely to have uncontrolled high blood pressure than women (see figure 3.50). Statistics show that 1 in 4 men (25 per cent) have uncontrolled high blood pressure, compared with 1 in 5 women (20 per cent). Current data also shows that males are almost twice as likely to have impaired glucose regulation than females.

int-8606

FIGURE 3.50 Prevalence of uncontrolled high blood pressure among adults, by age and sex, 2017–18
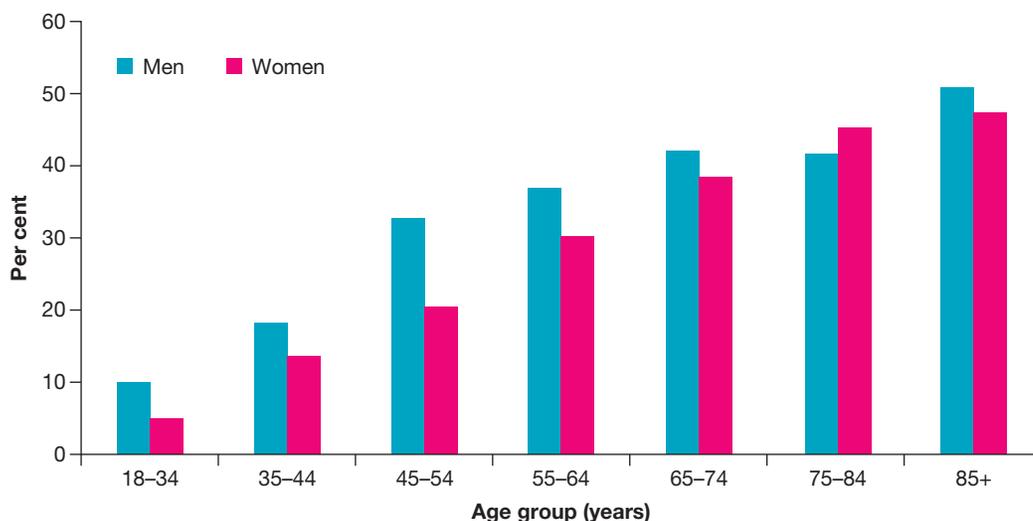
Source: ABS 2018a: AIHW analysis of ABS 2019 data.

Age

The proportion of adults with uncontrolled high blood pressure increases with age (see figure 3.50), as does the prevalence of impaired glucose regulation (see figure 3.51). Issues are not just restricted to adults; in 2017–18 (the most recent data), 1 in 4 of children and adolescents aged 2–17 (25 per cent) were classed as overweight or obese (see figure 3.52), which greatly increases the risk of developing type 2 diabetes.

FIGURE 3.51 Prevalence of impaired glucose regulation among those aged 12 and over, by age group, 2011–12
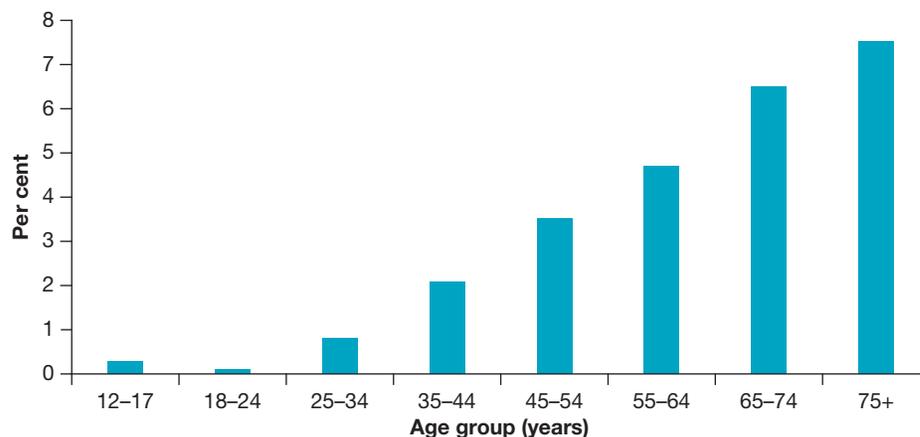
Note: This is the most recent survey to collect this data.
Source: ABS, *Australian health survey, 2011–12.*

FIGURE 3.52 Proportion of overweight and obese children and adolescents, by age group (years), 2017–18
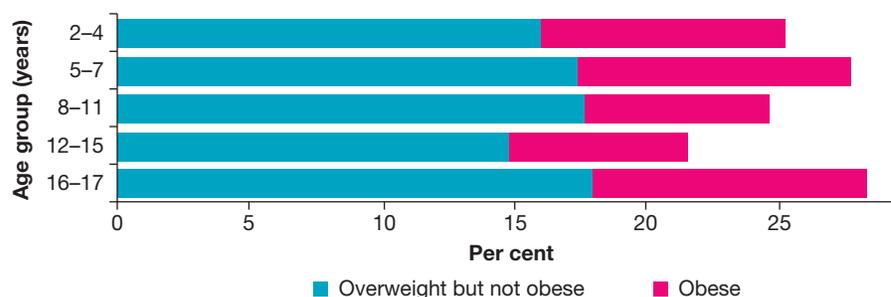
Source: ABS 2018; table S1.

Remoteness and socioeconomic status

According to figure 3.53, level of remoteness as well as socioeconomic status plays a large part in the likelihood that an individual will develop high blood pressure. High blood pressure is most prevalent in outer regional and remote areas (24 per cent) compared with major cities (22 per cent). In the lowest socioeconomic areas, 1 in 4 people (25 per cent) have uncontrolled high blood pressure compared with 1 in 5 people (19 per cent) in the highest socioeconomic areas

Aboriginal and Torres Strait Islander Peoples

Aboriginal and Torres Strait Islander Peoples are more likely to have high blood pressure and are also four times more likely than other Australians to have diabetes or pre-diabetes.

FIGURE 3.53 Prevalence of uncontrolled high blood pressure among adults, by socioeconomic status and remoteness, 2017–18
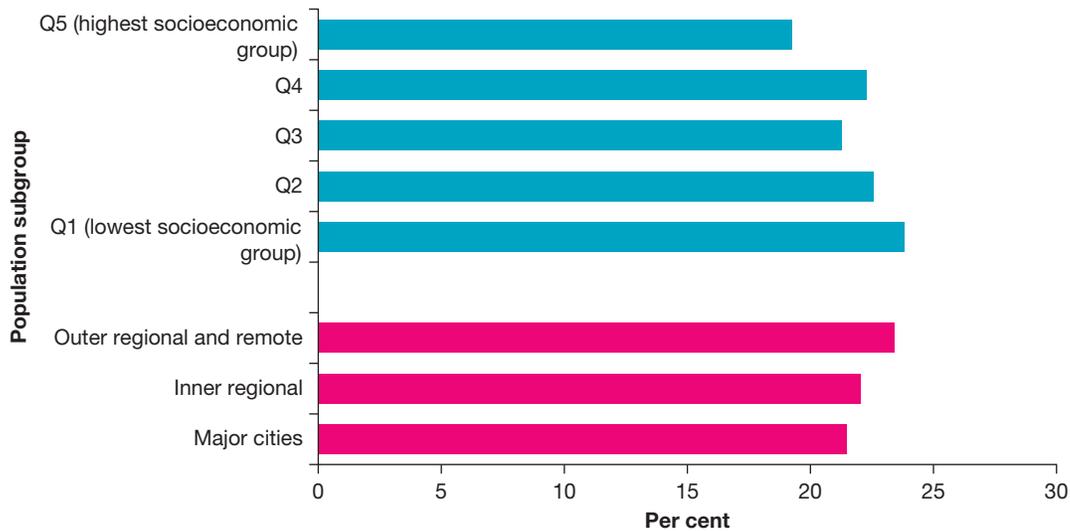
Source: AIHW analysis of ABS 2019 data.

On a positive note, there are many measures that individuals can take to control their own biomedical factors. These include:

- *eating healthily* — eating home-cooked meals and less takeaway food, as well as avoiding excess amounts of saturated fats and added sugar and salt
- *keeping active* — ensuring that you meet the daily recommended physical activity and sedentary behaviour guidelines as seen in table 3.3
- *getting regular check-ups* — booking in to see your doctor, health worker or nurse regularly so that your blood pressure, cholesterol levels, blood glucose levels and weight can be monitored, and preventative or early intervention methods can be put in place as soon as a risk emerges.

All of these behaviours can be supported through the mandatory K–10 PDHPE syllabus in NSW high schools, which aims to educate young people on the importance of protective factors. Engaging in this education and setting in place positive habits at an early age increases the likelihood that positive health behaviours will continue into adulthood.

DEPTH STUDY IDEA

Use the **Growing Up Tough — The Feed** weblink in the Resources panel to watch the video. Select one of the three featured individuals as a focus to answer the following open-ended questions.
1. How do the determinants of health interact to affect the health of the individual and their family?
2. Where do inequities exist and what can we do about them?

You could provide your responses as a multimodal presentation, speech or essay.

3.6 ACTIVITY

Use the **Growing Up Tough — The Feed** weblink in the Resources panel to answer the following questions.
1. What barriers exist that impact the health of the three young people interviewed in this short film?
2. Outline the positive attributes each young person has that should enable them to lead a healthy life.
3. Examine the role of the environmental and socioeconomic factors that could have an impact on the health of these families.

3.6 Exercises

3.6 Quick quiz **on**	**3.6 Exercise**

Learning pathway

■ **LEVEL 1**	■ **LEVEL 2**	■ **LEVEL 3**
4, 9	1, 2, 3, 5, 7, 8, 10	6

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Revise your knowledge

1. Discuss how socioeconomic factors and health behaviours interrelate to determine the health of an individual.
2. Using table 3.3, explain how the physical activity and sedentary behaviour guidelines would improve the health of children and young people.
3. Describe the inequities that exist for biomedical factors.
4. Using figure 3.33, outline the impact of geographic location on mortality rates across Australia.
5. Explain ways in which health inequities relating to the broad features of society can be overcome.

Apply your knowledge

6. Describe possible strategies that could overcome inequities for the following health determinants:
   a. broad features of society
   b. environmental factors
   c. socioeconomic factors
   d. health behaviours
   e. biomedical factors.
7. Explain how sociological causes have an impact on risky health behaviours.
8. Discuss how the determinants of health interact to affect the health of Aboriginal and Torres Strait Islander Peoples.
9. Use the **AIHW — *Australia's health 2022*** weblink in the Resources panel to research the health gaps that exist between Aboriginal and Torres Strait Islander Peoples and other Australians. (*Note:* This report is updated every two years — use the most recent version to gain accurate and reliable information.)
10. In small groups, explore the influence of social media on the health behaviours of young teenagers.

3.7 Sample exam question response

Question

To what extent do the interactions between the dimensions of health contribute to the dynamic nature of health? **(8 marks)**

Criteria	Marks
• Makes an accurate judgement about the degree in which the dimensions of health impact on the dynamic nature of health • Makes evident the relationship between each dimension of health • Provides relevant and specific examples	8
• Makes evident the relationship between each dimension of health and explains how health is dynamic • Provides relevant examples	6–7
• Provides characteristics and features of the dimensions of health • Sketches in general terms the dynamic nature of health • Provides examples	4–5
• Sketches in general terms the dimensions of health and/or the dynamic nature of health	2–3
• Provides some relevant information about the dynamic nature of health and/or the dimensions of health	1

Sample response

eles-5014

Breaking down the question

To what extent do the interactions between the dimensions of health contribute to the dynamic nature of health?

Identify the action word/s: To what extent — this requires a judgement while also making evident the relationship between things.

Syllabus terminology: dimensions of health and dynamic nature of health

Mark allocation: 8 marks — according to HSC past papers, questions worth 8 marks require answers that include multiple body paragraphs, each addressing the action word and providing clear examples.

Answering question using PEEL structure

P Identify the *Point* being raised/state topic sentence/what this paragraph is going to be about[1]

E *Expand/Elaborate* on the point and provide a strong link to what the question is asking[2]

E Apply *Examples* that are relevant and specific[3]

L *Linking* sentence that relates back to the question[4]

Sample annotated response

Health is considered dynamic, since it is constantly changing. The interaction between the physical, social, mental, emotional and spiritual dimensions of health contribute significantly to the changing state of an individual's health.[1]

An individual's physical health can change drastically due to an unexpected injury[2] such as a severely broken leg.[3] Whereas the individual used to move around freely, they may now be limited in their movements by being bed-ridden, using a wheelchair or using crutches.[4] This can affect their physical health by reducing the amount of physical activity they can participate in, which might result in weight gain.[3]

A severely broken leg can also have a great impact on a person's social health.[2] Due to their movement being limited they might be prevented participating in organised sports, which could then reduce their opportunities to interact within their normal social circles.[4] This can have an adverse effect on their mental health as their routine has been interrupted and they may no longer be able to enjoy the activities they once did.[3]

It is important to recognise that this negative influence on the individual's health can be reversed through the same interactions between the dimensions of health.[2] If a person has strong emotional health, characterised by a resilient nature, they will have an increased ability to bounce back from this moment of adversity.[3] This time in their life may also renew their spiritual health by allowing them to contribute towards their sporting club in a new way, such as volunteering to help compile statistics on each player's performance.[4] From all of these examples it is highly evident that each dimension can interact in both positive and negative ways due to the dynamic nature of health.[3]

3.8 Review

3.8.1 Topic summary

3.2 Meanings of health

- Health is diverse and means different things to different people.
- In the past health was defined as being free from disease or illness. However, the World Health Organization now defines health as 'a resource for everyday life, not the objective of living. Health is a positive concept emphasising social and personal resources, as well as physical capacities'.

3.3 The dynamic nature of health

- Health is continually changing; that is, it is dynamic.
- At an individual level, health depends on the interaction of five dimensions — physical, social, mental, emotional and spiritual.
- Interactions between each dimension of health have the potential to result in positive health outcomes as well as negative health outcomes.
- A health continuum can be used to record an individual's current health status, as well as to track their health status over time.
- The concept of good health is individual and can be highly subjective, as people see health in different ways, have different perceptions about what is optimal or 'normal' and define the extremes of the continuum differently.
- An individual's health will constantly change from birth, to childhood and adolescence, through adulthood and into their elderly years.
- The personal circumstances of each individual will determine their own level of health.

3.4 Measuring health status

- Epidemiology provides data and information about disease, injury, illness and death. It indicates the risk factors for and apparent determinants of disease.
- The common measures of epidemiology include mortality, infant mortality and morbidity.
- Epidemiological data reveal that the major causes of sickness and death in Australia are cancer and cardiovascular disease.
- Epidemiology is a valuable tool in providing information to health authorities. However, it has limitations, such as its failure to provide information about the social determinants of health.
- Prevalence refers to the number of cases of disease in a population at a specific time, whereas incidence refers to the number of new cases occurring in a population.

3.5 Social justice principles

- The social justice principles — participation, equity, access, rights — seek to improve the health of the most marginalised and disadvantaged groups in society.
- Participation involves empowering individuals and communities to be active participants in the decision-making processes surrounding their health.
- Equity can be achieved by allocating additional resources and funding so that disadvantaged groups can be provided with the opportunity to attain positive health outcomes.
- Access requires people of all ages, cultures and abilities to have the ability to attend and use health facilities and services.
- Rights can be achieved through legislation and policy decisions at a government level to allow individuals to have access to health facilities and services while being free of discrimination.

3.6 The determinants of health

- There are a range of factors that determine the health outcomes of individuals and populations. These include the broad features of society, environmental factors, socioeconomic factors, health behaviours and biomedical factors.
- Broad features of society include culture, affluence, social cohesion, social inclusion, political structures, the media and language. They play a significant role in determining the health of individuals and communities from birth.
- Environmental factors such as geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community can affect the health status of individuals and communities.
- Increasing levels of remoteness in Australia result in increased levels of mortality and morbidity.
- People living in high socioeconomic areas are more likely to engage in regular physical activity and consume the daily recommended intake of fruit and vegetables.
- Cultural background and traditions play a significant role in influencing the health and wellbeing of Australians.
- Socioeconomic factors such as earning a high income, having high educational attainment and maintaining stable employment increase an individual's chances of leading a healthy life.
- Health behaviours such as risky alcohol consumption, abuse of illicit and/or prescription drugs and a sedentary lifestyle can result in negative health outcomes.
- Rates of cigarette smoking and daily alcohol consumption have continued to decline among younger populations; however, young people are more likely to consume alcohol at a rate that exceeds single occasion risk guidelines, and vaping is on the rise.
- High blood pressure rates have remained stable over the past decade; however, the condition is still present in one-third of the population aged 18 and over.
- Rates of dyslipidaemia are similar across geographic areas and socioeconomic groups.
- Diagnoses of type 2 diabetes continue to climb in Australia, affecting Aboriginal and Torres Strait Islander Peoples at greater rates than other Australians.
- All of the determinants of health interact with each other and can have a compounding positive or negative outcome towards the health of population groups.
- Sociological causes refers to the diverse and complex social processes that influence people's behaviour in risk taking.
- Many inequities exist for different populations in terms of each determinant, however, with coordinated individual, community and government effort, it is possible to improve health outcomes for those in need.

on Resources

📄 **Digital document** Topic 3 summary (doc-35905)

3.8.2 Key terms

biomedical factors determinants of health that include genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment
blood glucose also referred to as blood sugar; a form of stored energy within the blood cells generated from the breakdown of carbohydrates
broad features of society determinants of health that include culture, affluence, social cohesion, social inclusion, political structures, the media and language
cancer a group of diseases characterised by abnormal cell growth which has the potential to spread throughout the body
cardiovascular disease refers to disease that affects the heart or blood vessels
determinants of health the range of factors, as identified by the AIHW, that determine the health status of individuals and populations
distribution the extent within a population

▶

dynamic health refers to the constant changes that occur in our level of health

dyslipidaemia a condition characterised by an abnormal amount of blood lipids

emotional health a state of health related to how we think and feel, and how we cope with our thoughts and feelings

environmental factors determinants of health that include geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community

epidemiology the study of the patterns, causes and effects of health-related states or events (including disease) in a population, through the collection and analysis of data; the goal is to prevent and control health problems by identifying and understanding the causes

equity the fair distribution of resources based on the needs of individuals and populations, with the aim of achieving equitable outcomes

family and domestic violence violent or aggressive behaviour towards family members that may occur within the home

food security when all people, at all times, have access to sufficient safe and nutritious food to meet their dietary needs for an active and healthy lifestyle

genetics refers to characteristics, features or hereditary diseases that are genetically linked and passed on within a family

health continuum a scale on which an individual's health can be measured or assessed; usually includes categories such as very poor, poor, fair, good and very good

high density lipoprotein (HDL) referred to as 'good' cholesterol as it assists in the removal of other forms of cholesterol from your blood

incidence the number of new cases (of e.g. an illness or event) occurring during a given period

infant mortality the number of deaths among children aged under 1 year in a given period, per 1000 live births in the same period

low density lipoprotein (LDL) referred to as 'bad' cholesterol as it transports excess cholesterol to the blood vessel walls

Medicare Australia's government-funded health scheme that subsidises the cost of medical services for all Australians

mental health a state of mental wellbeing that enables people to cope with the stresses of life, realise their abilities, learn well and work well, and contribute to their community

morbidity the ill health of an individual and levels of ill health in a population or group

mortality number or rate of deaths in a population during a given time period

physical health refers to the efficient functioning of the body and its systems, allowing people to carry out everyday activities and to be free from illness

prevalence the number or proportion (of e.g. cases or instances) in a population at a given time

social health refers to our interactions with other people as well as the social and communication skills and abilities we display

social justice principles principles that aim to reduce or eliminate inequality, foster inclusivity and diversity, and create supportive environments for all individuals

socioeconomic factors determinants of health that include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media

spiritual health feeling a sense of purpose and meaning in one's life

triglycerides a type of fat found in the blood

type 2 diabetes a condition in which the body develops a resistance to insulin or does not produce enough insulin

World Health Organization (WHO) a specialised agency of the United Nations that acts as the coordinating authority on international public health issues

on Resources

Digital documents   Key terms glossary (doc-36171)

   Revision quiz (doc-34732)

Interactivity   Missing word interactive quiz (int-8040)

3.8 Exercise

3.8 Exam questions

▶ Question 1 (1 mark)

Which of the following determinants of health are considered socioeconomic factors? (HM-11-01)

A. Educational attainment, genetics and disability
B. Culture, community safety and blood pressure
C. Social networks, employment status and social expectations
D. Cultural background, employment status and educational attainment

▶ Question 2 (1 mark)

Which term describes the number of new cases of an illness occurring in a given period? (HM-11-01)

A. Mortality
B. Morbidity
C. Incidence
D. Prevalence

▶ Question 3 (1 mark)

Which strategy addresses the social justice principle of *access*? (HM-11-01)

A. Encouraging young people to advocate for their own health
B. Raising awareness about health inequities through public education campaigns
C. Providing increased funding to specific populations to reduce health inequities
D. Ensuring health information is distributed in multiple languages in healthcare facilities

▶ Question 4 (1 mark)

Impaired glucose regulation is a precursor to the development of which condition? (HM-11-01)

A. Lung cancer
B. Type 2 diabetes
C. Alzheimer's disease
D. Coronary heart disease

▶ Question 5 (2 marks)

Distinguish between the terms 'prevalence' and 'incidence'. (HM-11-01)

▶ Question 6 (4 marks)

Describe how the physical and social dimensions of health can interact to lead towards positive health. (HM-11-01)

▶ Question 7 (4 marks)

Describe the role of epidemiology in improving the health of Australians. (HM-11-01)

▶ Question 8 (4 marks)

Describe the limitations of epidemiology. (HM-11-01)

▶ Question 9 (5 marks)

How can the dimensions of health interact to improve the health of an individual? (HM-11-01)

▶ Question 10 (3 marks)

Outline the role of protective factors in achieving a positive health status. (HM-11-01)

▶ Question 11 (4 marks)

Explain the four measures of epidemiology. (HM-11-10)

▶ Question 12 (5 marks)

Explain why individuals give different meanings to health. (HM-11-01)

▶ Question 13 (8 marks)

How do socioeconomic and environmental factors influence the health and wellbeing of Australians? (HM-11-06)

▶ Question 14 (12 marks)

Refer to the information below as well as your own knowledge to answer the question that follows.

> The following statistics from the AIHW relate to people under the age of 65 with a disability:
> - 1 in 5 did not see a GP due to cost
> - 2 in 3 delayed seeing or did not see a dentist due to cost
> - 2 in 5 had difficulty accessing medical facilities
> - 1 in 6 experienced discrimination by health staff
> - 2 in 5 have avoided situations such as going to school or work because of their disability.

To what extent can the social justice principles be used to achieve positive health outcomes for people with a disability? (HM-11-06)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

3.1 How do we understand and measure Australia's health? (tpdf-2177) ☐

📄 Digital documents

3.8 Topic 3 summary (doc-35905) ☐
Key terms glossary (doc-36171) ☐
Revision quiz (doc-34732) ☐

▶ Video eLessons

3.7 Sample exam question response (eles-5014) ☐

🧩 Interactivities

3.6 The majority of Australians live on the east coast and in major cities (int-8602) ☐
Leading cause of death by geographic location with comparison mortality rates with Australia overall, 2017–21 (int-8603) ☐
Age-standardised all-cause mortality rate, by country of birth, 2016 (int-8604) ☐
Number of young people employed in either full- or part-time work, 1990–2018 (int-8605) ☐
Alcohol use status for young people aged 14–24, by age and sex, 2019 (int-9277) ☐
Prevalence of uncontrolled high blood pressure among adults, by age and sex, 2017–18 (int-8606) ☐
Prevalence of uncontrolled high blood pressure among adults, by socioeconomic status and remoteness, 2017–18 (int-8607) ☐
3.8 Missing word interactive quiz (int-8040) ☐

🔗 Weblinks

3.2 What does being healthy mean to you? Children's perspective ☐
What does being healthy mean to you? Youth perspective ☐
What does being healthy mean to you? Global perspective ☐
3.3 Mental health continuum ☐
3.4 ABS ☐
AIHW ☐
3.5 Hear Our Heart ☐
Hear Our Heart video ☐
NACCHO ☐
TOOTH program ☐
NDIS ☐
3.6 Growing Up Tough — The Feed ☐
AIHW — *Australia's health 2022* ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

4 What are young people's meanings of health?

LEARNING SEQUENCE

4.1 Overview

Key inquiry question

What are young people's meanings of health?

Syllabus

	Syllabus content	Subtopic
○	■ Explore across generations aspects of young people's lives that make them similar and different to the young people of previous generations. **Example(s):** Developmental stages. Influence of family, peers, culture, technology and global events.	**4.2**
○	■ Investigate the meanings of health for young people **Including**: • creating a research question • developing a method(s) to collect data • considering how the determinants of health impact on a young person's meaning of health • analysing the different ways young people define what is important to their own health • discussing ethical considerations • validity, reliability and credibility data collection • presenting findings and drawing conclusions • identifying further research questions that could be explored **Example(s):** **Developing a method(s) to collect data:** Survey. Interview questions. Focus groups.	**4.3**

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Outcomes

- interprets meanings, measures and patterns of health experienced by Australians HM-11-01
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Research: analyse a range of sources to make conclusions about health and movement concepts HM-11-10
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07

on Resources

Digital documents　Topic 4 summary (doc-35906)
　　　　　　　　　　　Key terms glossary (doc-36172)
　　　　　　　　　　　Revision quiz (doc-34733)

4.2 Aspects of young people's lives now and in the past

Who makes up the group in our population that we refer to as 'young people'? According to the Australian Institute of Health and Welfare (AIHW, 2022), young people are considered to be those individuals aged between 15 and 24 years. The Australian Bureau of Statistics (ABS) reported that in June 2022 there were an estimated 3.2 million young people aged 15–24 living in Australia, of which 52 per cent (1.6 million) were male and 48 per cent (1.5 million) female. Together, young people aged 15–24 made up 12 per cent of the total population (ABS, 2022).

FIGURE 4.1 Different generations that make up Australia

BABY BOOMER   GEN X   GEN Y   GEN Z

In 2021 the ABS recognised six generations (five working generations) in its census count. These are known as the Interwar generation (born 1945 and before), Baby Boomers (born 1946–64), Generation X (born 1965–76), Generation Y (born 1977–95), Generation Z (born 1996–2013) and Generation Alpha (born 2014 onwards). Although each generation has its own understanding of health, there are similarities and differences between young people's meanings of health now and in previous generations. Some of the factors which may influence the shaping of health for young people include developmental stages and influence of family, peers, culture, technology and global events.

adolescence the transition period from childhood to adulthood

puberty a stage in the life cycle when rapid physical changes occur that signify that a person has reached sexual maturity

4.2.1 Developmental stages

The term 'young people' covers a broad range of years and therefore a wide range of developmental stages. The use of smartphones and social media and the impact of globalisation can affect how quickly young people mature. Despite still being in the developmental stage of childhood, the influence of technology means 12-year-olds now have global information at their fingertips. Developmentally, just like in generations before, **adolescence** is characterised by rapid physical growth and is accompanied by emotional, mental and social maturation. A young person's brain is still developing too, and it will keep doing that until their mid-20s; in particular a part of the brain called the prefrontal cortex, which is responsible for making decisions, controlling impulses and planning. As young people go through **puberty**, their feelings about love and relationships also start to develop.

FIGURE 4.2 Some of the physical changes experienced during adolescence

For males
- Sperm production begins.
- Erections begin to occur.
- Ejaculation and wet dreams occur.
- Muscles develop.
- The voice box enlarges and the voice deepens.
- Hair grows on face, under the arms and in the groin area.

For females
- Menstruation begins.
- Breasts develop.
- Body gets taller and curvier.
- Hips widen.
- Hair grows under the arms and in the groin area.

Modern young people have similar individual attributes to young Australians in the past. Both males and females experience the transition from puberty into adulthood. Adolescents both now and in the past often explore their values, beliefs and career interests. As they develop, young people begin to feel more confident about what their passions and talents are, and start thinking about what they want to do for work in the future. Despite the similarities between young people of today and those of past generations, there are differences.

- Young people today have a higher rate of education.
- According to the Workplace and Gender Equality Agency (WGEA 2022), women make up almost 50 per cent of the total number of employees in the workplace. This is significant because the ABS reported in 1966 that women made up only 30 per cent of the workforce.
- Young people are delaying marriage and taking longer to move out of the parental home.
- Home ownership has decreased.

The article in the following case study became a conversation starter in 2017, and was interpreted by some as a negative appraisal of Generation Y and Generation Z (often known as millennials).

CASE STUDY

Millionaire tells millennials: if you want a house, stop buying avocado toast

By Sam Levin

16 May 2017

An Australian millionaire and real estate mogul has advice for millennials struggling to purchase a home: stop buying avocado toast.

Tim Gurner, a luxury property developer in Melbourne responsible for over $3.8bn in projects, is facing heat for comments he made on *60 Minutes* in Australia, implying that young people can't afford to buy property because they're wasting money on fancy toast and overpriced coffee.

'When I was trying to buy my first home, I wasn't buying smashed avocado for $19 and four coffees at $4 each,' he said. 'We're at a point now where the expectations of younger people are very, very high.'

He added: 'We are coming into a new reality where … a lot of people won't own a house in their lifetime. That is just the reality.' Asked if he believes young people will never own a home, he responded: 'Absolutely, when you're spending $40 a day on smashed avocados and coffees and not working. Of course.'

The 35-year-old executive then offered a point of comparison, describing how hard he worked when he was young.

'When I had my first business when I was 19, I was in the gym at 6am in the morning, and I finished at 10.30 at night, and I did it seven days a week, and I did it until I could afford my first home. There was no discussions around, could I go out for breakfast, could I go out for dinner. I just worked.'

Gurner is not the first to suggest that young people's love of avocado toast was making it harder for them to buy homes. Demographer Bernard Salt wrote in the Australian last year that if young people stopped going to 'hipster cafés', they could purchase property.

…

Gurner's spokesperson did not immediately respond to a request for comment.

Source: https://www.theguardian.com/lifeandstyle/2017/may/15/australian-millionaire-millennials-avocado-toast-house.

Case study questions

1. Read the article and complete the activity below.
   - Your teacher will break the class into groups representing different generations. Each group will offer their generation's perspectives on this issue.
   - Complete the following scaffolded sentences to share different perspectives: I am thinking of … [name the issue]… from the viewpoint of… [name the generation]. I think… [describe the topic from your viewpoint]… because… [explain your reasoning]… A question or concern I have from this viewpoint is….
2. Evaluate how housing affordability might have an impact on the health of young Australians individually as well as collectively.

4.2.2 Influence of the family

Research suggests the family unit is still valued by today's young people. Although what makes up a family may look different for young people, having a close, supportive family is still a positive influence. Connections made between family members provide a positive protective factor for various health risks. For example, a decrease in the number of parents who smoke cigarettes positively influences their children to also not begin smoking. On the other hand, families can have a negative influence on a young person's relationships. For example, a risk factor in the rise in **domestic and family violence** is having a history of abuse, which may often be from the family unit.

FIGURE 4.3 Some of the different types of family units in Australia

The cross-generational dynamic of a family, which may include children, teenagers, adults and grandparents, provides young people with a variety of perspectives about life issues. This may increase a young person's **empathy** and widen their scope of understanding. While today's adults are increasingly aware of and sometimes more tolerant towards youth cultures, there is still said to be a 'generation gap' (a difference of opinions and outlooks between one generation and another). However, this gap might be overestimated, with research showing that young people's opinions often reflect those of their parents on core issues such as politics and religion, showing the immense influence family has on a young person.

4.2.3 Influence of peers

In previous generations, the influence of a **peer group** on young people was just as important but looked very different. The 1950s and '60s saw a post–World War II world where, for the first time, a separate 'teenage' culture thrived. Cars became readily available to young people, which meant they had more freedom to travel around. Young people in the 1960s bonded over new music styles such as 'rock and roll', and pop stars such as The Beatles and Elvis. The importance of the peer group still exists for young people today, with over 80 per cent of responders telling Mission Australia in 2023 that they identified friendship as their most valuable source of support (*Youth Survey Report*, 2023). Eighty per cent also identified friendships as the number one place to go for help with important health issues, above parents and health professionals. A strong peer group can aid in positive influences, such as when peers support each other in not smoking, not misusing drugs or by demonstrating positive **upstander** behaviour. However, there can also be negative influences, such as when peers encourage each other to take risks on the road. Additionally, the growing influence of the peer group might become a source of conflict with parents. As young people grow in independence they may increasingly follow the values and behaviours of their peers rather than those of their parents.
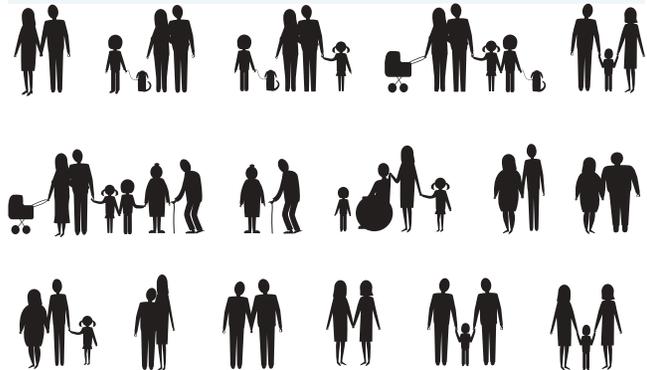
FIGURE 4.4 Friends enjoying time together outdoors and being physically active.

domestic and family violence violent, abusive behaviour or actions toward partners or family members in order to scare or control them; it is a criminal offence

empathy the ability to identify, appreciate and understand another's situation or feelings

peer group a social group of people who have similar interests, ages or backgrounds

upstander someone who takes action against bullying behaviour

4.2.4 Cultural influence

The influence of culture and relating to a particular part of society continues to be strong for young people. Aboriginal and Torres Strait Islander Peoples have the oldest living cultures in the world, going back at least 60 000 years. Aboriginal and Torres Strait Islander cultures continue to be relevant and important to their life today, with a depth and diversity of histories to share. For Aboriginal and Torres Strait Islander Peoples, culture also continues to be an important influence on health. Australia today is a culturally diverse country; however, this wasn't always the case. Over the last century the demographics of Australia have changed significantly. More than 100 years ago, the Immigration Restriction Act stopped non-European immigrants from settling in Australia. However, in the 1970s Australia adopted the policy of multiculturalism, which supported **diversity**, acceptance and equality of migrants from around the world. These shifts in policy boosted our economy, widened our choice of food options and exposed Australians to various cultural practices including traditions, beliefs and customs from around the world. One such example is the Lunar New Year celebrations.

FIGURE 4.5 Sydney Harbour is painted in red and fireworks are used to celebrate the Lunar New Year.

Young people over different generations have also had their own unique culture, shaping everything from fashion and music to social movements and attitudes. In the 1960s, a 'counterculture' was said to exist. 'Hippies' and others protested against the Vietnam War and nuclear arms, and advocated free love as a reaction to conservative society. In terms of music, the 1990s saw the development of rave culture, dance parties and styles such as grunge; while the 2000s saw a rise in rap and hip-hop, through to grime and drill in the late 2010s and into the 2020s.

The need for some young people to develop a certain look and be part of a youth subculture is about trying to express their feelings about the world around them and find a place of belonging. This can be help confirm their identity and may be important in maintaining **self-esteem** and self-confidence.

The mass media — that is, newspapers, television, the internet, social media, radio, podcasts and magazines — also help to identify and label various youth cultures throughout the world. For example, punk culture, a distinct movement in the United Kingdom in the 1970s, was widely driven via music and commented on through associated media. Young people were characterised by the wearing of safety pins, Dr. Martens' boots and coloured hairstyles. More recent youth culture movements have spread through social media.

FIGURE 4.6 Changing how you dress and act in adolescence to show a connection with a specific subculture has been occurring for generations.

diversity the differences that exist within a group, which can include age, sex, gender, gender expression, sexuality, ethnicity, ability/disability, body shape and composition, culture, religion and spirituality, learning differences, socioeconomic background, values and experiences

self-esteem the feeling or opinion (negative or positive) one has about oneself

4.2.5 Influence of technology

Technology plays a large part in the lives of young people and has both positive and negative influences. The rapid advances in communications technology over the last three decades have led to everyday use of the internet, email, social media and blogs. This means young people have far greater access than their parents did to information from around the world, and are able to communicate locally and internationally at any time of the day or night.

Technology and work

Due to the rapidly changing nature of technology, new jobs are continually being created that young people find easier to access than older people. This may be due to the skills required to use the technology as well as the increased rate of change. The rate of change is so great that it has been estimated that the majority of jobs that will exist in 2030 have not been invented yet. Jobs such as data analysts, software and application developers, programmers, web designers and social media specialists are now the most sought-after, but did not exist 40 years ago. The specific nature of these jobs means that some young people can be on high salaries because of the demand by businesses for these skills. Similarly, the web has opened up a whole new sector of online businesses and employment options. Young people can now easily sell products and services online to other people anywhere in the world, or work from home, leading to more entrepreneurship and legitimacy of the role of 'influencer'.

Technology and leisure

Online, young people have virtually unlimited access to music, computer games, videos and information regardless of its classification. Past generations of young people had more direct adult supervision of their leisure time, including their access to music and movies, because they had to physically go and buy products such as a newly released album in a store. Today, although some families attempt to filter the media influences on a young person, young people also need to be taught how to moderate their own online presence and use protective factors to enhance health and wellbeing. These include things such as setting timers, knowing how to protect your digital footprint and identity, and being able to think critically about content and its reliability.

Technology and communication

The ways in which young people communicate and the language they use has rapidly changed with the development of technology. Abbreviations, code words and emojis develop across online social networks, often extending beyond national or cultural boundaries. Young people have always felt a strong need to communicate with other young people, but online platforms have, meant that this communication can take place from a device via text and chat applications, rather than in person.

FIGURE 4.7 The rapid and vast expansion of online information gives young people immediate access to content that would have been impossible for earlier generations of teenagers to access.

FIGURE 4.8 New ways of communicating through emojis are a popular means of connection with young people.

Challenges of technology

However, the rapid increase in technology used by young people has created some problems. These can include:

- increased rates of addiction to gaming
- access to unrestricted and uncensored material on the internet
- negative social issues for young people who are missing out on face-to-face and in-person connections
- over-exposure to misleading information about social norms
- cyberbullying.

FIGURE 4.9 The advancement of the telephone has transformed digital and long-distance communication from a rare occurrence limited to the affluent to a tool accessible to all, held in the palm of one's hand.

1885　1920　1965　1985　1990　2000　2015　Future

The potential problems listed above are associated with additional stress or medical conditions that affect young people, which are different to the issues faced by young people of previous generations.

As an example, 'gaming disorder' became officially recognised as a medical condition by the World Health Organization in 2018. Gaming disorder is characterised by an inability to control time spent gaming — even when the gaming negatively affects a person's ability to function in personal, family, social, educational and occupational areas of their life. Gaming can also lead to vision problems, repetitive strain injuries and **mental health** issues. Prevention strategies used against gaming disorder focus on education, improving social skills and promoting healthier lifestyles in order to target **hypokinetic diseases** such as obesity and type 2 diabetes.

FIGURE 4.10 Social media may show only the highlights of a person's life.

While it can be of great benefit in many ways, technology can make social issues worse for young people, and it is linked to rising rates of depression and anxiety among youth. Social media brings connections through online chat, but the consequent reduction in face-to-face, in-person interaction can also lead to loneliness and insecurity. Misleading content on apps such as Instagram and TikTok can distort social norms, fostering envy and dissatisfaction. **Cyberbullying** and identity theft are on the rise, causing significant **stress** for young people.

4.2.6 Global events

Over the past 100 years, global events have had a significant impact on Australian young people. In the UK, the 1916 Military Service Act imposed conscription on all single men between the ages of 18–41. Although conscription was never introduced in Australia for World War I, many Australian young men and women felt the need to be loyal to Britain and so willingly went and fought in both world wars. If they survived the war, many returned injured leading to a generation who suffered significant disability. Despite the serious impact of this event, these young men and women led to the development of the ANZAC tradition and the values of mateship, sacrifice and service, which still resonates with the ideals and values of young people today.

mental health a state of wellbeing in which an individual realises their own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to their community

hypokinetic diseases a term given to modern lifestyle diseases associated with inactivity

cyberbullying deliberate harassment of a person using communications technology, such as instant messaging by email, on social media pages, in chat rooms or on other electronic media

stress a physiological or psychological influence that produces a state of tension in a person

More recently, global events such as the September 11 2001 terrorist attacks in New York, the COVID-19 pandemic, the war in Ukraine and the Israel–Palestine conflict have been brought close to home through the widespread sharing of images, footage and information. The availability of information on global events such as war, terrorism and political unrest can create a burden on young people, and needs to be balanced with the positive parts of life that are often underrepresented in media. As a result of the negative emphasis found in media coverage of these issues, many young people can develop a bleak outlook on life and perhaps suffer from mental health disorders.

Global events such as the #blacklivesmatter movement have also swept across nations around the world. Young people have used social media as a platform to promote positive social messages and to encourage social change. Through social media and the sharing of shocking footage, the global community quickly hears about social injustices. Social media provides a voice for young people to share their views, gather support and fight for a global cause.

FIGURE 4.11 Reports of events such as the war in Ukraine have spread rapidly to countries all over the world.

Environmental pollution disasters and concerns about climate change have also prompted young people to take action in their community. Climate activists such as Greta Thunberg have inspired a generation of young people around the world to join in global climate demonstrations, showing world leaders the importance of **climate action**.

climate action refers to increased efforts to reduce greenhouse gas emissions and strengthen resilience and adaptive capacity to climate-induced impacts

FIGURE 4.12 Swedish climate activist Greta Thunberg leads a protest in Rome, Italy.

International competitions, such as the Olympic Games, Grand Slam tennis matches, soccer World Cups and international cricket series can positively influence young people by increasing their participation rates in sport. The work of athletes such as Dylan Alcott has led to greater awareness of wheelchair sports, inspiring young wheelchair athletes to be physically active in their communities or even compete at an elite level. Sporting teams such as the Matildas and the Australian women's cricket team are inspiring a rapid increase in female participation at grass-roots level, encouraging young people to become more physically active.

FIGURE 4.13 Grand Slam Champion winner Dylan Alcott after winning the Australian Open 2016 quad singles wheelchair tennis final.

FIGURE 4.14 Participation in women's sport is on the rise.

4.2 ACTIVITY

Decide with your feet

Your teacher will divide your class into two groups: the left side of the classroom is 'Disagree' and the right side of the classroom is 'Agree'. For each statement below, move to the appropriate side of the room to show what you believe. For statements a and b, first use the **ReachOut cyberbullying** weblink in the Resources panel to read the article on cyberbullying.

a. Young people today should just turn off their phone if they don't want to get cyberbullied.
b. Young people today get bullied worse than young people of past decades.
c. The national legal age for drinking alcohol should be increased to 21.
d. Women in sport should get paid the same as men.
e. Young people should have to qualify for a phone licence (like a driving licence) before being given full access to a smartphone.
f. COVID-19 is the biggest influence on the health of Australian young people.

Justify your response by giving reasons to support your opinion.

---

on Resources

🔗 **Weblink** ReachOUT cyberbullying

4.2 Exercises

learnon

| **4.2 Quick quiz** **on** | **4.2 Exercise** |

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Learning pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3, 4	5, 6

Revise your knowledge

1. List three examples of how developmental changes and the influence of family, peers, culture, technology and global events impact the health of young people.
2. Outline the similarities and differences between young people today and those of past generations.
3. Describe how peer groups can be both a positive and negative influence on the health of young people.

4. Leon is 16 and is at home in an online group study session. His parents are confused as to how he is able to stay focused while interacting virtually with others. They comment on how the marks resulting from this study could affect his future career. Concerned that he spends too much time gaming and eating fast food, they encourage him to learn more about a healthy diet and physical activity levels.
   a. What are the influences on Leon's health?
   b. Why are his parents confused?
   c. Explain how Leon's experience of being a young person might be different from that of his parents.
5. Examine the various influences on young people and justify the most significant difference between young people today and those of the past.
6. Evaluate the most significant influence on you in comparison to previous generations.

4.3 Investigating the meanings of health for young people

> **Syllabus:** Investigate the meanings of health for young people
>
> **Including:**
> - creating a research question
> - developing a method(s) to collect data
> - considering how the determinants of health impact on a young person's meaning of health
> - analysing the different ways young people define what is important to their own health
> - discussing ethical considerations
> - discussing validity, reliability and credibility of data collection
> - presenting findings and drawing conclusions
> - identifying further research questions that could be explored.
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Meanings of health can vary from person to person and across generations. They can be based on personal, cultural and environmental factors and can determine the way young people are physically active in their communities. For example, health may have a different meaning for a young person in Year 7 at school than for someone who is in Year 12 at the same school. A young person in Year 7 may think that health is predominantly a physical concept, related to how agile, flexible and physically strong they are. Their Year 12 counterparts may place more value on mental and emotional health due to the stressors of juggling schooling, social life and part-time work. Previous generations, especially those born in times of war, may have viewed health relative to nutrition and access to medicines, rather than applying a focus on mental health, which was much less understood.

The following sections provide an example of a research process to investigate the meaning Year 7 students give to health. A typical Year 7 student will be 12 or 13 years old and experiencing regular **physical activity** through Physical Education lessons at school as well as other school-based sport options and perhaps also weekend sport. This modelled section will guide you through what to expect in your own independent research investigation.

physical activity body movement that is produced by a contraction of skeletal muscle and that increases energy expenditure. Physical activity is a broad term that includes playing sport; exercise and fitness activities such as dance, yoga and tai chi; everyday activities such as walking to work, doing household chores and gardening; and many other forms of active recreation.

4.3.1 Creating a research question

As discussed in topic 1, a research question is the key question for which you are trying to find an answer. In our example, it is:
- What does a Year 7 student think is the meaning of health?

4.3.2 Developing a method(s) to collect data

How do we know what meaning young people give health if we don't ask them? Topic 1 gives insight into various methods of collecting data about the meaning of health, including surveys, interview questions and focus groups.

Surveys

Surveys are a series of questions (often simple and closed questions) asked by a researcher; in our case, questions would be asked of a Year 7 student about the various meanings of health (see tables 4.1 and 4.2). The Year 7 student hears the question and gives an answer, and the researcher records the data. The same set of survey questions is posed to the next Year 7 student, and so on. It is important to ask the same questions, as this keeps the research reliable and valid. Thinking about what result you would like to gather from asking each question is a good place to start. A sample set of survey questions is shown in table 4.1.

TABLE 4.1 A sample set of survey questions designed for research into what a Year 7 student thinks is the meaning of health

Questions	Possible answers
1. Do you think that you have 'good health'?	YES NO
2. Please rate your own health on a scale of 1 to 5 (1 being the worst health and 5 being the best health).	1 2 3 4 5
3. What are the major influences on health for a Year 7 student?	
4. What are some factors that may influence YOUR meaning of health?	
5. Do you think you have a different meaning of health to your friends?	YES NO

Sample results from this survey are shown in table 4.2.

TABLE 4.2 Sample results from the survey of a Year 7 student

Questions	Possible answers
1. Do you think that you have 'good health'?	(YES) NO
2. Please rate your own health on a scale of 1 to 5 (1 being the worst health and 5 being the best health).	1 2 3 4 (5)
3. What are the major influences on health for a Year 7 student?	Social media Access to doctors Friends Family Mental health Body image Personal safety Stress
4. What are some factors that may influence YOUR meaning of health?	Social media, friends
5. Do you think you have a different meaning of health to your friends?	(YES) NO

Surveys are a great way to collect data as they are quick and can be easy to complete, but collating the results (see table 4.2) can be tricky as the researcher needs to take bias into account and be careful to accurately record and interpret the data. Alternatively, instead of going and asking each Year 7 student for their answers, online platforms such as Google Forms or SurveyMonkey can collect both quantitative or qualitative data through a questionnaire. Questionnaires are usually conducted without the presence of the researcher and can be anonymous.

Interview questions

Interview questions involve a face-to-face session of questions and responses; this can be in person or online. Types and wording of questions need to be appropriate to the age of the respondent (a Year 7 student) and can be used to collect the respondent's personal opinion. For example, you might ask a Year 7 student a series of questions about what they think about the meaning of health. Interviews provide qualitative data and allow for freedom of response, as follow-up questions may be needed and the Year 7 student can expand on their initial response by giving examples to support their opinion.

An example of interview questions for this research topic is shown in table 4.3.

FIGURE 4.15 A survey being conducted with quantitative data being collected and recorded by the surveyor

FIGURE 4.16 An interview being conducted with the responses being recorded

TABLE 4.3 A sample set of interview questions that could provide extra insight into the research topic

Research question: What does a Year 7 student think is the meaning of health?

Question 1: What are the most important elements that make up health and why are they important?

Question 2: What are the least important elements that make up health and why?

Question 3: If you could give one sentence to describe what your meaning of health is, what would it be?

Focus groups

Focus groups consist of a group of carefully selected individuals who are guided through a discussion on a topic. Their reactions and comments are recorded in order to collect qualitative data. For example, students in Year 7 who reflect different cultural backgrounds, gender, life experience or interests may be selected to participate in a group discussion in which responses may be interactive and dynamic.

Sample focus group questions are shown in table 4.4.

FIGURE 4.17 A focus group is led by the researcher, and participants share their thoughts in front of other participants. Responses are recorded by the researcher.

TABLE 4.4 A sample set of questions used in a focus group

Research question: What does a Year 7 student think is the meaning of health?
Question 1: Tell me how accurate this definition of 'health' is and why: 'Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.'
Question 2: Tell me what you think the opposite gender's definition of health would be in Year 7.
Question 3: How do you think your answer to question 2 compares to your own gender's definition of health?

DEPTH STUDY IDEA

Develop a case study looking at how your school community addresses the health of Year 7 students. Research what is currently happening in your school to address this issue, and suggest further strategies that your school could use to improve the health of Year 7 students. Present your case study as a multimodal presentation or video.


4.3 ACTIVITY 2

Methods of research

1. Using the research question you selected in Activity 1, decide which methods of research you would like to use to discover more about your question.
2. Record why these methods would be suitable and why other methods are unsuitable.

4.3.3 Determinants of health

The **determinants of health** include biomedical factors, socioeconomic factors, **environmental factors**, broad features of society and health behaviours (as identified by the Australian Institute of Health and Welfare); these determine the health status of individuals and populations. This is discussed further in topic 3. The AIHW *Australia's Health 2022* report (updated every two years) gives an indication about the way in which the determinants of health can have an impact on a young person's meaning of health. It is important to remember that there is an interrelationship between the determinants; for example, if a young person is living in a remote location (environmental factor), they might also experience reduced access to health services (socioeconomic factor).

FIGURE 4.18 Young people living in rural and remote areas lack access to many health services.
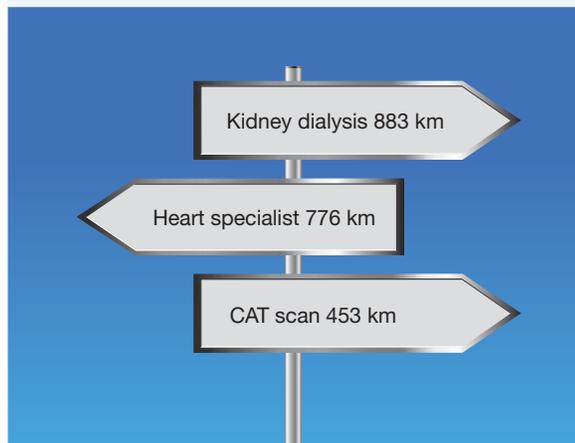
Kidney dialysis 883 km

Heart specialist 776 km

CAT scan 453 km

Biomedical factors

Biomedical factors include genetics, blood pressure, **blood glucose** levels, **cholesterol** levels and physical impairment. While issues with blood pressure mostly affect older people, problems associated with blood glucose levels increasingly affect young people. Despite a healthy diet, some young people can be genetically predisposed to developing high cholesterol levels. Furthermore, young people with a physical impairment find it harder to engage in physical activity, thus influencing the holistic meaning that a young person gives to health.

Socioeconomic factors

Socioeconomic factors include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media. For example, young people are greatly impacted by socioeconomic status because they generally spend a large amount of their time in school or tertiary education. Their access to and experience of education are affected by the income and wealth of their families, which also influences many other aspects of their lives. The level of access to good quality education and services, and the money to pay for food, healthcare and quality housing, all influences the health of young people.

Environmental factors

Environmental factors include geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community. For example, young people in rural and remote areas are more likely to have poorer health outcomes than their urban counterparts. Young people living in geographically rural and remote areas face barriers to accessing healthcare due to the challenges of geographic spread, low population density, limited infrastructure and the higher costs of delivering rural and remote healthcare. Such environmental factors may also have a negative impact on young people who are separated by physical distance from their community and social **support structures** such as friends, leading to poorer mental health outcomes such as depression. This affects the meaning that young people give to health because they value close proximity to support networks such as friends. These support networks lead to greater social interaction and an improved mental health status.

determinants of health biomedical factors, socioeconomic factors, environmental factors, broad features of society and health behaviours that determine the health status of individuals and populations

environmental factors factors in the built and natural environments that affect health; for example, geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community

biomedical factors factors present in the body that have an impact on health, such as genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment

blood glucose also referred to as blood sugar; a form of stored energy within the blood cells generated from the breakdown of carbohydrates

cholesterol a type of fat required for optimal functioning of the body that in excess can lead to a range of health concerns including blocking of the arteries

socioeconomic factors factors that include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media

support structures the people, places and programs that increase an individual's ability to make health-promoting choices

Broad features of society

Broad features of society include culture, affluence, social cohesion, social inclusion, political structures, the media and language. These can all affect an individual's current health and future health possibilities. Inequities in these broad features can affect a young person's health status, including their health literacy and access to services.

Health behaviours

A person's health is influenced by their behaviours, and **health behaviours** are often a result of a young person's beliefs and value systems. These beliefs and values lead to lifestyle behaviours and choices, such as whether to smoke, consume alcohol, take drugs and undertake physical activity, including how often and what type. Valuing good health might lead to a young person adopting a holistic approach, recognising that a combination of choices such as not smoking, eating healthy foods and undertaking physical exercise leads to the best health outcomes.

> **health behaviours** actions taken by a person that affects their health; the impact of many health problems could be reduced or prevented by changing behaviours, such as reducing alcohol intake, increasing physical exercise and practicing safe sex
>
> **primary data** information that is collected by the researcher, rather than getting it from a secondary source

---

DEPTH STUDY IDEA

Conduct a secondary-sourced investigation and develop a journal article comparing the meanings of health between different geographic locations (for example, rural and urban areas).

4.3 ACTIVITIES 3

1. Investigating the determinants of health

Use the **AIHW Health behaviours**, **AIHW Biomedical factors** and **AIHW Socioeconomic factors** weblinks in the Resources panel to answer the following questions. (Use the most recent data available on the AIHW website.)

1. What is the trend for each determinant of health?
2. How does each determinant of health affect a young person's meaning of health?

2. Constructing your questions

Consider each of the determinants of health as areas of investigation into the meaning that young people give to health. Use each area to construct interview questions, focus group questions and survey questions relevant to your topic.

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on Resources

🔗 **Weblinks** AIHW Health behaviours
AIHW Biomedical factors
AIHW Socioeconomic factors

4.3.4 The different ways that young people define what is important to their own health

As you have conducted your research, you will have compiled a number of different results about the meaning of health. It is important to read your results thoroughly in order to get a complete picture of the **primary data**. You may want to create a list of the trends which can help tell you the relationship or patterns you can see from the results of your survey, interviews and focus groups.

4.3 ACTIVITY 4

Identifying trends

1. Read your results and complete a table like the one below identifying any trends you can see from the results. (*Tip:* Think about what is similar or different.)

Survey	Interviews	Focus groups

2. List the relationships that you can see between the trends.

To analyse the **qualitative data** in our example, we would look at the responses students in Year 7 gave to question 1 in the focus group (table 4.4). Qualitative data involves the ways in which humans describe their experience, which in our example shows whether the majority of Year 7 students agreed that the definition of health given is accurate, and why. (The definition was: 'Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.')

qualitative data information that is expressed in words and narratives
quantitative data information that can be expressed in numbers

Their responses might include:
- Health is mostly influenced by physical attributes, because if you have a broken bone, the rest of your health is affected.
- Although very few people can identify with a complete sense of wellbeing, you can be healthy in one aspect (mental) but still have a disease.

Based on the collective responses of the Year 7 students, you might conclude that the research indicates Year 7 students think health is predominately a physical concept that is mostly about not having a common cold or any broken bones.

Quantitative data analysis investigates how numerical values show meaning from the research. To analyse quantitative data, it is sometimes helpful to create tables and graphs to present the numbers in a collated and easy-to-understand format. Turning data into percentages can also help show whether the numbers gathered either support or refute the hypothesis. For example, suppose a class of 30 Year 7 students completed the survey. The data gathered showed that 18 out of 30 students indicated positively that they thought they had 'good health'. This equates to 60 per cent of Year 7 students surveyed.

4.3 ACTIVITY 5

Analysing quantitative data

1. Read your results, and compile the data into final numbers and percentages.
2. Reflect on the quantitative data results and record your reflections by answering the following questions.
   a. What data surprised you? Why?
   b. What data did not surprise you? Why?

4.3.5 Discussing ethical considerations

As research is conducted, ethical considerations will guide your design and practices. Topic 1 outlines the ethical considerations of research in general but, when asking questions of Year 7 students, you need to follow school policy and procedures in relation to informed consent, privacy, integrity and respect.

To begin, consider the appropriateness of questions and methods of data collection for a Year 7 student.

- You may need to carefully consider word choice, so a Year 7 student can understand what is being asked of them.
- As students in Year 7 are under the age of 16, written permission must be granted by their parent/carer using a form that looks similar to the one shown in figure 4.19.
- You must provide information to the Year 7 students about what the research involves, the purpose of the research, methods of data collection (for example, a survey), and how the data will be used.
- The Year 7 students must then voluntarily provide their consent to be a part of research, with an understanding that they can withdraw at any time.

As research is collected, each of the Year 7 students has a right to their responses and identity being kept private and confidential. De-identifying a response may help to ensure anonymity, with all digital and paper-based files being kept securely. Furthermore, you must present the findings honestly and accurately and maintain as much objectivity as possible when conducting research with Year 7 students. You should cite all references properly.

doc-35902

FIGURE 4.19 A sample permission slip, which could be used to inform participants, gain consent and align with ethical considerations. This is available in the Resources panel as a Word template you can download.

Permission slip

INTERVIEW CONSENT FORM

Name of research project:

Name of researcher:

Name of research participant:

This interview will take [insert expected duration of interview]. No risks are expected with the interview. Should you wish to withdraw or stop the interview at any time you can do so.

Ethical research requires that you give explicit consent to participate. You are also required to know how the research will be used. This consent form is used to show you understand how you will be involved and the conditions of your participation.

Please read the following information and sign to show your approval:
- The interview will be recorded by notes and audio recording.
- A transcript (written record) of the interview will be produced.
- [Name of researcher] will analyse the transcript of the interview.
- Access to this transcript will be limited to [name of researcher] and colleagues who may collaborate on the research project.
- If direct quotes or a summary of information are used in research reports or publication, care will be taken to anonymise the information so you cannot be identified.

Signature:

Date:

4.3.6 Discussing validity, reliability and credibility of data collection

Validity and reliability are measurements of the quality of research undertaken (see also subtopic 2.4 in topic 2).
- *Reliability* is the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same.
- *Validity* means that a test or an experiment measures what it says it will measure. Results need to be valid to be able to draw conclusions from the research.
- *Credibility* refers to how trustworthy and accurate the data is that has been collected.

Validity and reliability should be considered at each stage of the research process.
- To produce valid results for research into what Year 7 students think is the meaning of health, Year 7 students must be the research participants and your group should include a diverse range of participants from Year 7.
- The methods of collecting responses must be suitable, as the Year 7 students need to understand the questions in order for their responses to be valid and reliable.
- Consideration of sampling methods: when conducting your research, it is important to think about how you select the participants. You should choose a method for selecting them that is reliable and consistent, so if someone else were to do the same study or test with a different group of people or things, they would get similar and consistent results. This helps ensure your research findings are dependable and can be trusted.

The collection of data is liable to bias from the researcher — even if they are not aware of it — as they choose participants, ask the questions and determine what is usable research. These decisions can reveal unknowing bias. Keeping the survey questions the same for each participant increases reliability, as all participants are given the same opportunity to answer. Since the researcher is also collecting secondary data, evaluation of the credibility of each source should be considered. This includes such things as relevance, accuracy of information, credentials of the author and whether the source is current.

4.3.7 Presenting findings and drawing conclusions

Tables and graphs are an easy and clear way to display information using the data collected. Software such as Microsoft Excel, Google Forms and SurveyMonkey can be used to turn the responses into summary information including charts, tables and graphs, while still giving you access to the raw data so you can see individual responses and control the data set. Popular graphs include line graphs, bar graphs (see figure 4.20) and pie charts (see figure 4.21).

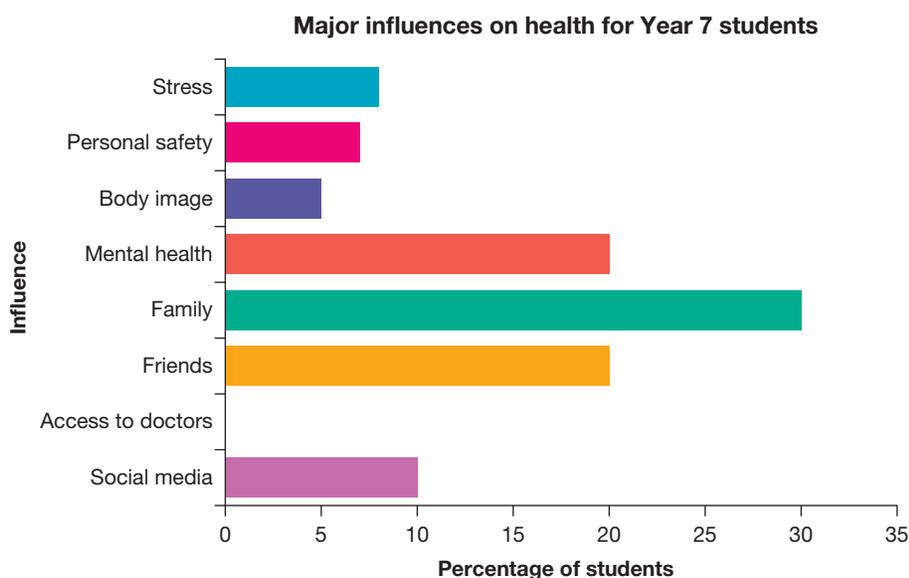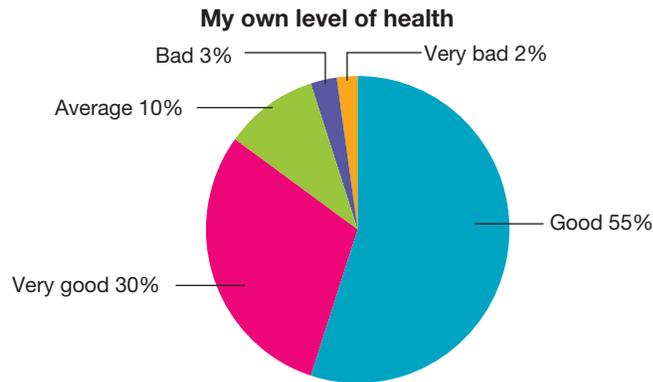**FIGURE 4.20** A bar graph showing results compiled from question 3 of the survey

Major influences on health for Year 7 students

My own level of health

It is important to annotate the graphs and tables presented. A discussion of the results is needed in order for the reader of the research to fully understand the context and further implications of the results. This will help in drawing conclusions from the research. Based on these conclusions, further possible implications can also be deduced. For example, this research hypothesised that 'the meaning of health is heavily influenced by physical attributes such as agility, fitness and physical independence through not having any broken bones'. In this case, the research indicated that Year 7 students identified physical attributes as a strong influence on their meaning of health. The implications of this research could include further education for Year 7 students about the need to recognise other forms of health (such as mental health) as important elements of their overall health. Another implication could be that, as Year 7 students value physical health highly, there could be an opportunity for schools to focus more on physical health for Year 7 students.

4.3 ACTIVITY 6

Compiling your data and making conclusions

1. From the research you have gathered, compile the qualitative and quantitative data into tables and graphs to present the data in an easy-to-understand format.
2. Answer the following questions based on your compiled data.
   a. What are the possible conclusions that can be drawn from each piece of data?
   b. What are the conclusions that can be drawn from the data as a whole?
3. Based on your conclusions, what are some implications from your research?

4.3.8 Further research questions

As you have conducted your research, the scope of the results may have led you to further questions about the subject. For example, the results of researching what a Year 7 student thinks about the meaning of health may have uncovered possible further research into the following areas:
- Does the meaning of health change as we get older?
- How influential is social media on the meaning of health?
- Does gender influence the meaning of health?
- Would Year 7 students in one geographic area have the same meaning of health as those in another area?

DEPTH STUDY IDEA

To further explore these topics, conduct a secondary-sourced investigation on one of the examples of further research questions listed in section 4.3.8.

4.3 Exercises

learn**on**

4.3 Quick quiz **on**	4.3 Exercise

Learning pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4, 7	5, 6, 8	9

Revise your knowledge

1. What is a research question?
2. Identify three methods of collecting data.
3. Distinguish between qualitative and quantitative data.
4. Create a table outlining the determinants of health. Include an example of each.
5. Outline why there is an interrelationship between the determinants of health.
6. What ethical considerations are present when collecting data from Year 7 students about their meaning of health?

Apply your knowledge

7. Explain why there might be various meanings of health for young people.
8. If the topic of investigation was: 'Year 11 students' experiences of health', determine the following:
    a. What type of data needs to be obtained?
    b. What methods of data collection could be undertaken?
    c. What determinants of health would be present?
    d. What ethical considerations need to be taken into account?
9. To what extent does research help people to understand the various meanings of young people's health?

4.4 Sample exam question response

Question

Analyse how the determinants of health influence a young person's meaning of health. **(8 marks)**

Criteria	Marks
• Draws out and relates the implications of how the determinants of health influence a young person's meaning of health • Provides clear and relevant examples	7–8
• Makes evident how the determinants of health can influence a young person's meaning of health • Provides relevant examples	5–6
• Provides characteristics and features of the determinants of health • Provides relevant examples	3–4
• Sketches, in general terms, the determinants of health OR • Sketches, in general terms, the various meanings a young person may have of health	2
• Provides some relevant information about a determinant of health OR meanings of health	1

Sample response

eles-5015

Breaking down the question

Analyse how the determinants of health influence a young person's meaning of health.

Identify the action word/s: Analyse — this requires a student to identify components and the relationship between them; to draw out and relate implications.

Syllabus terminology: determinants of health and meaning of health

Mark allocation: 8 marks — according to HSC past papers, questions worth 8 marks require answers that include multiple body paragraphs, each addressing the action word and providing clear examples.

Answering the question using PEEL structure

P Identify the **Point** being raised/state topic sentence/what this paragraph is going to be about[1]

E **Expand/Elaborate** on the point and provide a strong link to what the question is asking[2]

E Apply **Examples** that are relevant and specific[3]

L **Linking** sentence that relates back to the question[4]

Sample annotated response

The determinants of health include biomedical factors, socioeconomic factors, environmental factors, broad features of society and health behaviours. Each of these may be interrelated and will affect the way that the meaning of health may be given by a young person.[1]

The broad features of society include culture, affluence, social cohesion, social inclusion, political structures, the media and language.[1] These broader determinants are the parts of a young person's life that they are born into and therefore shape a young person's view of health.[2] For example, the Australian democratic approach to politics and the dominant language of English being spoken in Australia mean that media coverage is mainly aimed at educated Australians with an Anglo-Celtic background.[3] This leads to a distorted view of what it means to be an Australian young person from a multicultural background.[4]

Health behaviours of young people include individual beliefs and actions and will affect decisions about lifestyle including smoking or vaping, drinking alcohol and physical activity levels.[1] A young person may believe that being healthy in one area such as not smoking[3] may influence their meaning of health, as the other health behaviours are not seen to be as important to them.[2] A holistic approach to health by young people would see them not smoke or vape, not drink to excess, lead physically active lives and show attention to all areas of their health.[4]

Biomedical factors include genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment.[1] There has been an increase in issues associated with blood glucose levels in young people. For example, type 2 diabetes is more prevalent due to higher sedentary behaviours in young people. This may greatly affect the meaning that young people give to health as their blood glucose levels may cause their health to fluctuate.[2] In another example, a young person who is overweight may have low self-esteem and think worse of themself because of their weight.[3] This may greatly affect the meaning that young people give to health as they are heavily influenced by media stereotypes of what healthy must look and feel like.[4]

Environmental factors include geographic location, quality of air and water, safe workplaces, community safety and access to physical resources in a community.[1] Young people who live in urban areas have a greater variety of available health services and are able to access these services far more easily than those living in rural and remote communities.[2] For example, young people living in remote communities affected by drought must travel longer distances to their local mental health specialist. Lack of technology can also prevent them from gaining knowledge about available services.[3] As a result, environmental factors will influence the meaning a young person gives to health as young people value support networks so, when these are not as available, there is a detrimental impact on health.[4]

Socioeconomic factors, including socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media, greatly affect the meaning young people give health.[1] As young people are educated in school, they gain knowledge about how to maintain health, get a job and contribute to the wider community.[2] Education will give knowledge to young people about services that are available to help them to stay healthy, including what a healthy diet is and where to go for a youth allowance. In turn, this will help young people to earn a living, to avoid homelessness and to lead a healthy life.[3] This demonstrates how the meaning of health will differ from person to person, as those with higher socioeconomic status will define health differently from those who have lower socioeconomic status.[4]

4.5 Review

4.5.1 Topic summary

4.2 Aspects of young people's lives now and in the past

- Adolescence is characterised by rapid physical growth and is accompanied by emotional, mental and social maturation.
- Similarities between young people today and in the past include puberty, growth in confidence, and thinking about future employment and career choice.
- Differences between young people today compared with in the past include a higher education rate, more women in the workforce, delayed marriage and decreased home ownership.
- Families may look different in today's society but they can be a positive influence and a protective factor for health.
- Families can be made up of many generations and can provide a different perspective to young people as they learn about life. Families have a big influence on the health of young people through learned behaviour about social norms, healthy eating, physical activity and socialisation habits.
- Peer groups remain a consistent source of both positive and negative influence for young people.
- Young people place a high value on their relationships with peers.
- Peers can influence each other positively when they promote healthy behaviours such as not smoking or vaping.
- Peers can influence each other negatively when they engage in risky behaviours such as taking risks on the roads.
- The demographics of Australia have changed in the last century. In the 1970s Australia adopted the policy of multiculturalism, which supports diversity, acceptance and equality of peoples from all nations.
- Young people over different generations have had their own subcultures that allow them to express individuality while also creating a sense of belonging. For example, hippies existed in the 1960s, rave culture and grunge were popular in the 1990s, and a gaming culture has arisen through the new technology of the twenty-first century.
- Young people have far greater access than their parents did to information from around the world, and are able to communicate locally and internationally at any time of the day or night.
- Due to the rapidly changing nature of technology, new jobs are continually being created that young people may find easier to access than older people, such as software and app development.
- The way young people communicate has changed, including abbreviations, code words and emojis via online social media.
- Some problems exist with the influence of technology, including increased rates of addiction to gaming, exposure to violent images leading to desensitisation towards violence, and cyberbullying resulting in mental health issues.
- Technological development has allowed health consumers greater access to information and services.
- Historically, global events such as wars have led young Australians into forming national ideals and values, but have also had significant negative impacts on the health of young people.
- Increased exposure to images and knowledge about major global events such as the war in Ukraine has led to greater mental health issues for young people, but also greater awareness and activism about social causes.

4.3 Investigating the meanings of health for young people

- Meanings of health can vary from person to person and across generations.
- These meanings can be investigated through research.
- A research question is the specific question that will guide your research.
- Surveys are a series of questions (often simple and closed questions) asked by a researcher to a respondent about a topic. The same set of survey questions is posed to all respondents in order to generate quantitative data.
- Questionnaires are usually conducted without the presence of a researcher and can be anonymous. Both qualitative and quantitative data can be collected.
- Interview questions involve a face-to-face session of questions and responses; this can be in person or online. Types and wording of questions need to be appropriate to the age of the respondent and can provide qualitative data.
- Focus groups are made up of a group of carefully selected individuals who are guided through a discussion on a topic. Reactions and comments are recorded in order to collect qualitative data.
- The determinants of health include biomedical factors, socioeconomic factors, environmental factors, environmental factors, broad features of society and health behaviours.
- It is important to remember that there is an interrelationship between the determinants of health.
- Broad features of society include culture, affluence, social cohesion, social inclusion, political structures, the media and language.
- Health behaviours include are actions a person takes that influence their health, and are often a result of that person's beliefs and values. These lead to lifestyle behaviours and choices regarding smoking, diet, alcohol consumption, drug use, physical activity and sedentary behaviour.
- Biomedical factors include genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment.
- Environmental factors include geographic location, quality of air and water, safe work places, community safety and access to physical resources within a community.
- Socioeconomic factors include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media.
- To analyse quantitative data, it is helpful to create tables and graphs to show the numbers or percentages in a collated, easy-to-understand format.
- Ethical considerations of research include maintaining informed consent, privacy, integrity and respect.
- Validity, reliability and credibility of data collection must be considered at all stages of the research project. This includes being aware of bias, checking secondary data sources are credible, and developing questions that are age- and developmentally appropriate for the research participants.
- Discussion of the results is needed in order for the reader of the research to fully understand the context and further implications of the results. This will help to draw conclusions from the research.
- As you conduct your research, the scope of the results may lead you to further questions about the topic.

on Resources

📄 **Digital document** Topic 4 summary (doc-35906)

4.5.2 Key terms

adolescence the transition period from childhood to adulthood

biomedical factors factors present in the body that have an impact on health, such as genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment

blood glucose also referred to as blood sugar; a form of stored energy within the blood cells generated from the breakdown of carbohydrates

cholesterol a type of fat required for optimal functioning of the body that in excess can lead to a range of health concerns including blocking of the arteries

climate action refers to increased efforts to reduce greenhouse gas emissions and strengthen resilience and adaptive capacity to climate-induced impacts

cyberbullying deliberate harassment of a person using communications technology, such as instant messaging by email, on social media pages, in chat rooms or on other electronic media

determinants of health biomedical factors, socioeconomic factors, environmental factors, broad features of society and health behaviours that determine the health status of individuals and populations

diversity the differences that exist within a group, which can include age, sex, gender, gender expression, sexuality, ethnicity, ability/disability, body shape and composition, culture, religion and spirituality, learning differences, socioeconomic background, values and experiences

domestic and family violence violent, abusive behaviour or actions toward partners or family members in order to scare or control them; it is a criminal offence

empathy the ability to identify, appreciate and understand another's situation or feelings

environmental factors factors in the built and natural environments that affect health; for example, geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community

health behaviours actions taken by a person that affects their health; the impact of many health problems could be reduced or prevented by changing behaviours, such as reducing alcohol intake, increasing physical exercise and practicing safe sex

hypokinetic diseases a term given to modern lifestyle diseases associated with inactivity

mental health a state of wellbeing in which an individual realises their own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to their community

peer group a social group of people who have similar interests, ages or backgrounds

physical activity body movement that is produced by a contraction of skeletal muscle and that increases energy expenditure. Physical activity is a broad term that includes playing sport; exercise and fitness activities such as dance, yoga and tai chi; everyday activities such as walking to work, doing household chores and gardening; and many other forms of active recreation.

primary data information that is collected by the researcher, rather than getting it from a secondary source

puberty a stage in the life cycle when rapid physical changes occur that signify that a person has reached sexual maturity

qualitative data information that is expressed in words and narratives

quantitative data information that can be expressed in numbers

self-esteem the feeling or opinion (negative or positive) one has about oneself

socioeconomic factors factors that include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media

stress a physiological or psychological influence that produces a state of tension in a person

support structures the people, places and programs that increase an individual's ability to make health-promoting choices

upstander someone who takes action against bullying behaviour

Resources

Digital documents Key terms glossary (doc-36172)
  Revision quiz (doc-34733)

Interactivity Missing word interactive quiz (int-8041)

4.5 Exercises

4.5 Revision quiz on	4.5 Exam questions

4.5 Exam questions

Question 1 (1 mark)

Which row in the table best shows the biggest influences on how the meaning of health is shaped for young people today? (HM-11-01)

A.	Nuclear family	Puberty	World War II
B.	Smartphones	Cyberbullying	World War I
C.	2023 Women's soccer World Cup	Social media	Hippie culture
D.	Internet	Friends	COVID-19 pandemic

Question 2 (1 mark)

The COVID-19 pandemic has shaped young people's meaning of health. This is an example of the influence of which aspect of young people's lives? (HM-11-01)

A. Family

B. Global events

C. Technology

D. Peers

Question 3 (1 mark)

Genetics is an example of which determinant of health? (HM-11-01)

A. Biomedical factors

B. Socioeconomic factors

C. Environmental factors

D. Broad features of society

Question 4 (1 mark)

How does culture influence the health of young people? (HM-11-01)

A. Increasing the information available to young people about health
B. Leading to greater awareness of international sporting events
C. Embracing diversity of traditions, beliefs and customs from around the world
D. Increasing the risk of domestic and family violence

Question 5 (3 marks)

Describe how the developmental stages of youth influence the meaning young people give to health. (HM-11-01)

Question 6 (5 marks)

Compare the influence of aspects of young people's lives now and in previous generations. (HM-11-01)

Question 7 (5 marks)

Account for the difference in health status of young people compared with other age groups. (HM-11-10)

Question 8 (6 marks)

Explain how technological development has changed the meaning that young people give to health. (HM-11-01)

Question 9 (6 marks)

The World Health Organization defines health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'.

Discuss how young people in rural and remote areas of Australia might see this definition differently compared to the meaning of health given by young people in metropolitan areas. (HM-11-01)

Question 10 (7 marks)

Critically analyse how various global events have shaped young people's health across generations. (HM-11-01)

Question 11 (8 marks)

To what extent does the meaning of health for young people change depending on their age? (HM-11-01)

Explain how peers, family and culture can shape young people's meanings of health. Include examples to support your answer. (HM-11-06)

Question 13 (12 marks)

Examine how young people's meanings of health have been shaped by the similarities and differences of aspects of young people's lives across generations. (HM-11-10)

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Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

4.1 What are young people's meanings of health?
(tpdf-2178) ☐

🗎 Digital documents

4.3 Permission slip template (doc-35902) ☐
4.5 Topic 4 summary (doc-35906) ☐
Key terms glossary (doc-36172) ☐
Revision quiz (doc-34733) ☐

🧩 Interactivities

4.5 Missing word interactive quiz (int-8041) ☐

▶ Video eLessons

4.4 Sample exam question response (eles-5015) ☐

🔗 Weblinks

4.2 ReachOUT cyberbullying ☐
4.3 AIHW Health behaviours ☐
AIHW Biomedical factors ☐
AIHW Socioeconomic factors ☐
Mission Australia Report ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

5 What key health issues affect the health of young people?

LEARNING SEQUENCE

5.1 Overview

Key inquiry question

What key issues affect the health of young people and how can they protect and promote good health?

Syllabus

	Syllabus content	Subtopic
○	■ Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables **Including:** • what are the trends in key health issues? • what are the causes and protective factors of key health issues? • how do the determinants of health affect health-related behaviours?	5.2—5.16
○	■ Research **ONE** health-related issue for young people **Including:** • what is the nature of the issue? • what does the data tell us? • why is this an issue? • what are the protective factors to prevent the issue? • what strategies are currently in place to improve the health of young people? • what new strategies would be most effective to improve young people's health? • what further research questions could be explored to build understanding and advocacy?	5.4—5.14
○	■ Analyse how the skills for strengthening the individual can protect and enhance the health and wellbeing of themselves and others using the health issue researched **Including:** • self-efficacy • health literacy • help-seeking behaviours • problem-solving • resilience • coping strategies • sense of purpose • ethical behaviour • connectedness ■ Reflect on their own personal health and health behaviours and indicate courses of action for improved health and wellbeing.	5.17

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Outcomes

- interpret meanings, measures and patterns of health experienced by Australians HM-11-01
- analyses methods and resources to improve and advocate for the health of young Australians HM-11-02
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Research: analyse a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents   Topic 5 summary (doc-35907)
Key terms glossary (doc-36173)
Revision quiz (doc-34734)

5.2 The health status of young people

⊙ Syllabus: Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
Including:
- what are the trends in key health issues?
- what are the causes and protective factors of key health issues?
- how do the determinants of health affect health-related behaviours?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

The syllabus requires students to research ONE health-related issue for young people. The following issues could be chosen for investigation:
- food
- sense of self and body
- violence
- valuing movement
- gambling
- technology
- relationships
- sexual health
- alcohol and other drugs
- young people and mental health
- road safety
- addictive behaviours
- gambling.

Students must understand:
- the nature of the health issue
- what the trends in the data tell us
- the reasons why it is a health issue
- what its causes and protective factors are
- the strategies in place to improve young people's health
- new strategies that would be effective.

The issues covered in this topic provide an introduction to the health-related issues of young people. This can form a starting point for your independent research.

For each health issue, the causes and protective factors are discussed. Causes may contribute to a greater occurrence of the issue. Protective factors, however, are the personal skills, networks, health services, laws and policies that protect children and young people from health-related issues.

The content in this topic contains an introduction to key health issues. If you have been affected by any of the issues raised, details of organisations that offer advice and support can be found via the weblinks in the Resources panel for this topic.

5.2.1 Aboriginal and Torres Strait Islander young people

The syllabus requires you to examine the health status of young people, including Aboriginal and Torres Strait Islander young people. The *Australia's Health 2022* report indicated that the number of Aboriginal and Torres Strait Islander Australians was around 896 300 and is predicted to grow to about 1.1 million by 2031. The median age of Aboriginal and Torres Strait Islander Australians has been steadily increasing from 21 (in 2011) to 24 (in 2021). Aboriginal and Torres Strait Islander young people demonstrate **resilience** and a deep connection between family, friendship and kinship relations. The respect of Elders, collective community focus and engagement in spiritual practises contribute to a strong sense of identity, group cohesion, loyalty and interdependence. All of these factors help Aboriginal and Torres Strait Islander young people to cope with life's challenges, which are very similar for all young people in Australia.

> **resilience** the ability to 'bounce back' after difficult times or bad experiences

Connection to Country and health

The National Aboriginal Community Controlled Health Organisation defines Aboriginal health as 'not just the physical well-being of an individual but refers to the social, emotional and cultural well-being of the whole Community in which each individual is able to achieve their full potential as a human being thereby bringing about the total well-being of their Community. It is a whole of life view and includes the cyclical concept of life–death–life'.

For Aboriginal and Torres Strait Islander Peoples, health is holistic and is deeply embedded in a connection with Country. Country describes the land, waterways and seas to which Aboriginal and Torres Strait Islander Peoples are connected. The complexity behind the term includes family, identity, cultural practices, spiritual beliefs and customs. Figure 5.1 shows how the parts of Country are interconnected to affect the health of Aboriginal and Torres Strait Islander young people and broader communities.

FIGURE 5.1 The interconnected elements that have an impact on the health of Aboriginal and Torres Strait Islander young people.
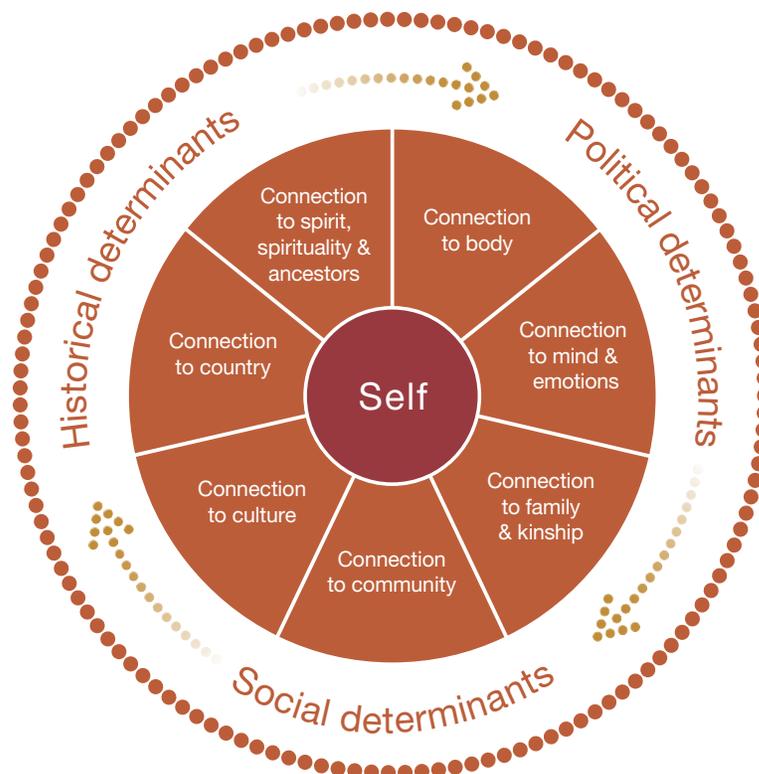
(Re)connection with Country is recognised as a protective factor for the health of Aboriginal and Torres Strait Islander young people. Participation in cultural activities, connection to family and kinship can all have a positive influence on overall health and wellbeing (AIHW, 2022). Data from the ABS National Aboriginal and Torres Strait Islander Health Survey 2018–19 found that Aboriginal and Torres Strait Islander Australians who lived in their homeland or traditional Country rated their own health much better than those who did not.

However, the devastating impact of colonisation, intergenerational trauma and historical lack of self-determination have led to overall poorer health outcomes in Aboriginal and Torres Strait Islander Peoples than in the non-Indigenous population. Aboriginal and Torres Strait Islander Peoples experience higher rates of psychological distress and chronic disease, poorer educational outcomes and lower literacy levels. These factors are linked to poorer health status, and ultimately to significant differences in life expectancy between Aboriginal and Torres Strait Islander and non-Indigenous peoples (see figure 5.2).

Recently, efforts to acknowledge the connection with Country have shown how addressing health determinants through a holistic understanding can improve the health status of Aboriginal and Torres Strait Islander young people. For example, the National Aboriginal and Torres Strait Islander Health Plan 2021–2031 has embraced cultural safety principles that seek to ensure healthcare is free from racism. This helps Aboriginal and Torres Strait Islander young people to recognise the importance of self-determined decision-making in matters that impact individual and community health.

By embracing connection to Country, the trends for the health of Aboriginal and Torres Strait Islander young people can continue to improve. Life expectancy is increasing for both males and females, and the median age at death has risen from 56.5 years in 2010 to 61.0 years in 2020.

FIGURE 5.2 Life expectancy per rate by area

5.2.2 Causes and protective factors for health of Aboriginal and Torres Strait Island young people

Table 5.1 shows the causes and protective factors for the health of Aboriginal and Torres Strait Islander young people. Consider which of these factors are likely to be the same for all young people living in Australia.
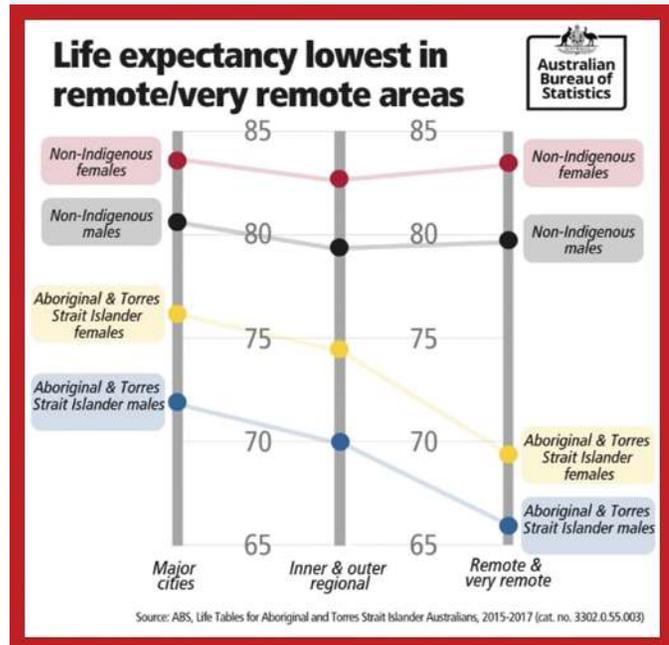
TABLE 5.1 Causes and protective factors for the health of Aboriginal and Torres Strait Islander young people

Causes	Protective factors
• Intergenerational trauma • Colonisation • Access to alcohol, drugs, and cigarettes/ e-cigarettes • Lower socioeconomic status • Lower education rates • Living in rural and remote areas • Lower life expectancy • Higher body weight	• Connection to Country • Kinship • Respect for Elders • Engagement in spiritual practices • Culturally appropriate medical services • Eating enough fruits and vegetables • Engaging in adequate physical activity levels • Not smoking/vaping or taking drugs

Access to health services

Around 28 per cent of the Australian population live in rural and remote areas (ABS, 2022). Aboriginal and Torres Strait Islander Peoples are more likely to live in urban and regional areas than remote areas (see figure 5.3). However, it is important to note that the proportion of the total population who are Aboriginal and Torres Strait Islander Peoples is generally higher in more remote areas.

FIGURE 5.3 Population of Aboriginal and Torres Strait Islander Peoples by geography, 2023
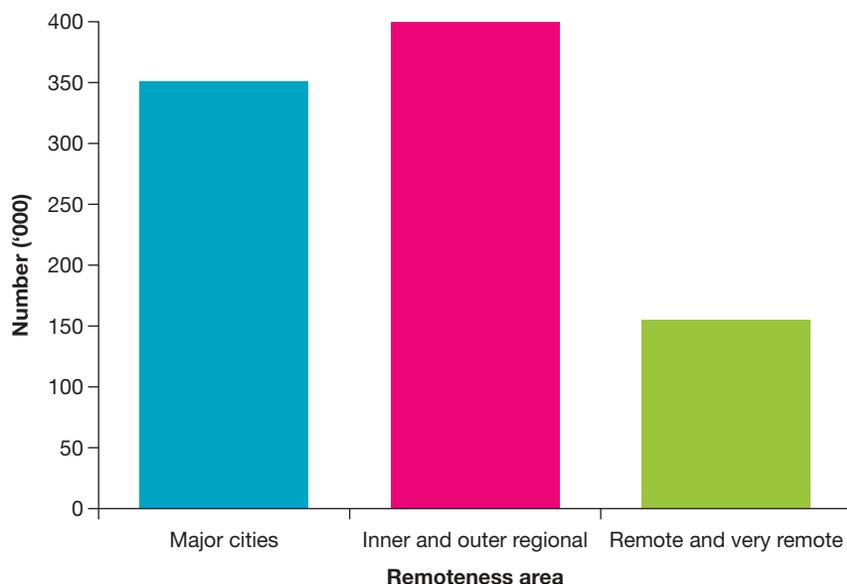
Source: © Australian Institute of Health and Welfare 2023.

Research indicates that the more geographically remote an Australian is, the poorer the health outcomes. In general, people living in rural and remote areas are more likely to live with, and die prematurely from, a disease or injury. This is particularly relevant to Aboriginal and Torres Strait Islander peoples. Significant barriers to accessing healthcare for people living in rural and remote areas include the spread of the geographic location and a comparative lack of infrastructure to support the delivery of healthcare. Medicare data indicates that the lowest attendance at doctors' surgeries is in rural and remote areas.

For Aboriginal and Torres Strait Islander Peoples, barriers to accessing healthcare include availability in their area, services being too far away, not having transport to get to the health service, the cost of the service and also the presence of culturally safe and responsible health services. Encouragingly, in 2021–22 the Australian Institute of Health and Welfare (AIHW) recorded that 4 million episodes of care were provided by Indigenous-specific healthcare organisations (see figure 5.4).

5.2.3 Strategies to improve the health of Aboriginal and Torres Strait Islander Peoples

Improving healthcare provision is an important part of the National Agreement on Closing the Gap. This National Agreement has 19 targets and 17 outcome areas that are designed in genuine partnership with Aboriginal and Torres Strait Islander Peoples to overcome inequality and achieve life outcomes — such as health — equal to all Australians. The National Agreement is based on four priority reforms; one of the reforms is to build the Aboriginal and Torres Strait Islander community-controlled sector. The National Aboriginal Community Controlled Health Organisation (NACCHO) addresses the need for Community to be involved and in control of the health of young people.

FIGURE 5.4 Episodes of care provided by Indigenous-specific healthcare organisations, 1999–2000 to 2021–22
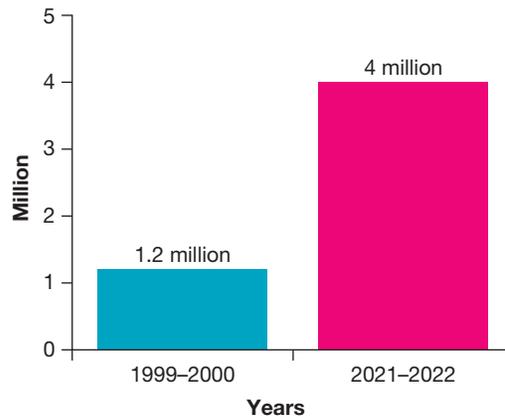
Source: Based on data from *Australian Institute of Health and Welfare 2023. Aboriginal and Torres Strait Islander Health Performance Framework: summary report July 2023.* Canberra: AIHW. p. 23.

The Aboriginal Medical Service (AMS) is based in Redfern, New South Wales, and was the first Aboriginal Community Controlled Health Organisation (ACCHO) in Australia. It helped to create the structure and design of many other ACCHOs. The AMS provides culturally appropriate healthcare to Aboriginal and Torres Strait Islander Peoples. The service is delivered and predominantly managed by professional Aboriginal staff who are aware of and sensitive to a community's needs. The aim of this service is to increase the voice of patient advocacy and self-determination of Aboriginal and Torres Strait Islander Peoples. The impact can be seen in how the healthcare services are intervening and preventing illness and disease, and promoting health within the community.

Use the **NACCHO location map** weblink in the Resources panel to explore the 140+ locations of ACHHOs across Australia. Notice how many are in each state/territory and in which geographic areas they are most common. The network of ACCHOs provides rural and remote communities with access to primary healthcare services to improve their health and wellbeing. While there remains a need for more services in rural and remote communities, ACCHOs are successfully engaging Aboriginal and Torres Strait Islander Peoples in healthcare from a holistic perspective that is comprehensive and culturally appropriate to the community which controls it.

DEPTH STUDY IDEA

1. Use the **NSW Knockout Health Challenge** weblink in the Resources panel as a case study of a program that aims to improve health issues facing young Aboriginal and Torres Strait Islander Peoples. Investigate its aims and analyse how it works towards achieving them.
2. Research a health issue faced by Aboriginal and Torres Strait Islander young people in your local area. Identify the problems and potential solutions designed to improve it. You could present your research as an essay or multimodal presentation.

on Resources

🔗 **Weblinks** NACCHO location map
NSW Knockout Health Challenge
Closing the Gap Partnership

5.2 Exercises

learn on

5.2 Quick quiz on	**5.2 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3	4

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Revise your knowledge

1. List the strengths that contribute to the health status of Aboriginal and Torres Strait Islander young people.
2. Figure 5.2 shows a difference in life expectancy between Aboriginal and Torres Strait Islander Peoples and other Australians in remote and very remote regions. Outline some reasons that contribute to this.
3. Revisit figure 5.4, which shows the increase in healthcare provision by Indigenous-specific healthcare organisations.
   a. Identify why it is important for Aboriginal and Torres Strait Islander Peoples to receive this type of specific healthcare provision.
   b. How might specific healthcare provision benefit Aboriginal and Torres Strait Islander Peoples in both remote and non-remote communities?

Apply your knowledge

4. Use current data (for example, from this subtopic or the AIHW website) to discuss specific health issues that are improving for Aboriginal and Torres Strait Islander young people.

5.3 Food

5.3.1 Trends and data

The health status of young people includes understanding health issues associated with food and nutrition. Food is a central part of family and social life and as young people get older, they have greater control over their food choices. Some of these choices have health experts worried. For example, only 3.3 per cent of young people aged between 15–24 eat enough fruit and vegetables. The Australian Guide to Healthy Eating states that adolescent boys aged 12–18 need 5½ serves of vegetables and 2 serves of fruit daily. Female adolescents aged 12–18 should have 5 serves of vegetables and 2 serves of fruit daily. Young people who do not eat the daily recommended serves of fruit and vegetables were found to have lower levels of wellbeing and physical and psychosocial functioning. Not having all nutritional needs met may affects a young person's growth, concentration in school and ability to be physically active.

Clean eating has been a recent, positive trend for teenagers who are conscious of what food they are putting into their body. Clean eating encourages reducing sugar and eating minimally processed whole foods. This has positive repercussions for the health of young people and their knowledge as it focuses on foods that enhance nutrition and wellbeing such as fresh fruit and vegetables.

5.3 ACTIVITY 1

Comparing healthy eating guides

The Aboriginal and Torres Strait Islander community have a specific guide to healthy eating.

Using figure 5.5 and the **Guide to Healthy Eating** weblinks in the Resources panel, compare the two sets of guidelines. What do you notice is different? What do you notice is the same?

on Resources

🔗 **Weblinks** Australian Guide to Healthy Eating
Aboriginal and Torres Strait Islander Guide to Healthy Eating

Aboriginal and Torres Strait Islander Guide to Healthy Eating

Eat different types of foods from the five food groups every day.

Drink plenty of water.

Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties

Vegetables and legumes/beans

Fruit

Lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans

Milk, yoghurt, cheese and/or alternatives, mostly reduced fat

Use small amounts

Only sometimes and in small amounts

5.3.2 Causes and protective factors concerning food

Table 5.2 summaries the causes and protective factors concerning food.

TABLE 5.2 The causes and protective factors concerning food

Causes	Protective factors
• Unemployment • Low level of education • Geographic location — rural/metropolitan • High disposable income • Low self-esteem • Low socioeconomic status • Sudden change in economic circumstance	• Personal skills based around assertiveness, resilience, decision-making and problem-solving • Laws regarding adequate storage of food in public places such as restaurants • Access to government and privately run health services and resources such as the Australian Guide to Healthy Eating • Education of the community and professionals who deal with young people at risk • Health promotion initiatives that encourage healthy eating such as eating 2 fruit and 5 vegetable portions a day

5.3.3 Strategies to improve the diet of young Australians

Australian Guide to Healthy Eating

The Australian Guide to Healthy Eating is a national strategy aimed at informing Australians about food habits. Its guidelines for young people indicate specific serving sizes and the number of servings of each recommended type of food. It gives a complete picture of what healthy eating should look like for different types of people.

Note: At the time of publication, the Australian Dietary Guidelines are being reviewed. Updated guidelines are due for release in 2026.

Crunch&Sip

One of the best strategies for healthy eating is to develop good habits early. The Cancer Council program Crunch&Sip is a national initiative aimed at the food habits of primary school students. It partners with schools and families, providing free educational resources, healthy lunchbox education sessions and explanation of food labels to encourage healthy food choices for parents and children.

5.3 ACTIVITIES 2

Crunch&Sip

The Crunch&Sip program is aimed at primary school students in order to help them eat healthily. Should this program be extended into secondary school to assist in the healthy habits of teenagers?

Use the **Crunch&Sip** weblink in the Resources panel to help answer the question above. Consider the following:
1. Summarise the aims of the Crunch&Sip program in primary schools.
2. What resources are provided to schools to help implement Crunch&Sip?
3. What positive outcomes are being seen as a result of Crunch&Sip in primary school students?

Healthy Eating for Children

1. Use the **Healthy Eating for Children** weblink in the Resources panel to access and read the Australian Dietary Guidelines brochure.
2. With a partner or individually, create a sample day's meal plan that includes foods from all five food groups. Emphasise portion sizes and variety.
3. Reflect on how following the Australian Dietary Guidelines can positively impact your health.
4. Are there any changes you can make to your own eating habits based on this knowledge?

5.3 ACTIVITY 3

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.4 Sense of self and body

▶ **Syllabus:** Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
Including:
- what are the trends in key health issues?
- what are the causes and protective factors of key health issues?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

5.4.1 Trends and data

Your sense of self is how you see yourself and where you fit in the world based on your personal traits, your cultural norms, and what people expect of you. The three main parts to this are:
- *self-concept* — how you evaluate your own characteristics, strengths and weaknesses
- *self-esteem* — how you judge and feel about your own value and worth
- *self-image* — a mental picture of yourself, how you see yourself and what you think others think about you.

Body image is dynamic and refers to the mental picture we create of ourselves. It is linked to the feelings we have about our bodies and can be positive or negative. In 2023, Mission Australia reported that body image remained in the top four major concerns for non-Indigenous young people. Body image was also identified in the top four (females) and top five (males) major concerns for young Aboriginal and Torres Strait Islander people. A healthy body image means that you accept and are comfortable with your body, including its limitations and strengths.

body image the attitude or feelings we have about our body and the way we think we look or we think others see us. A person's body image can be positive or negative.

Many things influence a sense of self and body, including age, personality and being teased or bullied. Sometimes this can lead to poorer overall wellbeing and make someone more susceptible to illnesses that affect the mind and body, including disordered eating patterns, eating disorders and body dysmorphic disorder. Figure 5.6 shows how young people in Australia perceive the importance of weight. It is important to note that these feelings may be due to societal expectations and current beauty ideals, which can be unobtainable.

FIGURE 5.6 The importance of weight in how you feel as a person, age 14–15, by gender

int-8384

	Not important	A bit important	Moderately important	Very important
Boys	2.43	37.3	27.3	11.1
Girls	9.5	29.3	36.7	24.6

Percentage

■ Not important ■ A bit important ■ Moderately important ■ Very important
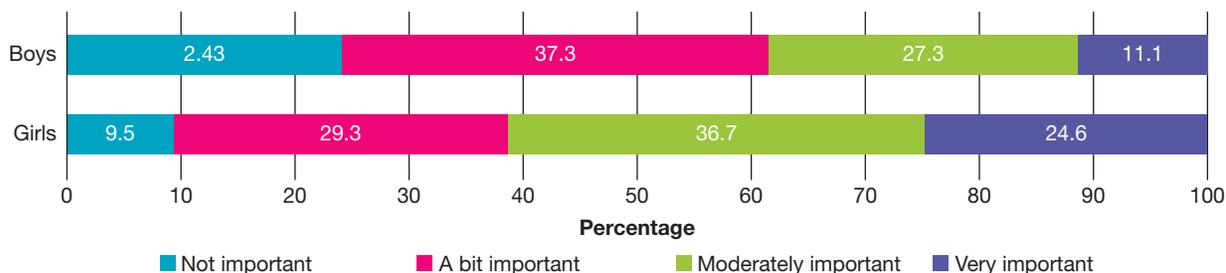
Source: Growing Up in Australia: The Longitudinal Study of Australian Children, 2017.

Disordered eating patterns and eating disorders

Several different types of eating disorders exist, including anorexia nervosa, bulimia nervosa and compulsive overeating or binge eating. According to the National Eating Disorders Collaboration, 31.6 per cent of Australian young people engage in disordered eating behaviours each year.

Anorexia nervosa

Anorexia nervosa is an emotional disorder characterised by severe weight loss (or failure to gain weight for some young people). This self-induced starvation eventually leads to the anorexic individual having no desire to eat at all and the body virtually shutting down.

anorexia nervosa an eating disorder accompanied by a progressive loss of appetite and consequent weight reduction beyond acceptable health levels (15 per cent less than normal for age and height). It is accompanied by an intense fear of gaining weight.

FIGURE 5.7 Adolescents who meet the diagnostic criteria for having anorexia or bulimia nervosa
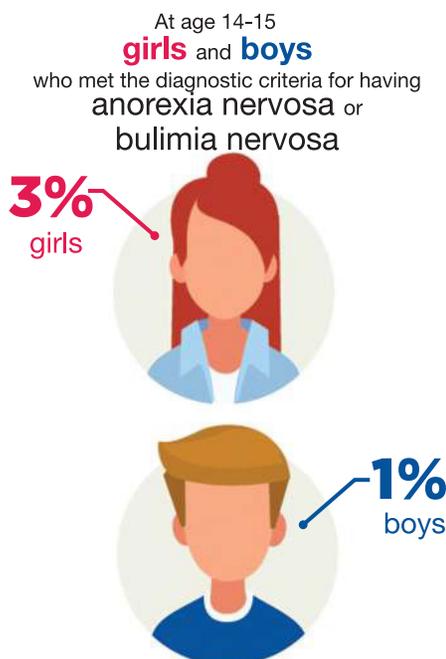
At age 14-15
girls and **boys**
who met the diagnostic criteria for having
anorexia nervosa or
bulimia nervosa

3%
girls

1%
boys

Source: Growing Up in Australia: The Longitudinal Study of Australian Children, 2017.

Hospitalisation and eating disorders

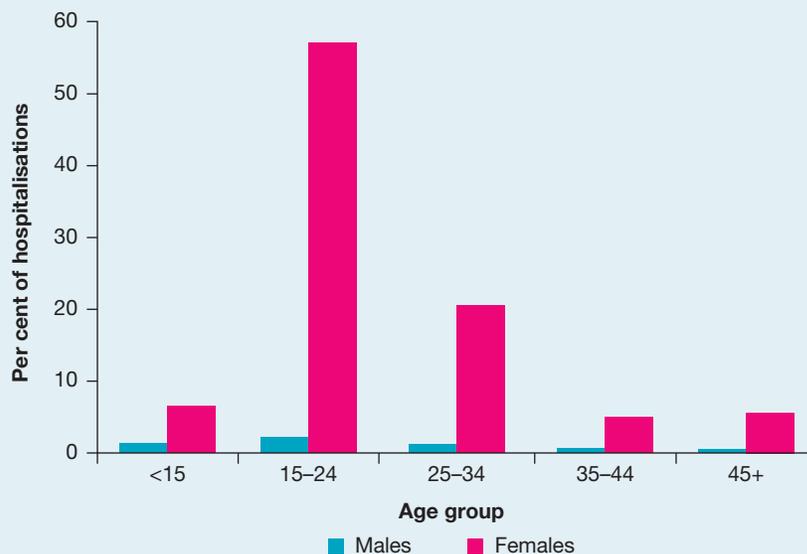**FIGURE 5.8** Hospitalisations with a principal diagnosis of eating disorders, by age and sex, 2015-16

Source: AIHW, *Australia's Health 2018.*

Use figure 5.8 to answer the following questions.
1. Is there a higher rate of males or females for hospitalisation with a principal diagnosis of eating disorders?
2. List the age groups that have higher rates of hospitalisation with a principal diagnosis of eating disorders.
3. Analyse the reasons the above rates are the way they are. Include statistics from figure 5.8 in your answer.

Bulimia nervosa

Bulimia nervosa is characterised by episodes of overeating or binge eating at least twice a week for three months or more, followed by behaviour such as self-induced vomiting, fasting or excessive use of laxatives to control weight. People who suffer from bulimia can be of normal weight, so it can be difficult to identify them and provide help.

bulimia nervosa an eating disorder in which large quantities of food are ingested at one time (bingeing) and then purged from the body by self-induced vomiting

Compulsive overeating or binge eating

People who develop a binge-eating disorder experience episodes of uncontrolled eating of large quantities of food but without the purging that characterises bulimia nervosa. After binge eating, they suffer feelings of guilt, embarrassment and self-loathing.

Obesity

Body mass index (BMI) is a way of classifying overweight and obesity in adults. The BMI calculation produces a number rating, with obesity associated with a BMI over 30. However, it is important to note that BMI does not reflect the distribution of fat or the percentage of muscle, so it can be misleading. A more useful measure to assess individual health risks of obesity is waist circumference.

A person's BMI can be calculated using the following formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Data from the Australian Institute of Health and Welfare (AIHW) in 2015 suggested that 33 per cent of young Australians aged 12–24 were overweight or obese. Obesity is reported as being higher among Aboriginal and Torres Strait Islander young people. However, AIHW data tells us that 75 per cent of children and adolescents are in the healthy weight range. Although rates of overweight and obesity have been rising over time, figure 5.9 shows that there is trend towards fewer young people being overweight.

Young people can improve their sense of self and body by:
- talking positively about yourself and your body
- setting goals that improve health and wellbeing (not focusing on weight)
- critically thinking about messages being portrayed by social media and other media outlets
- wearing clothes that make you feel comfortable
- eating foods that are healthy for you
- finding things that you like about your body
- taking care of your overall wellbeing through getting enough sleep and maintaining a broad range of movement activities.

FIGURE 5.9 Proportion of overweight and obesity in children and young people aged 5–17, 1995 to 2017–18
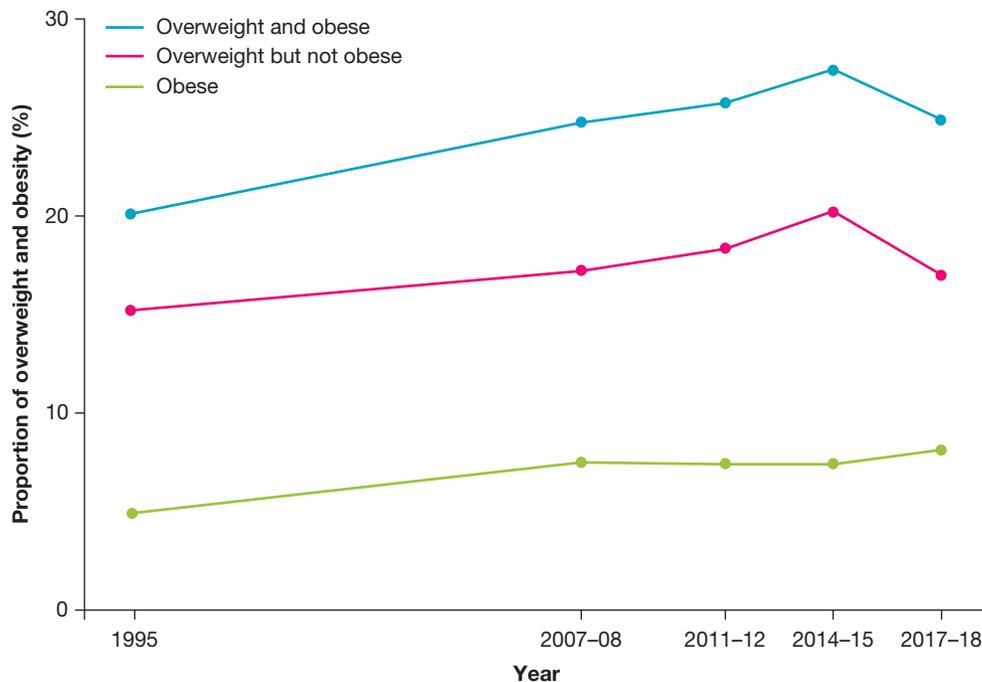
Source: © Australian Institute of Health and Welfare 2023.

5.4 ACTIVITY 2

Steroid abuse

Access the **Butterfly Foundation article** weblink in the Resources panel and read the article 'Australia and the UK are writing the same story on steroid abuse'. Hold a class discussion about the underlying issues that drive the desire of so many young people for the perfect physique.

on Resources

🔗 **Weblink** Butterfly Foundation article

5.4.2 The causes and protective factors for issues associated with a sense of self and body

Table 5.3 summarises the causes and protective factors affecting a sense of self and body.

TABLE 5.3 Causes and protective factors affecting a sense of self and body

Causes	Protective factors
• Low self-esteem • Profession; for example, jockey • Specific sports such as gymnastics, dance, diving and events with weight classes • Sexual abuse • Personality type — highly competitive or compulsive • Social alienation • Development of social construct and sex stereotyping by society; for example, masculinity and femininity • Personal history of substance abuse • Physical inactivity • Cultural background • Availability of fast food • Dissatisfaction with own body image • Age • Gender • Family history of mental illness	• Nutritionally sound diet and exercise patterns • Access to accurate information for making food choices; for example, glycaemic index • Strong personal support networks that help individuals to cope • Personal skills based around assertiveness, resilience, coping, decision-making, problem-solving and conflict resolution • Laws regarding food labelling and steroid use • Access to health services such as Kids Help Line, school counsellors, government health websites • Education of the community, GPs, coaches and other professionals who deal with young people • Society and cultural standards that aim to protect young people from self-harm • The media's general willingness to break down stereotypes in young people's magazines and promote real images • School curricula that promote the importance of a healthy diet, proper food preparation skills and physical activity • Healthy canteen policy at school • Increased awareness raised in the media of this issue for young people

5.4.3 Strategies to improve young people's sense of self and body image

There are many organisations that are working to improve the issue of sense of self and body image for young people, including the Butterfly Foundation and The Embrace Collective. They also include Australia's first digital body image program for boys created by the Butterfly Foundation, called RESET. Other examples include Dove's long-running campaign for 'Real Beauty' and its more recent pledge to 'Redefine Beauty' which aim to build self-esteem in girls. Use the weblinks in the Resources panel to find more information.

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on Resources

🔗 **Weblinks** Butterfly Foundation
The Embrace Collective
Butterfly Foundation: RESET program
Dove campaigns

5.5 Violence

5.5.1 Trends and data

Violence is unacceptable in any setting and is against the law. Violence can take many forms and includes physical bullying, sexual assault, sexual harassment, homophobic vilification and domestic abuse. It can occur because of an imbalance of power due to physical size, age or group numbers, or due to differences in emotional maturity. Increasing levels of violence are depicted in the media and computer games, which may desensitise people to the seriousness and the effects of violence. The rise of trolling and verbal abuse online has also been linked to an increase in bullying by young people online. Types of violence can include:

- *bullying.* This can be physical, emotional or verbal.
- *sexual assault.* This is any unwanted sexual behaviour that makes a person feel uncomfortable, threatened or scared. The term includes rape or attempted rape, fondling or unwanted sexual touching, or forcing a person to perform sexual acts. Perpetrators of sexual assault aim to inflict harm or assert power over the victim.
- *sexual harassment.* This is any form of unwelcome sexual behaviour that is offensive, humiliating or intimidating, and it is against the law. It might result from an imbalance of power and includes unwanted verbal comments or suggestions, physical gestures of a sexual nature, name calling, displaying of sexually explicit images or text messages, and obscene phone calls or online contact.
- *homophobic vilification.* This results from an irrational fear of or lack of tolerance towards LGBTQIA+ individuals. It can be expressed verbally or physically. Victims can suffer physical injuries and psychological damage, which can lead to depression or feelings of isolation or insecurity.

- *domestic and family violence.* This is violence associated with the family or home environment. The factors involved can be sociological (gender stereotypes), cultural (clash between old and new ways), environmental (overcrowding in the home) or physiological factors (differences in ages of siblings). Domestic abuse can be physical, social, sexual or psychological. It can also be perpetuated through different generations of families.
- *cyberbullying.* This is online harassment and threatening behaviour. Cyberbullying includes hate speech, trolling, threats of violence, and the spreading of sexual images and revenge porn — these are forms of online violence that are growing in occurrence. This kind of violence is sometimes fuelled by an online mob mentality and the increased, but often false, feeling of anonymity that some online forums claim.

Generally, there has been an increase in violence against young people. Studies suggest that up to one in four school students suffer a form of bullying each week. Most sexual assaults are committed by males against a known victim and go unreported. Figure 5.10 shows how young people are affected by violence against them.

int-9278

FIGURE 5.10 Young people experience all types of violence at high rates. a) Victims of family and domestic violence assault, by age group, 2019. b) Victims of sexual assault, by age and sex, 2019.

int-9279
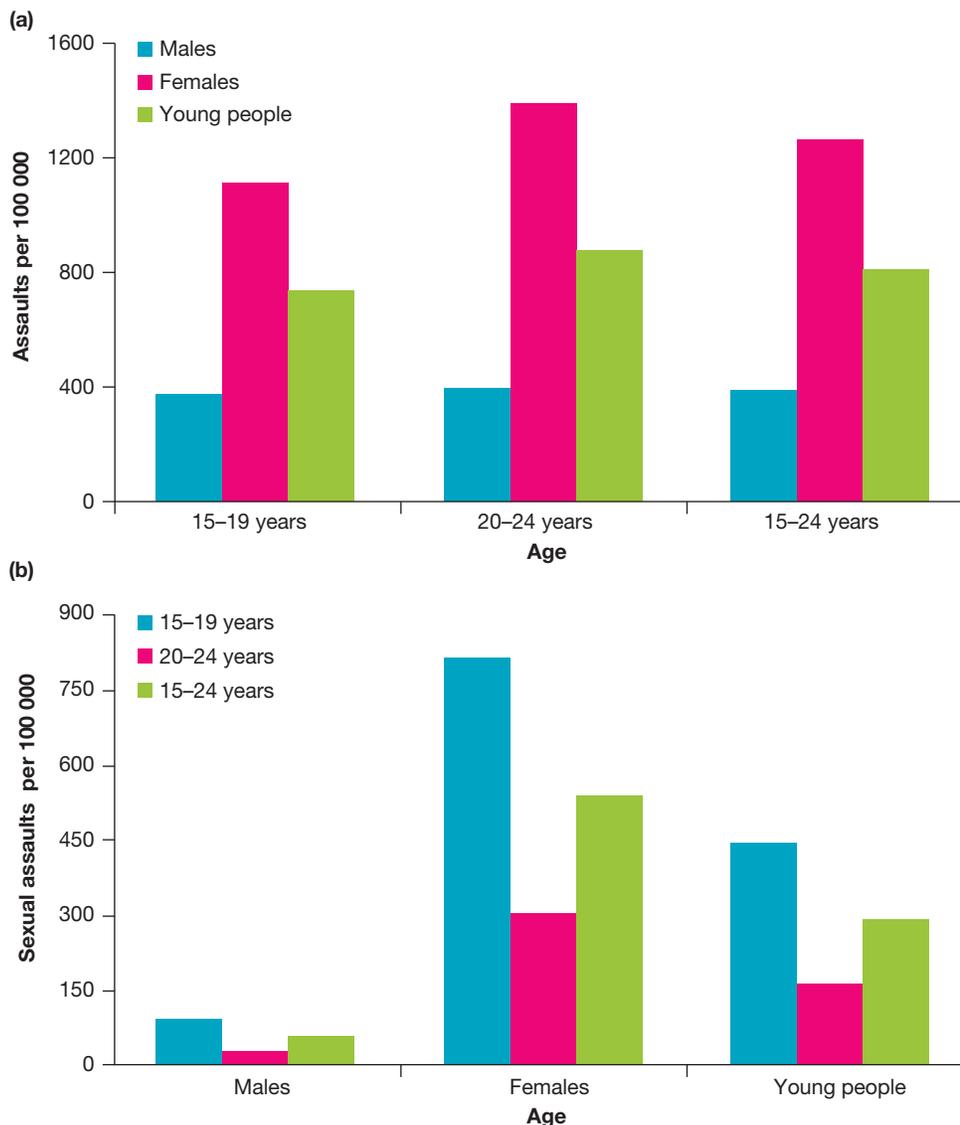
Source: AIHW, Australia's Health 2018.

5.5.2 Causes and protective factors concerning violence

Table 5.4 summarises the causes and protective factors concerning violence in young people.

TABLE 5.4 Causes and protective factors concerning violence

Causes	Protective factors
• Geographic location — remote/rural/metropolitan • Low self-esteem or poor social skills • Social alienation or isolation • Incarceration • Family breakdown or disharmony • Substance abuse • Low socioeconomic status • Overcrowded housing conditions • Poor **infrastructure**; for example, transport • Societal and cultural attitudes that are more accepting of violence • Migrant background • Aboriginal and Torres Strait Islander background • Gender • LGBTQIA+ identification • Family history of mental illness or domestic violence	• Strong personal support networks • Personal skills based around assertiveness, resilience, coping, decision-making, problem-solving and conflict resolution • Laws regarding domestic violence, family violence, physical violence, sexual violence, consent and abuse. • Access to health services and the development of health literacy skills by schools; such as Kids Help Line, school counsellors, health pamphlets and government health websites, refuges and safe houses, rape crisis centres • Education of the community and professionals who deal with young people • Society and cultural standards that aim to protect young people from self-harm; for example, censorship and classification restrictions of computer games • Community-based programs such as Youth off the Streets, blue-light discos and 'one-punch' awareness campaigns • Training in basic self-defence • Adequate late-night transport services with safe waiting areas

5.5 ACTIVITY 1

Analysing a health promotion program

Research a current or recent health promotion program aimed at reducing violence among young people. Examples include Domestic Violence NSW, Our Watch and White Ribbon Australia. Use the weblinks in the Resources panel to find more information.
  • List the organisation responsible for running the program.
  • State its approach to the problem, and its methods of advertising.
  • Outline the resources provided for individuals and their family and friends.
  • Present your findings as a multimedia presentation for the class.

on Resources

🔗 **Weblinks**   Domestic Violence NSW
              Our Watch
              White Ribbon Australia
              No to Violence

5.5.3 Strategies to reduce violence in NSW

The World Health Organization recognises violence by young people as an issue and provides a list of possible strategies that can be implemented to prevent youth violence. Domestic Violence NSW created the Safe State campaign, which has been jointly developed with the NSW Women's Alliance and New South Wales service providers in order to respond to and work towards prevention of violence.

infrastructure the technical structures that support a society, such as roads, railways, water supply, sewerage, public transport, schools and power grids

Domestic Violence NSW also works with Aboriginal and Torres Strait Islander Peoples to lead change in ending violence towards Aboriginal and Torres Strait Islander women and children.

In NSW, No to Violence is the peak body for organisations and individuals working with men to end violence towards family members. The main law for dealing with domestic and family violence in New South Wales is the *Crimes (Domestic and Personal Violence) Act 2007*.

5.5 ACTIVITY 2

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.6 Valuing movement

Syllabus: Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
Including:
- what are the trends in key health issues?
- what are the causes and protective factors of key health issues?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

5.6.1 Trends and data

Valuing movement is about developing movement skills and concepts in order for young people to participate in physical activities with confidence and competence. Participation in regular physical activity, while reducing the amount of time being sedentary, can add to the value of movement.

According to the World Health Organization, 'physical activity' is any bodily movement produced by skeletal muscles that requires energy expenditure, and should not be confused with 'exercise', which is planned, structured and repetitive physical fitness to achieve a specific aim. The Australian Physical Activity and Sedentary Behaviour Guidelines recommend doing both aerobic and strength-based activity as well as lowering sedentary activity for optimal health (see figure 5.11). The intensity required in different physical activities varies due to level of fitness and is calculated by working out your maximum heart rate (MHR). Your MHR is calculated by subtracting your age from 220.

For example, if you are 17 years old the equation would be:

$$220 - 17 = 203$$

Therefore, your maximum heart rate is 203 beats per minute.

Moderate activity is where the heart rate is noticeably increased and the amount of effort required is reasonable. Examples include dancing, gardening and brisk walking and can equate to 50–70 per cent of your MHR. Vigorous activity causes rapid breathing, a significant increase in the heart rate and requires a large amount of effort. Examples include running, cycling and aerobics and can equate to 70–85 per cent MHR.

5.6 ACTIVITY 1

Maximum heart rate

1. List the activities that you participate in according to the level of intensity required, using a table like the one below.

Moderate	Vigorous

2. Calculate your maximum heart rate. Identify your target heart rate when participating in moderate and vigorous activity.
3. Participate in one of the activities you noted in question 1. Identify whether you are reaching the required the level of intensity per activity. Report back to the class about your findings.

FIGURE 5.11 The Australian Physical Activity Guidelines

Children
5–12 years

60 minutes
of moderate to vigorous intensity physical exercise every day

Young people
13–17 years

60 minutes
of moderate to vigorous intensity physical exercise every day

Adults
18–64 years

150 to 300 minutes
(2½ hours to 5 hours) of moderate intensity physical activity

OR

75 to 150 minutes
(1¼ to 2½ hours) of vigorous intensity physical activity

or an equivalent combination of both moderate and vigorous activities each week
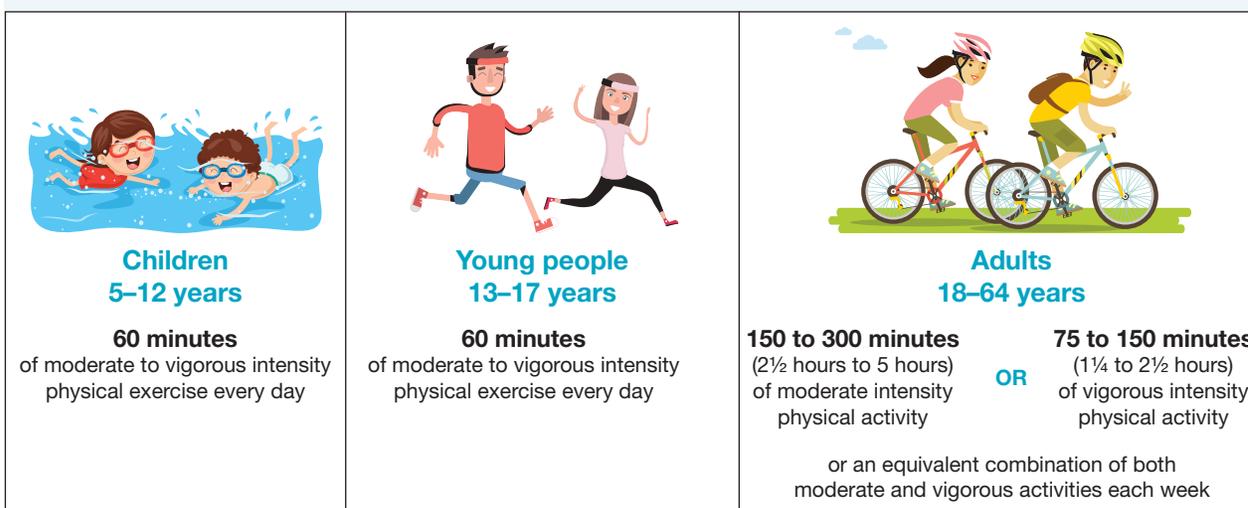
Australia's Physical Activity and Sedentary Behaviour Guidelines recommend that young people should be doing 60 minutes of moderate to vigorous physical activity each day (see figure 5.11). The most recent detailed data available on physical activity by young people aged 2–14 is from the Australian Bureau of Statistics 2011–12 National Nutrition and Physical Activity Survey. According to that data, about 3 in 10 (29 per cent) children (aged 5–11) and fewer than 1 in 10 (8.2 per cent) adolescents (aged 12–17) met the recommended amount of physical activity every day. Interestingly, the Australian Institute of Health and Welfare have conducted scenario modelling to assess the impact on future disease and burden in Australia. They deduced that the future disease burden could be reduced with increased physical activity (see figure 5.12).

FIGURE 5.12 Future burden of disease due to insufficient physical activity

14% of future disease burden due to insufficient physical activity could be reduced by **15 minutes** of brisk walking, 5 days each week	**26%** of future disease burden could be reduced if this time increased to **30 minutes**. All ages would benefit, particularly people aged 65 and over.

Source: AIHW

5.6.2 Causes and protective factors concerning valuing movement

Table 5.5 summarises the causes and protective factors concerning valuing movement.

TABLE 5.5 Causes and protective factors concerning valuing movement

Causes	Protective factors
• Sedentary behaviour • Recreational screen time • Low family value placed on movement • Chronic physical injury • Level of education about appropriate techniques for safety of some physical activities	• Staying fit • Including a social aspect to your activities • Personal skills based around assertiveness, decision-making and problem-solving • School-based physical education classes to build capability and confidence • Community-based initiatives; for example, parkrun and Colour Run • Improvements to shared pathways for cyclists and pedestrians • Proper lighting of public areas • Society and cultural standards that encourage physical activity • Improvements in accessibility of knowledge of types of physical activity through apps and technology, such as Zombies, Run! and Strava • Increased media attention about community-based events such as the annual City 2 Surf run • Government initiatives such as Girls Make Your Move and the Active Kids $100 rebate

5.6 ACTIVITY 2

Encouraging physical activity

Use the **Glow-in-the-dark bike path** weblink in the Resources panel to read the article, then answer the following question.

How could this be a protective factor for those wanting to conduct physical activity?

on Resources

🔗 **Weblink** Glow-in-the-dark bike path

5.6.3 Strategies to encourage young people to value movement

Sport Australia has designed a strategy which addresses Australians' lack of physical movement. The Find Your 30 campaign encourages Australians to find 30 minutes in which to be active each day. In addition, the NSW government offer the Get Healthy Service, which encourages a holistic view of getting healthy including healthy eating, being physically active and reducing alcohol consumption. This service also provides coaches to help set goals and achieve them. For children and adolescents aged 5–17, the Australian Physical Activity and Sedentary Behaviour Guidelines recommend 60 minutes of moderate to vigorous activity each day. They also recommend limiting sedentary behaviours such as recreational screen time to no more than 2 hours per day. By achieving the recommended daily physical activity guidelines, young people learn how to value movement and are provided with an opportunity to make new friends and build social and physical skills.

5.6 ACTIVITY 3

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
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6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.7 Technology

5.7.1 Trends and data

Technological advances have boosted health outcomes for young people, offering up-to-date health information, faster diagnosis and greater awareness of healthy behaviours.

The dangerous aspects of new technologies and social networking sites have gained extensive media attention in recent years. The increase in screen time and addictive online behaviours mixed with the misuse of social media has led to greater instances of cyberbullying. The ease with which false, abusive or incriminating information about a person can be spread through a social group, a community or across the world has led to new forms of cybercrime that are difficult for authorities to tackle. The effects of online gaming, spending too much time online, trolling and catfishing are becoming an increasing concern for Australian young people.

Social media usage

Technology provides opportunities for young people to use their expertise and be connected in various new ways. A 2023 survey reported that almost one-third of teenagers between the ages of 13 and 17 use at least one of the five major social media sites (YouTube, TikTok, Snapchat, Instagram and Facebook) 'almost constantly'. The prolific use of social media by young people can help them build social networks and connect with like-minded people from around the world, which can provide support and encouragement through difficult times.

The eSafety Commissioner reported in 2020 that both males and females aged 12–17 prefer to use YouTube over other social media services. Instagram is the second most popular social media service. The same research tells us that young people have the agency to actively manage their online experiences. More than 80 per cent of teens took some form of action after a negative online experience. Fifty-four per cent of teens (aged 12–17) have blocked a person online, 43 per cent have spoken to family and friends, and 36 per cent have unfriended a person due to a negative online experience. More teenagers are reporting negative online experiences to the social media company, their school or the police.

> **telehealth** doctor–patient consultations that use any form of technology, including video conferencing, internet or telephone, as an alternative to face-to-face consultations

Online support services

Many young people seek information about their health via apps or the internet. Being able to book appointments with the GP, search for up-to-date information about a health treatment and talk online to qualified professionals means that young people are active health consumers and many are confident to take control of their own health. During the COVID-19 pandemic, **telehealth** became a much-needed resource for young people to access healthcare. The benefit of telehealth to access specialists, mental health professionals and nurses was recognised when it was added to the Medicare Benefits Schedule during the COVID-19 pandemic.

FIGURE 5.13 Technology helps young people find health information.

This meant telehealth was able to be bulk-billed for the first time. Its popularity led to telehealth becoming an ongoing service via Medicare for all types of healthcare. Data from the Australian Institute of Health and Welfare shows that these services were used in large numbers in 2020; the rates of telehealth GP consultations rose from 1 per cent in 2019 to 20 per cent in 2020. This spike during the pandemic has largely endured, with telehealth GP consultations remaining at 20 per cent in 2023.
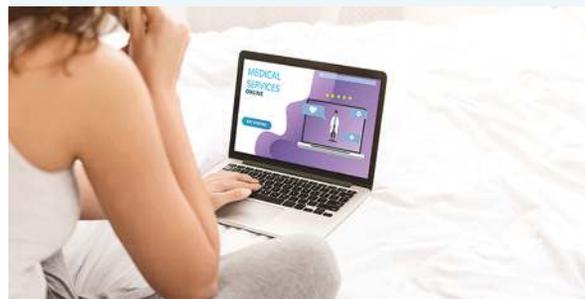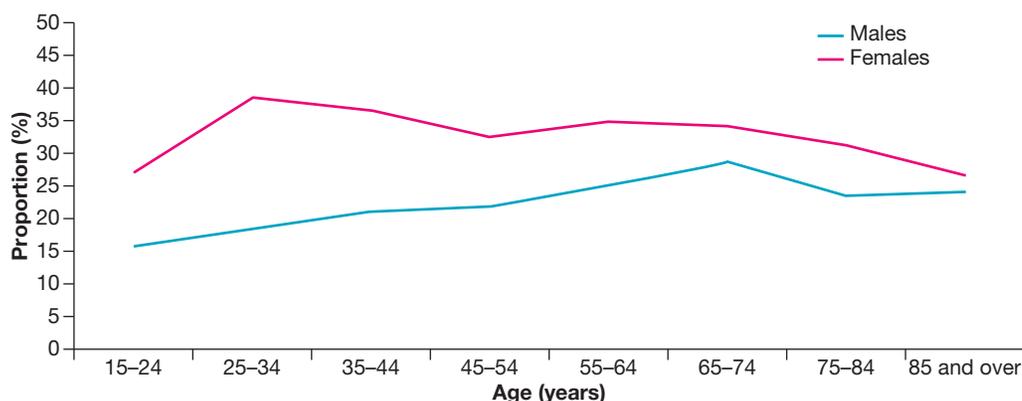
FIGURE 5.14 Proportion of people aged 15 years and over who have had a telehealth consultation for their own health in 2022–23


Source: © Australian Bureau of Statistics, Patient Experiences 2022–23 financial year.

Study options

ICT capacity is a compulsory part of the Australian curriculum and schools provide many opportunities to use technology. Being able to think flexibly, operate collaboratively and use technology means young people finish school with technology skills that will enhance their further learning and workforce options. The significant impact of the COVID-19 pandemic in 2020–21 led to about 1.6 billion young people around the world, including in Australia, being unable to attend school in person. This meant that remote online learning significantly increased. This has increased the availability of online study options, which means greater access to learning and skill development for young people.

Despite the positive aspects of social media, online support services and technology-based study options, there are negative aspects of evolving technologies and social networking sites, such as cyberbullying.

FIGURE 5.15 Remote online learning enabled young people to keep learning during the COVID-19 pandemic.
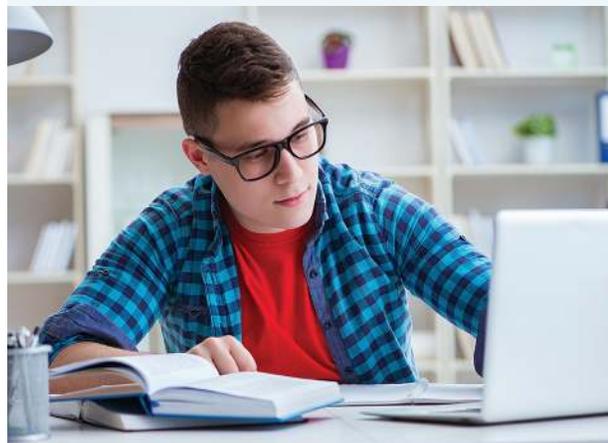
Cyberbullying

Bullying is the deliberate psychological, emotional and/or physical harassment of one person by another person or a group. **Cyberbullying** is bullying that uses an electronic carrier service such as a phone, website or messaging services, text/video messaging, chat rooms and school or community websites.

Cyberbullying is generally considered to be underreported, but research has shown the following trends and figures.

cyberbullying deliberate harassment of a person using communications technology, such as instant messaging, email, social media, chat rooms or other electronic media

- The eSafety Commissioner identified that 44 per cent of Australian young people had a negative online experience in a 6-month period in 2021.
- The Kids Helpline summary of services identified cybersafety and bullying issues as a major area of growing concern for young people. This included nearly 3000 referrals to Kids Helpline from cybersafety and anti-bullying websites. For sessions run in schools by Kids Helpline, 16 per cent of all sessions were booked to specifically discuss cyberbullying and online safety.

CASE STUDY

Mental health experts say a national strategy to deal with cyberbullying is well overdue

9 September 2018

Cyberbullying is on the rise, with more than one in three young people being bullied online.

Among 14- to 16-year-olds, reported cyberbullying has doubled in the last 12 months from 18 per cent to 36 per cent.

Teenagers aged between 17 and 19, however, experienced the highest prevalence of online bullying with a whopping 43 per cent of all bullying happens online.

These alarming numbers were revealed on Sunday in a new survey conducted by mental health organisation ReachOut Australia. The survey involved 1000 young people aged between 14 and 25 and aimed to uncover how bullying is being experienced.

The undeniable result is that cyberbullying is getting worse.

'We are seeing that is this an issue that is not getting any better and we are really calling on the government and industry to really say "time's up". We have got to get serious about this and we have got to tackle it now,' ReachOut CEO Jono Nicholas said.

National bullying statistics obtained by ReachOut showed in 2016 — of the bullying being reported, 25 per cent was occurring online, with 52 per cent happening on a school premises, and the remainder at work.

One year later, online bullying jumped to represent over one third of cases — and both school and work bullying dropped.

TABLE 5.6 Bullying overall (national), 2016 and 2017

Where did the bullying take place?	2016	2017
On school premises	52%	47%
Work	25%	19%
At home	15%	15%
Online	25%	38%

Source: ReachOut Australia.

More social platforms means more bullying

Nicholas said one of the key reasons for the rapid growth in online bullying is the increasing number of platforms available to young people. These include more traditional sites like Facebook, Instagram and Twitter, and increasingly, video games that have a chat function built into them.

'We see now, for example, with the growth of online gaming —the "fortnite" game that has taken Australian kids by storm — that has chat that is built into that game. So for many parents what they are seeing is an expanding risk-base,' Nicholas said on Sunday.

National safety standards needed to hold online bullies accountable

Nicholas called on both industry and government leaders to front the charge and says Australia needs national safety standards — which includes making perpetrators accountable.

'We need to keep focused on individual behaviours, we need to support young people and families to keep themselves safe online,' Nicholas said.

'We have to look at what are the penalties, how do we keep people safe online and how do we penalise people who are harming our young people.'

Nicholas said current efforts to make online spaces safer for young people simply aren't going far enough because cyber bullying numbers are increasing.

'Cyber bullying is the leading concern of Australian parents,' Nicholas said.

Source: 10 Daily: 'Cyberbullying rates have doubled in the past year', 9 September 2018.
For information and support relating to cyberbullying, please visit: https://au.reachout.com/bullying/cyberbullying.

Case study questions

1. Do you agree with mental health experts when they say that a national approach to cyberbullying is needed? Explain your answer.
2. If cyberbullying numbers are increasing, what should be done about the penalties attached to cyberbullying?
3. If harsher penalties are attached to cyberbullying, is that enough? What else needs to be done to reduce the rates of cyberbullying?

5.7.2 Causes and protective factors concerning cyberbullying

Table 5.7 summarises the causes and protective factors concerning cyberbullying.

TABLE 5.7 Causes and protective factors concerning cyberbullying

Causes	Protective factors
• Low socioeconomic status • Being perceived as different/new or alternative in your ways of thinking • High achievement • Family mobility • Age • Gender • Having a disability • LGBTQIA+ identification • Cultural background • Aboriginal and Torres Strait Islander background • Previous history of being bullied	• Strong personal and community support networks • Developing personal skills based around assertiveness, resilience, coping, conflict resolution and protection of private details • Laws regarding anti-discrimination, racism and using electronic devices to harass and distribute/take sexual images of minors (including of yourself and your partners) • School policies regarding bullying • Access to health services such as Kids Helpline and ReachOut • Knowledge of rights; police and school responsibilities related to bullying • Education of the family, community and professionals who deal with young people such as police visits to schools • Education about all the functions of your device and services available from your internet provider and social media sites, such as blocking or reporting particular people and knowing how to take screenshots of threatening messages • Limiting the number of friends you keep in contact with on social media and refusing friend requests from strangers • Maintaining security of passwords

5.7.3 Strategies for improving safe technology use and cyberbullying

There are several strategies which promote safe technology use, including the eSafety Commissioner and Safer Internet Day.

eSafety Commissioner

The eSafety Commissioner is dedicated to 'empowering all Australians to have safer, more positive online experiences'. The Australian government-run agency is the only one of its kind in the world, and is solely committed to keeping Australian citizens safe online. It achieves this mission through working with other agencies, responding to complaints about cyberbullying and image-based bullying. The eSafety website provides information, advice and educational materials to young people. Finally, it provides training in online safety from a research basis to make sure that negative trends are decreasing as online safety increases.

Safer Internet Day

The eSafety Commissioner also runs the Australian arm of the international annual Safer Internet Day, aimed at educators, families and businesses to raise awareness and encourage everyone to be safer on the internet.

DEPTH STUDY IDEA

Conduct a secondary-sourced investigation and compare the findings with current primary data of young people in your school. Use the comparative data to analyse how technology can be used to improve the health status of young people.

5.7 ACTIVITY 1

Cyberbullying strategies

In addition to being safer on the internet, specific cyberbullying strategies exist in NSW.
1. Use the **Kids Helpline** and **Bullying. No Way!** weblinks in the Resources panel to explore issues concerning cyberbullying, and find out about the National Day of Action against Bullying and Violence.
2. Discuss how a range of strategies can improve the health status of young people when using technology.

5.7 ACTIVITY 2

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.

1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.8 Relationships

> **Syllabus:** Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
> **Including:**
> - what are the trends in key health issues?
> - what are the causes and protective factors of key health issues?
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Relationships are an important and essential part of a young person's life. A young person must learn how to navigate relationships across the different areas of life including family, friendships and romantic partners, as well as across professional relationships, such as co-workers, teachers and other professionals.

Some scientists believe that having healthy and loving personal relationships can bring various health benefits such as lower blood pressure, decreased stress and increased wellbeing. Studies have proven that stronger friendship networks lead to longer life compared with those without such networks. This may be due to the positive influence that friends can have on health behaviours, such as exercising together, as well as the impact of support, care and concern through tough emotional times.

As they mature, young people are likely to experience romantic relationships. For a healthy relationship between young people, there is a need to communicate effectively about relationship expectations. It is also important to seek help when necessary from others such as trusted adults and health practitioners, especially when unsure about the risks associated with sexual intimacy. Giving and receiving consent

FIGURE 5.16 Communication is important when forming respectful relationships.

is a crucial part of a healthy relationship. Legally, consent is an individual's free agreement to participate in an activity. Consent must be given freely, without coercion and needs to be informed; that is, a person needs to know what they are agreeing to. That may include online activities, use of personal information, medical procedures or sexual activity.

Consent in sexual activity is summarised in figure 5.17. Research from the Seventh National Survey of Australian Secondary Students and Sexual Health 2022 showed that:

- 40 per cent of young people aged 14–18 were not sexually active
- just under one-third of the secondary students surveyed reported experiencing unwanted sex
- trans and non-binary young people and young women were more likely than young men to have experienced sex when they did not want to
- verbal pressure from their partner was the most common reason for students having sex when they did not want to.

FIGURE 5.17 Kids Helpline describes what consent looks like

Mutual	Both partners need to agree, every single time.
Freely given	You both need to choose without pressure, guilt or threats.
Informed	You both understand what's about to happen.
Certain and clear	Your consent is a YES, not a 'maybe', 'I think so' or 'I guess so'.
Enthusiastic	You are positive and WANT to participate in the sexual activity.
Reversible	You can stop or change your mind at any time.
Specific	If you say yes to one thing, it doesn't mean that you are saying yes to everything.
Ongoing	Consent must be given before and during any sexual activity, every time.

Source: https://kidshelpline.com.au/teens/issues/what-consent

5.8.1 Trends and data

In 2022, Relationships Australia reported that almost all adult Australians it loved (94.55 per cent) and that of all groups aged 18 or over, people aged 18–24 years felt safest in their most important relationship. However, 45.9 per cent of young people aged 18–24 years reported feeling emotionally lonely, which was the highest level for all age brackets (see figure 5.18).

FIGURE 5.18 Social and emotional loneliness levels across age groups
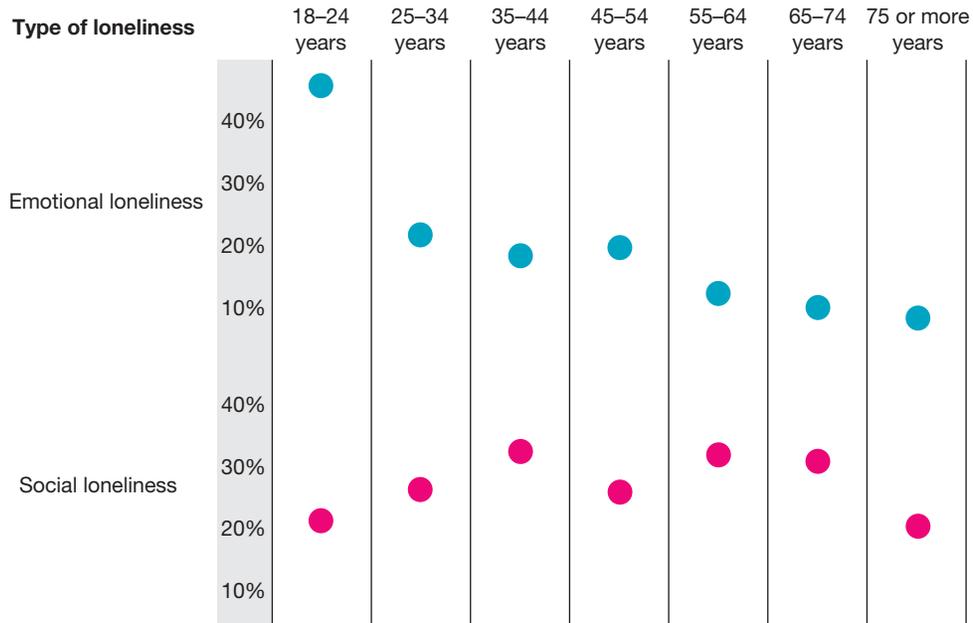
Figure 5.19 indicates that two-thirds of young people have been involved in a romantic relationship by the time they are in Year 11. It is important to consider that once a young person embarks on an intimate relationship, they can be exposed to intimate partner violence (see figure 5.20). Navigating through this will be a new experience for many young people. Unfortunately, the young adult life period has the highest rates of intimate partner violence. Reducing the risk of intimate partner violence and increasing support are crucial.

FIGURE 5.19 Many 16–17-year-olds are in romantic relationships.

By the age of **16–17**, **two thirds** of teenagers had been involved in **a romantic relationship**

Source: Growing Up in Australia: The Longitudinal Study of Australian Children, 2018

FIGURE 5.20 Women are at greater risk of family, domestic and sexual violence than men.

Since age 15:

1 in 6 women   **1 in 16 men**
have experienced physical and/or sexual violence by a current or previous partner

1 in 4 women   **1 in 6 men**
have experienced emotional abuse by a current or previous partner

1 in 5 women   **1 in 20 men**
have been sexually assaulted and/or threatened
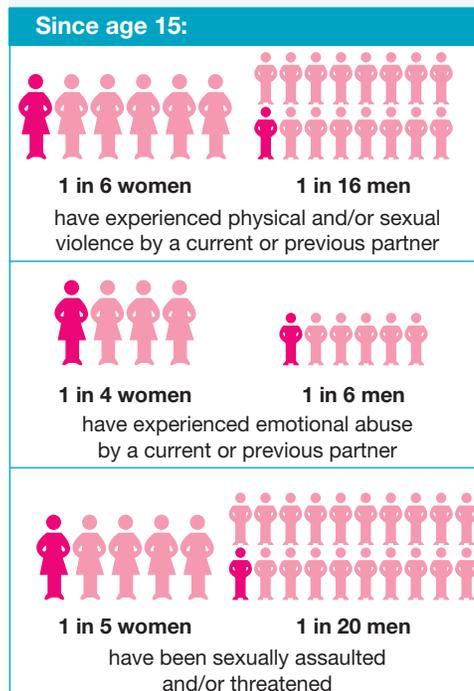
5.8.2 Causes and protective factors concerning relationships

Table 5.8 summarises the causes and protective factors concerning relationships.

TABLE 5.8 The causes and protective factors concerning relationships

Causes	Protective factors
• Low self-esteem • Family breakdown • Substance abuse; for example, cannabis • Low socioeconomic status • Cultural/religious beliefs that encourage or discourage • Alcohol consumption • Gender • Bullying • Peer pressure • Power differences • Aggressive behaviour	• Strong personal support networks • Personal skills based around assertiveness, resilience, coping, decision-making and problem-solving • Laws regarding sexual consent and intimate partner violence • Access to health services such as Relationships Australia • The development of health literacy skills by schools; for example, information from health lessons on consent and respectful relationships; and support from school counsellors and year advisers • Training for community workers and professionals who deal with young people who can then refer them to other services

5.8.3 Strategies to promote healthy relationships

Relationships Australia

Relationships Australia, a not-for-profit independent organisation, aims to reshape lives one relationship at a time. Among other services, it runs Family Relationship Centres, Building Healthy Relationships school programs, adolescent mediation and family therapy, all aimed at assisting the family unit as a whole.

5.8 ACTIVITY 1

Peer mentoring

As a class, design a peer mentoring program that enhances relationships in your school, specifically addresses loneliness and consent, and builds the skills young people need to create positive relationships.

5.8 ACTIVITY 2

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.

1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.

▶

6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.
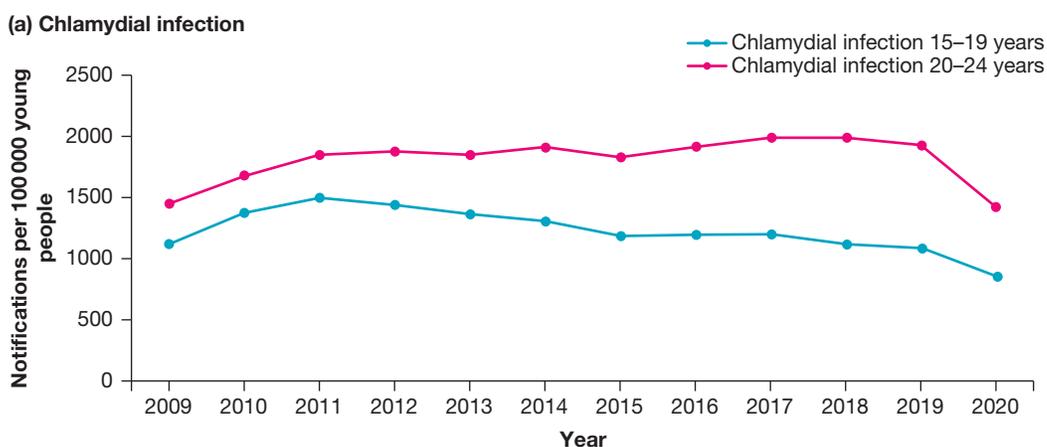
5.9 Sexual health

The World Health Organization describes sexual health as a 'positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence'. It is an important part of general health and wellbeing. Sexual health includes awareness of how to protect yourself and others from sexually transmitted infections (STIs), illnesses and conditions relating to sexual exploration, sexual behaviour and unplanned pregnancy.

5.9.1 Trends and data

The 2019 report *Growing up in Australia: The Longitudinal Study of Australian Children* indicated that, by the age of 16–17, around one-third of young people had engaged in sexual intercourse. Of those who were sexually active, four out of five had done something to protect against an STI. Condoms were the most common method to protect against pregnancy and STIs. The Australian Institute of Health and Welfare reports that most sexually active students in Years 10, 11 and 12 discussed having sex (81 per cent) and protecting their sexual health (77 per cent) prior to sex, and were using condoms (57 per cent) and/or oral contraception (41 per cent).

In 2017, males accounted for more than half (56 per cent) of all new STI cases. Data from the AIHW indicates that viral hepatitis and HIV have remained stable over time in males. However, while rates of chlamydia, gonorrhoea and syphilis notifications had previously increased, there has recently been an encouraging downturn in notifications (see figure 5.21).

FIGURE 5.21 Rate of notifications for selected STIs among young people aged 15–19 and 20–24, 2009–20

(a) Chlamydial infection

(b) Gonococcal infection and syphilis

Legend:
- Gonococcal infection 15–19 years
- Gonococcal infection 20–24 years
- Syphilis (< 2 years) 15–19 years
- Syphilis (< 2 years) 20–24 years

Source: AIHW, https://www.aihw.gov.au/reports/children-youth/infectious-diseases.
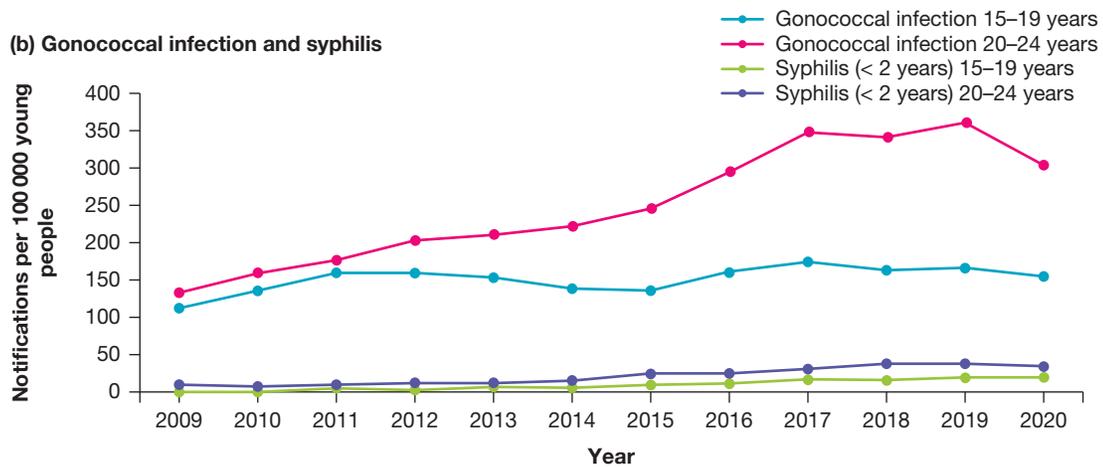
5.9.2 Causes and protective factors concerning sexual health

TABLE 5.9 The causes and protective factors concerning sexual health

Causes	Protective factors
- Low level of education/knowledge of contraceptive methods or STIs - Geographic location — limited access to support services such as Family Planning Association in rural areas - Experiencing difficulties with issues of sexuality - Low self-esteem - Family breakdown - Substance abuse; for example, cannabis - Sexual abuse — rape - Low socioeconomic status - Cultural/religious beliefs that encourage or discourage the use of contraception - Cultural/religious beliefs that encourage or discourage the concept of sex before marriage such as celibacy - Alcohol consumption - Engaging in unprotected sex - Having many sexual partners - Gender	- Strong personal support networks - Personal skills based around assertiveness, resilience, coping, decision-making and problem-solving - Laws regarding minimum years of schooling, marriage, sexual consent and discrimination - Access to health services such as the Family Planning Association, health pamphlets and government health websites - The development of health literacy skills by schools; for example, information from health lessons on contraception/STIs and support from school counsellors and year advisers - Training for community workers and professionals who deal with young people who can then refer them to other services - Society and cultural standards that aim to protect young people from self-harm; for example, abstinence or celibacy - Teenage mothers in school programs that allow young mothers to continue their education - Collecting statistics that allow health authorities to measure the incidence and prevalence of HIV/AIDS and STIs so that health promotions can be targeted - Immunisation programs that protect young people from contracting the human papilloma virus (HPV) - Advances in the treatment of HIV/AIDS and STIs

5.9.3 Strategies to promote sexual health

Playsafe

Playsafe is a sexual health website from NSW Health aimed at increasing knowledge about sexual health practices. It provides information about services available in assisting sexual health and an online forum for young people to ask questions.

Take Blaktion

The Take Blaktion campaign is an STI prevention and testing campaign aimed at Aboriginal and Torres Strait Islander young people.

5.9 ACTIVITY 1

Take Blaktion

Use the **Take Blaktion** weblink in the Resources panel to read about the features of the campaign.

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on Resources

🔗 **Weblink** Take Blaktion

5.9 ACTIVITY 2

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.10 Alcohol and other drugs

▶ **Syllabus:** Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
Including:
- what are the trends in key health issues?
- what are the causes and protective factors of key health issues?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

In many countries it is common practice for alcohol and other drugs including tobacco and illicit drugs such as cannabis to be consumed as part of social gatherings, festivals, celebrations and during periods of grief (funerals). In Australia, it is considered part of our culture for a teenager to have their first drink when they turn 18, and alcohol is a part of many celebrations and social gatherings. While alcohol is widely accepted, the use of illicit drugs remains controversial. The trial of pill testing at music festivals from 2018 aimed to help people better understand the unknown and potentially dangerous substances in illicit drugs, but is opposed by some people. Education about the harmful effects of alcohol has yielded positive results, with data showing a decline in the use of alcohol and other drugs among young people.

5.10.1 Trends and data

Alcohol is widely consumed by many Australians. However, the harmful use of alcohol continues to take a huge toll on the health and wellbeing of Australian communities, families and young people. The WHO states that 'alcohol consumption is a causal factor in more than 200 disease and injury conditions'.

Binge drinking occurs when alcohol is consumed at a high level over a short period of time, or drinking continues over a number of days or weeks. It results in immediate and severe intoxication, with young people taking greater risks or becoming more vulnerable in dangerous situations. Common side effects include hangovers, headaches, nausea and vomiting. Encouragingly, the trends in levels of drinking alcohol in Australia have generally decreased, leading to better health for Australian young people. The DrinkWise data in figure 5.22 shows how drinking trends changed in the 10 years between its two comparative surveys.

FIGURE 5.22 Trends of drinking patterns 2007–17 in Australia

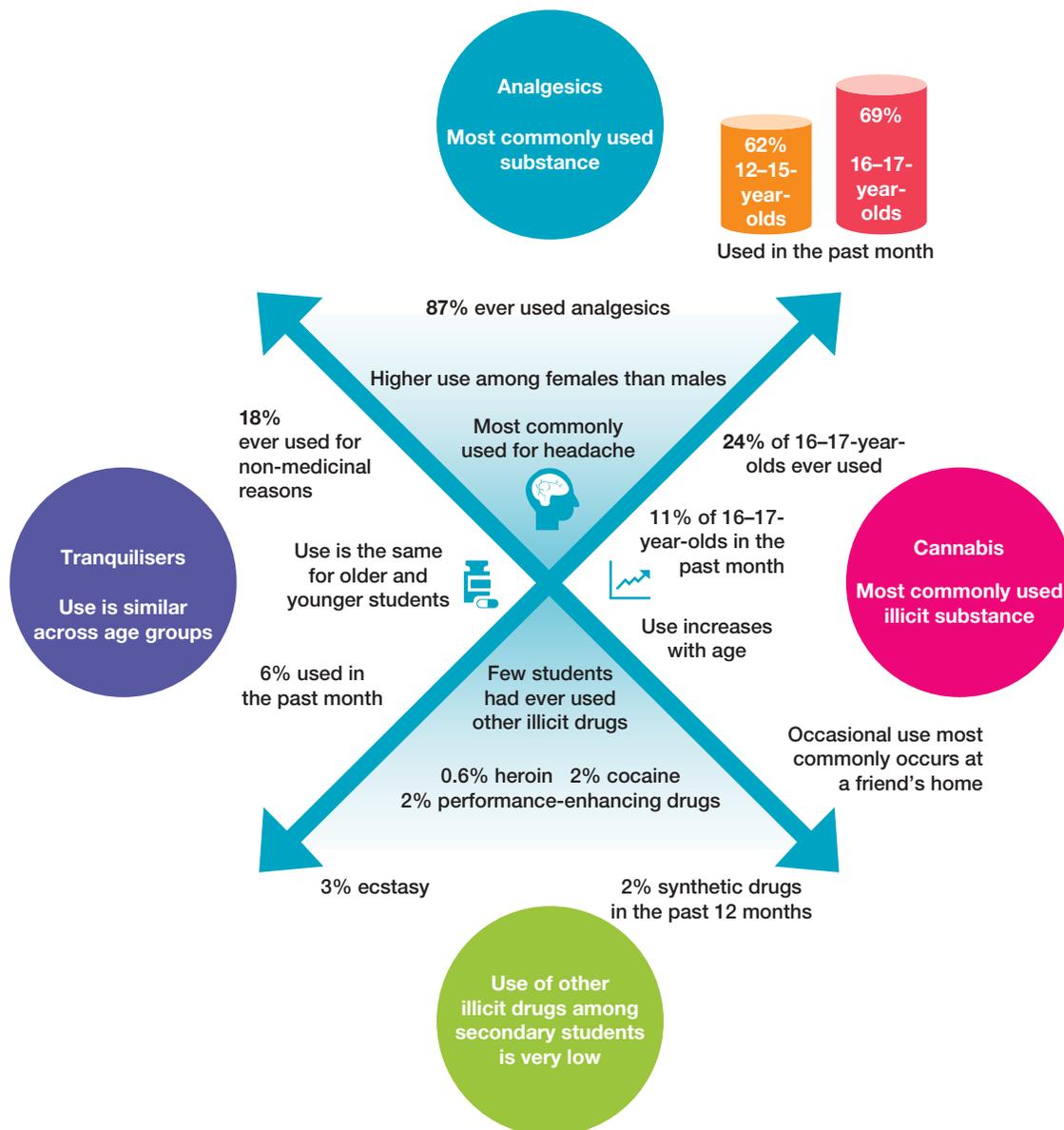| NUMBER OF MODERATE DRINKERS	DRINKING TO EXCESS	NUMBER OF ABSTAINERS	DAILY DRINKING	WEEKLY DRINKING
IN 2017 **63%** OF DRINKERS USUALLY CONSUME NO MORE THAN 2 STANDARD DRINKS — UP FROM 48% IN 2007	IN 2017 **16%** OF DRINKERS USUALLY CONSUME 5 OR MORE STANDARD DRINKS — DOWN FROM 24% IN 2007	IN 2017 **20%** OF AUSTRALIANS ABSTAIN FROM ALCOHOL — UP FROM 11% IN 2007	IN 2017 **6%** OF AUSTRALIANS DRINK DAILY — DOWN FROM 9% IN 2007	IN 2017 **37%** OF AUSTRALIANS DRINK WEEKLY — DOWN FROM 47% IN 2007

Source: DrinkWise.

5.10 ACTIVITY 1

Alcohol Think Again

Use the **Alcohol Think Again** weblink in the Resources panel to discover how much you know about standard drinks and the risks associated with drinking at those levels.

The *Australian secondary school students' use of alcohol and other substances* reports present data collected every three years from secondary school students aged 12–17. The 2022/2023 ASSAD survey shows that fewer older students are drinking alcohol, while the trend for cannabis use remained stable for younger students (12–15 years) between 2008 and 2022/23 and declined for older students (16–17 years) between 2017 and 2022/23. The use of other illicit substances remains uncommon (see figure 5.23).

FIGURE 5.23 Use of over-the-counter drugs and illicit substances by secondary students in Australia in 2022–23

Analgesics

Most commonly used substance

62% 12–15-year-olds

69% 16–17-year-olds

Used in the past month

87% ever used analgesics

Higher use among females than males

Most commonly used for headache

18% ever used for non-medicinal reasons

Use is the same for older and younger students

24% of 16–17-year-olds ever used

11% of 16–17-year-olds in the past month

Tranquilisers

Use is similar across age groups

Cannabis

Most commonly used illicit substance

Use increases with age

6% used in the past month

Few students had ever used other illicit drugs

0.6% heroin   2% cocaine
2% performance-enhancing drugs

Occasional use most commonly occurs at a friend's home

3% ecstasy

2% synthetic drugs in the past 12 months

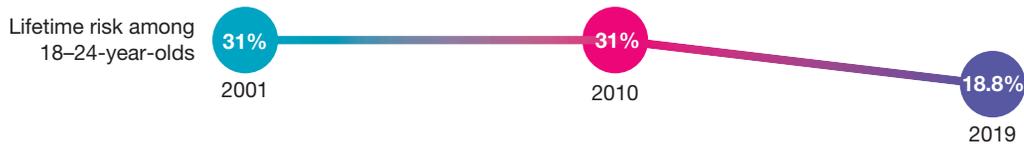Use of other illicit drugs among secondary students is very low

Source: Adapted from Guerin, N. & White, V. (2020). ASSAD 2017 Statistics & Trends: Australian Secondary Students' Use of Tobacco, Alcohol, Over-the-counter Drugs, and Illicit Substances. Second Edition. Cancer Council Victoria. Data from Scully, M. et al. ASSAD 2022–2023: Australian secondary school students' use of alcohol and other substances. Centre for Behavioural Research in Cancer, Cancer Council Victoria: Melbourne. Prepared for: Australian Government Department of Health and Aged Care. December 2023.

As noted, rates of drinking among young people are in decline. The 2022/2023 ASSAD survey showed that among 12- to 17-year-old students, drinking in the past month was less common in 2023 than in 2017 (22 per cent versus 27 per cent). This was the case especially among younger students. In 2017, 15 per cent indicated that they had drunk alcohol in the past week, but in 2023 that figure had reduced to 10 per cent. Unfortunately, when alcohol is consumed, it is often drunk at risky levels.

A study by the Centre for Alcohol Policy Research at Melbourne's La Trobe University, surveying the drinking habits of Australians over 18 years of age, also found that that young people were drinking less, in terms of quantity, than previous generations — approximately half the amount that they consumed, on average, ten years ago. In addition, the National Drug Strategy Household Survey of 2019 found in its research (carried out every three years) that 72 per cent of teenagers abstained from drinking alcohol entirely, up from 39 per cent in 2007 (see figure 5.24).

FIGURE 5.24 Trends shown in the National Drug Strategy Household Survey 2019 suggest that young people are drinking less and starting later.

(a) The proportion of people exceeding the lifetime risk guidelines has declined for younger age groups.

Lifetime risk among 18–24-year-olds

31% (2001) — 31% (2010) — 18.8% (2019)

(b) Risky drinking is declining among younger age groups.

Single occasion risk (monthly) among 18–24-year-olds

57% (2001) — 54% (2010) — 41% (2019)

(c) In 2019, 2 out of 3 (66%) 14–17-year-olds had never consumed a full standard alcoholic drink.

66% (2019)

28% (2001)
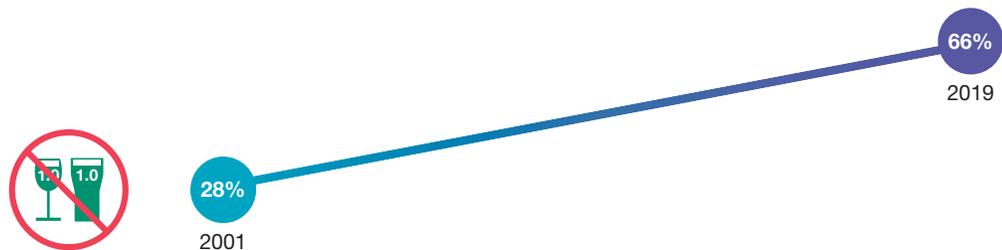
Source: AIHW. National Drug Strategy Household Survey 2019.

Similarly, the AIHW have identified that for young people, tobacco smoking and illicit drug use are in decline. However, there is increased concern about vaping (use of e-cigarettes). Data from the 2022/2023 ASSAD survey indicated that the number of young people aged 12–17 who reported having vaped in the last month has increased significantly since 2014 (from 3 per cent to 16 per cent), and almost 30 per cent reported having vaped at some point. NSW Health (in their vaping toolkit, developed to provide information for young people, teachers and carers) reports that 4 in 5 young people in NSW do not regularly vape. A vape can contain 50 times the amount of nicotine found in a cigarette, which makes them highly addictive (see figure 5.25). It used to be thought that vaping could help someone to stop smoking, but research shows vaping makes a young person three times more likely to start smoking cigarettes. It has been linked with serious lung diseases and many other health issues such as cardiovascular disease, cancer and respiratory disease.

FIGURE 5.25 Vapes contain a number of harmful chemicals.

DO YOU KNOW WHAT YOU'RE VAPING?

NICOTINE

Many vapes contain nicotine making them *very addictive*

FRUITY

The nicotine in 1 vape can = **50** cigarettes

If you vape you are **3 times** as likely to take up smoking cigarettes

Vaping has been linked to *serious lung disease*

Vape aerosol *is not water vapour*

Vapes can contain the same *harmful chemicals* found in cleaning products, nail polish remover, weed killer and bug spray.

Source: © State of New South Wales NSW Ministry of Health. For current information go to www.health.nsw.gov.au.

5.10.2 The causes and protective factors affecting alcohol consumption, smoking and vaping, and illicit drug use

Table 5.10 summaries the causes and protective factors affecting alcohol consumption, smoking and vaping, and illicit drug use.

TABLE 5.10 Causes and protective factors affecting alcohol consumption, smoking and vaping, and illicit drug use

Causes	Protective factors
• Early exposure at home or work • Easy access or availability • Older siblings who use or supply • Poor mental health • Limited recreational and entertainment opportunities in some areas • Cultural expectations	• Strong personal support networks • Personal skills based around assertiveness, resilience, coping, decision-making, problem-solving and conflict resolution • Laws regarding age limits such as supply of e-cigarettes or alcohol to minors, alcohol consumption laws

Causes	Protective factors
• Unemployment • Low level of education • Geographic location — rural/metropolitan • Difficulty with sexuality issues • Low self-esteem • Social alienation • Family breakdown or disharmony • Poly drug use; for example, tobacco, cannabis • Sexual abuse • Aboriginal and Torres Strait Islander background • Gender • Family history of poor mental health • Parent/sibling with a disability or a mental health issue	• Access to health services, information and the development of health literacy skills by schools; for example, Kids Helpline, school counsellors, health pamphlets and government health websites • Education of the community and professionals who deal with young people, such as the responsible service of alcohol by pub and club staff • Society and cultural standards that aim to protect young people from self-harm; for example, finding alternate sponsorship for sporting events, curfews and lock-out laws and alcohol-free areas and events for young people • Government health initiatives that raise awareness by young people such as 'What are you doing to yourself?' • Crossroads programs run at schools to educate senior students of the dangers of alcohol and road use

5.10 ACTIVITY 2

Analysing a health promotion program

Research a current or recent health promotion program aimed at reducing alcohol consumption, smoking or vaping or illicit drug use by young people. List the organisation responsible for running the program, its approach to the problem, its methods of promotion, and the resources provided for individuals and their family and friends. Present your findings to the class.

5.10.3 Strategies to reduce the consumption of alcohol and other drugs by young people

Strategies to improve the choices of Australian young people regarding alcohol and drug use, and reduce the negative consequences, include numerous government-funded resources including the 'You won't miss a moment if you DrinkWise' and 'Positive Choices: Drug and Alcohol Information' campaigns, as well as NSW Health's factsheets on alcohol and other drugs and their vaping toolkit. In October 2021, the government introduced legislation which requires Australians to have a prescription to lawfully access nicotine containing e-cigarette products. This is part of a strategy to protect young people from the harms of vaping. Further restrictions around sales and advertising of e-cigarettes were introduced in 2024.

5.10 ACTIVITIES 3

Positive Choices

Use the **Positive Choices** weblink in the Resources panel to explore the website.
1. Search through some of the resources found in the 'Students' tab, including factsheets, apps and games.
2. Use the information to determine if this is an effective strategy in improving young people's health around drugs and alcohol by addressing the following:
   a. What types of resources are available to young people?
   b. In what ways does this strategy cater for various needs of young people?
   c. How does the strategy inform parents and teachers of young people?

Cancer Council NSW: Generation Vape

Use the **Cancer Council NSW: Generation Vape** weblink in the Resources panel to explore the website.
1. Read about the Generation Vape campaign.
2. Develop your own campaign including: a slogan, a 30-second advertisement, a poster, an infographic and an anti-e-cigarettes information kit for young people (of school age).
3. Present your campaign in class.

on Resources

> **Weblinks** Positive Choices
> Cancer Council NSW: Generation Vape
> NSW Health vaping toolkit
> Quit: Vaping facts

5.10 ACTIVITY 4

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.11 Young people and mental health

If any of the issues discussed in this subtopic cause you concern, seek help from the organisations below. You can also access these sites using the weblinks in the Resources panel.
- Kids Helpline: 1800 55 1800 / kidshelpline.com.au
- headspace: 1800 650 890 / headspace.org.au
- ReachOut: au.reachout.com

on Resources

🔗 **Weblinks**   Kids Helpline
headspace
ReachOut

5.11.1 Trends and data

The World Health Organization describes mental health as 'a state of well-being in which every individual realises their own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to their community'. This focuses on a young person's wellness in mental health. The AIHW tells us that most young people in Australia are happy and positive about the future. Despite this, sometimes young people experience periods of time when mental health is less than optimal. Mental health issues such as anxiety, depression and **stress** may be present due to the experience of loss, family breakdown or school pressure. According to the National Study of Mental Health and Wellbeing, young people experienced the highest prevalence of mental disorders across all age groups. Of those aged 16 to 24 years, 38.8 per cent had experienced a mental disorder within the last 12 months. This includes almost half of females (45.5 per cent) compared with a third of males (32.4 per cent), with **anxiety** disorders the most common at 31.8 per cent. It is important for a young person to realise that they are not alone and that there are services available to help in these times, such as Kids Helpline and Beyond Blue.

stress a physiological or psychological influence that produces a state of tension in a person

anxiety uneasy emotional state that may be brought on by an actual or perceived threat to the safety and wellbeing of the individual

Stress

Everyone will experience stress at some point in their life. Stress is a physiological or psychological influence that produces a state of tension in a person. Young people are experiencing increasing levels of stress, often due to factors beyond their control; for example, the higher incidence of divorce leading to the breaking up or merging of families, or the impacts of poverty, climate change or family trauma.

Stress is experienced throughout life, but because adolescence is characterised by rapid change it makes young people particularly vulnerable. The Mission Australia Youth Report 2023 reported that 38 per cent of young people were extremely or very concerned about

FIGURE 5.26 School pressure can cause stress in young people.

coping with stress. In the same report, stress was the top mental health challenge faced by young people, at 26 per cent. The stress associated with high school, completing examinations or experiencing loss is a real concern for young people. In addition, stigma is attached to not being able to cope with stress, which means many young people do not seek help. Young people can arm themselves with strategies to help overcome times of stress such as using coping mechanisms, talking with a trusted adult or accessing local support services.

Anxiety and depression

There are different types of mental disorders, including anxiety, depression, psychosis and substance use disorder. These can have varying degrees of severity. Of these, anxiety and depression are the two most common among both male and female youth in Australia.

Anxiety disorders include things like phobias, panic disorder and general anxiety. A common feature of anxiety is an uneasy mental state that may be brought on by a real or perceived threat to the individual's safety and wellbeing.

Although everyone feels sad from time to time, depression is more than feeling sad. It is a feeling of low mood that lasts for a long time and affects your everyday life, rather than just 'feeling down'. Both conditions are treatable and can be managed through proper treatment and the correct support.

The Mission Australia Youth Survey 2023 reported that:
- anxiety was an issue of personal concern to 17 per cent of young people nationally; 18.6 per cent of females and 14.4 per cent of males
- 11.7 per cent of gender-diverse young people indicated that anxiety was a personal concern.

It is important to note that, as each young person is unique, the signs and symptoms of anxiety and depression are also different; however, feeling tired easily, not sleeping, trauma, relationship breakdowns, experiences of loss, feeling worried or anxious, difficulty concentrating, and muscle tension are common contributing factors.

Of the total youth population in Australia, 1 to 3 per cent of young people will be affected by a major depressive disorder and 15 to 40 per cent of young people will report having symptoms of a depressed mood disorder. It is believed that by the age of 18, approximately 24 per cent of young people will have suffered from a major episode of depression.

Despite this, young people are becoming more aware of mental health as something that needs to be managed carefully. Females are more likely than males to seek mental health help. The use of phones, internet and other digital technologies has made seeking help more accessible. In 2020–22, young people sought more help for mental health than any other age group in Australia (see figure 5.27).

FIGURE 5.27 Prevalence of mental disorders among 12–17-year-olds, by sex, 2013–14*
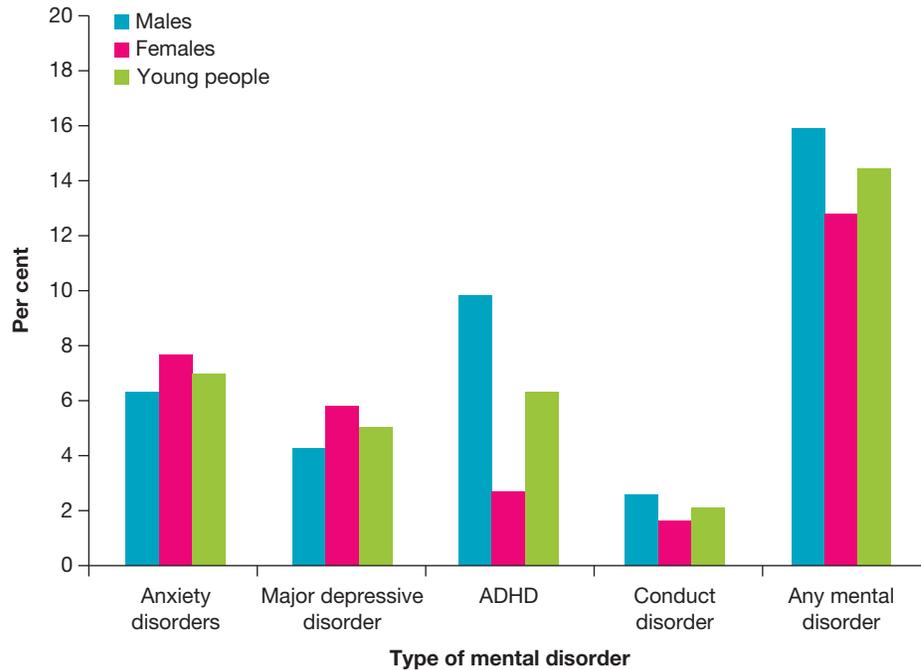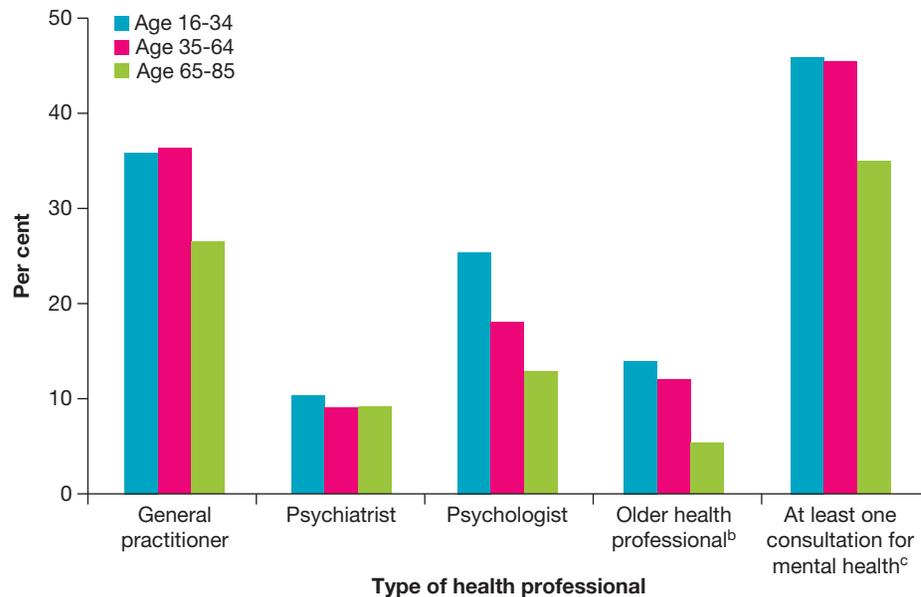

Source: AIHW analysis of the Young Minds Matter Survey Results Query Tool.
*This is the most current available national data on child and adolescent mental health.

FIGURE 5.28 Consultation with health professionals for mental health[a] by people with any 12-month mental disorder, by age, 2020–22

Notes:
    a. In the 12 months prior to interview
    b. Includes mental health nurse and other mental health professional, specialist doctor or surgeon and other health professional.
    c. Also includes hospital admissions for mental health

Source: Australian Bureau of Statistics. www.abs.gov.au/statistics/health/mental-health/national-study-mental-health-and-wellbeing/latest-release#use-of-services.

5.11.2 Causes and protective factors concerning mental health conditions

Table 5.11 summarises the causes and protective factors concerning mental health conditions in young people.

TABLE 5.11 The causes and protective factors concerning mental health conditions in young people

Causes	Protective factors
• Unemployment • Low level of education • Geographic location — rural/metropolitan • Low self-esteem • Social alienation • Incarceration • Family breakdown • Substance abuse • Sexually abused as a child • Low socioeconomic status • Migrant background • Aboriginal and Torres Strait Islander background • Gender • Family history of mental illness	• Strong personal support networks that function in good times and bad • Personal skills based around assertiveness, resilience, coping, decision-making, problem-solving and conflict resolution • Access to health services and the development of health literacy skills by schools, such as Kids Helpline, school counsellors, health pamphlets and government health internet sites • Education of the community and professionals who deal with young people • Societal and cultural standards that aim to protect young people from self-harm; for example, censorship and classification restrictions • Participation of young people in community decision-making to enhance feelings of connectedness; for example, student representative council • Adequate nutrition to allow for full physical and mental development • Positive school environments where students feel they can achieve and are free of bullying • Economic security that fosters optimism for the future • Completion of Year 12 or other educational qualification • Government paid youth allowance

5.11.3 Strategies to improve mental health

A young person's personal support network is important in promoting positive mental health. This includes connection with family, friends and the wider community. A listening ear from a trusted person can make all the difference to the mental wellbeing of young people. When further help is needed, however, the following strategies aim to help improve the mental health of young people.

- *National Mental Health Workforce Strategy* — aims to help plan a sustainable workforce to deliver mental health treatment, care and support that meets the needs of current and future populations.
- *13YARN* — provides free and confidential crisis support to Aboriginal and Torres Strait Islander Peoples. It is non-judgemental, culturally safe and run by Aboriginal and Torres Strait Islander Peoples.
- *headspace: National Youth Mental Health Foundation* — provides early-intervention mental health services for 12–25-year-olds. They operate in-person centres, phone and online support, and school-based support.
- *This Way Up* — offers free online courses and tools designed for people experiencing chronic stress. The self-paced courses include questionnaires, lessons, summaries and engaging activities so young people are able to reflect on their learning about how to deal with stress.
- *ReachOut.* — offers a variety of strategies including tools and apps specifically aimed at young people; for example, 'Calm Harm', 'Headspace' and 'The Check—in'. The ReachOut forums are a place where young people can anonymously share their concerns about themselves or a situation a friend might be going through. The site also provides information for young people to educate themselves on mental health topics such as depression and anxiety.
- *Beyond Blue* — a section of this website is specifically designed to inform young people about mental health. It includes information and resources about self-help mechanisms to help manage anxiety, advice on helping others you might be worried about, and a forum where you can read, share and learn from people who understand what you are going through.

5.11 ACTIVITY 3

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.

1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as females or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.12 Road safety

5.12.1 Trends and data

Road safety is an important health issue for young people. Statistics from the AIHW National Mortality Database 2015–17 show that land transport accidents were responsible for 29 per cent of injury deaths in young people up to 14 years old. They were also a leading cause of hospitalisation. Of children who died because of a road transport accident, 59 per cent were passengers and 29 were pedestrians.

The most common causes of motor vehicle accidents involving young people relate to poor perception of risks, driver fatigue, thrill seeking, inexperience and environmental hazards. Young people are often injured as passengers because they tend to drive with friends as a social activity. As a group, young people also tend to be more mobile and independent, which puts them at greater risk of injury as pedestrians, especially if alcohol or other drugs have been consumed or distractions such as mobile phones are involved.

Young drivers may take risks in motor vehicles by not wearing seatbelts, running red lights, using their phones, allowing too many passengers in the car, driving at high speeds or driving under the influence of a drug.

Motor vehicle accidents represent the greatest cause of unintentional death and injury in young people. Male death rates are higher than female death rates. Hospital admission rates for males are three times that of females. Aboriginal and Torres Strait Islander young people and young people in rural areas are more likely to be involved in motor vehicle accidents than non-Indigenous young people and those in urban areas. The higher rates relate to differences in road conditions, higher speed limits and distances travelled in rural and remote areas.

5.12 ACTIVITY 1

Young driver trends

Use the **Young driver trauma trends** weblink in the Resources panel to investigate the latest trends about young people and road related deaths.
1. How have alcohol, fatigue and speeding affected the rates of road fatalities?
2. How do the rates for young people (those under 25) compare to those who are over 25? Why do you think this is so?

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on Resources

🔗 **Weblink**   Young driver trauma trends

5.12.2 Causes and protective factors affecting road safety

Table 5.12 summarises the causes and protective factors affecting road safety.

TABLE 5.12 Causes and protective factors affecting road safety

Causes	Protective factors
• Alcohol consumption, particularly for drivers of motor vehicles and pedestrians • Using mobile phones while driving • Lack of driver experience • Driver fatigue, especially for young people with part-time jobs • Poor road design; for example, no roundabouts or traffic lights at busy intersections • Geographic location — rural areas have higher speed limits and more dirt roads in comparison with metropolitan areas • Risk-taking behaviours such as not wearing a seatbelt or driving at high speeds • High performance vehicles • Poor infrastructure — a lack of adequate alternative transport forces young people to use cars more often, especially in isolated areas • Poly drug use; for example, cannabis, tobacco, alcohol • Mobility — desire to move from one party to the next • Not obeying road rules such as driving with an overcrowded motor vehicle • Gender — males tend to drive more irresponsibly and this is reflected in higher insurance premiums	• Personal skills based around assertiveness, decision-making and problem-solving • Laws regarding driver licensing, speed limits, phone use, breath testing and alcohol consumption; for example, 0 BAC for P plate drivers, 3-year P plates • Access to driver education programs such as U Turn the Wheel, and the increase in the number of hours and experience required on L plates • Community-based initiatives; for example, Driver Reviver stops, courtesy buses and free soft drinks for designated drivers • Improvements to roads; for example, dual carriageways, roundabouts, speed cameras and the identification of road black spots • Society and cultural standards that aim to protect young people from self-harm such as curfews in some rural towns and alcohol-free communities/areas and events for young people • Improvements in the safety features of motor vehicles; for example, air bags, ABS brakes, side intrusion bars • Increased media attention • Lobbying by groups to make changes to improve driver education and licensing conditions for young people • Government initiatives such as double demerits for holiday periods

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5.12 ACTIVITY 2

Researching an area of concern

Use the **AIHW report** weblink in the Resources panel to find more information and data on risk taking and road-related injuries in Australia from 2001 to 2010. Present the data in table or graph form.

Use the **Young driver trauma trends** weblink in the Resources panel to find more information and use the data to see why this is an issue for young people and how it has an impact on road-related injuries in NSW. Present the data as a report.

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on Resources

🔗 **Weblinks** AIHW report

Young driver trauma trends

5.12.3 Road safety strategies

Since the introduction of more effective road safety laws, the number of road transport deaths in New South Wales has been dropping. This is partly due to greater emphasis on strategies that target young people and road safety. While more work is yet to be done to reduce road injury and fatalities, the following Australian strategies are improving outcomes.

FIGURE 5.29 Laws regarding seatbelt use are a protective factor for road safety.

2026 Road Safety Action Plan

The 2026 Road Safety Action Plan is designed to halve the number of road deaths and reduce serious injuries by 30% by 2030. The plan includes a strategic initiative called Towards Zero, which is a long-term goal for reducing road-related trauma on the New South Wales road network.

Road safety education — driver awareness program

District Rotary Clubs developed the Road Safety Youth Driver Awareness (RYDA) program in response to a fatal crash involving four teenage boys in 2000. This community-based initiative was designed to deliver practical road safety information and target young people's attitudes and awareness. The program is designed for 16–18-year-old students who are approaching the time in their lives when they start to drive independently or are travelling as passengers with novice drivers. It aims to stop the tragedy of losing young people on our roads.

5.12 ACTIVITIES 3

Towards Zero

Use the **Towards Zero** weblink in the Resources panel to find out more about this initiative.
1. Outline the main features of the initiative.
2. Navigate to the 'Campaigns' section and watch Matt's story.
   a. List some of the causes of the accident.
   b. List some of the protective factors that could have been used to avoid the accident.
   c. Describe how Matt's story could aid in achieving the aim of the strategy.

RYDA

Use the **RYDA** weblink in the Resources panel to investigate the program and how it affects students' knowledge, attitudes and behaviour.

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on Resources

Weblinks Towards Zero
            RYDA

5.13 Addictive behaviours

Syllabus: Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
Including:
- what are the trends in key health issues?
- what are the causes and protective factors of key health issues?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Addictive behaviours such as gambling, and addiction to the internet and gaming, are similar to drug addiction except that the individual is not addicted to a substance. Instead, a person is addicted to the behaviour or the feeling experienced when they carry out the activity.

A growing trend in young people is an addiction to screen time, including the internet and gaming. This is when the use of a screen becomes so compulsive that it impairs daily functioning in relation to productivity, social relationships, physical health and emotional wellbeing. An estimated 94 per cent of teenagers own a smartphone and although there are many benefits of having this technology, including keeping in touch with friends and family, the AIHW has linked it with sedentary behaviours. This could lead to poorer health outcomes including reduced bone density, increased obesity and reduced cardiovascular fitness.

5.13.1 Trends and data

In Australia, the national sedentary behaviour guidelines advise that young people aged 13–17 have no more than 2 hours per day and adults aged 18 years and over have minimal sedentary behaviour including screen time. In 2018, the AIHW reported that only 1 in 5 (20 per cent) children aged 13 met the sedentary screen-based behaviour guideline.

In 2018, the World Health Organization recognised 'gaming disorder' due to the increase in young people becoming addicted to gaming and the health issues that ensue as a result, including vision problems, repetitive strain injuries and mental health issues. This can also lead to health problems such increased occurrence of diabetes and obesity, and reduced physical activity.

5.13.2 Causes and protective factors concerning addictive behaviours

Table 5.13 summarises the causes and protective factors concerning addictive behaviours.

TABLE 5.13 The causes and protective factors concerning addictive behaviours including gaming, and screen addiction

Causes	Protective factors
- Unemployment - Low level of education - Geographic location — rural/metropolitan - High disposable income - Low self-esteem - Substance abuse - Low socioeconomic status - Early exposure - Personality type; for example, compulsive - General acceptance by society - Easy access to gaming at home or on the internet - Migrant background - Family history of poor mental health - Gender — males game more frequently - Age	- Personal skills based around assertiveness, resilience, coping, decision-making and problem-solving - Education of the community and professionals who deal with young people at risk - Health promotion initiatives that warn of the dangers of gaming - Economic security - Full employment - Involvement in community projects or sporting/social groups that limit time available to become addicted to screens - Offline social connection and sense of belonging

5.13.3 Strategies to reduce addictive behaviours

While this issue remains complex, various services aim to help young people with addictive behaviour problems such as gaming and excessive screen time.

Addiction counselling

Addiction counselling and psychologists are available in various locations around New South Wales to help young people identify addictive behaviour and overcome destructive patterns.

on Resources

🔗 **Weblink** headspace — maintaining healthy gaming

5.13 ACTIVITY

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.

1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as males or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).
3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

5.14 Gambling

Gambling has been recognised by the World Health Organization as an increasingly prevalent issue among young people. While for most young people who gamble it is just a hobby, it becomes a health issue when it is a significant part of their lives, leads them into heavy debt, and affects their psychological and physical health and relationships. Young people should be aware of how much time they spend on gambling sites, particularly when it takes the place of other activities and relationships. The initial thrill of gambling on a machine, race or card game can quickly be replaced by anxiety when the practice becomes an addiction. The opportunities for young people to engage in gambling have increased over the last decade with the wide availability of sports gambling outlets in clubs and hotels, and the popularity of online gambling sites.

FIGURE 5.30 The ability to gamble on your mobile phone has made gambling more accessible for young people.

5.14.1 Trends and data

Gambling statistics for young people in 2020 indicated that about 30 per cent of young people aged between 12 and 17 had gambled. The NSW Youth Gambling Study 2022 found that 4 per cent of young people have a gambling problem. The growing concern about young people gambling is associated with the rise of gambling advertising, which has led to greater normalisation of gambling in society, especially gambling on sports. Research also shows that one in five adults with a gambling problem began gambling as a young person, before they turned 18. Figure 5.30 shows the difference in gambling participation at age 16–17 years compared to age 18–19 years.

FIGURE 5.31 Changes in gambling participation from age 16–17 years (2016) to age 18–19 years (2018) in Australia
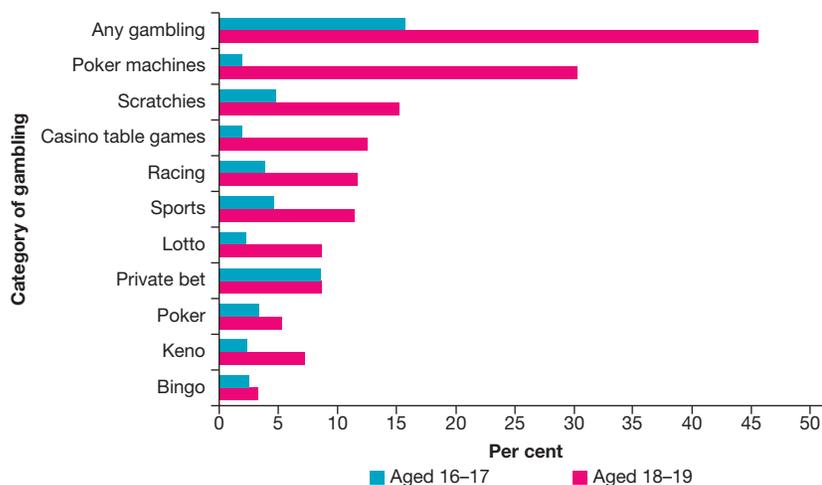
Source: Australian Institute of Health and Welfare 2023.

5.14.2 Causes and protective factors concerning gambling

Table 5.14 summarises the causes and protective factors concerning gambling.

TABLE 5.14 The causes and protective factors concerning gambling

Causes	Protective factors
- Unemployment - Low level of education - Geographic location — rural/metropolitan - High disposable income - Low self-esteem - Substance abuse - Low socioeconomic status - Early exposure - Family history of problem gambling - Personality type; for example, compulsive - Sudden change in economic circumstance - Cultural acceptance; for example, gambling is popular in many cultures - General acceptance by society, such as betting on the Melbourne Cup - Easy access to gambling at home or on the internet - Association of sports such as horse racing and football games with gambling - Migrant background - Family history of poor mental health - Gender — males gamble more frequently - Age	- Personal skills based around assertiveness, resilience, coping, decision-making and problem-solving - Laws regarding poker machine limits, age limits when entering licensed premises, gambling warnings on machines and alcohol consumption limits - Access to government and privately run health services such as gambling helplines - Education of the community and professionals who deal with young people at risk - Health promotion initiatives that warn of the dangers of gambling - Economic security - Full employment - Involvement in community projects or sporting/social groups that limit time available to gamble

5.14.3 Strategies to reduce gambling issues

While this issue remains complex, various services aim to help young people with gambling problems. They also educate the public to help those who have a problem with gambling-related issues.

GambleAware

GambleAware is a NSW government initiative aimed at providing a safe and responsible gambling environment. The gambling helpline is free and confidential, and includes services aimed at groups including women, Aboriginal and Torres Strait Islander Peoples and culturally and linguistically diverse communities. Young people can access the counselling service via 24/7 email, online chat service or phone call. GambleAware also promotes self-exclusion — anyone can nominate themselves to be excluded from any NSW gaming venue, meaning that you are not allowed to set foot inside and be influenced to gamble.

5.14 ACTIVITY

Research scaffold

Answer the following questions to help you to consolidate your knowledge and provide guidance for your further research into the health issue you have selected for investigation.
1. Outline the nature of the health issue (make sure you include key information such as a definition of the key health issue, and major population groups affected, such as males or rural and remote young people).
2. Use at least three credible sources to outline what the data tell us about the health issue (do not forget to include trends and use the most up-to-date data including graphs/tables/other data).

3. Provide reasons as to why it is an issue and use these reasons to analyse the impact this has on young people.
4. List three protective factors and explain why they may help in reducing the health issue.
5. Describe two strategies that are currently in place and how they help to improve this health issue.
6. Propose two new strategies that would enhance the protective strategies or address the statistics and for which there is currently a gap in health promotion. Justify why you chose this (include graphs/tables/data).
7. Based on your research of the health issue, write a conclusion summing up your analysis.

on Resources

🔗 **Weblinks** GambleAware
NSW Youth Gambling Study 2020

5.15 The determinants of health

> ▶ **Syllabus:** Examine the health status of young people, including Aboriginal and Torres Strait Islander young people, using Australia's Health and other health reports, graphs and tables
> **Including:**
> - how do the determinants of health affect health-related behaviours?
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

The determinants of health are discussed in detail in topic 3. They are the range of factors, as identified by the Australian Institute of Health and Welfare, that determine the health status of individuals and populations. The determinants of health are divided into the following groups: broad features of society, environmental factors, socioeconomic factors, health behaviours and biomedical factors. These have impacts on the health-related behaviours of young people. Health behaviours are what a person believes and does about their health and wellbeing.

5.15.1 Biomedical factors

The AIHW defines biomedical risk factors as 'bodily states that have an impact on a person's risk of disease'. These include:
- genetics
- blood pressure
- blood glucose levels
- cholesterol levels
- physical impairment.

These individual factors influence a person's health but are affected by health behaviours. A young person's sense of self and body image is affected by their weight and the way they see themselves. Long-term impacts such as genetic predispositions to high cholesterol and blood pressure are often seen in older Australians, yet positive healthy behaviours start in young people as they gain independence in what they eat and whether they choose to lead a physically active lifestyle. These choices about health behaviours then have an impact on biomedical factors.

FIGURE 5.32 Genetics are a biomedical factor that influences your health.

5.15.2 Socioeconomic factors

Socioeconomic factors refer to the multiple factors that relate to an individual's social and economic environment, and include:

- socioeconomic status
- educational attainment
- employment status
- cultural background
- disability
- social networks
- social expectations and attitudes
- cultural traditions
- the media.

These factors will affect the way a young person interacts with health-related behaviours; for example, low socioeconomic status is linked to poorer health outcomes and an increased exposure to health risks. Studies have indicated that those with a lower educational attainment engage in higher-risk activities such as drinking excessive amounts of alcohol and taking illicit drugs. They also have a decreased level of regular exercise and lower consumption of fresh fruits and vegetables. This can lead to short-term issues including poor nutrition and weight gain.

Further long-term effects from the impacts of socioeconomic factors on health-related behaviours include obesity leading to type 2 diabetes and cardiovascular disease. As educational attainment is often related to employment opportunities and occupation, young people who are educated are more likely to find a job and engage in positive health-related behaviours such as socialisation through work and knowledge about health services that are available to help young people.

FIGURE 5.33 Education is a sociocultural factor that affects health and wellbeing.

5.15.3 Environmental factors

Environmental factors are the factors in the natural and built environment that have an impact on health. They include:

- geographic location
- quality of air and water
- safe workplaces,
- community safety
- access to physical resources within a community.

For example, young people living in rural and remote areas have poorer health outcomes than those living in urban areas. As young people need to travel further for school, work and social connections, this can lead to road-related injury such as speeding or drink driving. Harsher living and working conditions, as well as a greater sense of isolation, can also lead to mental health issues in young people.

Young people living remotely have reduced access to services, including health services, due to their location, and this can adversely affect their health. The higher proportion of Aboriginal and Torres Strait Islanders Peoples who live remotely means this factor has a greater impact on this population.

FIGURE 5.34 Environmental factors, such as where you live, affect your health.

5.15.4 Broad features of society

Broad features of society include:

- culture
- affluence
- social cohesion
- social inclusion
- political structures
- the media
- language.

These can all interact and affect an individual's health and future health possibilities. Inequities in these broad features can affect a young person's health status including their health behaviours, health literacy and access to services.

According to the Australian Bureau of Statistics, same-sex couples are more likely to live in major capital cities than outside this area. This results in cities having a higher level of support services for young LGBTQIA+ people, helping to promote positive health-related behaviours such as attending health screenings and seeking advice from health professionals about sexual health and relationships.

5.15.5 Health behaviours

Health behaviours are a person's individual beliefs and actions about their health and wellbeing. This includes whether you use tobacco or drink alcohol, how physically active you are, what you eat, and your sexual practices. Protective health behaviours include seeking help in violent situations such as domestic and family violence; making healthy food choices; avoiding alcohol and tobacco use; being physically active; accessing medical advice; and getting tested for STIs. These are all behaviours that young people can choose to improve their health.

FIGURE 5.35 Health behaviours include beliefs and actions about healthy eating.

Health behaviours are affected by the environment. They either enable health actions or become a barrier to healthy choices. For example, young people are encouraged to exercise for 60 minutes per day. If there are no parks, fields or safe areas for physical activity, young people will be less likely to engage in this health behaviour.

Similarly if young people are exposed to advertising about fresh fruits and vegetables as they are making food choices, their health behaviours will be positively influenced to make wiser decisions about nutritious and healthy food options.

The interrelationship between the determinants of health will affect the health outcomes for young people in Australia. Determinants such as biomedical factors, socioeconomic factors, environmental factors, broad features of society and health behaviours all influence individual and population health.

DEPTH STUDY IDEA

Choose one health-related issue for young people and investigate how the determinants of health affect it. Conduct a roleplay by identifying the problem and proposing a solution to the problem from the perspective of young people.

5.15 Exercises

learn**on**

5.15 Quick quiz **on**	5.15 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	4, 5	3, 6

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Revise your knowledge

1. Explain the nature of the health issue that you have studied and include your research findings to support you.
2. Discuss how the protective factors prevent the health issue studied.
3. Identify a strategy that is currently in place and describe how it aims to improve the health status of young people in your chosen health-related issue.
4. Propose two new strategies that would address specific areas of your chosen issue. Use data to justify your choice.

Apply your knowledge

5. Argue why the determinants of health have a significant influence on the health of all Australian young people.
6. Reflect on the research that you have conducted about one health-related issue for young people, and evaluate how effective current strategies are at addressing this issue.

5.16 Scaffold for health-related issues for young people

> **Syllabus:** research ONE health-related issue for young people
> **Including:**
> - what is the nature of the issue?
> - what does the data tell us?
> - why is this an issue?
> - what are the protective factors to prevent the issue?
> - what strategies are currently in place to improve the health of young people?
> - what new strategies would be most effective to improve young people's health?
> - what further research questions could be explored to build understanding and advocacy?
>
> ***Source:*** *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

The syllabus calls for you to conduct research on ONE health-related issue for young people. The issues in subtopics 5.3–5.14 provide a guide for you in the structure and content required. Use the information in these subtopics as a model of how to research your health-related issue. You can use the scaffold provided in 5.16 Activity as a starting point for planning your own research.

5.16 ACTIVITY

Scaffold for health-related issue research

Structure your health-related research around the following questions:
1. What are the trends in the health issue?
   Hint: Look at the AIHW and ABS websites and other reports about your health issue. Look at the data to see if it goes up or down over time. This is your trend.
2. What are the causes and protective factors of the issue?
   Hint: These may include factors such as geographic location, age groups most at risk, available services, or education levels.
3. How do the determinants of health affect health-related behaviours for the issue?
   Hint: Use the information about determinants of health in subtopic 5.15 and list all the possible ways that each could impact the health issue.
4. What new strategies would be most effective to improve young people's health?
   Ask the following questions about your health-related issue for young people:
   - What is the nature of the issue?
   - What does the data tell us?
   - Why is this an issue?
   - What are the protective factors to prevent the issue?
   - What strategies are currently in place to improve the health of young people?
   - What new strategies would be most effective to improve young people's health?
   - What further research questions could be explored to build understanding and advocacy?

Use the scaffold provided as a starting point for your own research into a health-related issue for young people.

To start, either choose one of the examples in subtopics 5.3–5.13 or brainstorm with the class other health-related issues for young people.

Use the information provided in this topic as a starting point and conduct further research on the health-related issue you have chosen.

Use this scaffolded plan to make sure you address all the areas required.

on Resources

🔗 **Weblinks** AIHW: *Australia's health 2022*
ABS statistics

5.17 How skills for strengthening and sustaining the individual can protect and enhance health and wellbeing

The syllabus requires students to learn to analyse how the skills for strengthening the individual can protect and improve the health and wellbeing of themselves and others. To do this, use what you have learned from your chosen health-related issue. Lists of possible programs are included in each subtopic as examples. You should not feel restricted to these, and you should endeavour to research other appropriate programs that relate to your chosen health issue.

5.17.1 Self-efficacy

Self-efficacy is a person's degree of confidence in being able to carry out a particular task and manage emotions, behaviour and motivations. The more confidence you have, the more likely you are to prioritise healthy behaviours. Young people with a strong sense of self-efficacy view problems as tasks to be mastered, have a strong sense of commitment to an activity and recover quickly after a setback. It takes energy to protect and enhance your health and wellbeing by achieving goals such as keeping a regular exercise regime or staying connected with support networks such as friends and family. For example, a Year 11 student may be struggling with a large workload of assessment tasks. They might feel stressed and anxious about getting the work done, but their self-efficacy helps them stay on track, work hard and follow the recommendations of their teachers in order to submit their assessment tasks on time.

self-efficacy a person's degree of confidence in being able to carry out a particular task and manage emotions, behaviour and motivations

FIGURE 5.36 Self-efficacy can help young people challenge themselves.

5.17.2 Health literacy

Children and young people make up nearly 40 per cent of the total Australian population. The habits you develop while growing up should be ones that promote good health throughout your lifetime. Good health choices made by young people are influenced by their level of **health literacy**. Health literacy is the ability to understand and interpret health information and use it to promote and maintain good health. Low health literacy has been linked to poorer health, whereas people with better health literacy skills are **empowered** to have better health outcomes. Some of the ways that young people develop and practice health literacy skills include:

FIGURE 5.37 Communication with health professions can increase the health and wellbeing of young people.

- increasing knowledge about health-related issues of young people
- gaining understanding about how to self-manage through prevention strategies rather than externally manage through cure-based strategies
- using accurate sources of health information, including assessing how reliable an internet source is, identifying trusted websites such as research-supported information
- communicating truthfully with health professionals to collaborate in decision-making.

health literacy the ability to understand and interpret health information and use it to promote and maintain good health

empower to give an individual the ability to make decisions about, or have personal control over, their life

5.17.3 Help-seeking behaviours

Help-seeking begins with an awareness and understanding of the problem. Once an issue is recognised, a person can then seek help through the services and support groups available. Help may come in forms such as family and friends, government organisations or religious affiliations. The Mission Australia Youth Survey 2023 indicated that the three most common places to seek help for Australian young people were friends (72.8 per cent), parents or carers (66.3 per cent) and other relatives or family friends (41.9 per cent). The internet was used to seek help by 24.6 per cent of young people, and social media by 13.6 per cent. By listening to the experiences of those closest to you, help-seeking behaviours are enhanced.

FIGURE 5.38 Help-seeking can include talking to a health professional.

5.17.4 Problem-solving

Problem-solving requires that the problem is identified, there is an analysis of the problem that leads to possible alternatives or solutions, and a solution is tried and tested, leading to an evaluation of that solution. Young people can use problem-solving when they assess their own health and wellbeing. Accessing health services to assist in their health and wellbeing requires problem-solving skills such as listening, communicating, decision-making and analysis in order to work out the best health service for a health issue.

5.17.5 Resilience and coping strategies

Your ability to cope with life's ups and downs directly influences your level of health. It is important for young people to develop skills and actions that promote resilience. This resilience improves when your mental responses to situations reflect a positive outlook on life, and this can protect and enhance your health and wellbeing.

Seeing problems in perspective

We face problems every day; it is a natural part of living. Some problems are relatively minor and can be solved quickly, while others are more serious and can take many years to overcome. Stress develops in young people when they think they can control all the factors in their lives.

Having a good self-image and self-esteem can help you to see the positive aspects of any problem. Each problem can be viewed as an opportunity to demonstrate resourcefulness, initiative, determination and creativity and, most importantly, to develop resilience. These are personal life skills that are essential to maintaining good health in young people.

Positive thought habits

Positive thoughts are important in maintaining good self-esteem. A positive approach enables you to identify alternatives and see beyond the problem to the future. It raises self-confidence, as you can believe in your own ability to overcome the challenge. The development of negative thoughts causes people to enter a downward spiral that can make them look for the 'bad' elements in any situation. Practicing positive self-talk can help to create the habit of positive thought.

Distancing and disengaging

To cope with stress, you sometimes need to distance yourself from situations. Distancing lets you step back and have the space and time to consider alternatives. By **disengaging** (a process of letting go of one's personal or emotional involvement with a situation or belief), you might realise that the issue is not personal and that other people are likely to be experiencing the same problem elsewhere; or discover a humorous side to the dilemma.

Sometimes, by taking a break, the subconscious is able to work on relieving the stress. For example, 'sleeping on it' can sometimes be a very good approach to a problem. When our emotions are aroused, we can experience intense feelings of frustration or anger, which can be detrimental to health.

> **disengaging** a process of letting go of one's personal or emotional involvement with a situation or belief

5.17.6 Sense of purpose

When you have goals and plans for the future, you develop a sense of purpose. By remaining positive you can see that your development as an adult relies on experiences that improve life skills, such as healthy decision-making, problem-solving ability, coping skills and the attainment of knowledge.

Recognising and rewarding personal success

When faced with challenging circumstances, the mental promise of a reward at the end can keep you focused on dealing with the stressor in a positive way. It can improve self-esteem and self-confidence in dealing with future similar events. A material reward, such as a new article of clothing, might also help recognise the achievement in personal growth.

FIGURE 5.39 Having a goal can keep you motivated and help provide a sense of purpose.

The responsibility for creating a sense of future rests with both the individual and society. The individual needs to develop positive personal actions, while society needs to support these actions with appropriate programs and strategies.

Establishing a purpose

If you lack a sense of purpose and take a negative and pessimistic view of the world, you may not feel able to make positive lifestyle changes that will improve your health. By maintaining a positive frame of mind and formulating a plan for achieving goals, you are more likely to face the challenges of life with confidence and identify opportunities when they come.

5.17.7 Ethical behaviour

Ethical behaviour refers to acting in ways that are consistent with what society and individuals typically think are good values. These moral principles govern what young people do to enhance their own and others, health and wellbeing. For example, a young person can accept responsibility for their own actions regarding their health and wellbeing. This is seen when a young person visits a doctor and tells the truth about a health concern; or when a young person treats someone with respect and dignity by not being violent and respecting the points of view of other people.

5.17.8 Connectedness

Young people are an integral part of society and the future. When young people are encouraged to participate in decision-making about issues that affect them, it increases their connectedness to their community. When governments and local communities give young people a voice, it shows they value their contributions and the impact they can have. By developing youth-focused policies and giving young people opportunities that encourage responsibility, the **connectedness** of a community is improved, which promotes good health and wellbeing for all.

FIGURE 5.40 Young people can work to make a positive social change.

Connectedness with the community

When a person feels a sense of belonging to an organisation or group of individuals, they share a common set of values, beliefs and sense of purpose. Young people need to feel they are valued in their community. By being made to feel part of the community, young people are more likely to:
- express concern for community members and work towards supporting the community as a whole
- respect the differences that make us all individual
- value the benefits of cooperating to achieve common goals such as safety for all
- develop interpersonal skills to show health-promoting behaviours such as practicing safe sex and not drinking to excess.

Being part of the community allows young people to access the expertise and support that is available from many adults. The support may be in the form of **mentor** programs, access to facilities and resources, or financial grants. A sense of connectedness with the community will lead young people to protect and enhance their own and others' health and wellbeing.

connectedness a sense of belonging and feeling valued and supported
mentor wise or trusted adviser

FIGURE 5.41 Connections between community members allows for greater access to resources and a greater contribution from young people towards their health.

5.17.9 Personal health behaviours and skills

What does this mean for you? What about your own health and wellbeing as a young Australian? It is now time to reflect on the health behaviours that you demonstrate and make a plan to improve your own health and wellbeing. Personal health behaviours and the skills for strengthening your self (discussed above), enable young people to enjoy good health and wellbeing. Health behaviours such as choosing not to smoke or drink alcohol to excess prolong a young person's life by reducing the likelihood of cancers and cardiovascular disease. Following safety measures while driving, such as sticking to the speed limits and wearing a seatbelt, improves health as young people reduce the risk of crashing and injuring themselves and others. Wellbeing is enhanced through personal health behaviours such as seeking medical advice for an STI, or using interpersonal skills such as resilience and problem-solving to help a friend who is feeling down. The daily choices young people make about positive health behaviours regarding food and physical activity help them to enjoy good health and wellbeing.

These positive health behaviours, combined with the personal skills discussed in this topic, enhance the good health and wellbeing of young people today and in the future. It helps them to make positive choices about their health and wellbeing and to cope with the ups and downs of health they encounter.

5.17 ACTIVITY

1. Take one minute to think about an average week for you. This might include school, work, family and friends, sleeping, eating meals, sporting commitments, assessment tasks and a party, among other things. Jot these things down to help you to reflect on the following:
   a. How much time do you spend on each activity? What do each of these things add to your life?
   b. Looking at the guidelines given for healthy eating, screen time and levels of physical activity, how does what you do compare with what is recommended?
   c. Are there any patterns that emerge in your week that are detrimental for your health and wellbeing? What could be done differently to encourage a balanced approach between all parts of your life?
   d. How can you change things to improve your levels of health and wellbeing?

2. Use the reflective questions above to plot a course of action to improve your own health and wellbeing. This may include building in 30 minutes of exercise each day, going to sleep earlier, or even making plans to eat less junk food.
3. Use the SMART goal-setting acronym (see figure 5.42) to set goals for improving your own health and wellbeing.

FIGURE 5.42 SMART goal-setting is an easy way to put your goals into an action plan.

5.17 Exercises

5.17 Quick quiz **on**	5.17 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 9, 11, 12	3, 4, 5, 7, 10, 13, 14	6, 8, 15, 16, 17

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Revise your knowledge

1. Define self-efficacy and state how this helps young people to prioritise their health.
2. How does an improvement in health literacy levels lead to increased good health in a lifetime?
3. Explain how young people can seek help about health issues and what they need in order to seek the right help.
4. Create a mind-map of possible health-related issues of young people. For each, identify the problem and suggest a solution that addresses the health-related issue.
5. Why might resilience and coping strategies be a useful tool for improving the health of young people?
6. Justify why a sense of purpose helps improve the health of young people.
7. Explain why it is important for young people to act ethically about their health.
8. Analyse the benefits of being connected to the community for the health of young people.

Answer the following questions using your ONE health-related issue.

9. How does self-efficacy impact your chosen health-related issue?
10. How can better health literacy skills lead to an improvement in your chosen health-related issue?
11. What are three reputable places that young people can go to seek help about the health-related issue?
12. Identify the problem using current research and provide two possible solutions for your chosen health-related issue.
13. Explain how young people can demonstrate resilience and coping strategies for your chosen health-related issue.
14. How can a young person use a sense of purpose to improve their health for your chosen health-related issue?
15. Identify the ethical issues that a young person needs to consider for your chosen health-related issue. Predict possible outcomes if a person were to act unethically.
16. Explain how community connection can improve the health of young people in your chosen issue.
17. Analyse how the skills for strengthening the individual can protect and enhance the health and wellbeing of yourself and others in relation to the health issue studied.

5.18 Sample exam question response

Question

Examine how connection with Country protects and promotes good health for Aboriginal and Torres Strait Islander young people.   **(8 marks)**

Criteria	Marks
• Comprehensively shows how the connection with Country protects and promotes good health for Aboriginal and Torres Strait Islander young people • Provides clear and relevant examples	8
• Makes evident how the connection with Country protects and promotes good health for Aboriginal and Torres Strait Islander young people • Provides relevant examples	6–7
• Provides characteristics and features of how connection with Country protects and promotes good health for Aboriginal and Torres Strait Islander young people • Provides relevant example(s)	4–5
• Sketches in general terms about how the connection with Country can protect and promote good health for Aboriginal and Torres Strait Islander young people	2–3
• Provides some relevant information about connection with Country and the health of Aboriginal and Torres Strait Islander young people	1

Sample response

eles-5016

Breaking down the question

Examine how connection with Country protects and promotes good health for Aboriginal and Torres Strait Islander young people.

Identify the action word/s: Examine — inquire into

Syllabus terminology: connection with Country, protects and promotes and Aboriginal and Torres Strait Islander young people

Mark allocation: 8 marks — according to HSC past papers, questions worth 8 marks require answers that include multiple body paragraphs, each addressing the action word and providing clear examples.

Answering question using PEEL structure

P Identify the **Point** being raised/state topic sentence/what this paragraph is going to be about[1]

E **Expand/Elaborate** on the point and provide a strong link to what the question is asking[2]

E Apply **Examples** that are relevant and specific[3]

L **Linking** sentence that relates back to the question[4]

Sample annotated response

Connection with Country helps to protect and promote good health for Aboriginal and Torres Strait Islander young people. Health is viewed as a holistic concept that impacts the community as a whole, and therefore specific Aboriginal and Torres Strait Islander services are available to address concerns and promote good health practices.[1]

Connection to Country is more than just connecting with the land. It describes the interconnection with family and the community, which creates a sense of belonging.[1] This interrelated concept means that health is holistic in nature and is interconnected with identity and concepts that affect health.[2] For example, due to intergenerational trauma from the impacts of colonisation and the removal of children from their families, Aboriginal and Torres Strait Islander Peoples have experienced better health when they are living on Country. This might be because of a spiritual connection to the land and ancestors who created it and also a connection with family, which are both protective factors for Aboriginal and Torres Strait Islander Peoples' health.[3] Research has demonstrated that connecting to Country results in better health outcomes and levels of resilience.[4]

Health is protected and promoted through a recognition of this holistic understanding in Aboriginal and Torres Strait Islander health services, as there is a strong connection to Country.[1] A core purpose of Aboriginal and Torres Strait Islander health services is to elevate, dignify and sustain the health status of Aboriginal and Torres Strait Islander Peoples, while being grounded in cultural integrity.[2] The Aboriginal Medical Service embraces a healthcare model that helps Aboriginal and Torres Strait Islander young people access health services —including medical, dental, drug and alcohol services, mental health and other specialists — provided by Aboriginal Health Workers trained in being able to assess health and enhance connection to Country.[3] This protects and promotes the health of Aboriginal and Torres Strait Islander young people as services address health concerns from a culturally sensitive position.[4]

5.19 Review

5.19.1 Topic summary

5.2–5.14 The health status and health issues of young people

- Young people have a diverse range of health issues that affect them, including food, a sense of self and body, violence, valuing movement, technology, relationships, sexual health, alcohol and other drugs, mental health, road safety, and addictive behaviours.
- As a group, young people are generally healthy, but trends and data prove the need to continue to focus on key areas in improving the health of young people in Australia.
- Aboriginal and Torres Strait Islander young people demonstrate resilience and a deep connection between family, friendship and kinship relations.
- Connection to Country is a strong protective factor that positively influences overall health and wellbeing.
- The causes and protective factors concerning health issues vary according to the health issue.
- Several strategies are in place to assist young people who experience key health issues, including government organisations, community-based initiatives and personal skill development.
- Strategies used to help improve the health of young people target social actions, legislation and the implementation of health promotion initiatives by government and non-government agencies.
- Sexual health includes awareness of how to protect yourself and others from sexually transmitted infections (STIs), illnesses, and conditions relating to sexual exploration, sexual behaviour and unplanned pregnancy.
- Young people who are victims of violence, including family and domestic violence, cyberbullying and homophobic vilification can use positive health behaviours such as seeking help from Domestic Violence NSW.
- Young people who seek activities that enhance their health and wellbeing through physical activity reduce the likelihood of long-term health issues such as type 2 diabetes and cardiovascular disease.
- Technology has significantly affected health behaviours of young people in both positive and negative ways; it can be used to access health information to enhance health and wellbeing, or as a platform for bullying and harassment.
- Relationships are crucial for young people to maintain their health and wellbeing, including positive sexual health practices.
- The use of alcohol, tobacco and illicit drugs remains a concern for young people, yet data indicates a decreasing trend in overall use. The use of e-cigarettes (vaping) is on the rise.
- Young people suffer from a high incidence of poor mental health with an increasing trend of depression and anxiety, which is a concern for the future. Risk-taking through drink-driving and not wearing a seatbelt negatively affects the health and wellbeing, but various strategies are proving to be effective in reducing the rates of accidents and deaths in young people.
- The rise of gambling through online sports betting has normalised gambling for young people. More research needs to be undertaken to study this health issue and how it is affecting young people.

5.15 Determinants of health

- The determinants of health that affect the health of a young person can be classified as biomedical, socioeconomic, environmental, broad features of society, and health behaviours.
- The determinants of health may be interrelated and affect a young person in both the short term and long term.

5.16 Scaffold for health-related issues for young people

Your research about your health-related issue for young people should ask the following questions:
- What is the nature of the issue?
- What does the data tell us?
- Why is this an issue?
- What are the protective factors to prevent the issue?
- What strategies are currently in place to improve the health of young people?
- What new strategies would be most effective to improve young people's health?
- What further research questions could be explored to build understanding and advocacy?

5.17 How skills for strengthening and sustaining the individual can protect and enhance health and wellbeing

- The development of self-efficacy is able to enhance health, as young people build the confidence to overcome challenges in their life.
- It is important for young people to develop health literacy so they can maintain good health throughout life.
- Help-seeking behaviours include young people using sources of help to make decisions about their health. These sources include peers, family and online information.
- Young people demonstrate problem-solving skills by identifying the problem and developing possible solutions while accessing services to help.
- Developing resilience and coping strategies enhances the health and wellbeing of young people as they develop the ability to see problems in perspective, use positive thought processes and use distancing to deal with the pressures of life.
- Telling a doctor the truth about a health issue is an example of using ethical behaviour to enhance health.
- Young people feel a sense of connectedness when they are a part of decision-making for their community, as a sense of belonging and achievement of common health goals is established.
- A sense of purpose can also protect and enhance young people's health, as there is a sense of achievement and personal growth through overcoming challenges and establishing a purpose.

on Resources

📄 **Digital document** Topic 5 summary (doc-35907)

5.19.2 Key terms

anorexia nervosa an eating disorder accompanied by a progressive loss of appetite and consequent weight reduction beyond acceptable health levels (15 per cent less than normal for age and height). It is accompanied by an intense fear of gaining weight.
anxiety uneasy emotional state that may be brought on by an actual or perceived threat to the safety and wellbeing of the individual
body image the attitude or feelings we have about our body and the way we think we look or we think others see us. A person's body image can be positive or negative.
bulimia nervosa an eating disorder in which large quantities of food are ingested at one time (bingeing) and then purged from the body by self-induced vomiting
connectedness a sense of belonging and feeling valued and supported
cyberbullying deliberate harassment of a person using communications technology, such as instant messaging, email, social media, chat rooms or other electronic media
disengaging a process of letting go of one's personal or emotional involvement with a situation or belief
empower to give an individual the ability to make decisions about, or have personal control over, their life
health literacy the ability to understand and interpret health information and use it to promote and maintain good health
infrastructure the technical structures that support a society, such as roads, railways, water supply, sewerage, public transport, schools and power grids
mentor wise or trusted adviser ▶

resilience the ability to 'bounce back' after difficult times or bad experiences

self-efficacy a person's degree of confidence in being able to carry out a particular task and manage emotions, behaviour and motivations

stress a physiological or psychological influence that produces a state of tension in a person

telehealth doctor–patient consultations that use any form of technology, including video conferencing, internet or telephone, as an alternative to face-to-face consultations

on Resources

Digital documents   Key terms glossary (doc-36173)
                        Revision quiz (doc-34734)

Interactivity   Missing word interactive quiz (int-8042)

5.19 Exercises

| 5.19 Revision quiz **on** | 5.19 Exam questions |

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5.19 Exam questions

▶ Question 1

Which of the following is a protective factor for Aboriginal and Torres Strait Islander young people's health? (HM-11-02)

A. Living in rural and remote areas
B. Intergenerational trauma
C. Colonisation
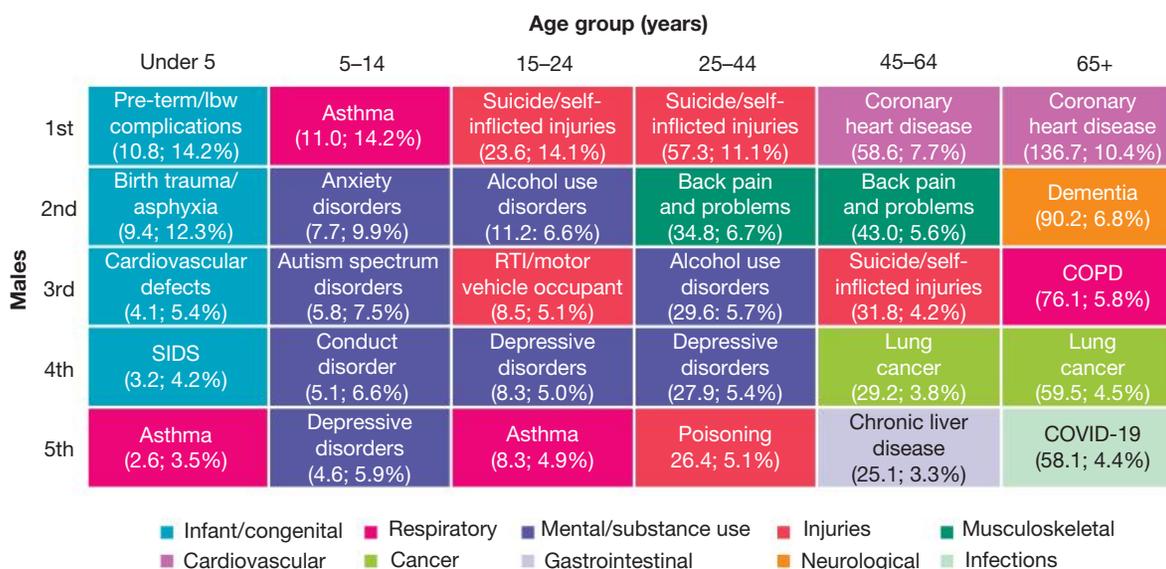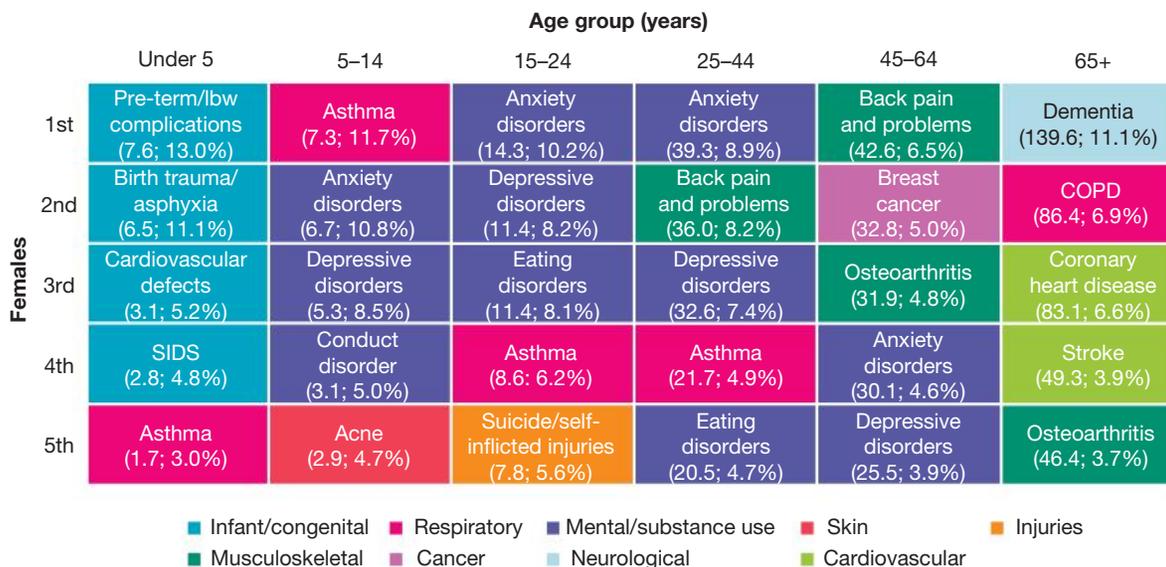**D.** Connection to Country

▶ Question 2

The Aboriginal Medical Service in Redfern was the first NACCHO. What does NACCHO stand for? (HM-11-02)

A. Native Aboriginal Community Controlled Organisation
B. National Aboriginal Community Controlled Organisation
C. National Aboriginal Comprehensive Controlled Organisation
D. National Assembly of Community Controlled Organisations

The following tables from the AIHW *Australia's Health 2022* report show the diseases that caused the greatest burden over the life course by sex and age group.

Age group (years)

Females	Under 5	5–14	15–24	25–44	45–64	65+
1st	Pre-term/lbw complications (7.6; 13.0%)	Asthma (7.3; 11.7%)	Anxiety disorders (14.3; 10.2%)	Anxiety disorders (39.3; 8.9%)	Back pain and problems (42.6; 6.5%)	Dementia (139.6; 11.1%)
2nd	Birth trauma/ asphyxia (6.5; 11.1%)	Anxiety disorders (6.7; 10.8%)	Depressive disorders (11.4; 8.2%)	Back pain and problems (36.0; 8.2%)	Breast cancer (32.8; 5.0%)	COPD (86.4; 6.9%)
3rd	Cardiovascular defects (3.1; 5.2%)	Depressive disorders (5.3; 8.5%)	Eating disorders (11.4; 8.1%)	Depressive disorders (32.6; 7.4%)	Osteoarthritis (31.9; 4.8%)	Coronary heart disease (83.1; 6.6%)
4th	SIDS (2.8; 4.8%)	Conduct disorder (3.1; 5.0%)	Asthma (8.6; 6.2%)	Asthma (21.7; 4.9%)	Anxiety disorders (30.1; 4.6%)	Stroke (49.3; 3.9%)
5th	Asthma (1.7; 3.0%)	Acne (2.9; 4.7%)	Suicide/self-inflicted injuries (7.8; 5.6%)	Eating disorders (20.5; 4.7%)	Depressive disorders (25.5; 3.9%)	Osteoarthritis (46.4; 3.7%)

■ Infant/congenital ■ Respiratory ■ Mental/substance use ■ Skin ■ Injuries
■ Musculoskeletal ■ Cancer ■ Neurological ■ Cardiovascular

Age group (years)

Males	Under 5	5–14	15–24	25–44	45–64	65+
1st	Pre-term/lbw complications (10.8; 14.2%)	Asthma (11.0; 14.2%)	Suicide/self-inflicted injuries (23.6; 14.1%)	Suicide/self-inflicted injuries (57.3; 11.1%)	Coronary heart disease (58.6; 7.7%)	Coronary heart disease (136.7; 10.4%)
2nd	Birth trauma/ asphyxia (9.4; 12.3%)	Anxiety disorders (7.7; 9.9%)	Alcohol use disorders (11.2; 6.6%)	Back pain and problems (34.8; 6.7%)	Back pain and problems (43.0; 5.6%)	Dementia (90.2; 6.8%)
3rd	Cardiovascular defects (4.1; 5.4%)	Autism spectrum disorders (5.8; 7.5%)	RTI/motor vehicle occupant (8.5; 5.1%)	Alcohol use disorders (29.6; 5.7%)	Suicide/self-inflicted injuries (31.8; 4.2%)	COPD (76.1; 5.8%)
4th	SIDS (3.2; 4.2%)	Conduct disorder (5.1; 6.6%)	Depressive disorders (8.3; 5.0%)	Depressive disorders (27.9; 5.4%)	Lung cancer (29.2; 3.8%)	Lung cancer (59.5; 4.5%)
5th	Asthma (2.6; 3.5%)	Depressive disorders (4.6; 5.9%)	Asthma (8.3; 4.9%)	Poisoning 26.4; 5.1%)	Chronic liver disease (25.1; 3.3%)	COVID-19 (58.1; 4.4%)

■ Infant/congenital ■ Respiratory ■ Mental/substance use ■ Injuries ■ Musculoskeletal
■ Cardiovascular ■ Cancer ■ Gastrointestinal ■ Neurological ■ Infections

Source: AIHW, *Australia's Health 2022*.

What are the leading causes of disease burden for 15–24-year-olds, by sex? (HM-11-02)

	Females	Males
A.	Asthma	Suicide/self-inflicted injuries
B.	Anxiety disorders	Suicide/self-inflicted injuries
C.	Suicide/self-inflicted injuries	Asthma
D.	Depressive disorders	RTI/motor vehicle occupant

▶ Question 4

Which of the following is an example of a young person showing ethical behaviour to enhance health and wellbeing? (HM-11-02)

A. Listening to the expertise of community members such as mentors about how to contribute to health and wellbeing

B. Practicing positive self-talk

C. Telling the doctor the truth about their concerns about symptoms that may correlate with a sexually transmitted infection

D. Being aware of the health services available for a health issue

▶ Question 5 (2 marks)

Poor mental health is a health issue relevant to many young people. **Identify** the strategies that exist to address this issue. (HM-11-02)   **(2 marks)**

▶ Question 6 (3 marks)

Briefly **outline** the skills that enable young people to maintain and promote their good health. Use specific examples. (HM-11-06)   **(3 marks)**

▶ Question 7 (5 marks)

Young people from low socioeconomic backgrounds suffer poorer health compared with other young people. **Outline** the roles of the government and the community in addressing this issue and **discuss** strategies that they could adopt to improve the health status of this group. (HM-11-06)   **(5 marks)**

▶ Question 8 (5 marks)

Briefly **discuss** the biomedical factors that affect the health of young people. (HM-11-01)   **(5 marks)**

▶ Question 9 (5 marks)

Explain how discrimination can have an impact on a young person's health. (HM-11-02)   **(5 marks)**

▶ Question 10 (5 marks)

Explain the role of schools in developing the health literacy of young people. (HM-11-02)   **(5 marks)**

▶ Question 11 (8 marks)

Argue the benefits of promoting the connectedness of young people with their community in enhancing positive health behaviours. (HM-11-06)   **(8 marks)**

▶ Question 12 (12 marks)

Using ONE health-related issue affecting young people, **analyse** how the skills for strengthening and sustaining the individual can protect and enhance the health and wellbeing of young people. (HM-11-06)   **(12 marks)**

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

5.1 What key health issues affect the health of young people? (tpdf-2179) ☐

🗎 Digital documents

5.19 Topic 5 summary (doc-35907) ☐
Key terms glossary (doc-36173) ☐
Revision quiz (doc-34734) ☐

✦ Interactivities

5.4 The importance of weight in how you feel as a person (int-8384) ☐
5.5 Victims of family and domestic violence assault, by age group, 2019 (int-9278) ☐
Victims of sexual assault, by age and sex, 2019 (int-9279) ☐
5.11 Consultation with health professionals for mental health by people with any 12-month mental disorder, by age, 2020–22 (int-9280) ☐
5.19 Missing word interactive quiz (int-8042) ☐

▶ Video eLessons

5.6 Sample exam question response (eles-5016) ☐

🔗 Weblinks

5.2 NACCHO location map ☐
NSW Knockout Health Challenge ☐
Closing the Gap Partnership ☐
5.3 Australian Guide to Healthy Eating ☐
Aboriginal and Torres Strait Islander Guide to Healthy Eating ☐
Crunch&Sip ☐
Healthy Eating for Children ☐
5.4 Butterfly Foundation article ☐
Butterfly Foundation ☐
The Embrace Collective ☐
Butterfly Foundation: RESET program ☐
Dove campaigns ☐
5.5 Domestic Violence NSW ☐
Our Watch ☐
White Ribbon Australia ☐
No to Violence ☐
5.6 Glow-in-the-dark bike path ☐
5.7 Kids Helpline ☐
Bullying. No Way! ☐
5.9 Take Blaktion ☐
5.10 Alcohol Think Again ☐
Positive Choices ☐
Cancer Council NSW: Generation Vape ☐
NSW Health vaping toolkit ☐
Quit: Vaping facts ☐

5.11 Kids Helpline ☐
headspace ☐
ReachOut ☐
Beyond Blue ☐
Mission Australia Youth Survey ☐
5.12 Young driver trauma trends ☐
AIHW report ☐
Towards Zero ☐
RYDA ☐
5.13 headspace — maintaining healthy gaming ☐
5.14 GambleAware ☐
NSW Youth Gambling Study 2020 ☐
5.15 AIHW: *Australia's health 2022*
ABS statistics

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

6 What are the opportunities for improving and promoting young people's health?

LEARNING SEQUENCE

6.1 Overview

Key inquiry question

What are the opportunities for improving and promoting young people's health?

Syllabus

	Syllabus content	Subtopic
○	■ Examine how young people advocate for their own and others' health using various sources considering past, current and future advocacy and the role of individuals within their communities	**6.2**
○	■ Discuss how organisations and communities advocate for the health of young people **Including**: • the role government and non-government organisations and communities have in promoting the health of young people, including Aboriginal and/or Torres Strait Islander young people • the impact of organisations and communities on the health of young people **Example(s):** **The role of government and non-government organisations and communities:** Office of the Advocate for Children and Young People (ACYP). National Aboriginal Community Controlled Health Organisation (NACCHO). Children and Young People with Disability Australia (CYDA).	**6.3**
○	■ Explain the nature of health promotion in Australia **Including:** • how have various approaches to health influenced health promotion? • what global health policies have impacted health promotion in Australia? • how has the Ottawa Charter been used to improve Australia's health? • how does health promotion in partnerships with communities strengthen the health of individuals and communities across a range of cultural groups including Aboriginal and Torres Strait Islander Peoples? **Example(s):** **How various approaches to health influenced health promotion:** Aboriginal and Torres Strait Islander approaches to health. Biomedical model. Sociocultural model. Salutogenic model. Ecological model. **Global health policies that have impacted health promotion in Australia:** UNESCO. WHO.	**6.4**

○	■ Examine how the United Nations Sustainable Development Goals (SDGs) are being used to improve health **Including**: • what are the SDGs? • how has the World Health Organization applied a health lens to the SDGs? • how are the SDGs being used in Australia? • how could the SDGs be used to promote the health of young people in a local community?	**6.5**

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Outcomes

- analyses methods and resources to improve and advocate for the health of young Australians HM-11-02
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents Topic 6 summary (doc-35908)
Key terms glossary (doc-36174)
Revision quiz (doc-34735)

6.2 How young people advocate for their own and others' health

Young people face a range of health-related issues which can have a significant impact on their short-term and long-term health and wellbeing. In the past, young people may have had to rely on other members of society to advocate for their needs; however, today there are many opportunities for young people to voice their opinions on their own health and the health of others. **Advocacy** is the process of arguing in support of a cause or position or acting on behalf of yourself or someone else to make sure that your or others' best interests are taken into account. With advancements in technology such as globalised social media platforms, individuals can communicate their needs with a national or worldwide audience. Organisations and communities, including schools, have also recognised the importance of providing young people with a voice and giving them a role to play in the decisions that affect them in order to improve health outcomes.

> **advocacy** the process of supporting a cause or position, or acting on behalf of yourself or another individual to make sure your or their best interests are taken into account

6.2.1 Past, current and future advocacy

School Representative Council (SRC)

A young person's first introduction to formalised advocacy may come in the form of becoming a member of their school's Student Representative Council or SRC. This service to the school community allows students to meet regularly to achieve goals such as organising important information to be passed on to fellow students, creating events to meet students' physical and social health needs, and to meet with teachers and principals to discuss the implementation of new ideas such as uniforms, playground and equipment access and fundraising. This can be a rewarding experience for students as they are able to follow the process of advocacy from idea creation to implementation.

Young Australian of the Year

Each year in Australia there are countless examples of young people who go out of their way to change the lives of others and society for the better. These individuals can be nominated for Young Australian of the Year at a state and national level, or may even be recognised as a Young Citizen of the Year in their local town or region. Winners from previous years have had their efforts recognised across a range of fields including sport, fashion, philanthropy, disability rights, science and music.

Past winners include:
- 2022 — Awer Mabil, a Socceroo player who is the co-founder of the not-for-profit organisation Barefoot to Boots, which aims to improve health, education, policies and gender equality for refugees
- 2020 — Ashleigh Barty, a professional tennis player who at the time was only the second Australian woman to be ranked number 1 in the World Tennis Association singles. Ashleigh is also a National Indigenous Tennis Ambassador for Australia.
- 2019 — Danzal Baker, a Northern Territory artist who works across disciplines including rap, dance and graffiti. Danzal uses his talent to inspire First Nations youth to embrace their culture and take up leadership positions.

FIGURE 6.1 Champion tennis star Ashleigh Barty won the 2020 Young Australian of the Year award.

Lions Youth of the Year

This program recognises young people aged 15–19 for their outstanding community service involvement, leadership and public speaking ability. By engaging in this program, young people are given the opportunity to seek experience in community involvement, broaden their awareness of their communities' needs and improve their communication skills. Youth of the Year participants have organised community fundraisers, blood donations and environmental clean-ups as well as being involved in volunteer firefighting and cadet programs.

Future advocacy

Across the world we can see young people having an impact through advocacy. The explosion of social media since the early 2010s has allowed young people to communicate their concerns to a global audience. Social media has been used to communicate, interact and organise demonstrations to raise local or global awareness of the issues affecting them. An example of this can be seen in climate activist Greta Thunberg, who has inspired countless individuals and organisations by using social media and the internet to convey important messages about climate change. Her advocacy has led to meetings with high-ranking officials in many countries, as well as the opportunity to speak at the United Nations Climate Action Summit. In Australia, future areas of advocacy may include improving access to mental health

FIGURE 6.2 Greta Thunberg became a well-known climate activist at the age of 15.

services, reducing inequities experienced by Aboriginal and Torres Strait Islander Peoples, disability rights and housing affordability. With technology constantly advancing, there will continue to be new ways for young people to get their message out and have their voices heard.

6.2.2 The role of individuals within their communities

While challenges and inequities are faced by people and groups in all areas of our nation, change always occurs through the actions of individuals. In many instances the seeds for change are grown and fostered at a community level, and young people have a role to play in this area through the means of advocacy. Through advocacy, young people can:

- be encouraged to participate
- address inequalities
- improve services
- change attitudes and values.

The **World Health Organization (WHO)** states that youth-led advocacy and accountability are critical to the success of health outcomes among young people. Meaningful youth participation in the planning, implementation and evaluation of youth-focused health initiatives will boost their success.

FIGURE 6.3 Youth-led advocacy can be important for improving the health of all young people.

In order to be an effective advocate, you must:

- research in detail the issue on which you are going to focus
- find others to assist you and provide different points of view on the issue
- search for allies who can assist you in achieving your goals
- formulate clear goals and expectations within a realistic time frame.

World Health Organization (WHO) a specialised agency of the United Nations that acts as the coordinating authority on international public health issues

An example of a young person acting at a community level is Scout Sylva-Richardson from South Australia. In 2019 at the age of 14, Scout wrote a book titled *Excuse Me, Can I Tell You Something* to explain what autism is to children. She decided to write the book because her younger brother is autistic and she recognised there was a lack of resources for people and schools about children with autism. Since the book was published it has been distributed to schools and organisations across her state of South Australia and nationally.

DEPTH STUDY IDEA

Advocating for your local region

a. Create a mind map showing the main issues that are important to young people in your local school, town or region.
b. Narrow the list down to a smaller number of issues and survey your year group to determine which health context you will focus on.
c. Based on the needs of the students surveyed, design a multimodal presentation advocating for your chosen health issue in order to improve the health of young people.

6.2 ACTIVITIES

1. Use the **Australian of the Year Nominee — Taya Davies** weblink in the Resources panel to help you answer these questions.
   a. What inspired Taya to become an advocate for others?
   b. Who does Taya advocate for in her occupation?
   c. What impact do you think Taya's work would have on the young people she engages with?
2. Use the **Brave Foundation** weblink in the Resources panel to help you answer these questions.
   a. What members of the population does this advocacy program target?
   b. What kind of information and resources does this website provide?
   c. Describe the benefits a website like this can provide for individuals.
3. Use the **Disability advocacy** weblink in the Resources panel to help you answer these questions.
   a. How does the program Confident Speakers advocate for people with a disability?
   b. What benefits do those who go through the program gain?

on Resources

🔗 **Weblinks**   Australian of the Year Nominee — Taya Davies
Brave Foundation
Disability advocacy

6.2 Exercises

learn on

6.2 Quick quiz **on**	**6.2 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 5	3, 4, 6	7

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Revise your knowledge

1. Define the term 'advocacy'.
2. List three examples of past advocacy programs and describe their impact.
3. Describe the process by which individuals can become an effective advocate in their community.
4. Explain the benefits of youth-led advocacy.

5. Research other past or current advocacy programs that have been conducted in Australia.
    a. What was the nature of these programs?
    b. What aims or goals did these programs have?
    c. Did the programs meet these aims or goals?
6. What barriers may young people face when trying to advocate for their health or the health of others?
7. Explain the role of individuals within their communities when advocating for their own or others' health.

6.3 How organisations and communities advocate for the health of young people

> **Syllabus:** Discuss how organisations and communities advocate for the health of young people
> **Including:**
> - the role government and non-government organisations and communities have in promoting the health of young people, including Aboriginal and/or Torres Strait Islander young people
> - the impact of organisations and communities on the health of young people
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

The responsibility for health promotion does not lie with any one individual or organisation. It should be founded in a sense of collaboration among all key stakeholders. Effective health promotion allows those affected to have their voices heard within the development and implementation of key policies, strategies and initiatives. In Australia there are several peak bodies and **non-government organisations** whose key responsibilities include advocating for the health of young people. These organisations and communities all have a role in ensuring that young people have their voices heard about the issues affecting them. They do this by engaging with young people, opening dialogues with them about their concerns, needs and wants, and working with them to influence government decision-making and policies at local, state and/or federal levels.

non-government organisations
organisations that are independent of the government

6.3.1 Government organisations

Office of the Advocate for Children and Young People (ACYP)

The Office of the Advocate for Children and Young People (ACYP) was established in 2014 and is an independent statutory office which reports directly to the NSW Parliament. The role of the ACYP is to improve the safety, welfare and wellbeing of all children and young people in New South Wales by ensuring the rights of young people are protected and that their opinions are heard by those in power.

FIGURE 6.4 The ACYP helps to improve the wellbeing of all young people in NSW.

The ACYP aims to initiate change by:
- making recommendations to Parliament, and government and NGO agencies
- promoting participation and decision-making by young people in decisions that affect them
- researching issues that affect young people
- providing information that will assist young people.

Young people can register to be involved in the ACYP by engaging with and participating in survey pools, advocacy training, events and round tables to provide perspective on the range of issues affecting young people in New South Wales.

The impact of ACYP on the health of young people

Since 2015, the ACYP has consulted with over 44 000 children and young people through face-to-face consultations and online surveys. Consultation topics included mental health, education, violence and safety, allowing young people to put forward views and recommendations from their perspective. These consultations provide a voice for young people which otherwise would not be heard; findings can then be effectively communicated to Parliament to better inform public policies.

6.3.2 Non-government organisations

National Aboriginal Community Controlled Health Organisation (NACCHO)

Aboriginal and Torres Strait Islander Peoples represent the oldest continuing culture in the world. They are a very diverse population, with each nation of people having differences in culture, languages, kinship structures and ways of life. Until the 1960s, Australian governments did not implement specific health programs for Aboriginal and Torres Strait Islander Peoples. When they finally did, the programs were designed and run by non-Indigenous people. In response to this mainstream approach not working, the first Aboriginal Community Controlled Health Organisation (ACCHO) was established in Sydney in 1971.

NACCHO is the national leadership body representing all of the ACCHOs. Across Australia there are more than 140 individual ACCHO members incorporating urban, rural, remote and very remote areas. These organisations have empowered Aboriginal and Torres Strait Islander Peoples to design, deliver and, importantly, have control over their own model of healthcare for each of their own distinct communities.

NACCHO aims to reform Aboriginal health by promoting and supporting best practice models of culturally appropriate and comprehensive primary healthcare, as well as promoting research that will build evidence-informed best practice in policy and service delivery.

FIGURE 6.5 NACCHO was established in Albury in 1974.

Some of the ways healthcare can be considered culturally appropriate includes:
- *developing cultural competency*. Healthcare providers have an understanding and awareness of the values, norms and traditions of the communities they serve. This includes recognising the diversity among different Aboriginal and Torres Strait Islander groups.
- *involving community*. Engagement with local communities and Elders is essential. Healthcare providers should collaborate with community leaders and organisations to ensure healthcare services are relevant and responsive to the needs of the community.
- *ensuring cultural safety*. Cultural safety ensures that healthcare environments are free from discrimination and that patients feel safe expressing their cultural needs and concerns. This includes respecting the concept of cultural safety and addressing power imbalances within healthcare.

The impact of NACCHO on the health of young people

NACCHO has had a significant impact on health promotion. Their 2022–23 annual report highlighted that in one year alone they:

- provided 3.1 million episodes of care for around 410 000 Aboriginal and Torres Strait Islander Peoples, across 145 ACCHOs
- experienced rapid growth (17 per cent in a three-year period) in numbers of new patients
- achieved a 5 per cent greater lifetime impact than if the same interventions were delivered by mainstream health professionals.

Children and Young People with Disability Australia (CYDA)

CYDA is a not-for-profit community organisation that aims to empower young Australians with disability. In Australia, people with disabilities face a range of inequities including reduced access to healthcare, education, employment and housing. CYDA advocates for the health of young people with disabilities through:

- *policy advocacy*. CYDA works with government agencies, policy-makers and service providers to ensure that policies are inclusive and address the unique needs of young people with disabilities. Policy advocacy is a critical component of creating a society that values diversity, inclusion and equal opportunities for all its members, without exception.
- *inclusive education*. CYDA recognises the right of every young person and child to be included in mainstream education settings. Inclusive education promotes diversity, accessibility and support for students with disabilities to learn alongside their peers without discrimination. Valuing and implementing inclusive education allows us to challenge stereotypes, foster empathy and promote a more just and accepting society.
- *youth-led advocacy*. CYDA places a strong emphasis on youth-led advocacy, recognising the unique and powerful voice of young people with disabilities. By empowering young individuals to become advocates for their own rights and the rights of their peers, CYDA cultivates a new generation of change-makers. Through leadership programs and networking events, young people are encouraged to share their experiences, articulate their concerns and actively participate in the decision-making processes that affect their lives.

The impact of CYDA on the health of young people

CYDA has positively affected the health of young people with disabilities through organising and presenting a series of webinars on inclusive education, tailored for families and their support networks. The goal of these webinars was to present the real-life experiences of young individuals with disabilities, with the aim of fostering high expectations and aspirations for all children and their educational journey among families, caregivers and communities. CYDA also coordinated LivedX, which was a consultation process allowing young people with disability to share their lived experiences. As a result of these consultations, a number of papers and talks have been presented at the National Youth Disability Summit each year since 2021, on a range of topics including education, financial security and developing confidence in yourself.

6.3.3 Communities

Schools

Schools are sometimes referred to as the centre of the community, and can have a significant impact in promoting the health of young people. Schools in New South Wales recognise that a whole-school approach to health promotion is the best practice in achieving positive health outcomes for young people. The NSW Ministry of Health takes specific measures to collaborate with schools to ensure that healthy eating habits and levels of activity are established early in a young person's life. The Live Life Well @ School initiative is an example of this kind of collaboration, which targets health promotion across all primary schools in the state.

FIGURE 6.6 Mandatory PDHPE lessons from K–10 promote health in a variety of contexts.

FIGURE 6.7 Schools play an integral role in health promotion.

Examples of health promotion policies in schools in New South Wales include:

- the NSW Healthy Canteen Strategy, which aims to make the healthy choice the easy choice when it comes to nutrition
- sun safety policies, which encourage students to take precautionary efforts to reduce the risk of sunburn by wearing a hat or using sunscreen
- anti-bullying policies, which strive to create the safest possible environment for all students as well as a clear pathway to report incidents
- sport and physical activity policies, which could include structured and unstructured opportunities for play during recess and lunch breaks as well as meeting the recommended hours of school-based physical activity in sport and physical education periods.

The impact of schools on the health of young people

One of the many roles of schools is to deliver education, wellbeing, health and physical activity programs that help young people to develop the knowledge, understandings and skills needed to make positive health choices. Schools also provide opportunities for young people to develop the skills needed to participate confidently in all aspects of society, such as decision-making, communication and self-management. By educating students about health issues and modelling healthy behaviours in all parts of school life, schools provide the best possible opportunity for young people to implement healthy behaviours and maintain them throughout the rest of their lives.

DEPTH STUDY IDEA

Research a government, non-government or community organisation that promotes the health of young people in your local region. Prepare an oral presentation or viva voce on the impact this organisation has had on the health of young people.

6.3 ACTIVITIES

1. Refer to the **NACCHO Youth Conference** weblink in the Resources panel.
   a. Describe the impact that attending this event would have on individuals.
   b. Suggest possible outcomes that could occur in local communities because of young people attending this conference.
2. Refer to the **Children and Young People with Disability Australia (CYDA)** weblink in the Resources panel and identify ways that CYDA advocates for the health of young people.

6.3 Exercises

learn on

6.3 Quick quiz **on**	6.3 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3	4, 5, 6	7

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Revise your knowledge

1. What is the difference between a government and a non-government organisation?
2. Provide the full names for the following acronyms:
   a. ACYP
   b. NACCHO
   c. CYDA
3. Choose one of the organisations listed in question 2 and describe the impact it has had on promoting the health of young people.

Apply your knowledge

4. Outline reasons why Aboriginal and Torres Strait Islander Peoples may prefer to attend an Aboriginal Community Controlled Health Organisation (ACCHO) for their health.
5. Identify the current health promotion approaches that exist within your school and discuss their impact.
6. Discuss the impact of organisations and communities on the health of young people.
7. Compare the role of government and non-government organisations in promoting the health of young people.

6.4 Understanding health promotion in Australia

▶ **Syllabus:** Explain the nature of health promotion in Australia
Including:
- how have various approaches to health influenced health promotion?
- what global health policies have impacted health promotion in Australia?
- how has the Ottawa Charter been used to improve Australia's health?
- how does health promotion in partnerships with communities strengthen the health of individuals and communities across a range of cultural groups including Aboriginal and Torres Strait Islander Peoples?

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Health promotion is the process of helping people to have more control over and improve their health. Health promotion can come in a variety of forms, including mass media campaigns, educational seminars, the built environment (for example, walkways and cycle paths) and legislation.

health promotion the process of helping people to have more control over and improve their health

Over the past 40 years in Australia, health promotion has gradually evolved to encompass a more holistic approach which aims to improve the individual's health, takes into account the determinants of health, and in some cases attempts to negate the effects of living with chronic disease and disability. As a result of all these measures, there has been a steady increase in the average life expectancy of the Australian population; teenagers are less likely to use illicit drugs or cigarettes; and mortality rates for conditions such as cardiovascular disease have fallen. It must be noted that despite all the successes of health promotion in Australia, inequitable health outcomes, such as a lower life expectancy for Aboriginal and Torres Strait Islander Peoples, still remain.

6.4.1 Approaches to health

Aboriginal and Torres Strait Islander approaches to health

Aboriginal and Torres Strait Islander approaches to health reflect:
- a holistic attitude
- community-based practices.

They include:
- practicing culture
- cultural healers.

A holistic attitude

In 1979, the National Aboriginal Community Controlled Health Organisation (NACCHO) adopted the following definition of health from an Aboriginal perspective.

> Aboriginal health does not mean just the physical wellbeing of an individual, but refers to the social, emotional and cultural wellbeing of the whole community. For Aboriginal people this is seen in terms of a whole-life view. Healthcare services should strive to achieve a state in which every individual is able to achieve their full potential as human beings, and must bring about the total wellbeing of their communities.

This holistic understanding of health and wellbeing involves a balance between physical, cultural and spiritual health, with land being central to wellbeing. Consequently, when there is disruption between these interrelated elements, Aboriginal and Torres Strait Islander Peoples will experience ill health.

Community-based practices

To promote the health and wellbeing of Aboriginal and Torres Strait Islander individuals facing challenges, a multi-dimensional approach is required. Effective care of Aboriginal and Torres Strait Islander Peoples uses the strengths and resources of communities, families and individuals as seen by the effectiveness of Aboriginal Community Controlled Health Organisations (ACCHO). Strategies include counselling and social support, culturally informed practice and, when needed, support with family reunification. It is important to recognise that Aboriginal and Torres Strait Islander People's understanding of health and wellbeing will vary between different cultural groups and individuals.

Aboriginal and Torres Strait Islander approaches to health an approach to health that is holistic and includes interconnections between physical, social, emotional, mental, cultural and spiritual aspects of health and wellbeing. The approach includes the importance of Country/Place and the role of cultural knowledge.

Practising culture

The significance of culture and cultural identity in promoting health wellbeing cannot be overstated. For Aboriginal and Torres Strait Islander Peoples, engaging with their cultural heritage includes a connection with ancestors and a deep attachment to lands, waters and sky. Furthermore, it helps shape identity and is essential for the health and wellbeing of communities by bringing different generations together. It is important in healthcare settings that a culturally safe environment of respect is created. This means a place where Aboriginal and Torres Strait Islander Peoples feel that they can practise their culture without risking harm through disrespect, racism or discrimination.

Cultural healers

In managing Aboriginal and Torres Strait Islander health and wellbeing, cultural healers play an important role. Today, health services use a holistic approach to healthcare by combining traditional healing and treatments with western clinical approaches. The Ngangkari are the traditional healers of the Ngaanyatjarra, Pitjantjatjara and Yankunytjatjara lands in the remote western desert of Central Australia. Ngangkari have looked after people's health for thousands of years and continue their work today in collaboration with communities, clinics and hospitals across Australia.

CASE STUDY

Community benefits from Ngangkari healing

26 April 2023

After a night of poor sleep, Aunty Bronwyn Penrith was glad to be able to take part in a traditional Aboriginal healing session.

'I was kind of tired and dragging when I came in and now, I'm smiling all the time. I feel like a bit of weight has lifted, although no words were really spoken,' she said.

Aunty Bronwyn, who is Chair of the Mudgin-Gal Aboriginal Women's Corporation, was one of many community members who experienced a healing by Ngangkari healers during a recent program of cultural immersion hosted by Sydney Local Health District in partnership with Chris O'Brien Lifehouse and supported by Cancer Institute NSW.

Ngangkari is a Pitjantjatjara word that means traditional healer.

Healers Uncle Cyril McKenzie from Ernabella in the Anangu Pitjantjatjara Yankunytjatjara (APY) lands in the remote north-west of South Australia, and Aunty Debbie Watson, from Pipalyatjara in the APY lands, held sessions with both Aboriginal and non-Aboriginal people during their two-week stay in the District.

The consultations, held at Chris O'Brien Lifehouse, were a space for the Ngangkari to provide clients with physical, emotional and spiritual support, employing healing practices traditionally used by First Nations people.

'The Ngangkari connect ancestors to ancestors and, in a way, allow the individual to heal themselves,' explained Dr Clayton Spencer, a patron of the Anangu Ngangkari Tjutaku Aboriginal Corporation, the organisation which Uncle Cyril and Aunty Debbie represent.

'Modern health settings are built on what has come before us and what people have been doing for a long, long time,' Professor Michael Boyer AM, an oncologist and the Chief Clinical Officer at Lifehouse, said.

'Although we have a framework within which we work in modern healthcare, we should never lose sight of traditional healing that has been going on for a very long time.'

Reflecting on his own healing experience, he added, 'It was very restful, very calm and really gave me a chance to sort of get out of myself and take a few moments to be calm.'

The cultural immersion event was held to emphasise the value of culture in healthcare and to engage and empower the District's Aboriginal community.

It also included Aboriginal cultural activities such as dance and art workshops, yarning circles where community members could connect and discuss issues relating to health and healthcare, and a First Nations sound healing session.

It was launched with an opening ceremony held on the King George V Lawn at RPA, attended by NSW Health Secretary Susan Pearce, the District's Chief Executive Dr Teresa Anderson, Lifehouse CEO Eileen Hannagan, members of the District's board and guests from Lifehouse and the Aboriginal Medical Service Redfern.

The ceremony featured a Welcome to Country by the Metropolitan Local Aboriginal Land Council and a performance by the Brolga Dance Academy.

FIGURE 6.8 Healers Uncle Cyril McKenzie and Aunty Debbie Watson pictured at the opening ceremony for the Ngangkari Cultural Immersion event in 2023.

'It's wonderful to celebrate traditional healing in a place that provides such amazing clinical care and to recognise that those two things need to come together,' Dr Anderson said.

Summing up the value of the Ngangkari healing sessions, Aunty Bronwyn was clear, 'The benefit of traditional healing is that people will get better and heal their spirit,' she said.

Source: https://slhd.health.nsw.gov.au/sydneyconnect/news/community-benefits-ngangkari-healing

Case study questions
1. How was culture incorporated into this healthcare event organised by the community?
2. Suggest reasons why modern medicine may benefit from integrating cultural healing into the health system.

A model of social and emotional wellbeing

The Aboriginal and Torres Strait Islander model of social and emotional wellbeing focuses on the development of seven overlapping cultural domains that influence an individual's ability to maintain optimal wellbeing (see figure 6.9 and table 6.1). These seven domains include:

- *connection to body*. This includes all of the normal biological markers that indicate the physical health of a person (for example weight, nutrition, illness and disability).
- *connection to mind and emotions*. Mental health is the ability to manage thoughts and emotions. The 2008 National Aboriginal and Torres Strait Islander Social Survey found that the majority of adults reported feeling happy, calm and peaceful and full of life all or most of the time. However, nearly one-third of Aboriginal and Torres Strait Islander adults reported experiencing high to very high levels of psychological distress (more than twice the rate for other Australians).

- *connection to family and kinship*. Connections to family and kinship systems are central to the functioning of Aboriginal and Torres Strait Islander societies. The kinship system provides a very secure attachment system that establishes caring relationships, so that everyone grows up with multiple carers and attachment figures. (Use the **Kinship** weblink in the Resources panel for more information.)
- *connection to community*. Community can take many forms. A connection to community provides opportunities for individuals and families to connect with each other, support each other and work together. The establishment of ACCHOs has been proven to play a significant role in strengthening cultural identity and increasing a sense of ownership, cultural pride and belonging for communities.
- *connection to culture*. A connection to a culture provides a sense of continuity with the past and helps underpin a strong identity. Culture includes all systems of knowledge, law and practices for each group. Aboriginal and Torres Strait Islander Peoples can maintain a secure sense of cultural identity when they are able to exercise their cultural rights and responsibilities through participation in cultural practices.
- *connection to Country*. Connection to Country helps underpin identity and a sense of belonging. Country is defined as the area (including lands, waterways and seas) to which people have a traditional or spiritual association. This sense of connection is a deep experience of belonging and contains complex ideas about law, place, custom, language, spiritual belief, cultural practice, material sustenance, family and identity.
- *connection to spirituality and ancestors*. Spirituality provides a sense of purpose and meaning. It refers to the traditional systems of knowledge left by ancestors in the form of stories, rituals and ceremonies that connect person, land and place.

FIGURE 6.9 The Aboriginal and Torres Strait Islander model of social and emotional wellbeing with its seven overlapping cultural domains

Source: Adapted from the diagram depicting Social and Emotional Wellbeing from an Aboriginal and Torres Strait Islanders' Perspective © Gee, Dudgeon, Schultz, Hart and Kelly, 2013. Artist: Tristan Schultz, RelativeCreative.

on Resources

Weblinks Cultural healers
Kinship

TABLE 6.1 The domains of social and emotional wellbeing with risk and protective factors

Domain	Description	Examples of risk factors	Examples of protective factors
Connection to body	Physical health — feeling strong and healthy and able to physically participate as fully as possible in life	• Chronic and communicable diseases • Poor diet • Smoking	• Access to good healthy food • Exercise • Access to culturally safe, culturally competent and effective health services and professionals
Connection to mind and emotions	Mental health — ability to manage thoughts and feelings	• Developmental/cognitive impairments and disability • Racism • Mental illness • Unemployment • Trauma including childhood trauma	• Education • Agency: assertiveness, confidence and control over life • Strong identity
Connection to family and kinship	Connections to family and kinship systems are central to the functioning of Aboriginal and Torres Strait Islander societies.	• Absence of family members • Family violence • Child neglect and abuse • Children in out-of-home care	• Loving, stable accepting and supportive family • Adequate income • Culturally appropriate family-focused programs and services
Connection to community	Community can take many forms. A connection to community provides opportunities for individuals and families to connect with each other, support each other and work together.	• Family feuding • Lateral violence • Lack of local services • Isolation • Disengagement from community • Lack of opportunities for employment in community settings	• Support networks • Community controlled services • Self-governance
Connection to culture	A connection to a culture provides a sense of continuity with the past and helps underpin a strong identity.	• Elders passing on without full opportunities to transmit culture • Services that are not culturally safe • Languages under threat	• Contemporary expressions of culture • Attending national and local cultural events • Cultural institutions • Cultural education • Cultural involvement and participation
Connection to Country	Connection to Country helps underpin identity and a sense of belonging.	• Restrictions on access to Country	• Time spent on Country
Connection to spirituality and ancestors	Spirituality provides a sense of purpose and meaning.	• No connection to the spiritual dimension of life	• Opportunities to attend cultural events and ceremonies • Contemporary expressions of spirituality

Source: https://www.niaa.gov.au/sites/default/files/publications/mhsewb-framework_0.pdf (p. 8).

Social, historical and political determinants

When considering the seven domains of social and emotional wellbeing, it is important to recognise the ongoing and cumulative impact of social, historical and political determinants. These affect the ability of each Aboriginal and Torres Strait Islander person and their communities to maintain optimal health and wellbeing.

Social determinants include socioeconomic status, unemployment, housing, educational attainment, racial discrimination, exposure to violence, trauma and stressful life events, and access to community resources. It also includes the influential role of cultural systems of knowledge, law and practices of each cultural group and community.

Historical determinants refer to the impact of government policies (past and present) such as the dispossession of land, policies of discrimination and child removals associated with colonisation. For some individuals, families and communities, this entrenched disadvantage is intergenerational due to the extent of historical oppression and cultural displacement. Conversely, this also includes the extent to which communities have managed to resist and withstand these impacts to maintain cultural continuity.

Political determinants include the unresolved issues of land, control or resources, cultural security and the rights of self-determination and sovereignty. Each of these are considered fundamental to the attainment of health and wellbeing and reducing health inequities for Aboriginal and Torres Strait Islander Peoples.

Solutions to the ongoing impact of these determinants is not something the healthcare sector alone can provide. They need diverse, strengths-based approaches and caring that respects different cultures. By providing this kind of culturally sensitive care, healthcare workers go beyond just treating symptoms and aim to take care of the whole person in a comprehensive way.

FIGURE 6.10 The Aboriginal Maternal and Infant Health Service (AMIHS) is an example of a successful culturally customised approach to health for expecting and new mothers.

CASE STUDY

First Nations peoples and COVID-19 pandemic planning, response and management

By Kristy Crooks, Dawn Casey and James S. Ward, 17 August 2020

In past pandemics, Aboriginal and Torres Strait Islander peoples have experienced poorer health outcomes and increased hospitalisations compared to other Australians. In order to combat this during the COVID-19 pandemic, the Federal Department of Health set up an Aboriginal and Torres Strait Islander Advisory Group on COVID-19. Their role was to assist in planning and recovery planning, and to facilitate two-way communication. The group was co-chaired by the National Aboriginal Community Controlled Health Organisation with the Department of Health and included members from the Aboriginal Community Controlled Organisation sector, First Nations communicable disease experts, and state and territory governments.

Key issues for the group to consider in relation to the pandemic and First Nations people in Australia were equity, logistics and planning, and to ensure that actions were not only locally led, but also holistic and culturally safe for communities.

Key actions of the group involved contributions to the national management and operational plans for Aboriginal and Torres Strait Islander peoples and to the COVID-19 national guidelines. Examples include restricting travel to remote communities, ensuring priority to Aboriginal and Torres Strait Islander peoples in the national pandemic response, health services planning, planning for infrastructure needs (e.g. testing locations and places to quarantine if required in remote communities), health education and promotion material that was culturally specific and appropriate, as well as advocacy.

Key differences to prior pandemic responses were giving Aboriginal and Torres Strait Islander peoples a voice to define their issues and priorities and to come up with solutions that were culturally informed and suitable for local needs. It reflects putting Aboriginal and Torres Strait Islander peoples' voices first to create a shared understanding with public health agencies to make a real difference.

Source: Adapted from Crooks, K., Casey, D. and Ward, J.S. (2020) First Nations peoples leading the way in COVID-19 pandemic planning, response and management. *Med J Aust* 2020; 213 (4): 151-152.e1. |doi: 10.564/mja2.50704, published online 17 August 2020.

Case study questions

1. Why was an Aboriginal and Torres Strait Islander Advisory Group on COVID-19 developed to address this particular pandemic?
2. Identify the significant actions proposed by the advisory group and explain how they affected overall infection rates within Indigenous communities.
3. Explain why it was essential that First Nations people were involved in each step of the process when planning and delivering this COVID-19 response.

Biomedical model of health

The **biomedical model of health**, which focuses on the physical or biological aspects of disease and illness, became the dominant view of health in the eighteenth century. This is a medical model of care practised by doctors and health professionals, and is associated with the diagnosis, treatment and curing of disease. Using the biomedical model of health, doctors may schedule diagnostic procedures such as X-rays, blood tests or ultrasounds to determine the cause and then act to reverse the effects of the illness. Referring to topic 3, it is possible to see the parallels between this model of health and the early definitions of health where health was seen as the absence of disease.

> **biomedical model of health** focuses on the physical or biological aspects of disease and illness. It is a medical model of care practised by doctors and health professionals and is associated with the diagnosis, treatment and curing of disease.

Continued use of the biomedical model of health since then has allowed for excellent advancements in medical technology through the development of improved screening for disease (for example via MRI, CT scans and ultrasound), less invasive surgical techniques (such as keyhole surgery) and new vaccinations (such as HPV vaccine to reduce cervical cancer rates). It has therefore led to vast improvements in life expectancy through the reduction of mortality rates, and improved the quality of life for many individuals by returning them to good health.

FIGURE 6.11 Technological advances have allowed for significant improvements towards the biomedical model of health.

Despite the successes of the biomedical model, its limitations when used in isolation became noticeable over time. Rather than thinking that individuals could make changes to their lifestyle to avoid becoming ill, there was a perception that if you were diagnosed with an illness the doctor would be able to fix you. This 'band-aid' approach led individuals to feel that they were not responsible for making important lifestyle changes (such as eating a balanced diet, being physically active and not smoking) that would allow them to lead healthier lives. Also, by treating people in isolation of their environments, the biomedical model ignored the role that various determinants such as socioeconomic status or geographic location played in achieving good health.

This method of diagnosis, treatment and cure can also be very expensive — to the individual, in terms of medical costs for repeated doctors' visits and inability to attend work; and to society, as it places a large cost on the public health system.
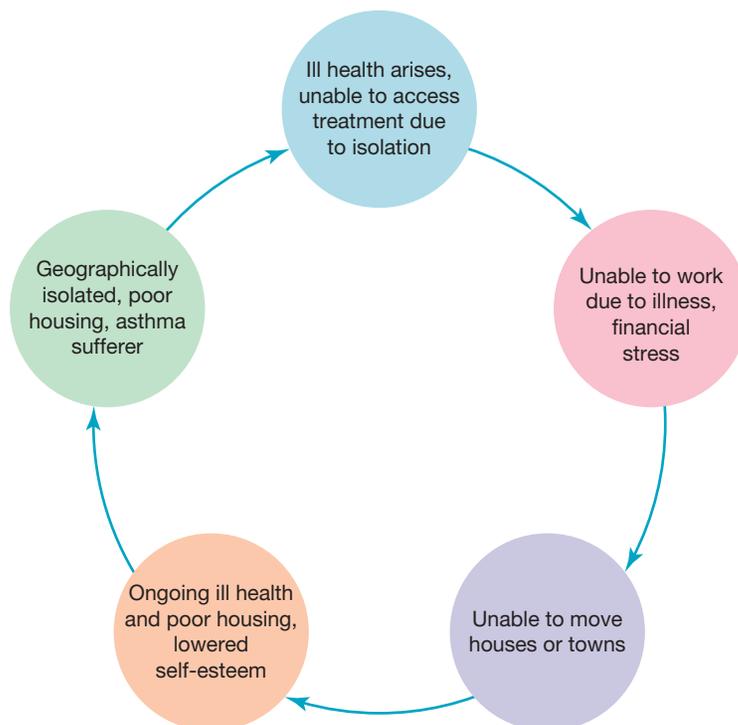
Sociocultural model of health

Despite advances in diagnosis, cure and treatment in the 1970s, health professionals at that time acknowledged that there were persistent differences in health between population subgroups. As a result, a **sociocultural model of health** was implemented with attempts to address the broader influences on health (social, cultural, environmental and economic factors) rather than focusing solely on disease and injury. By taking these broad influences into consideration, it became possible to see that despite an individual's best intentions to make positive lifestyle choices, they might still have a wide range of structural and environmental barriers that limit their ability to make substantive and sustainable changes (see figure 6.13).

FIGURE 6.12 Different population groups experience different levels of health.

sociocultural model of health aims to target the wider influences on health (social, cultural, environmental and economic factors) rather than disease and injury. The focus is on health promotion, policies and education.

FIGURE 6.13 The impact of determinants on an individual's health demonstrates the need for a transition to a social model of health.

- Ill health arises, unable to access treatment due to isolation
- Unable to work due to illness, financial stress
- Unable to move houses or towns
- Ongoing ill health and poor housing, lowered self-esteem
- Geographically isolated, poor housing, asthma sufferer

This new approach to health focuses on the policies, education and health promotion needed to make social changes that are outside the control of an individual. It begins within a community setting and then expands to include all levels of government as well as NGOs, all working collaboratively to design the best possible strategy or initiative. By allowing communities to be actively involved in identifying the issues that are affecting them, and then to be consulted during the planning, designing and implementation phases, the chances of the health promotion being successful are increased. This process is empowering as it allows local knowledge to determine the best possible solution for the environment in which an individual lives.

Another advantage of the social model of health is that it is much more cost effective to prevent the disease or illness from occurring in the first place. Conducting health promotion initiatives that focus on educating people about preventative strategies, improving access to healthcare services for all Australians and reducing social inequities will improve the quality of life for individuals. It will also ease the economic burden placed on the health system due to overreliance on the biomedical model of health.

Examples of health promotion initiatives from a social model of health include:
- *Oral Health 2020* — a New South Wales government initiative to improve access to oral health services, and reduce disparities among children, people with special needs, Aboriginal and Torres Strait Islander populations and rural and remote communities through primary prevention strategies
- *Girls Make Your Move* — a federal government initiative aimed at increasing the involvement and retention of girls in a range of physical activities that they enjoy
- *Game on Mole* — developed by the Melanoma Institute Australia to increase the awareness of preventative strategies for those at risk of developing melanoma
- *National Bowel Cancer Screening Program* — a program designed by the Australian government Department of Health, which sends free home-testing kits to people aged 50–74 to complete at home and send back to a laboratory for analysis.

FIGURE 6.14 By using prevention strategies, social models of health have proven to be cost effective.

Salutogenic model of health

Salutogenesis is a term developed by Israeli–American sociologist Aaron Antonovsky in 1968 to describe the way in which people manage to maintain quality of life even when suffering from an extreme illness or condition. The **salutogenic model of health** can be defined as an approach to human health that examines the factors contributing to the promotion and maintenance of physical and mental wellbeing rather than focusing on disease. It has an emphasis on how individuals use coping mechanisms to help preserve health despite stressful conditions.

salutogenic model of health focuses on the factors that promote and maintain physical and mental wellbeing, rather than focusing on disease and injury. It pays special attention to how people deal with stressful situations and still manage to stay healthy.

Evidence of this approach can be seen in hospitals and aged-care facilities which allow patients to feel relaxed and comfortable while providing activities for them to engage in. Before the development of this model, contracting a severe chronic illness or developing a disability may have led people to believe that their life was over. By flipping this narrative and helping individuals to further develop their social, emotional, mental and spiritual health, this model empowers people to manage their physical health to the best of their ability.

The salutogenic approach to health promotion focuses on asking strengths-based questions such as 'What keeps me healthy and active?' rather than 'What risky behaviours should I avoid?' An example of the salutogenic approach to health promotion is the change in mass media campaigns on drink-driving. Previous campaigns such as 'If you drink, then drive, you're a bloody idiot' and 'Better get a lawyer' (see the **Anti drink-driving campaign** weblinks in the Resources panel) focused on the negative consequences of drink-driving to shock or scare people onto the right path. In 2012, the 'Plan B' campaign began with an emphasis on the positive choices individuals can make, to engage young people in sound decision-making.

FIGURE 6.15 The Royal Children's Hospital in Melbourne reflects a salutogenic model of health with a child-friendly physical environment.

Other examples of this approach include:
- the PDHPE curriculum, which focuses on ways in which young people can lead healthy and active lives
- complementary health treatments (such as acupuncture, aromatherapy, naturopathy, reiki and yoga) which, when used alongside traditional medicine, may allow individuals to take care of their spiritual, mental and emotional health
- shifting healthcare expenditure from treatment and curing illness and disease to a prevention model. This will give individuals the skills to achieve and maintain positive health practices with the goal of reducing the incidence of many lifestyle diseases.

on Resources

🔗 **Weblinks** Anti drink-driving campaign 1
Anti drink-driving campaign 2
Anti drink-driving campaign 3

Ecological model of health

The **ecological model of health** is based on evidence that there is no single factor to explain why some people or groups are at higher risk than others. The ecological approach focuses on both individual and social determinants of health. Since this model was introduced in the 1980s, it has grown in popularity among health researchers. The model itself focuses on the interplay of the determinants of health (as discussed in topic 3).

ecological model of health based on evidence that no one factor can explain why some people or groups are at higher risk than others. It looks at both individual and social determinants of health.

According to the World Health Organization, an ecological model of health relies on the interaction of many factors at four levels:
- *Individual level.* Your background and personal biomedical factors will have a large influence on how you behave, and may increase or decrease the likelihood of achieving good health. For example, an individual who is exposed to violence and abuse in their childhood may be more likely over their lifetime to commit violence to others.

- *Relationships level*. Your family, friends, peers and intimate partners may have an influence, both positive and negative, on your health. For example, having friends who are constantly engaged in physical activity may allow you to develop positive physical activity habits as well.
- *Community level*. These are the contexts in which your relationships occur, and include schools, sporting teams, cultural groups, neighbourhoods and workplaces. The factors that may influence your health in any of these communities could include the socioeconomic status of the community, transport availability and access to health services. A young person living in an area of low socioeconomic status or a rural area may have limited options for quality education or choice of sporting teams compared to a young person living in a larger regional centre or capital city.
- *Societal level*. At this level, behaviours are determined by whether they are encouraged or deemed unacceptable. Social and cultural norms that choose to either accept or denigrate specific population groups such as females, **LGBTQIA+** individuals, Aboriginal and Torres Strait Islander Peoples, or migrants and refugees will play a determining factor in the health of individuals within those groups and the behaviours of those living there.

An example of health promotion using this ecological model of health is the Maranguka Justice Reinvestment program initiated in the north-western NSW town of Bourke. The first program of its kind in Australia, it was implemented in Bourke due to the town's high level of socially disadvantaged people and its rising crime rates. The program operated on the key principles of:

- building trust in the community and with service providers
- identifying community priorities
- identifying and implementing 'circuit-breakers' that could deal with the root causes rather than waiting for a crime to occur.

> **LGBTQIA+** acronym that stands for lesbian, gay, bisexual, transgender, queer/questioning, intersex, asexual and others

An example of a circuit-breaker used in the Maranguka Justice Reinvestment program was the More Driver Licences Less Driving Offences initiative, which was a driver-licensing crime-and-prevention program. This allowed community members to access driving lessons and eliminated barriers to obtaining identity documents needed to gain a license, such as low literacy levels and difficulties in getting birth certificates. This circuit-breaker enabled residents of Bourke to gain driver licences and incur fewer driving-related offences, making it easier for them to keep their job as travel is often a key component of work in rural New South Wales. Between December 2015 and January 2019, this initiative led to 310 people in Bourke obtaining their learner or provisional licences.

FIGURE 6.16 By engaging the community in Bourke and identifying the underlying determinants that influence health, better health outcomes are achieved.

In the 5 years between 2013 and 2017 the Maranguka Justice Reinvestment Program reported significant impacts, including:

- a 23 per cent reduction in police-recorded instances of domestic violence and comparable reductions in rates of reoffending
- a 31 per cent increase in Year 12 student retention rates
- a 38 per cent reduction in charges in the top five juvenile offence categories
- a 42 per cent reduction in days spent in custody.

The Justice Reinvestment Program has since been extended to three more New South Wales communities.

on Resources

🔗 **Weblink**   Justice reinvestment in Bourke

6.4.2 What global health policies have impacted health promotion in Australia?

The health policies that are implemented in Australia are often based on information provided by reputable international organisations such as the World Health Organization and the **United Nations Education, Scientific and Cultural Organization (UNESCO)**. Examples of global health policies which have been implemented in Australia include large-scale health promotion campaigns to curb the infection rates for diseases such as HIV/AIDS and the COVID-19 virus, and to increase vaccination rates for other diseases such as measles and rubella.

United Nations Education, Scientific and Cultural Organization (UNESCO) agency of the United Nations that promotes international collaboration in education, sciences and culture to protect human rights

United Nations Education, Scientific and Cultural Organisation

The United Nations Education, Scientific and Cultural Organisation (UNESCO) focuses primarily on educational, cultural and scientific aspects, but its work indirectly intersects with health promotion in several ways.

- *Education for health.* UNESCO promotes education as a fundamental tool for improving health and wellbeing. It supports educational programs that teach people about healthy lifestyles, disease prevention, sexual health and environmental health. By ensuring access to quality education, UNESCO indirectly contributes to health promotion efforts.
- *Environmental sustainability.* UNESCO is actively involved in environmental protection and sustainability, which has direct implications for public health. Environmental issues such as clean water, air quality and conservation are essential for maintaining good health.
- *Medical ethics.* UNESCO is involved in the development of ethical guidelines and standards in areas such as genetics and biomedicine. These guidelines help ensure that advances in science and technology are aligned with ethical principles, which in turn influence health promotion policies.

An example of UNESCO's work was seen when UNESCO Member States declared the first Thursday in November as International Day against Violence and Bullying at School Including Cyberbullying. This policy was developed to strengthen partnerships and initiatives between organisations to combat the spread of school-related violence. The purpose is to maintain the right for children to access education without harming their health and wellbeing.

Data from UNESCO's 2019 report showed that almost one in three students have been bullied by their peers at school. The impact of this bullying can include children finding it difficult to concentrate in class, missing classes, avoiding activities or dropping out altogether. For Australian schools, recognising this day and providing education for children, parents and the wider community about the risks and protective behaviours for violence and bullying aims to lead to a decrease in bullying cases.

World Health Organization

The World Health Organization (WHO) plays a significant role in health promotion on a global scale. Its responsibilities in health promotion include the following.

- *Setting global health priorities and policies:* WHO identifies and prioritises global health challenges, ensuring that health promotion efforts focus on the most pressing issues. During the global COVID-19 pandemic, WHO developed policies and guidelines that governments and organisations could use to shape their health promotion programs and initiatives. These policies included recommendations for disease prevention, health equity and other critical areas.
- *Coordination and collaboration:* WHO acts as a coordinating body, bringing together governments, NGOs and other stakeholders to collaborate on health promotion efforts. This coordination ensures that resources and knowledge are shared effectively to address health challenges such as communicable diseases, non-communicable diseases, mental health and environmental health.
- *Health promotion frameworks:* WHO has developed health promotion frameworks and strategies, including the Ottawa Charter for Health Promotion, which have provided guidance for health promotion efforts worldwide. The Ottawa Charter is versatile and adaptable, making it a valuable resource for addressing diverse health challenges across different cultural and social contexts.

Ottawa Charter

How has the Ottawa Charter been used to improve Australia's health?

Despite being developed in 1986, the Ottawa Charter is still regarded as essential to any effective health promotion worldwide. It changed the way we think about healthcare, shifting the focus from just individuals taking care of their own health to a more holistic approach. Its guiding principles are based on the understanding that health is socially determined and that health professionals and governments should not only educate people about health matters, but also strive to change the physical environments in which people live to be more conducive to health, and to involve the community in projects to improve the areas of health they see as a priority.

The Ottawa Charter for Health Promotion identified the following prerequisites for health.
- The basic necessities for health are peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice and equity.
- Health is a positive concept emphasising social and personal resources, as well as physical capabilities.
- All people should be able to achieve their health potential through the provision of equal opportunities and resources.
- All sectors within the community are responsible for health promotion — health, social and economic sectors, governments, industry, local authorities, media and voluntary organisations.

Within Australia, the Ottawa Charter has acted as the framework for a range of health promotion initiatives such as Close the Gap (2008), the National Chronic Disease Strategy (2005) and the National Road Safety Strategy (2011–20). The framework itself allows for the development of a clear pathway in which each stakeholder is aware of their own responsibilities and with each strategy designed to work towards a common goal.

DEPTH STUDY IDEA

In small groups, choose a health issue relevant to young people and, using the salutogenic model of health, design a fully formed health promotion campaign. Your group may present your campaign in the form of a multimodal presentation.

6.4 ACTIVITIES

1. View the communication materials found in the **COVID-19 campaign 2020** weblink in the Resources panel. These resources were distributed nationwide in Australia during the pandemic. After viewing the videos and the print and radio communications, answer the following questions.
   a. Which model of health do these health promotion materials follow?
   b. How effective do you think these campaign materials were in getting the message out to Australians? Suggest reasons why.
   c. Using research, explain how these materials were shaped by the global health policies distributed by the World Health Organization.
2. View the video in the **Ngangkari Healers** weblink in the Resources panel and answer the following questions.
   a. What services do the Ngangkari Healers provide?
   b. How do the Ngangkari Healers fit with the Aboriginal and Torres Strait Islander model of health?
   c. Which dimensions of health does this type of medical practice cater for?
3. Work in small groups. Your teacher will assign each group a model of health. Focusing on this specific model, create a written scaffold of a health promotional campaign targeted towards a specific health context. This could include road safety, mental health, infectious diseases, cancer, injury, sexual health, gender violence, alcohol and other drugs, or other emerging topics.

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on Resources

Weblinks   COVID-19 campaign 2020
                      Ngangkari Healers

6.4 Exercises

6.4 Quick quiz on	6.4 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3	4, 6, 7	5

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Revise your knowledge

1. What is health promotion?
2. Define the following approaches to health.
   a. Biomedical model
   b. Sociocultural model
   c. Ecological model
   d. Salutogenic model
   e. Aboriginal and Torres Strait Islander
3. Provide examples of strategies used within the biomedical and social models of health.
4. Using research, identify past or current health promotion campaigns linked to each approach to health. Share your answers as a class to create a comprehensive list.
5. Describe the evolution of these approaches to health over time.

Apply your knowledge

6. Explain how the salutogenic model of health can lead to improved health outcomes for young people.
7. Discuss the benefits and limitations of the biomedical model of health.

6.5 Using the Sustainable Development Goals to improve health

> ▶ **Syllabus:** Examine how the United Nations Sustainable Development Goals (SDGs) are being used to improve health
>
> **Including:**
> - what are the SDGs?
> - how has the World Health Organization applied a health lens to the SDGs?
> - how are the SDGs being used in Australia?
> - how could the SDGs be used to promote the health of young people in a local community?
>
> *Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).*

6.5.1 What are the Sustainable Development Goals (SDGs)?

The 2030 Agenda for Sustainable Development was agreed to by all 193 UN Member States, including Australia, at the United Nations Sustainable Development Summit in New York in 2015. This led to the collaborative development of 17 **Sustainable Development Goals (SDGs)** to reach by 2030. The goals apply equally to Australia and Australians as they do internationally. They have the purpose of recognising:

> that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth — all while tackling climate change and working to preserve our oceans and forests.

Sustainable Development Goals (SDGs) a set of 17 global goals developed by the UN to be achieved by 2030. The goals are universally applied to all to end poverty, fight inequalities and tackle climate change. They influence strategies that build economic growth and address a range of social needs including education, health, social protection and job opportunities, while tackling climate change and environmental protection.

FIGURE 6.17 The 17 United Nations Sustainable Development Goals (SDGs)

These 17 goals are like a world-changing roadmap for the years leading up to 2030. They are focused on improving quality of life for people and our planet. They act as a guide for creating programs and projects and facilitate partnerships between communities, states and nations to achieve results.

The five areas of critical importance for humanity and the planet include:

1. *People*
   - end poverty and hunger of all types
   - make sure all humans can fulfill their potential in dignity and equality and in a healthy environment
2. *Planet*
   - protect the planet from degradation
   - encourage sustainable consumption and production
   - sustainably manage natural resources
   - take urgent action on climate change
3. *Prosperity*
   - make sure all humans can enjoy a prosperous and fulfilling life
   - have economic, social and technological progress happen in harmony with nature
4. *Peace*
   - foster peaceful, fair and inclusive societies
   - make sure there is no fear or violence
   - sustainable development needs peace, and peace needs sustainable development
5. *Partnership*
   - implement this agenda with a strong global partnership
   - focus on helping the poorest and most vulnerable
   - involve all countries, stakeholders and people.

FIGURE 6.18 The UN's five areas of critical importance for humanity and the planet

6.5.2 How has the World Health Organization applied a health lens to the SDGs?

The World Health Organization has played a significant role in applying a health lens to the Sustainable Development Goals (SDGs) by promoting and advocating for a comprehensive approach that places health at the centre. A **health lens** in relation to the SDGs refers to the application of the goals in a way that targets the health outcomes of the community. WHO recognises that attaining a positive health status for individuals and communities cannot be achieved through health services and practitioners alone. Instead, it is through creating and improving physical and social environments, and expanding on community resources, that people are helped to reach their full potential.

> **health lens** a way of looking at broader systems, such as public policy, that aims to improve health while promoting inclusivity and social justice

Some ways in which WHO has applied a health lens to the SDGs include the following.

- *Placing health as a core goal.* WHO recognises health as both a fundamental human right and a crucial prerequisite for sustainable development. Health is not just one of the SDGs (SDG 3: Good Health and Well-being), but it also influences and is influenced by many other SDGs. For example, better access to healthcare (SDG 3) can enhance workplace productivity (SDG 8) and reduce poverty (SDG 1).
- *Interconnectedness of the SDGs.* WHO emphasises the interconnectedness of health with other development goals. Progress in areas such as education (SDG 4), poverty reduction (SDG 1), gender equality (SDG 5), clean water and sanitation (SDG 6) and others directly affects health outcomes such as improved life expectancy and positive impacts on mental health.

FIGURE 6.19 Access to clean water and sanitation has a direct impact on health.

- *Shared responsibility.* WHO encourages different sectors to work together to share the responsibility of tackling health inequities. This needs health implications to be considered in the development and implementation of policies across various sectors, not just in the health sector. For example, coronary heart disease remains a leading cause of mortality in Australia. Collaboration across various sectors can improve levels of morbidity and mortality in the following ways:
  - The *healthcare sector* focuses on early detection, treatment and management of heart disease.
  - The *education sector* includes cardiovascular health education in PDHPE lessons, ensuring that students are informed about the risk factors associated with heart disease and the importance of healthy living.

- *Workplace* health and wellness programs provide incentives for employees to adopt healthier lifestyles, including exercise and stress reduction, which reduce the risk of heart disease.
- *Urban planning* strategies create environments that facilitate physical activity, such as parks, walking paths and bike lanes, to promote an active lifestyle and reduce sedentary behaviour.
- Creating *global partnerships* with research institutions and pharmaceutical companies can accelerate the development of new treatments, medications and medical technologies for coronary heart disease.

FIGURE 6.20 Environments that promote physical activity can lead to healthy populations.

6.5.3 How are the SDGs being used in Australia?

The UN SDGs that have been adopted by Australia are not just intended for use by the government to design initiatives and activity, but also involve the business sector, civil society, academia, communities, families and individuals. The SDGs provide a framework for governments, businesses, organisations and individuals to determine a problem or objective and work in partnership to drive progress.

Examples include:
- *5000 Meals Program* (SDGs 1, 2, 4 and 12). This project aims to provide teaching aids, skills classes and support for home education classes to produce packaged meals for the homeless.
- *We're All in this Together* (SDGs 3, 4, 5, 10, 11, 12 and 17). This initiative is a partnership between Healthy Cities Illawarra and the University of Wollongong that aims to harness the spirit of the local community in the Illawarra region to 'leave no-one behind'.
- *Promoting the Advancement of Women Everywhere* (SDGs 5, 8, 10 and 17). This program's goal is to eliminate discrimination, abuse and slavery of women, through partnerships with female empowerment groups and through the implementation of domestic gender equality practices.

FIGURE 6.21 The 5000 Meals Program aims to meet goals 1, 2, 4 and 12 of the SDGs.

Role of the government

The government plays a significant role in the implementation of the SDGs. It will collate data, report progress and design policies that will engage other sectors in meeting each goal.

The first step for the government is to work out what data already exists that matches or aligns with the SDGs. This allows relevant Australian government agencies to determine which data sources to use for reporting on the SDG indicators. This is challenging because:

- there are many different sources of data within the Australian government
- data sets are spread across several states and territories and not necessarily compiled into a national set
- some SDG indicators currently have no accepted method to collect the data.

Individual government agencies (such as the Department of Health, Department of Agriculture and Department of Foreign Affairs and Trading) are then responsible for integrating the SDGs into their policies, communications and reporting. Periodically, each department must report on their progress toward the goals and indicators as we work towards 2030.

Role of business

To make a positive impact on the SDGs, businesses need to start by acting responsibly in their operations. They can then work on finding innovative solutions and partnering with others to address social issues. You can see this in action when we look at SDG 3, which focuses on promoting good health and wellbeing.

Good health and wellbeing is crucial to the sustainability and prosperity of a business all the way through the supply chain. This includes the workforce, people working for the suppliers, customers and those affected when a product is thrown away. Other things for the business sector to consider are pollution and wasteful use of natural resources such as water. Businesses must follow the laws governing work health and safety (WHS) and make sure their operations do no harm to workers or the community in which they are based.

Ways in which businesses can address the SDGs include:

- providing workers with a safe environment
- ensuring the safety of the manufactured product
- paying a living wage to employees
- investing in workplace health and wellbeing programs.

Role of universities

Universities play a significant role in the implementation of the SDGs in Australia due to their ability to provide knowledge and innovation. These institutions are also responsible for creating the future thinkers, leaders and implementers across all sectors, both locally and internationally. SDG 4: Quality Education is directly applicable to the university role.

Some of the targets in SDG 4 call for direct action by universities, while others have a direct influence on the teaching and learning programs that occur within universities.

Ways in which universities can meet the SDGs include:

- integrating the SDGs into all undergraduate and post-graduate courses
- offering education for external sectors to provide them with the knowledge and skills to address the SDGs
- forming links with business and industry to monitor employment trends and skills requirements.

FIGURE 6.22 Universities have a role in promoting, researching and implementing strategies to achieve the SDGs.

6.5.4 How could the SDGs be used to promote the health of young people in a local community?

There are many ways in which the SDGs can be used to promote the health of young people. By exploring a few of the goals, it is possible to make the connection.

SDG 3: Good Health and Well-being

Australian action within SDG 3 includes the formation of the National Disability Insurance Scheme (NDIS), which aims to improve delivery of information and connection to services for people with a disability in their communities. Through the provision of this scheme, young Australians with a permanent or significant disability are provided with support to live a more independent life. This support could include funding for equipment such as wheelchairs and prosthetics, provision of personal care and domestic care, and other therapies. Encouraging this group of young people to further develop their knowledge, skills and capability will allow them to participate in their local community and increase their opportunities to gain meaningful employment. This will have a positive benefit on their social and emotional health and wellbeing as they will feel like valued members of their community and society.

SDG 4: Quality Education

This goal aims to ensure inclusive and equitable quality education from pre-school to tertiary education, as well as to promote lifelong opportunities for all. Australia's education system ranks highly when compared to other OECD (Organisation for Economic Co-operation and Development) countries. However, education outcomes vary greatly within specific population subgroups.

According to the *Closing the Gap Report* released in 2022, Aboriginal and Torres Strait Islander Peoples are less likely to attend school and are more likely to record lower levels of literacy and numeracy than other Australians. At a community level, schools can choose to implement programs such as Positive Behaviour for Learning (PBL), which aims to encourage and reward positive behaviours rather than following the traditional punitive (punishment) approach to discipline. Strategies such as these are used to increase attendance among students by increasing the self-worth of individuals through positive recognition, and to improve communication with parents by making them aware of the good things happening with their child at school.

SDG 11: Sustainable Cities and Communities

Making towns, regional centres and cities inclusive, safe, resilient and sustainable increases the quality of life of the citizens residing there. In major cities, particularly in suburbs with increasing population densities, it can become more difficult to access public spaces for leisure and recreation and traffic can be a hindrance to those commuting to and from work.

Through the creation of walkways and footpaths, and by opening up more green spaces, communities can increase the opportunities available to their residents to lead healthy and active lives. In many metropolitan suburbs and even in some rural areas, the construction of designated cycling lanes on roads has increased the accessibility of safe and sustainable methods of transport. These structures can also assist in reducing emissions and pollution by reducing the number of cars on the road.

FIGURE 6.23 Sustainable cities aim to include more green space.

DEPTH STUDY IDEA

In small groups, collaborate to design a health promotion initiative which uses the SDGs. Research existing goals, explain why your chosen initiative is important and identify the key steps to make it happen. Use this information to create a report outlining your initiative. It should include:

- your goal
- why it is important
- the key steps needed to make it happen
- partnerships
- potential for impact.

Host a gallery walk so that all groups have the opportunity to view and explore the initiatives designed by each group.

6.5 ACTIVITY

Research the ways in which the SDGs are being used in Australia and present your findings to the class. Use the **SDGs in Australia** weblink in the Resources panel to guide your research.

---

on Resources

🔗 **Weblinks**   SDGs in Australia
                  SDGs from paper to practice

6.5 Exercises

learn**on**

6.5 Quick quiz **on**	6.5 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4	5, 7	6, 8

These questions are even better in jacPLUS!
- Receive immediate feedback
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Revise your knowledge

1. What is the purpose of the United Nations' Sustainable Development Goals (SDGs)?
2. How many SDGs are there?
3. Define the term 'health lens'.
4. Provide examples of initiatives in Australia that use the SDGs.

Apply your knowledge

5. Choose a specific SDG and:
   a. outline its goal
   b. describe its importance
   c. explain a global example of a program, strategy or initiative that has been implemented using this SDG.
6. Review all 17 of the SDGs and choose three that you believe are the most essential for improving health outcomes. Justify your case as to why your chosen three SDGs are the most important. Present your arguments to the class and allow for peer rebuttal.
7. How has the World Health Organization applied a health lens to the SDGs?
8. Examine how the SDGs could be used to promote the health of young people in a local community.

6.6 Sample exam question response

Question

How can the salutogenic model of health lead to improved health outcomes?   **(5 marks)**

Criteria	Marks
• Makes the relationship evident between the salutogenic model of health and improved health outcomes • Provides relevant examples to demonstrate the salutogenic model of health	5
• Provides characteristics and features of the salutogenic model of health and its role in improving health outcomes • Provides example/s	3–4
• Sketches in general terms the salutogenic model of health • Attempts to provide examples	2
• Provides some relevant information about the dynamic nature of health and/or the dimensions of health	1

Sample response

eles-5017

Breaking down the question

How can the salutogenic model of health lead to improved health outcomes?

Identify the action word/s: How — a question concerning the way or manner in which something is done or achieved. This is often used instead of *explain*.

Syllabus terminology: salutogenic model of health

Mark allocation: 5 marks — according to HSC past papers, questions worth 5 marks require body paragraphs, each addressing the action word and providing clear examples.

Answering question using PEEL structure

P Identify the ***point*** being raised/state topic sentence/what this paragraph is going to be about[1]

E *Expand/Elaborate* on the point and provide a strong link to what the question is asking[2]

E Apply ***examples*** that are relevant and specific[3]

L ***Linking*** sentence that relates back to the question[4]

Sample annotated response

The salutogenic model of health focuses on the factors that contribute to maintaining physical and mental wellbeing rather than focusing on the disease itself.[1] By taking this approach to health, individuals can attempt to lead a fulfilling life despite living with a chronic or terminal disease or condition.[2] This could include adding architectural designs that help to lower anxiety and stress.[3]

Nursing homes for dementia patients may design their buildings[1] to incorporate features such as gardens and tranquillity pools and might organise physical activities such as aerobics to allow those living there the comforts of home as well as opportunities to engage in social activities.[3] This will lead to improved health outcomes in the patients as they are allowing for improvements in their social and emotional health.[4]

6.7 Review

6.7.1 Topic summary

6.2 How young people advocate for their own and others' health

- Advocacy plays an important role in allowing groups to have their voices heard in order to protect their rights and interests.
- Through youth-led advocacy, young people can be encouraged to participate, address inequalities, improve services and change attitudes and values.
- Examples of youth advocacy include involvement in Student Representative Councils (SRCs) and participation in the Young Australian of the Year and the Lions Youth of the Year awards.
- To be an effective advocate, you must research your issue, find others willing to assist you, search for allies to assist you in achieving your goals, and formulate clear goals and expectations.

6.3 How organisations and communities advocate for the health of young people

- Health promotion is a collective responsibility between the individual, communities, governments and the business sector.
- The Office of the Advocate for Children and Young People (ACYP) makes recommendations to the NSW Parliament by addressing the key issues affecting young people.
- The National Aboriginal Community Controlled Health Organisation (NACCHO) was established in 1974 to give Aboriginal and Torres Strait Islander Peoples greater ownership over the healthcare they receive.
- Schools play a major role in health promotion by increasing education on health issues and modelling healthy behaviours in all facets of school life.
- All of these organisations have a significant impact on the health of young people through health promotion campaigns, strategies and initiatives.

6.4 Understanding health promotion in Australia

- Health promotion can come in many forms, including mass media campaigns, educational seminars, the built environment and legislation.
- Health promotion aims to use a holistic and strengths-based approach to achieve the desired health outcomes.
- Aboriginal and Torres Strait Islander approaches to health are holistic and incorporate social justice, equity and rights as well as traditional knowledge, traditional healing and connection to Country.
- Culturally customised health and wellbeing models and practices allow Aboriginal and Torres Strait Islander Peoples to become more comfortable using healthcare services and can therefore help to improve the health outcomes of this population.
- The biomedical model of health focuses on diagnosing, treating and curing disease or illness. This can be a very expensive approach.
- The sociocultural model of health recognises the impact of lifestyle and behaviours on an individual's health and uses preventative approaches to promote positive health and prevent negative health outcomes. This approach to health is much more cost-effective than the biomedical model.
- The salutogenic model of health is an approach that aims to preserve the health of individuals who are living in stressful conditions, such as those experiencing a chronic or terminal illness.

- The ecological model of health focuses on the individual and social determinants of health. The interplay of these determinants can affect the level of control individuals have over their own health.
- Global policies developed by the United Nations Education, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO) shape the approach to health promotion within Australia.

6.5 Using the Sustainable Development Goals to improve health

- The Sustainable Development Goals (SDGs) were developed by the United Nations (UN) to address poverty, education, inequality, economic growth and climate change by the year 2030.
- There are 17 specific goals, which provide a blueprint for nations to improve the quality of life for individuals and the planet.
- A health lens is a way of looking at broader systems, such as public policy, in a way that improves health while promoting inclusivity and social justice.
- Governments, businesses and universities all play important roles in implementing the SDGs.
- The SDGs can be used to promote the health of young people in any local community by creating specific initiatives to address their needs.

on Resources

Digital document Topic 6 summary (doc-35908)

6.7.2 Key terms

Aboriginal and Torres Strait Islander approaches to health an approach to health that is holistic and includes interconnections between physical, social, emotional, mental, cultural and spiritual aspects of health and wellbeing. The approach includes the importance of Country/Place and the role of cultural knowledge.

advocacy the process of supporting a cause or position, or acting on behalf of yourself or another individual to make sure your or their best interests are taken into account

biomedical model of health focuses on the physical or biological aspects of disease and illness. It is a medical model of care practised by doctors and health professionals and is associated with the diagnosis, treatment and curing of disease.

ecological model of health based on evidence that no one factor can explain why some people or groups are at higher risk than others. It looks at both individual and social determinants of health.

health lens a way of looking at broader systems, such as public policy, that aims to improve health while promoting inclusivity and social justice

health promotion the process of helping people to have more control over and improve their health

LGBTQIA+ acronym that stands for lesbian, gay, bisexual, transgender, queer/questioning, intersex, asexual and others

non-government organisations organisations that are independent of the government

salutogenic model of health focuses on the factors that promote and maintain physical and mental wellbeing, rather than focusing on disease and injury. It pays special attention to how people deal with stressful situations and still manage to stay healthy.

sociocultural model of health aims to target the wider influences on health (social, cultural, environmental and economic factors) rather than disease and injury. The focus is on health promotion, policies and education.

Sustainable Development Goals (SDGs) a set of 17 global goals developed by the UN to be achieved by 2030. The goals are universally applied to all to end poverty, fight inequalities and tackle climate change. They influence strategies that build economic growth and address a range of social needs including education, health, social protection and job opportunities, while tackling climate change and environmental protection.

United Nations Education, Scientific and Cultural Organization (UNESCO) agency of the United Nations that promotes international collaboration in education, sciences and culture to protect human rights

World Health Organization (WHO) a specialised agency of the United Nations that acts as the coordinating authority on international public health issues

6.7 Exercises

| **6.7 Revision quiz** on | **6.7 Exam questions** |

6.7 Exam questions

▶ **Question 1 (1 mark)**

Which of the following organisations is responsible for improving the safety, welfare and wellbeing of all children and young people in New South Wales? (HM-11-02)

A. Schools

B. Children and Young people with Disabilities Australia (CYDA)

C. Office of the Advocate for Children and Young People (ACYP)

D. National Aboriginal Community Controlled Health Organisation (NACCHO)

▶ **Question 2 (1 mark)**

According to the World Health Organization, which of the following is considered important for the success of youth-led advocacy? (HM-11-02)

A. Only focus on issues which impact you directly.

B. Use confrontational tactics to make your message heard.

C. Ignore the perspectives and concerns of other age groups.

D. Search for allies who can assist you in achieving your goals.

▶ **Question 3 (1 mark)**

Which model of health does the following definition describe? (HM-11-02)

'an approach to human wellbeing that assesses the factors contributing to the promotion and maintenance of both physical and mental health, rather than primarily concentrating on diseases'

A. Ecological

B. Biomedical

C. Salutogenic

D. Sociocultural

Question 4 (1 mark)

The formation of the National Disability Insurance Scheme is an example of which Sustainable Development Goal (SDG)? (HM-11-02)

A. SDG 3: Good Health and Well-being
B. SDG 4: Quality Education
C. SDG 11: Sustainable Cities and Communities
D. SDG 17: Partnerships for the Goals

Question 5 (2 marks)

What is health promotion? Provide examples. (HM-11-06)

Question 6 (3 marks)

Outline the role of individuals in communities regarding advocacy. (HM-11-02)

Question 7 (3 marks)

Describe ways in which schools can contribute to health promotion. (HM-11-09)

Question 8 (3 marks)

Describe the importance of the United Nations' Sustainable Development Goals. (HM-11-10)

Question 9 (4 marks)

Describe how advocacy programs of the past have led to improvements in the health of young people. (HM-11-02)

Question 10 (5 marks)

How has the Ottawa Charter been used to improve Australia's health? (HM-11-02)

Question 11 (4 marks)

Compare the biomedical and social models of health. (HM-11-06)

Question 12 (5 marks)

Explain how Aboriginal and Torres Strait Islander approaches to health achieve better health outcomes for this population. (HM-11-06)

▶ Question 13 (5 marks)

Discuss the impact of TWO organisations on the health of young people. (HM-11-06)

▶ Question 14 (8 marks)

Investigate the way Australia has incorporated the Sustainable Development Goals in order to improve health. (HM-11-10)

▶ Question 15 (12 marks)

Refer to the information below as well as your own knowledge to answer the question that follows.

> Your community is designing a collaborative initiative between the local high school, local businesses, community organisations and health professionals. It aims to use SDG 3: Good Health and Well-being and SDG 4: Quality Education to holistically address the health and educational needs of young people in the local community.

Examine the impact of the Sustainable Development Goals (SDGs) in promoting the health of young people through this collaborative initiative. (HM-11-10)

Online Resources

on Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

6.1 What are the opportunities for improving and promoting young people's health? (tpdf-2180) ☐

🗎 Digital documents

6.7 Topic 6 summary (doc-35908) ☐
Key terms glossary (doc-36174) ☐
Revision quiz (doc-34735) ☐

▶ Video eLessons

6.6 Sample exam question response (eles-5017) ☐

🧩 Interactivities

6.7 Missing word interactive quiz (int-8043) ☐

🔗 Weblinks

6.2 Australian of the Year Nominee — Taya Davies ☐
Brave Foundation ☐
Disability advocacy ☐
6.3 NACCHO Youth Conference ☐
Children and Young People with Disability Australia (CYDA) ☐
Office of the Advocate for Children and Young People (ACYP) ☐
6.4 Cultural healers ☐
Kinship ☐
Anti drink-driving campaign 1 ☐
Anti drink-driving campaign 2 ☐
Anti drink-driving campaign 3 ☐
Justice reinvestment in Bourke ☐
COVID-19 campaign 2020 ☐
Ngangkari Healers ☐
6.5 SDGs in Australia ☐
SDGs from paper to practice ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

2 The body and mind in motion

OUTCOMES

- analyses the systems of the body in relation to movement HM-11-03
- investigates movement skills and psychology to improve participation and performance HM-11-04
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

7 How do the systems of the body influence and respond to movement?

LEARNING SEQUENCE

7.1 Overview

Key inquiry question

How do the systems of the body influence and respond to movement?

Syllabus

	Syllabus content	Subtopic
○	■ Explain the interrelationship between the skeletal and muscular systems and movement **Including:** • structure and function • major bones and synovial joints • joint actions • major muscles • characteristics and functions of muscle fibres • types of muscle contractions • muscle relationship **Example(s):** **Joint actions:** Flexion and extension. **Characteristics and functions of muscle fibres:** Slow versus fast twitch muscle fibres. **Types of muscle contractions:** Isotonic concentric. Isotonic eccentric. Isometric contractions. **Muscle relationship:** Agonist/antagonist/stabiliser relationship.	7.2 7.3 7.4 7.5
○	■ Explain the interrelationship between the respiratory and circulatory systems and movement **Including:** • structure and function • pulmonary and systemic blood circulation and gaseous exchange • factors that impact on the efficiency of the cardiovascular system **Example(s):** **Factors that impact on the efficiency of the cardiovascular system:** Altitude. Haemoglobin levels. Vascular disease.	7.6 7.7 7.8
○	■ Explain the interrelationship between the digestive and endocrine systems and movement, including structure and function and factors that impact on the efficiency of the systems **Example(s):** Macronutrients and micronutrients to support healthy body functioning. Stress.	7.9, 7.10

○ ■ Explain the interrelationship of the nervous system and movement, including structure and function	**7.11**
○ ■ Demonstrate and analyse how the systems of the body work together in a variety of movements	**7.12**

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Outcomes

- analyses the systems of the body in relation to movement HMS11-03
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents   Topic 7 summary (doc-35909)
                        Key terms glossary (doc-36175)
                        Revision quiz (doc-4736)

7.2 Structure and function of the skeletal system including major bones, synovial joints and joint actions

7.2.1 Structure and function of the skeletal system

The human body has 206 bones, more than 200 joints and over 600 muscles that work together in order to enable movement to occur. The skeletal system is made up of bones, cartilage and joints.
- Bones form the framework of the human body and vary in shape and size depending on the role that they fulfill.
- Bones are classified under four main categories: long, short, flat and irregular.
- The structure of the outer part of a bone consists of dense, strong compact tissue.
- At the ends of bones, there is a criss-cross network of spongy tissue, which is strong but light and able to withstand stress (see figure 7.1). This is the area that flares out to meet with adjacent bones, forming joints.
- Bone ends are covered with articular cartilage, which prevents jarring and chipping of bones.

FIGURE 7.1 The structure of a long bone

Articular cartilage · Cancellous bone · Bone marrow · Compact bone
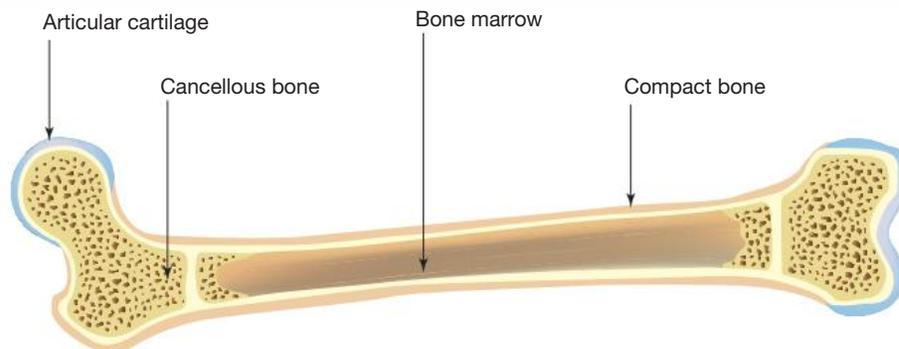
Joints

A joint is a junction of two or more bones and is referred to as an articulation. There are three types of joint:
- immovable or fibrous
- slightly movable or cartilaginous
- freely movable or synovial.

An **immovable** or **fibrous joint** is a joint where no movement is possible. Examples of this type of joint include the bones of the skull.

immovable or **fibrous joint** a joint in which no movement is possible. Examples include the bones of the cranium, which are fused in lines called sutures.

A **slightly movable** or **cartilaginous joint** is a joint that permits limited movement. Examples of this joint exist in the vertebral column, where fibrous cartilage between discs allows a limited range of movement.

A **freely movable** or **synovial joint** is one that allows maximum movement. Most joints in the body are synovial joints; for example, the hip joint, which allows us to move our leg freely and complete activities such as running or kicking a ball. The most important structures in synovial joints are ligaments, tendons, synovial fluid and articular cartilage.

Ligaments

Ligaments are well-defined, fibrous bands that connect bone to bone. They are designed to assist the joint capsule to maintain stability in the joint by restricting excessive movement, but can also control the degree and direction of movement that occurs. Ligaments are relatively inelastic structures that can become permanently lengthened or torn when stretched excessively. This can occur in injury to the joint and may lead to some joint instability.

FIGURE 7.2 The sutures in the skull are an example of an immovable or fibrous joint.

Sutures
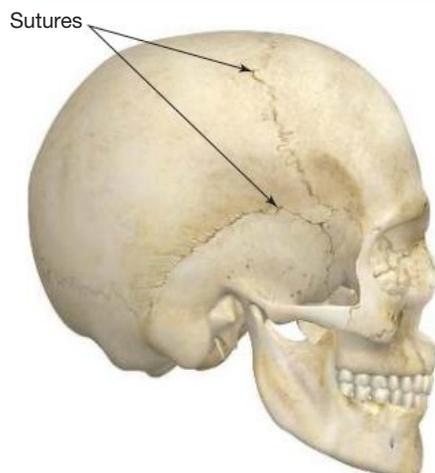
FIGURE 7.3 Example of a slightly movable or cartilaginous joint

Cartilage disc

Vertebra

FIGURE 7.4 Basic structure of a freely movable or synovial joint

Yellow bone marrow
Periosteum
Spongy bone
Compact bone
Ligament
Synovial membrane
Joint cavity (contains synovial fluid)
Articular cartilage
Joint capsule (reinforced by ligaments)
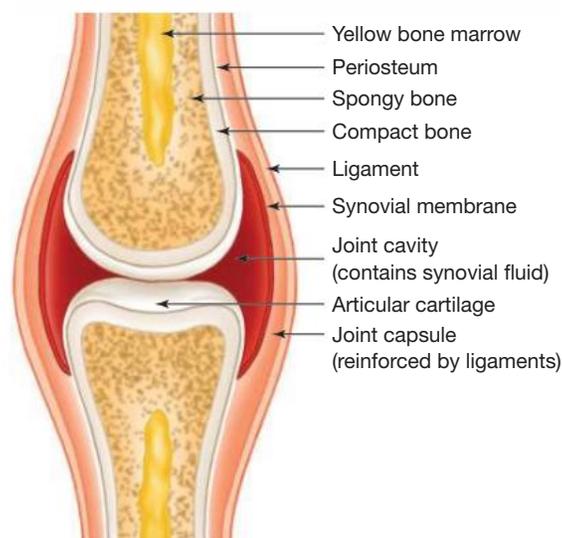
Tendons

Tendons are tough, inelastic cords of tissue that attach muscle to bone. Joints are further strengthened by muscle tendons that extend across the joint and help ligaments to hold the joint closed. One of the best-known tendons is the Achilles tendon, which that attaches the calf muscles to the heel bone.

Synovial fluid

Synovial fluid acts as a lubricant, keeping the joint well-oiled and the moving surfaces apart. As no two joint surfaces fit together perfectly, synovial fluid forms a fluid cushion between them. It also provides nutrition for the cartilage and carries away waste products. The amount of synovial fluid produced depends on the amount and type of physical activity of the joint. When the articular cartilage is under pressure — that is, during vigorous movement — fluid is 'pumped' into the joint space.

slightly movable or **cartilaginous joint** a joint that permits limited movement. Examples exist in the vertebral column, where fibrous cartilage between discs allows a limited range of movement.

freely movable or **synovial joint** a joint that allows maximum movement. Most joints in the body are synovial joints; for example, the hip joint.

Articular cartilage

While synovial fluid acts as a cushion between the articulating surfaces of the bones, they are also covered with a layer of smooth, shiny cartilage that allows the bones to move freely over each other. Articular cartilage has a limited blood supply but receives nourishment via the synovial fluid. This cartilage is thicker in the leg joints such as the knee joint, where there is greater weight bearing.

7.2.2 Major bones and synovial joints

The major bones of the human body are shown in figure 7.5. Not all the bones identified in this figure are involved in movement. For example, the skull comprises many bones, but their role is to protect vital brain tissue rather than assist movement. The focus of this topic is on the bones that make up and surround joints, establishing connecting structures that enable movement.

FIGURE 7.5 Major skeletal bones from the anterior and posterior view of the body

int-6616
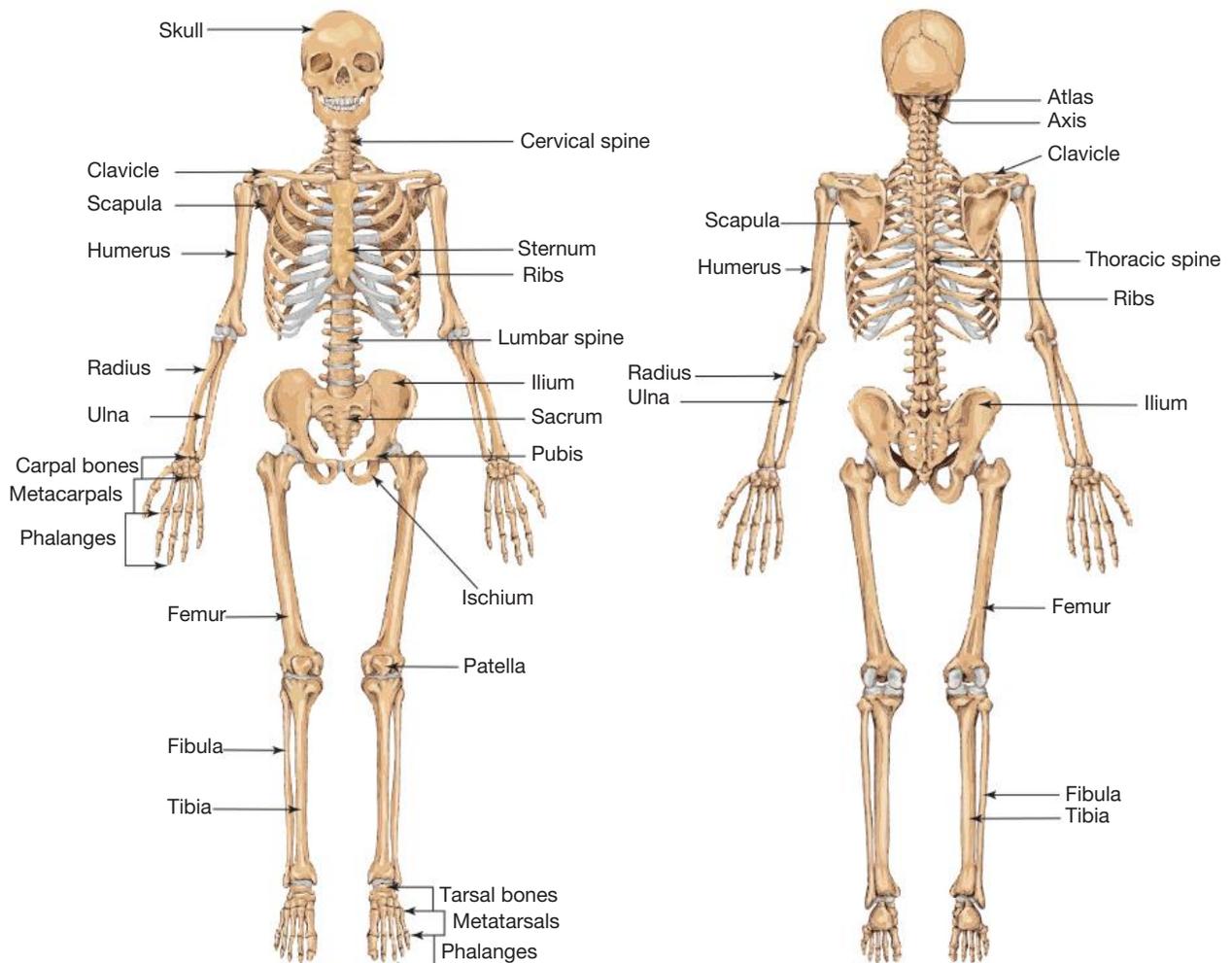
There are six different types of synovial joints found in the human body.
- *Ball-and-socket joints.* These are freely moving joints that can rotate on any axis. The hip and shoulder joints are examples of ball-and-socket joints.
- *Hinge joints.* These move on just one axis, meaning that they can bend one way but not the other. These joints allow for flexion and extension. Major hinge joints include the elbow and knee joints.
- *Gliding joints.* These move against each other on a single plane. Major gliding joints include the intervertebral joints and the bones of the wrists and ankles.

- *Pivot joints.* These provide rotation. At the top of the spine, there is a pivot joint that allows for rotation of the head.
- *Condyloid joints.* These allow for circular motion, flexion and extension. The wrist joint between the radius and the carpal bones is an example of a condyloid joint.
- *Saddle joints.* These allow for flexion, extension and other movements, but not rotation. In the hand, the thumb contains a saddle joint.

int-8617

FIGURE 7.6 The six types of synovial joints

Ball-and-socket joint
Allows a wide range of movement (sideways, backwards/forwards, rotation), e.g. hip, shoulder

Hinge joint
Allows movement in only one direction (backwards/forwards), e.g. elbow, knee

Pivot joint
Allows one bone to rotate about another (rotation), e.g. atlas/axis in neck, radius and ulna in forearm

Gliding joint
Allows only gliding or sliding movements (sideways, backwards/forwards), e.g. carpals of the wrist, tarsals of the ankle

Saddle joint
Allows movement in two directions (sideways, backwards/forwards), e.g. thumb

Condyloid joint
Allows movement in two directions (backwards/forwards, sideways), e.g. metacarpophalangeal joint (where the finger meets the hand)

Head of humerus
Scapula
Humerus
Ulna
Radius
Carpal bone
Metacarpal bone
Metacarpal bone
Phalanx

The major bones and synovial joints involved in movement are as follows.

- *Clavicle (collarbone).* This is a long bone that provides an attachment between the shoulder girdle and the vertebral column. It forms part of the shoulder joint, which is a ball-and-socket synovial joint. It allows movements such as throwing a softball.
- *Scapula (shoulder blade).* This is a large, triangular flat bone that also forms part of the ball-and-socket joint of the shoulder. The scapula enables movements such as returning a serve in tennis. Many muscles involved in movement attach to this bone.
- *Humerus.* This is the major long bone in the upper arm joining the shoulder joint (ball-and-socket) to the elbow joint (hinge joint). It can move in most directions and even rotate within the shoulder joint, such as when bowling in cricket.
- *Radius.* This long bone is found on the thumb side of the forearm. It works with the ulna in providing structure to the forearm and allowing it to rotate on the hinge joint in the elbow. Muscles work on and around the radius and ulna rotating the palm of the hand at the condyloid joint in the wrist; an example of this movement can be seen in the hands when doing freestyle swimming.
- *Ulna.* This is the longer bone of the forearm, found on the little-finger side of the hand and, like the radius, it forms part of the hinge joint in the elbow. It is also used is used for rotating the palm of the hand. such as when playing table tennis.
- *Carpals, metacarpals* and *phalanges.* These are the bones of the wrist and fingers. Carpals are short bones; metacarpals and phalanges are long bones. There are a number of major joints found in the wrist and hands, such as the saddle joint at the base of the thumb, a condyloid joint which connects the radius and carpals, gliding joints between the carpals, and condyloid and hinge joints between the metacarpals and phalanges. Collectively they provide structure to the hand, allowing it to perform fine motor movements such as catching, holding a bat and spinning a ball.
- *Pelvic girdle.* The pelvis comprises a number of bones and provides the base of support necessary for the weight of the upper body. While not directly contributing to movements such as kicking, it is important because it also allows for the attachment of the lower limbs and muscles of the leg and lower back. The pelvic girdle allows less movement than the shoulder girdle because the supporting ligaments are short and strong. The hip joint is a deep ball-and-socket joint where the femur (thigh bone) attaches, adding to the stability of the structure.

FIGURE 7.7 Bones of the upper limb

Clavicle
Scapula
Humerus
Radius
Ulna
Carpals
Metacarpals
Phalanges
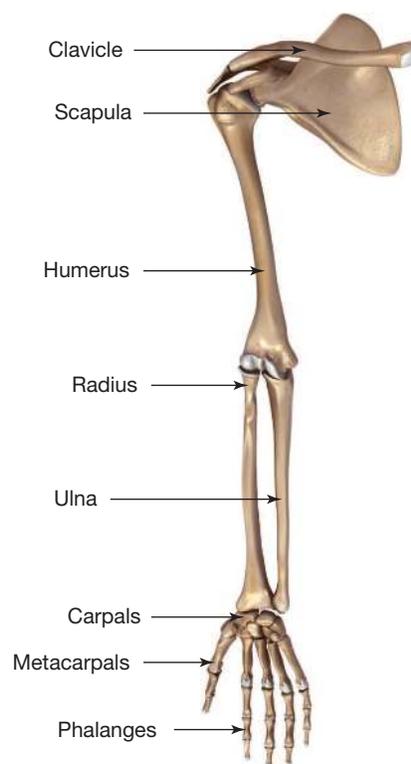
FIGURE 7.8 Detailed view of the scapula and clavicle

Clavicle
Humerus
Scapula
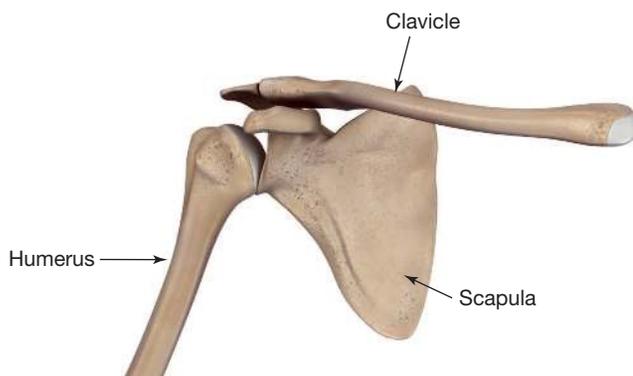
FIGURE 7.9 Bones of the pelvis

Ilium
Pubis
Ischium
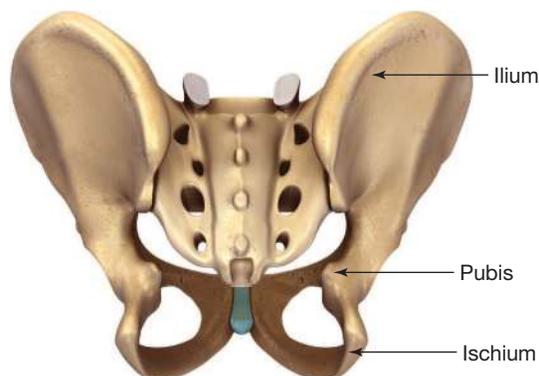
- *Femur* (thighbone). The femur is the longest and strongest bone in the body, capable of supporting up to 30 times the weight of an adult. The upper end of the bone forms part of the ball-and-socket joint of the hip and the lower end forms part of the hinge joint of the knee. The bone is covered by large muscles that extend from the pelvic girdle to the shin, enabling many movements such as running and kicking.
- *Patella* (kneecap). This is a small, flat triangular bone whose main role is to provide protection to the hinge joint of the knee.
- *Tibia* (shinbone). The tibia is the larger of two long bones that form the lower leg. The top end of the tibia forms part of the hinge joint of the knee and the lower end forms part of the hinge joint of the ankle. It bears most of the bodyweight and of course is involved in all movements of the lower body, such as running, kicking and swimming.
- *Fibula*. This is a slender long bone that lies parallel with and on the lateral side (outside) of the tibia. Like the tibia, the top end of the fibula forms the hinge joint of the knee and the bottom end forms part of the hinge joint of the ankle. It works with the tibia in providing support and stability to the lower leg while allowing slight rotation from the knee joint.
- *Tarsals, metatarsals* and *phalanges*. These are the bones of the foot. Tarsals are short bones; metatarsals and phalanges are long bones. Like the wrists and hands, there are many joints in the ankles and feet. Some of the major joints include condyloid and hinge joints in the ankles, gliding joints between the tarsals, and condyloid and hinge joints between the metatarsals and phalanges. They work as a unit, providing a structure that enables movements including balancing, hopping and standing on your toes.

FIGURE 7.10 Bones of the lower limb

Pelvic girdle
Femur
Patella
Fibula
Tibia
Tarsals
Metatarsals
Phalanges
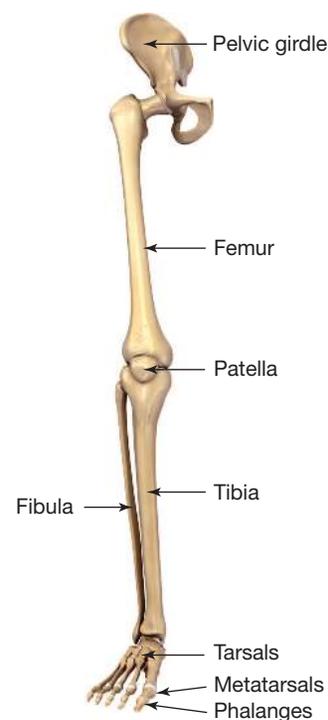
7.2.3 Joint actions

The numerous joints of the body, together with the muscles around these joints, allow us to perform a remarkable range of twisting, turning and rotating movements. Two joint actions that are used in most sporting movements are flexion and extension. Flexion refers to decreasing the angle of a joint, as seen when performing a bicep curl, which involves bending the elbow at the hinge joint. During this action, the radius and ulna draw closer to the humerus. Extension involves an increase in the angle within a joint, such as straightening the elbow after completing a bicep curl. In this action, the radius and ulna move away from the humerus. The joint actions flexion and extension are summarised in table 7.1.

TABLE 7.1 Flexion and extension

Joint action	Definition	Example	
Flexion	Decrease in the angle of the joint	Bending the elbow or knee	
Extension	Increase in the angle of the joint	Straightening the elbow or knee	

DEPTH STUDY IDEA

Select various conditions that affect the bones, such as osteoporosis, rickets, fractures or bone disease, and explore through a secondary-sourced investigation how each condition impacts movement.

7.2 PRACTICAL ACTIVITY

The skeletal system and its role in movement

1. Work in pairs, rotating the role of performer and analyst during the following activities. As one student slowly mimics the action of each movement, the other should identify the major bones, joints and joint actions involved in the movement.
   a. Throwing a javelin
   b. Kicking a football
   c. Paddling a canoe
   d. Bowling in cricket
   e. Shooting in netball
   f. Swinging a golf club
2. Use the **Major bones of the skeletal system** interactivity (int-6616) in the Resources panel to label all the major bones of the human body.

on Resources

Interactivity   Major bones of the skeletal system (int-6616)

Weblink   The skeletal system

7.2 Exercises

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| 7.2 Quick quiz **on** | 7.2 Exercise |

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Revise your knowledge

1. Copy and complete table 7.2. Use the information you have learned in this subtopic to discuss the relationship between the types of bone and movement allowable at each joint.

TABLE 7.2 Types of joint and allowable movement

Joint name	Joint type	Major bones	Movement allowable
Shoulder			
Elbow			
Wrist			
Hip			
Knee			
Ankle			

2. What are the major bones found in the arm?
3. What are the major bones found in the leg?
4. Outline the six different types of synovial joints found in the human body.

Apply your knowledge

5. Explain the main roles played by bones and joints.
6. Describe the role played by each structure of a synovial joint to allow movement to occur.
7. Explain how the various bones of the arms and legs work with muscles to produce movement.
8. Closely examine the illustrations in table 7.3. Indicate the type of movement taking place at the specified joint. An example has been provided for you for movement a.

TABLE 7.3 Joints involved in movements

Movement	Joint
a.	Knees (points 4–6): *Extension to flexion* Knees (9–10): *Flexion to extension* Hips (4–6): *Extension to flexion* Hips (9–10): *Flexion to extension* Neck (3–6): *Extension to flexion*
b.	Elbows (2–4) Elbows (5–6)
c.	Hips (5–7)
d.	Hips (5–7)
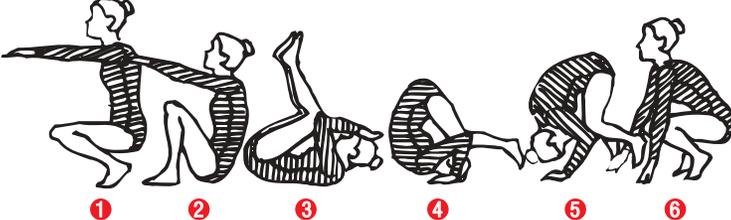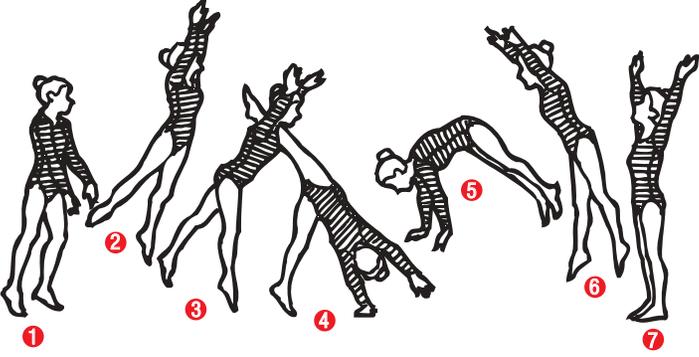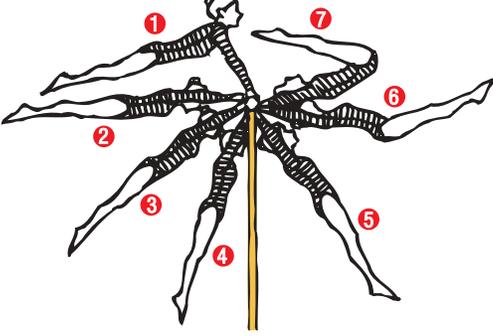
7.3 Structure and function of the muscular system including major muscles and interrelationship with the skeletal system

There are more than 600 muscles in the body and they are all attached to bones. The role of muscles is to contract (shorten) and extend (lengthen) in order to pull on the bones to allow movement to occur. Figure 7.11 shows the three types of muscles in the human body, each fulfilling a different role.

- **Cardiac muscle**. This is found in the heart and is responsible for making the heart beat to delivering blood around the body. The action of this type of muscle is involuntary, meaning we do not have control over when it contracts and relaxes.
- **Skeletal muscles**. These are the muscles that produce movement and their action is voluntary, meaning we can control when to contract and relax them.
- **Smooth muscles**. These muscles line the walls of hollow internal organs such as the bladder, and their action is involuntary.

cardiac muscle involuntary muscle responsible for keeping the heart beating

skeletal muscle voluntary muscles that produce movement

smooth muscle involuntary muscles found in the walls of internal organs

FIGURE 7.11 The three types of muscles in the human body

Cardiac muscle tissue
(involuntary control)

Skeletal muscle tissue
(voluntary control)

Smooth muscle tissue
(involuntary control)
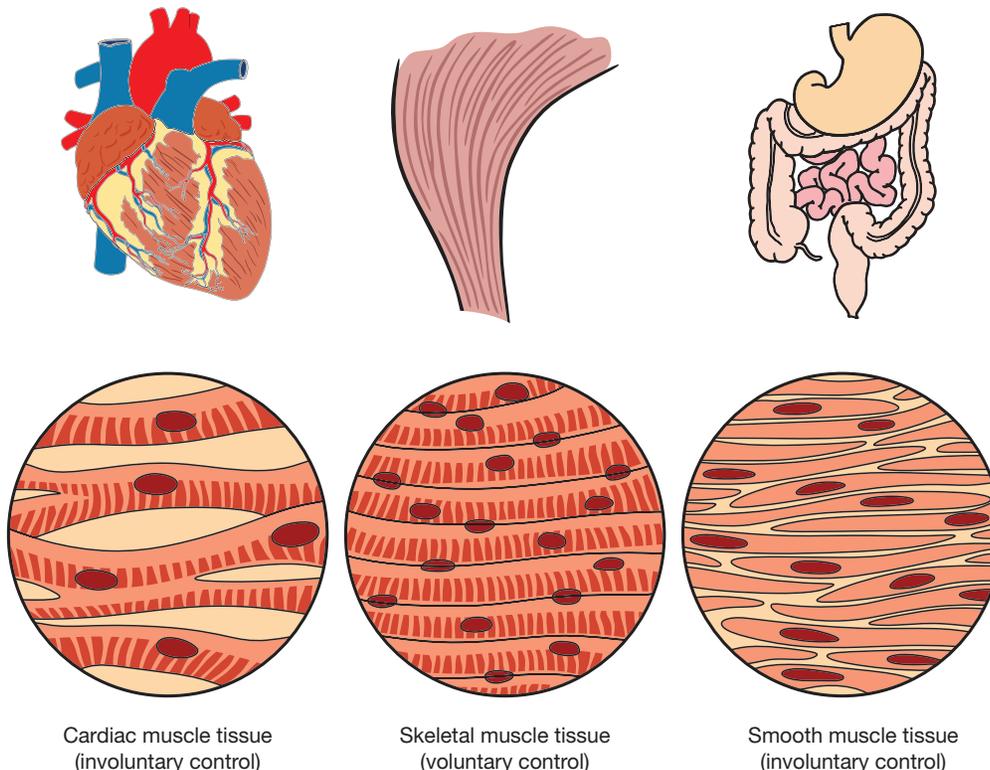
7.3.1 Major muscles

The major muscles involved in movement are shown in figure 7.12.

FIGURE 7.12 Muscles of the human body: (a) anterior (front) view and (b) posterior (back) view

(a)

- Trapezius
- Deltoid
- Pectoralis major
- Serratus anterior
- Wrist flexors
- Sartorius
- Gastrocnemius
- Soleus
- Biceps brachii
- Rectus abdominis
- Obliques
- Adductors
- Rectus femoris
- Vastus intermedius (underneath)
- Vastus lateralis
- Vastus medialis
- *Quadriceps femoris*
- Tibialis anterior

(b)

- Trapezius
- Deltoid
- Latissimus dorsi
- Obliques
- Adductors
- Triceps brachii
- Erector spinae
- Gluteus maximus
- Semitendinosus
- Biceps femoris
- Semimembranosus
- Gastrocnemius
- *Hamstrings*
- Soleus

7.3.2 The interrelationship between the skeletal and muscular systems and movement

The interrelationship of the skeletal system and muscular system (musculoskeletal system) is vital in helping our bodies to respond and move efficiently. Although they are often studied in isolation, they work together to:

- provide our body with shape and stability
- protect our vital organs
- produce all voluntary movement necessary for daily activities such as eating, talking, walking and exercise.

It is the ability of the muscles to contract that enables them to pull on the bones which act as levers, bringing about movement throughout our entire body. Joints play an important role in this process because they allow us to move body parts in different directions, such as flexion and extension of our limbs.

The connective tissue, such as the ligaments and tendons, makes sure those joints remain stable. It also connects the bones to each other (ligaments) and the muscles to the bones (tendons) so that movement between different areas of the body is coordinated and efficient. For example, in order to flex the elbow, the bicep muscle running over the humerus bone contracts, which pulls on the tendons and ligaments in the hinge joint of the elbow. This then pulls on the bones of the forearm, the radius and ulna, causing them to move closer to the upper arm via the joint action of flexion. Table 7.4 outlines how some major muscles and bones work together to produce various movements.

TABLE 7.4 Major muscles, bones and movements

	Muscle	Major bones connected to this muscle	Major joint that the muscle acts on	Example of a movement that this muscle and bones enable
Upper limb	Deltoid	Scapula, clavicle and humerus	Ball-and-socket joint of the shoulder	The arm action when doing a star jump
	Biceps brachii	Humerus, scapula and radius	Ball-and-socket joint of the shoulder and hinge joint of the elbow	Bicep curls
	Triceps	Scapula, humerus and ulna	Ball-and-socket joint of the shoulder and hinge joint of the elbow	Shooting in netball
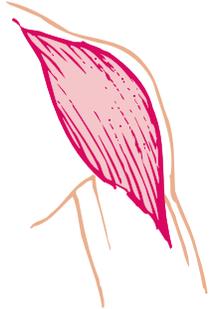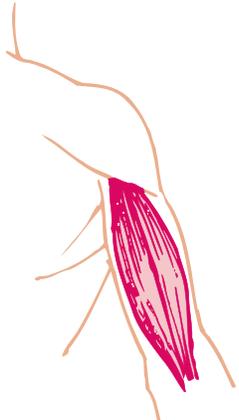
(continued)

TABLE 7.4 Major muscles, bones and movements *(continued)*

	Muscle	Major bones connected to this muscle	Major joint that the muscle acts on	Example of a movement that this muscle and bones enable
Trunk	Latissimus dorsi	Vertebrae, ribs, humerus and scapula	Ball-and-socket joint of the shoulder	The arm movement required for ten-pin bowling
	Trapezius	Skull, vertebrae, scapula and clavicle	Ball-and-socket joint of the shoulder	Shoulder shrugs
	Pectorals	Sternum, clavicle and humerus	Ball-and-socket joint of the shoulder	Underhand serve in volleyball
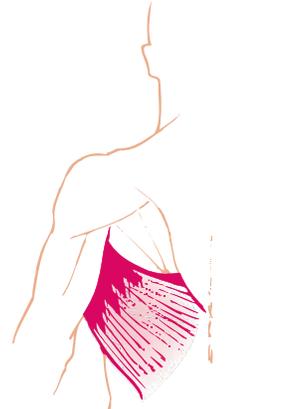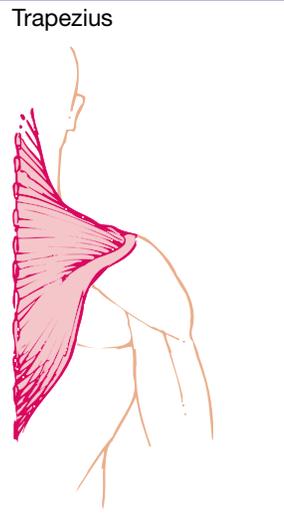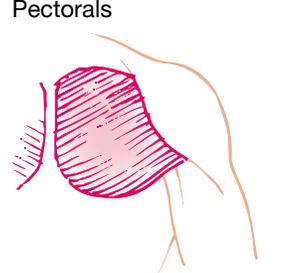
	Muscle	Major bones connected to this muscle	Major joint that the muscle acts on	Example of a movement that this muscle and bones enable
Trunk	External obliques	Ribs and ilium	Ball-and-socket joint of the hip	Completing a golf shot
	Erector spinae (sacrospinalis)	Skull, vertebrae and sacrum	Provides stability for ball-and-socket joint of the hip	Maintaining an upright posture when running
	Rectus abdominis	Pubis, ribs and sternum	Ball-and-socket joint of the hip	Bending forward to dive into a pool
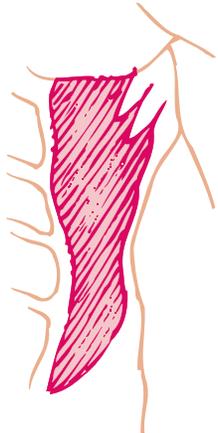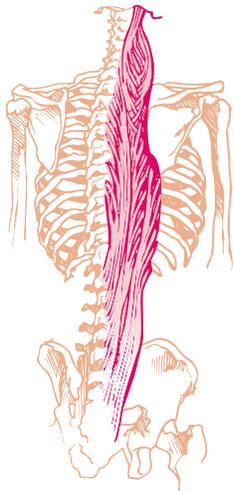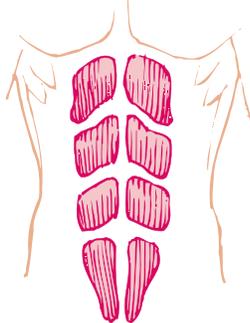
(continued)

TABLE 7.4 Major muscles, bones and movements *(continued)*

	Muscle	Major bones connected to this muscle	Major joint that the muscle acts on	Example of a movement that this muscle and bones enable
Trunk	Gluteus maximus	Pelvis, sacrum and femur	Ball-and-socket joint of the hip	Bringing the leg up to do a side kick in martial arts
Lower limb	Hamstrings	Ischium, femur, tibia and fibula	Ball-and-socket joint of the hip and hinge joint of the knee	Providing flexion in the knee to enable running
	Quadriceps	Ilium, femur, tibia and patella	Ball-and-socket joint of the hip and hinge joint of the knee	Pushing off the blocks in a 100 m sprint
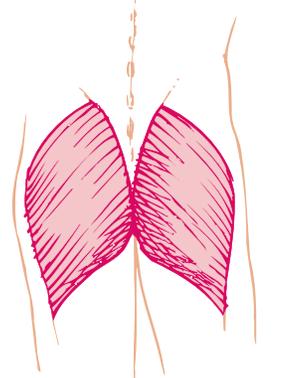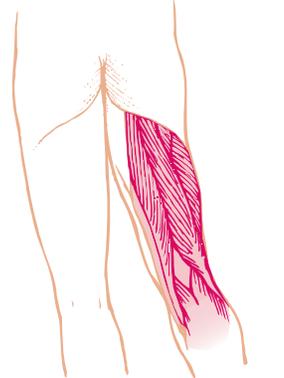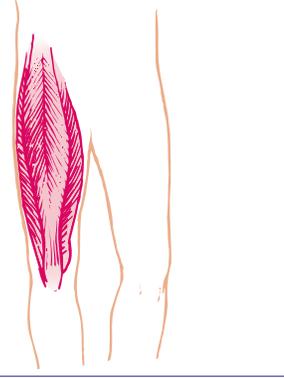
	Muscle	Major bones connected to this muscle	Major joint that the muscle acts on	Example of a movement that this muscle and bones enable
Lower limb	Gastrocnemius	Femur and heel bone	Hinge joints of the knee and ankle	Standing on your toes in ballet
	Soleus	Tibia, fibula and heel bone	Hinge joints of the knee and ankle	Pointing your toes in diving
	Tibialis anterior	Tibia, tarsals and metatarsal	Hinge joints of the knee and ankle and condyloid joint in the ankle	Kicking a soccer ball
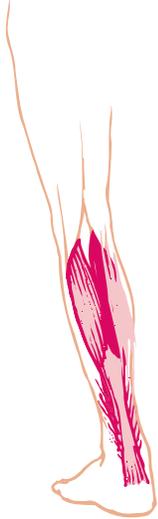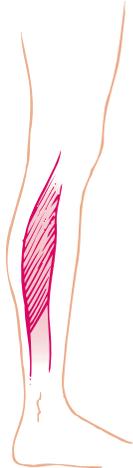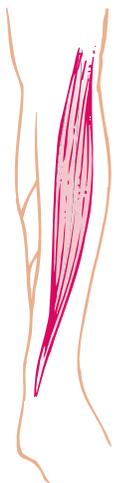
on Resources

Interactivity Muscles (int-6623)

Weblink Muscle anatomy

7.3 Exercises

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7.3 Quick quiz **on**	**7.3 Exercise**

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1, 2, 3	4, 5, 6	7

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Revise your knowledge

1. What are the main roles of muscles?
2. Identify all the major muscles found in the:
   - arms
   - legs
   - core
   - back.
3. What does 'voluntary control' mean in relation to muscle movement?
4. Identify three movements that the bicep muscle contributes to.

Apply your knowledge

5. Explain the key differences between cardiac muscle, skeletal muscle and smooth muscle.
6. Explain how muscles, bones and joints work together to produce movement.
7. Analyse the muscles, bones and joints involved in performing a push-up.

7.4 Characteristics and functions of muscle fibres

Figure 7.13 shows the structure of a skeletal muscle. Skeletal muscle is made up of thousands of muscle fibres. Muscle fibres are bundled together and wrapped in a connective tissue called *facia.* Within each muscle fibre are *myofibrils*, long cylindrical structures that lie parallel to the muscle fibre and are the contractile elements of skeletal muscles. Within myofibrils there are repeated sections of *sarcomere,* which are the structure units that contain two protein filaments known as *actin* and *myosin*. When actin and myosin slide alongside one another they cause sarcomere to shorten, which causes the muscle to contract and hence allows movement to occur. Skeletal muscle is also called *striated muscle* because of its striped appearance, as seen in figure 7.14. This is caused by the overlapping of actin and myosin filaments within the muscle fibre.

FIGURE 7.13 Structure of a skeletal muscle
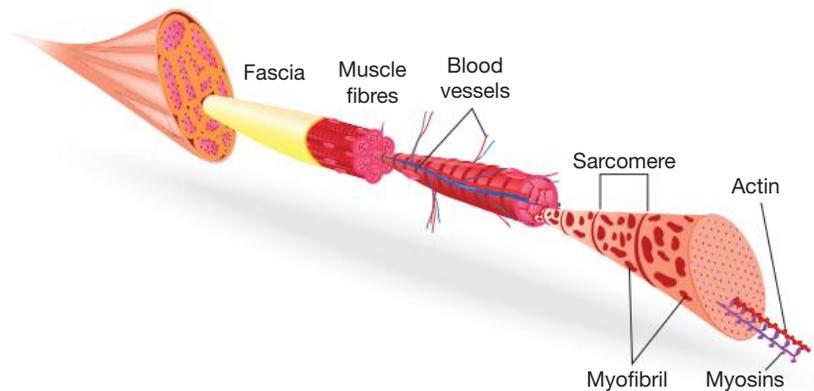
FIGURE 7.14 Striated muscle fibres looked at under a high-magnification microscope
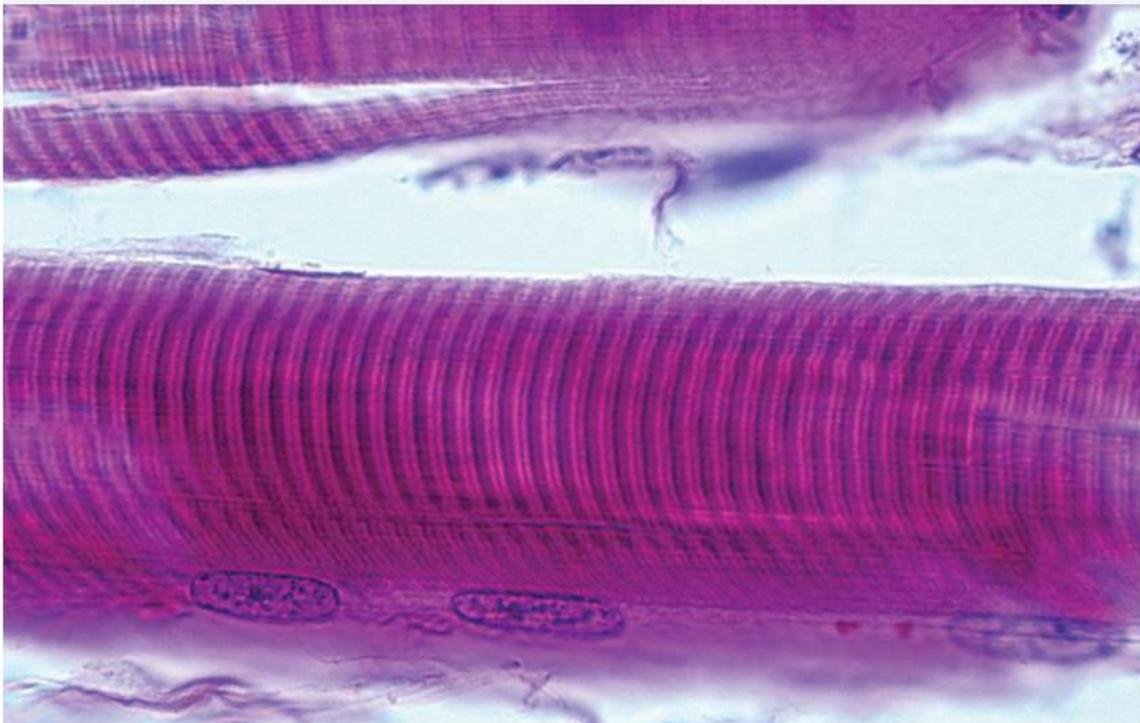
7.4.1 Slow-twitch and fast-twitch muscle fibres

There are two types of muscle fibre:
- **Slow-twitch muscle fibres (ST)** or red fibres. These contract slowly and for long periods of time. They are recruited for endurance-type activity, such as marathons.
- **Fast-twitch muscle fibres (FT)** or white fibres. These reach peak tension quickly and are recruited for power and explosive movements, such as sprinting.

A range of red (shown as dark red) and white (shown as light pink) fibres are identified in figure 7.15. Note that the white fibres tend to be slightly larger than the red fibres. While most people have approximately equal numbers of red and white fibres, some individuals genetically have higher proportions of one type or the other, which tends to result in them being better suited to aerobic activities if they have more slow-twitch fibres or anaerobic activities if they have more fast-twitch fibres.

FIGURE 7.15 Slow-twitch and fast-twitch muscle fibres

Fast-twitch fibres   Slow-twitch fibres

slow-twitch muscle fibres muscle fibres that contract slowly and are used during endurance activities; referred to as 'red' as they contain more blood

fast-twitch muscle fibres muscle fibres that contract quickly and are used during fast, explosive activities; referred to as 'white' as they contain less blood

Slow-twitch fibres contract slowly and release energy gradually as required by the body during sustained activity such as jogging. They have a good blood supply, which is why they are red in colour. Because of this, they are efficient in using oxygen to generate fuel (ATP), making them resistant to fatigue, but they are unable to produce the power and force of white, fast-twitch fibres. The body preferentially recruits slow-twitch fibres for endurance activities such as marathon running, cycling, triathlons and long-distance swimming.

Fast-twitch fibres contract quickly but fatigue rapidly, which is a feature of anaerobic metabolism used to supply their energy needs. They are less reliant on oxygen supplied by the blood for energy and can even produce energy without oxygen. It is because of the lack of oxygen, and hence blood, that the fibres appear white. There are two types of fast-twitch fibres, often referred to as fast-twitch a (FTa) and fast-twitch b (FTb) muscle fibres. FTa fibres are immediate fast-twitch fibres that can produce a high output for longer periods than FTb fibres because they have the ability to draw on both aerobic (oxygen) and anaerobic metabolism to support contraction. The body preferentially recruits FTa fibres for speed, strength and power activities lasting for a couple of minutes, such as a 400-m run, a 200-m freestyle swim or moderately heavy resistance training (8–12 reps). FTb muscle fibres possess high levels of glycolic enzymes and draw energy solely from anaerobic sources. FTb fibres contract extremely quickly and create forceful muscle contractions, but they fatigue rapidly. FTb fibres are recruited to perform speed, strength and power activities — often at a higher intensity and of a more explosive nature — that last for approximately 10 seconds, such as 100-m sprints, weight-lifting and shot put.
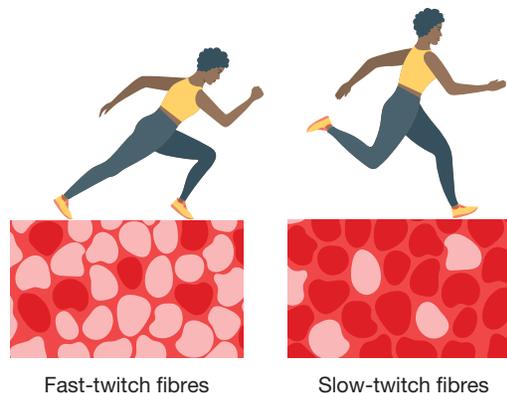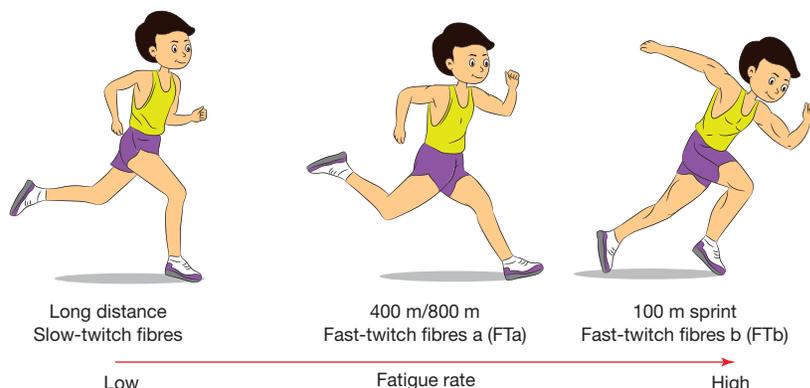
FIGURE 7.16 Activities best suited for each type of muscle fibre type

Long distance
Slow-twitch fibres

400 m/800 m
Fast-twitch fibres a (FTa)

100 m sprint
Fast-twitch fibres b (FTb)

Low   Fatigue rate   High

7.4 Exercises

learn on

7.4 Quick quiz **on**	**7.4 Exercise**

Select your pathway

■ **LEVEL 1** 1, 2, 3, 4	■ **LEVEL 2** 5, 6	■ **LEVEL 3** 7

Revise your knowledge

1. Outline the different structures that make up skeletal muscle.
2. Name three sports or events that would draw upon fast-twitch a muscle fibres.
3. Name three sports or events that would draw upon fast-twitch b muscle fibres.
4. Name three sports or events that would draw upon slow-twitch muscle fibres.

Apply your knowledge

5. Explain why slow-twitch muscle fibres are recruited for endurance-type activities.
6. Explain why fast-twitch muscle fibres are recruited for power and explosive activities.
7. In 2019, Usain Bolt set the world record for the fastest person to run the 100 m sprint, in a time of 9.58 seconds. In 2019, Eliud Kipchoge set the world record for the fastest person to run a marathon distance (42.2 km), in a time of 1 hour 59 minutes and 40 seconds. Compare and contrast these two elite runners in relation to the composition of muscle fibres that they would be likely to possess, and explain how these fibres influenced their performance in their chosen event. Use the **Usain Bolt** and **Eliud Kipchoge** weblinks in the Resources panel to watch the highlight videos of both these races.

FIGURE 7.17 Usain Bolt, current world record holder in the 100 m sprint

FIGURE 7.18 Eliud Kipchoge, current world record holder over the marathon distance

7.5 Types of muscle contractions, and muscle relationships

When a muscle is stimulated, it contracts. This may happen in a number of ways. There are three principal types of muscle contraction:
- **isotonic concentric**
- **isotonic eccentric**
- **isometric**.

Both concentric and eccentric contractions are isotonic contractions because the length of the muscle will change; that is, it will become shorter or longer. In contrast, an isometric contraction is a form of static contraction in which length of the muscle is unchanged despite application of tension.

Examples of isotonic concentric contractions are:
- the contraction of the rectus abdominis to raise the trunk during a sit-up
- the biceps contracting to lift a weight when doing a dumbbell curl, as shown in figure 7.19.

isotonic concentric contraction the most common type of muscular contraction; the muscle shortens, causing movement at the joint

isotonic eccentric contraction occurs when the muscle lengthens while under tension; often happens with the assistance of gravity

isometric contraction occurs when muscle fibres are activated and develop force but muscle length does not change; that is, movement does not occur

Examples of isotonic eccentric contractions are:
- the rectus abdominis extending to gradually lower the trunk during the downward action of a sit-up
- the biceps muscle fibres lengthening as the weight is returned to its original position in a dumbbell curl, as shown in figure 7.20.

FIGURE 7.19 An example of an isotonic concentric contraction. The biceps shortens to lift the weight.

Movement

Muscle contracts (concentric contraction)
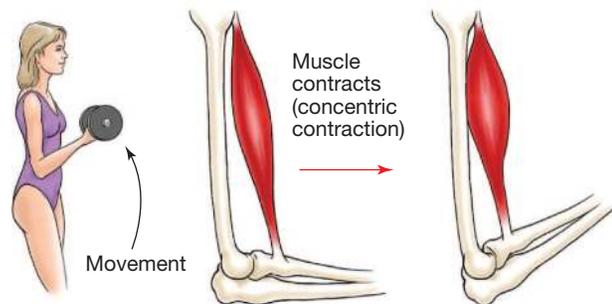
FIGURE 7.20 An example of an isotonic eccentric contraction. The biceps lengthens to lower the weight.

Movement

Muscle elongates (eccentric contraction)
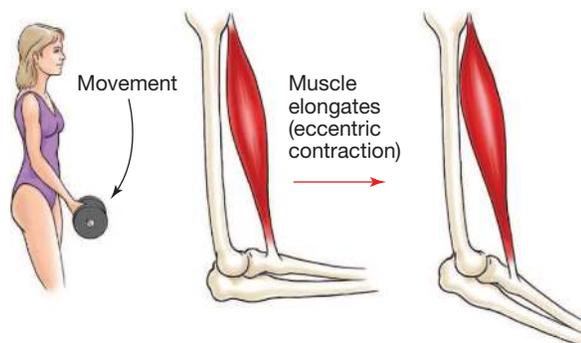
FIGURE 7.21 Isometric muscle contractions are important in rock climbing and many other physical activities and sports.

Isometric contractions occur when a person holds a plank position because the core muscles are being engaged and tension is being applied but the length of the muscles in the rectus abdominis and erector spinae are not changing in length.

FIGURE 7.22 An example of an isometric contraction. When the weight is held in the same spot for a period of time, the muscles generate force and the length of the muscle remains the same.

No movement

Muscle contracts (isometric contraction)
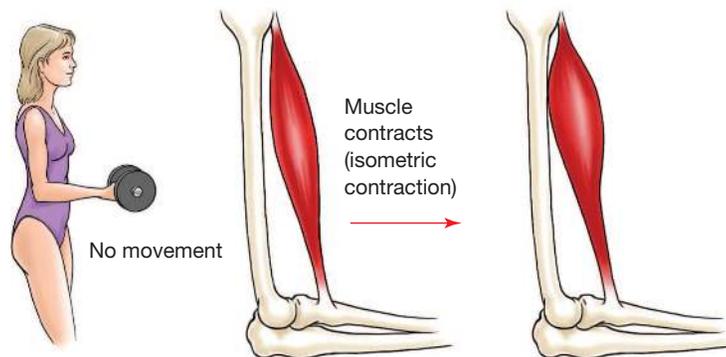
FIGURE 7.23 The plank is an isometric exercise for the core.

7.5.1 Muscle relationship

In producing a particular movement, a muscle performs one of three roles. It can act as an agonist, an antagonist or a stabiliser.

Agonist

An *agonist* or prime mover is the muscle causing the major action. It is the muscle that is doing the most work during the movement. There are agonists for all movable joints and usually more than one is involved in a particular joint movement.

Antagonist

An *antagonist* is a muscle that must relax and lengthen to allow the agonist to contract, thus helping to control an action. The agonist works as a pair with the antagonist muscle. The two roles are interchangeable depending on the direction of the movement.

Antagonists cause an opposite action to that caused by the agonist. For example, figure 7.24 shows that:
- when flexion occurs at the hinge joint of the elbow, the radius and ulna bones come closer towards the humerus bone. The movement occurs because the contracting muscle (the biceps) is the agonist and it pulls the forearm closer by flexing the elbow joint. The extending muscle (the triceps) is the antagonist muscle in the movement because it relaxes for flexion to occur.
- when extending the elbow at the hinge joint, the radius and ulna bones move further away from the humerus. This movement occurs because the contracting muscle (the triceps) is the agonist and it pulls the forearm away by extending the elbow joint. The extending muscle (the biceps) is the antagonist muscle in the movement because it relaxes for extension to occur.

Similarly, abductors and adductors are generally antagonistic to each other.

FIGURE 7.24 The changing roles of muscles — straightening and bending the arm
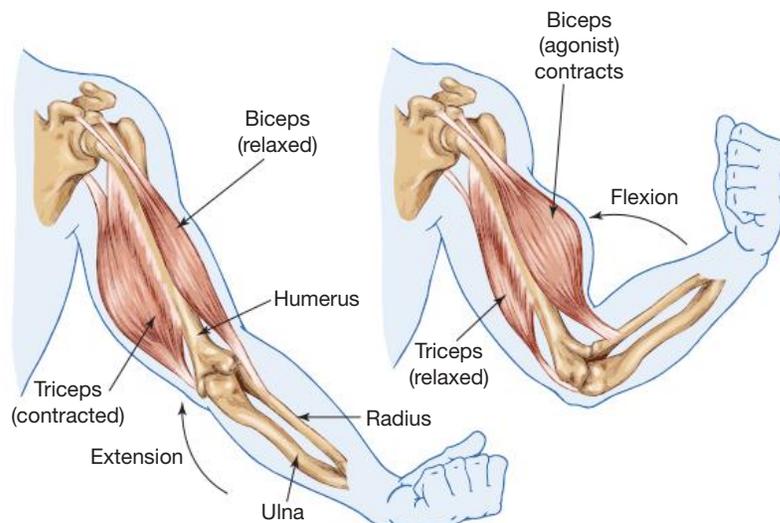
Stabiliser

Stabiliser muscles act at a joint to stabilise it, giving the muscles a fixed base. The muscle shortens very little during its contraction, causing minimal movement. This permits the action to be carried out correctly and allows other joints to work more effectively. For example, when bending the elbow to do a dumbbell curl, the deltoid muscle in the shoulder acts as a stabiliser to allow the efficient working of the shoulder and elbow joint, biceps and triceps, and to reduce the possibility of damage to the joint.

7.5 PRACTICAL ACTIVITY 1

Muscles used during exercise

Design an exercise circuit that has ten different stations of exercises that engage various skeletal muscles. Stations should target different muscles groups, for example from the:
- arms, such as push-ups
- core, such as sit-ups
- legs, such as squats.

Complete the circuit as a practical class. Work on each station for 45 seconds and have a 15-second recovery between each station. Complete two full rounds of the circuit then copy and complete table 7.5 below and answer the questions that follow.

TABLE 7.5 Muscle training circuit

Station/Exercise	Major muscles worked	Agonist	Antagonist	Stabiliser
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

1. Which exercises did you find most challenging? Why?
2. Choosing one of the exercises, explain the role of the stabiliser muscle throughout the movement.
3. Why is it important to work both the agonist and antagonist muscle groups?

7.5 PRACTICAL ACTIVITY 2

Interrelationship between the skeletal and muscular systems

Working in pairs, have one person imitate each of the actions of the following common sporting movements.
- Arm action while taking a shot in basketball
- Wrist action while taking a shot in netball
- Arm action during an overarm throw
- Knee action during a vertical jump
- Foot action when going up onto your toes

Observe each action closely and then copy and complete table 7.6.

TABLE 7.6 Skeletal and muscular contribution to movement

Movement	Bones involved	Muscles and their roles	Joint action	Type of contraction
Arm action — basketball shot				
Wrist action — netball shot				
Arm action — overarm throw				
Knee action — vertical jump				
Foot action — go up on your toes				

Pick one of the movements listed above and explain the interrelationship of the skeletal and muscular systems in producing the movement.

DEPTH STUDY IDEA

Research and create a strength training program that would bring about the best results for a specific athlete in a given sport or event.

7.5 Exercises

learnon

7.5 Quick quiz **on**	**7.5 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3	4, 5

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Revise your knowledge

1. What are the three different types of muscle contractions? Give one specific example of each.
2. Identify the different roles that muscles play during a movement. Give specific examples to support your answer.

Apply your knowledge

3. Why are stabiliser muscles important to help prevent injury?
4. Explain the major muscles, bones, joints, joint actions and muscle relationship when performing a kick in soccer.
5. Copy and complete a mind map similar to figure 7.25 to respond to the question: 'How does the body's musculoskeletal system influence and respond to movement?'

FIGURE 7.25 Sample mind map
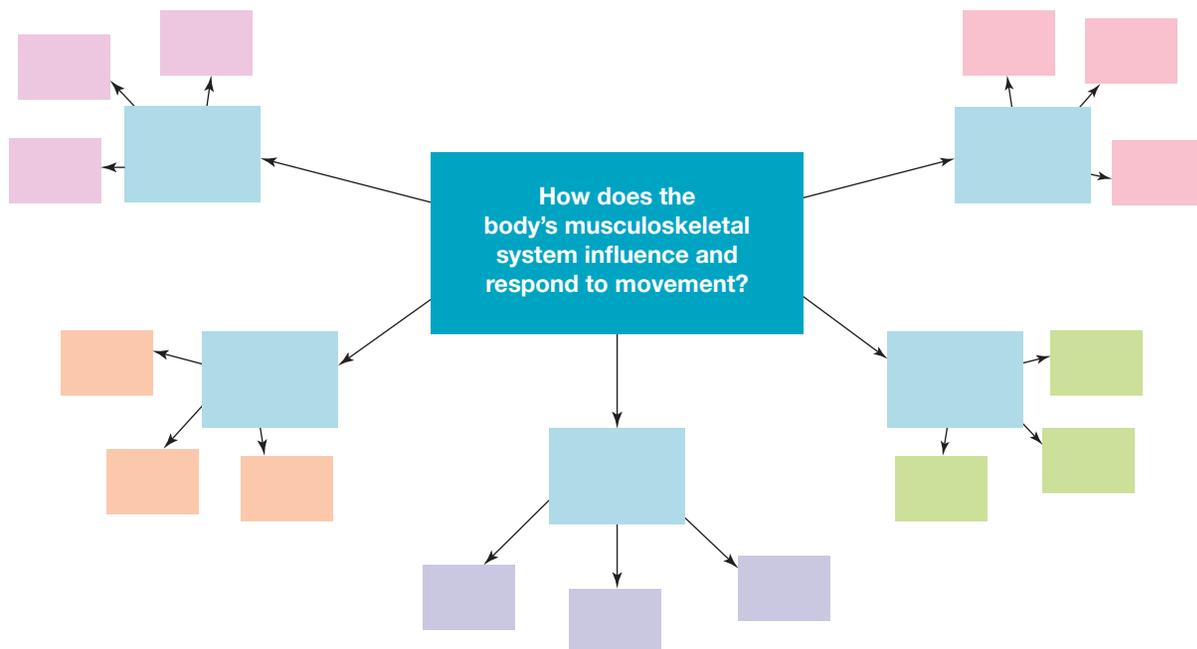
7.6 Interrelationship, structure and function of the respiratory and circulatory systems

Cells require oxygen in order to produce energy. The respiratory system is comprised of the lungs and airways and the circulatory system is made up of the heart and blood vessels. These two systems work together to transport oxygen to the muscles and organs of the body and remove waste products. The main functions of these systems are:
- transporting oxygenated blood from the lungs to the body, and delivering deoxygenated blood from the body to the heart and then lungs to be removed
- distributing vital nutrients to the cells and removing metabolic waste products
- maintaining thermoregulation by regulating heat via blood flow to the skin along with preventing dehydration by maintaining fluid volume.

7.6.1 Structure and function of the respiratory system

Every cell in our body needs a constant supply of oxygen (O_2) and food to maintain life and to keep the body operating effectively. Through the process of **respiration**, the human body takes in oxygen from the atmosphere, and delivers it to the muscles and body tissues while also removing carbon dioxide (CO_2).

respiration the process by which the body takes in oxygen and removes carbon dioxide

Respiration is a process that occurs in practically all living cells. It uses oxygen as a vital ingredient to free energy from food, and can be characterised by the following equation:

FIGURE 7.26 Respiration equation

| Glucose (from food) | + | Oxygen (O_2 breathed in) | ⇒ | Carbon dioxide (CO_2 breathed out) | + | Energy | + | Water |
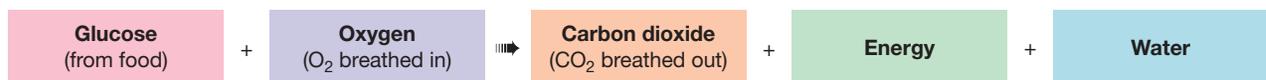
This process is made possible through the respiratory system that facilitates the exchange of gases between the air we breathe and our blood. The respiratory system acts to bring about this essential exchange of gases (CO_2 and O_2) through breathing; the movement of air in and out of the lungs. The lungs and the air passages that ventilate them make up the basic system.

The passage of air from the nose or mouth to the lungs can be followed in figure 7.27.
1. Air containing oxygen from the atmosphere enters the body either through the nose or the mouth. When entering through the nose it passes through the nasal cavities and is warmed, moistened and filtered of any foreign material.
2. The pharynx or throat serves as a common passage for air to the trachea (windpipe) or food to the oesophagus. It leads from the nasal cavity to the larynx (voice box) located at the beginning of the trachea.
3. The trachea is a hollow tube strengthened and kept open by rings of cartilage. After entering the chest cavity or thorax, the trachea divides into a right and a left bronchus (bronchial tube), which lead to the right and left lungs respectively.
4. The inner lining of the air passages produces mucus that catches and holds dirt and germs. It is also covered with microscopic hairs (cilia) that remove dirt, irritants and mucus through steady, rhythmic movements.

5. The lungs consist of two bag-like organs, one situated on each side of the heart. They are enclosed in the thoracic cavity by the ribs at the sides, the sternum at the front, the vertebral column at the back and the diaphragm (a dome-shaped muscle) at the base. The light, soft, lung tissue is compressed and folded and, like a sponge, is composed of tiny air pockets (see figure 7.28).

FIGURE 7.27 The respiratory system
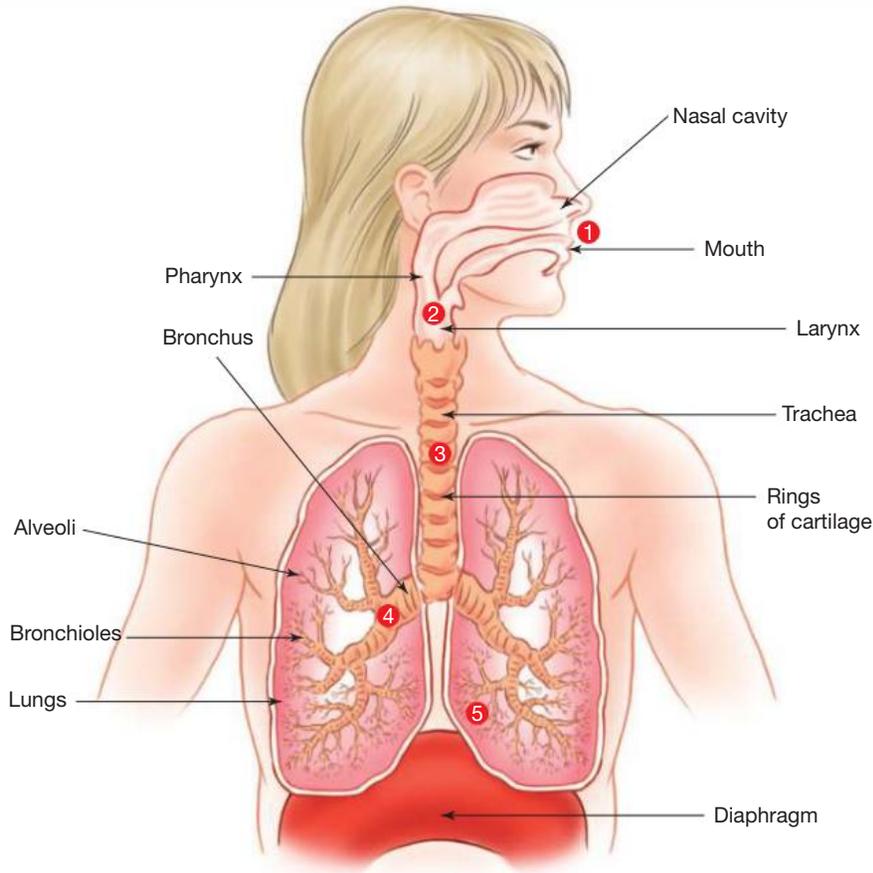
The right and left bronchi that deliver air to the lungs divide into a number of branches or bronchioles within each lung. These bronchioles branch many times, eventually terminating in clusters of tiny air sacs called *alveoli* (singular — alveolus). The walls of the alveoli are extremely thin, with a network of capillaries (tiny vessels carrying blood) surrounding each like a string bag (see figure 7.29). This is where oxygen from the air we breathe is exchanged for carbon dioxide from our bloodstream.

FIGURE 7.28 Human lungs are made up of bronchi, bronchioles and alveoli.
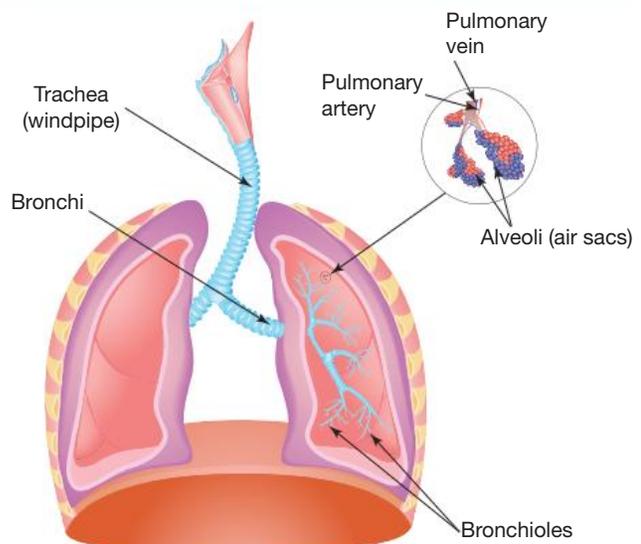
FIGURE 7.29 Air enters the lungs through the bronchi. The air moves into the bronchioles, then enters microscopic air sacs called alveoli.
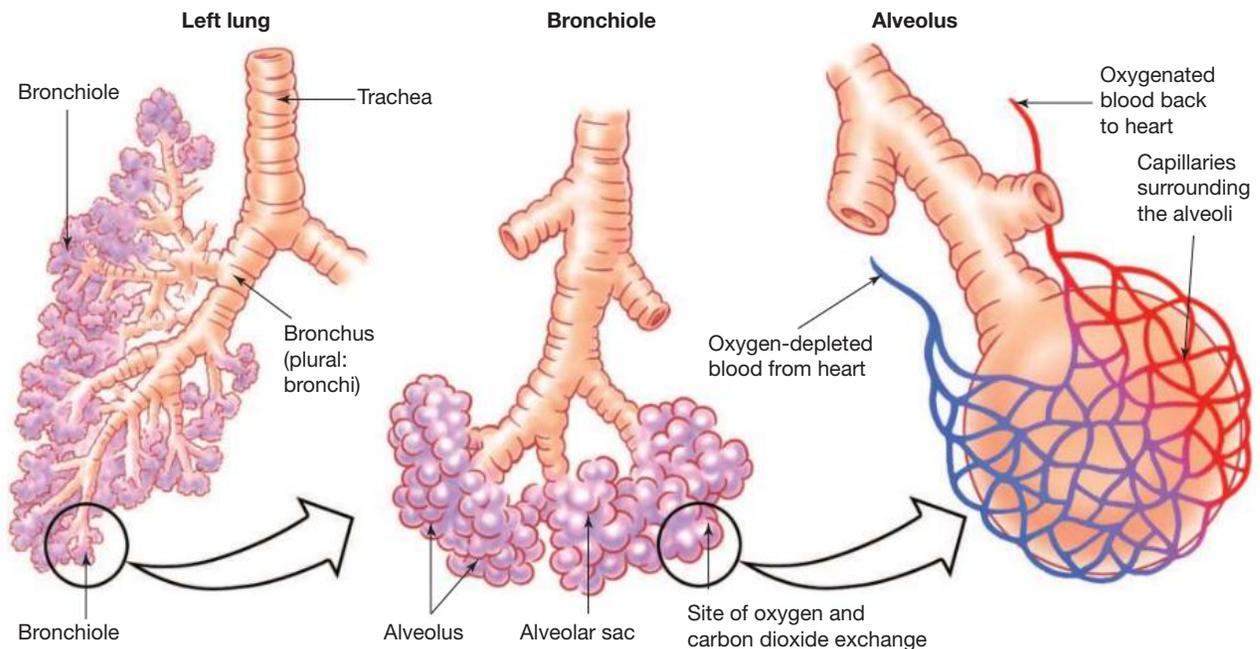
7.6.2 Lung function

Breathing is the process by which air is moved in and out of the lungs. It is controlled automatically by the brain and involves two phases: inspiration and expiration. **Inspiration** is air movement from the atmosphere into the lungs; breathing in. **Expiration** is air movement from the lungs to the atmosphere; breathing out.

inspiration air movement from the atmosphere into the lungs; breathing in

expiration air movement from the lungs to the atmosphere; breathing out

Inspiration and expiration

During inspiration, the diaphragm contracts and flattens as the external intercostal muscles (between the ribs) lift the ribs outwards and upwards (see figure 7.30a). This movement increases the volume of the chest cavity and pulls the walls of the lungs outwards, which in turn decreases the air pressure within the lungs. In response to this, air from outside the body rushes into the lungs through the air passages.

During expiration, the diaphragm relaxes and moves upwards as the internal intercostal muscles allow the ribs and other structures to return to their resting position (see figure 7.30b). The volume of the chest cavity is therefore decreased, which increases the air pressure inside the lungs. Air is consequently forced out to make the pressures inside and outside the lungs about equal.

Under normal resting conditions we breathe at a rate of approximately 12 to 18 breaths per minute. This rate can increase with physical activity, excitement or elevated body temperature. It also changes with age, being higher in babies and young children.

FIGURE 7.30 (a) Inspiration and (b) expiration of air via the lungs

(a) Inspiration

Air drawn into lungs

Ribcage expands up and out

Intercostal muscles contract

Lungs expand

Diaphragm contracts and moves downwards

(b) Expiration

Air forced out of lungs

Ribcage moves down and in

Intercostal muscles relax

Lungs relax

Diaphragm relaxes and moves upwards
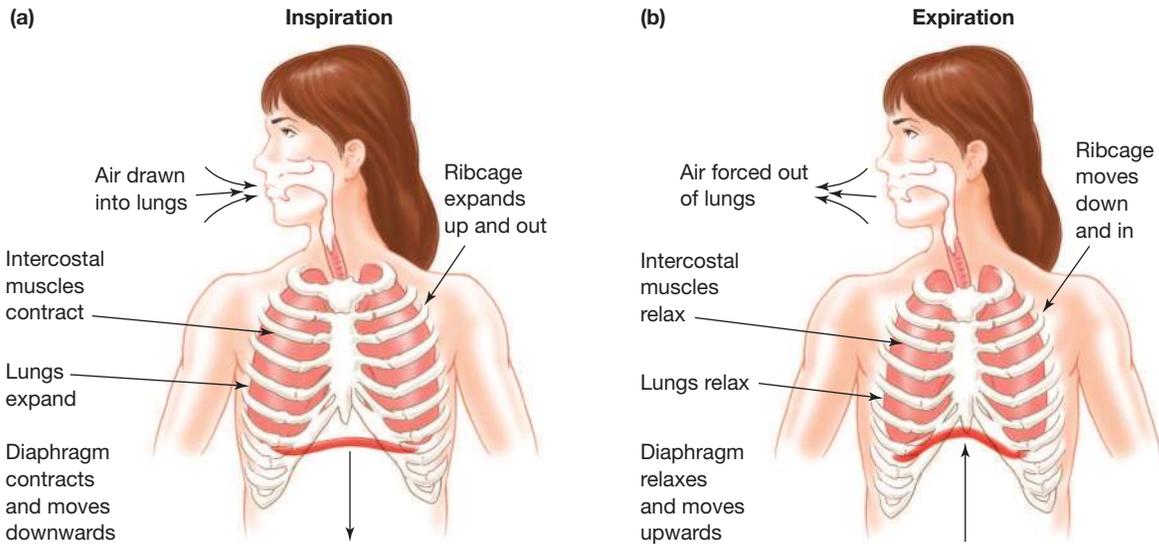
7.6.3 Interrelationship of the circulatory and respiratory systems in movement

Like the skeletal and muscular systems, the circulatory and respiratory systems (cardiorespiratory) work together to enable our body to move. Although each of the systems has its own structure, they interrelate in order to deliver blood to the muscles and tissues that is rich in oxygen and nutrients, and to remove waste products from the blood and body such as carbon dioxide and lactic acid. The process of respiration enables oxygen to react with glucose and provide the energy required for movement. The respiratory system must then coordinate with the **circulatory system** or **cardiovascular system** to distribute the oxygen we breathe in as well as the nutrients we need to the entire body along with removing waste products. This process is completed by the structures of the circulatory system, which are the blood, heart and blood vessels.

circulatory or **cardiovascular system** a network that distributes blood containing oxygen and nutrients and collects wastes; it comprises the heart, arteries, blood and veins

plasma a straw-coloured liquid component of blood, consisting mainly of water (about 90 per cent)

platelets fragments of cells found in blood and responsible for clotting

haemoglobin oxygen-carrying component of the blood

7.6.4 Structure and function of the circulatory system

Blood

Blood is a complex fluid circulated by the pumping action of the heart. It nourishes every cell of the body. An average-sized person contains about five litres of blood. Blood's main functions include:

- transportation of oxygen and nutrients to the tissues and removal of carbon dioxide and wastes
- protection of the body via the immune system and by clotting to prevent blood loss
- regulation of the body's temperature and the fluid content of the body's tissues.

Blood consists of four components, **plasma**, red blood cells, white blood cells and **platelets**, which all perform a different function in the body. Red blood cells serve the most important role in relation to movement because they are responsible for carrying oxygen to the working muscles and carbon dioxide to the lungs to be exhaled. Red blood cells contain a protein called **haemoglobin**. Haemoglobin readily combines with oxygen and carries it from the lungs to the cells and working muscles so that movement can occur.

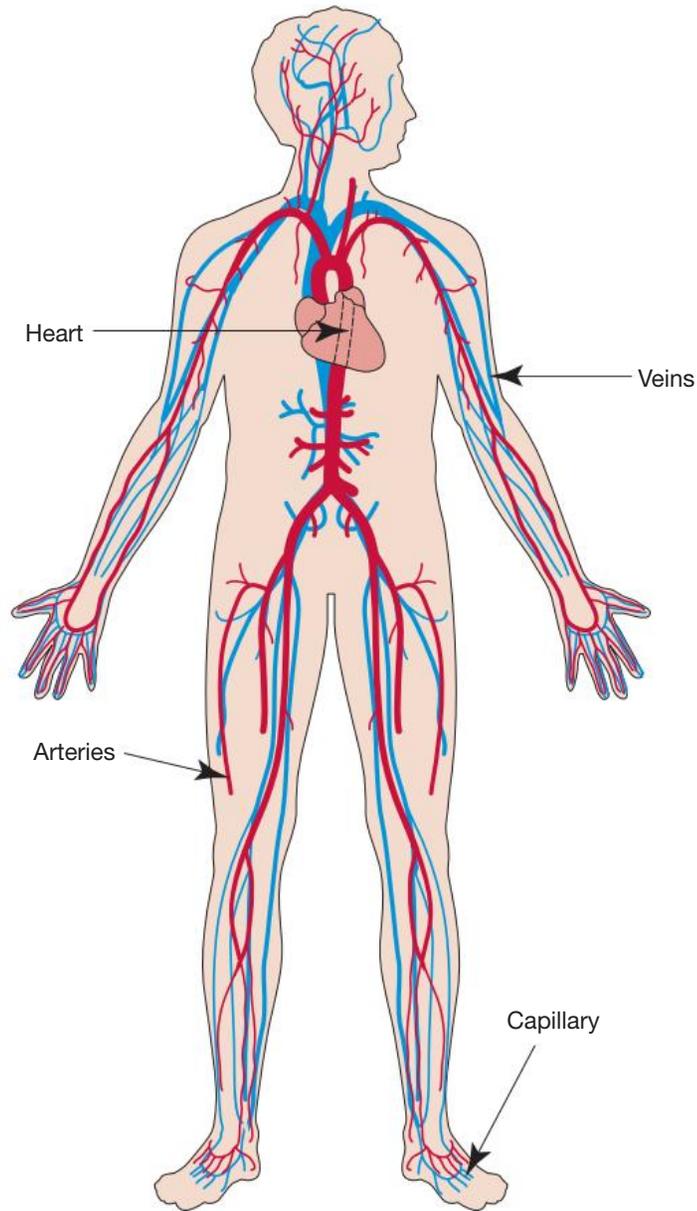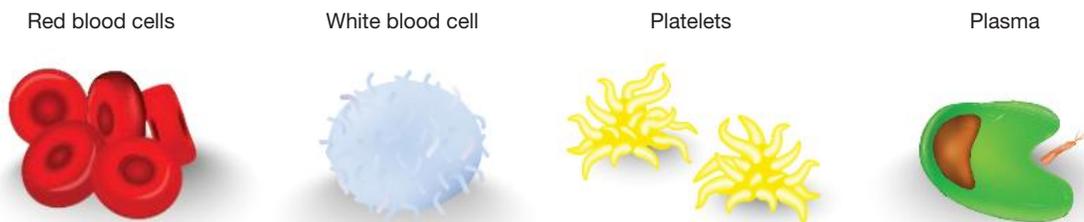**FIGURE 7.31** The circulatory system

Heart

Veins

Arteries

Capillary

FIGURE 7.32 The components of blood

Red blood cells

White blood cell

Platelets

Plasma

Heart

The heart is a muscular pump that contracts rhythmically, providing the force to keep the blood circulating throughout the body. It is slightly larger than a clenched fist and is the shape of a large pear. The heart lies in the chest cavity between the lungs and above the diaphragm, and is protected by the ribs and sternum.

The heart beats an average of 70 times per minute at rest. This amounts to more than 100 000 beats per day. In one day the heart pumps approximately 12 000 litres of blood, which is enough to fill a small road tanker.

A muscle wall divides the heart into a right and left side. Each side consists of two chambers:
- *atria* — the upper, thin-walled chambers that receive blood coming back to the heart
- *ventricles* — the lower, thick-walled chambers that pump blood from the heart to the body.

A system of four one-way valves allows blood to flow in only one direction through the heart; that is, from the atria to the ventricles (via the atrioventricular valves) and from the ventricles into the main arteries taking blood away from the heart (via the arterial valves).

The heart and lungs work closely together during rest and exercise to ensure that all cells are receiving adequate supplies of oxygen and nutrients and waste products are being removed.

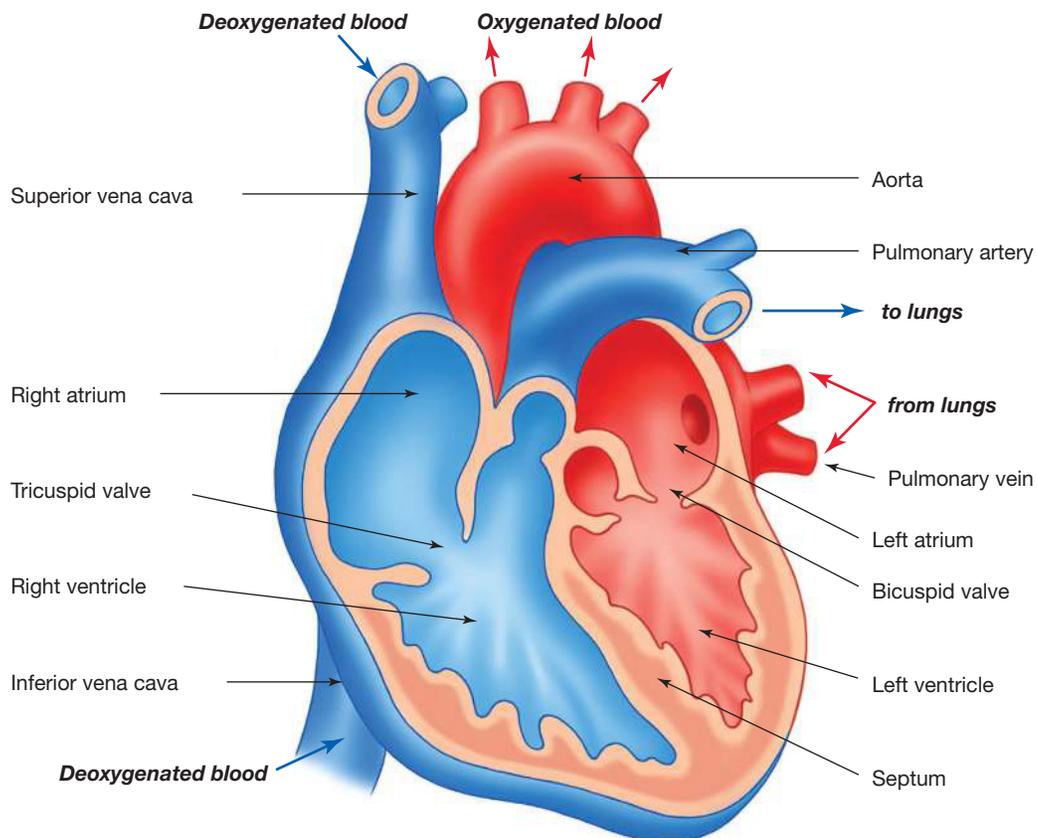**FIGURE 7.33** Position of the heart
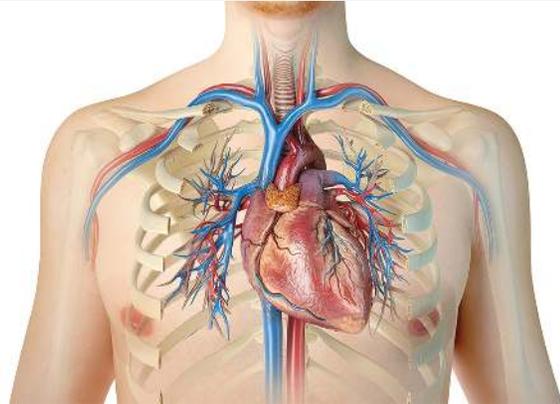
FIGURE 7.34 Deoxygenated blood (blue) is pumped to the lungs. There, after receiving oxygen, it turns reddish and returns to the heart to be pumped through the body.

7.6 PRACTICAL ACTIVITY

Breathing rate and heart rate during exercise

Work in pairs, with one person being the subject completing all the activities and the other person being the recorder. Switch roles so that both partners perform the role of subject and recorder.

1. Before you begin the physical activities, sit down quietly and manually measure your resting heart rate. Do this by using a heart rate monitor or smartwatch if one is available, or by finding the pulse of the subject, counting how many beats occur within a 30-second period and then doubling it to work out their resting heart rate (calculated in beats per minute).

2. Perform each of the following activities, taking the subject's pulse for 10 seconds immediately after they complete each activity. Observe what happens to the subject's depth and rate of breathing while completing the exercises. The subject should then rest until their heart rate has returned to their resting rate between each activity.
   - Walking for 2 minutes
   - Jogging for 2 minutes
   - Sit-ups for 30 seconds
   - Step-ups on a bench for 2 minutes
   - Seated toe-touches for 30 seconds
   - Running as fast as possible for 2 minutes

3. Record and graph your results. Multiply each result by six to determine your heart rate.

4. Identify which activity caused the highest heart rate. Suggest reasons for this.

5. What happened to the depth and rate of breathing throughout the activities? Why did this occur?

6. Discuss the relationship between your heart rate, your breathing rate and the intensity of the activity. Provide examples.

Blood vessels

Blood vessels make up the network of tubes through which blood is pumped around the body. Along with the heart and the blood, the blood vessels are classed as part of the cardiovascular system.

arteries blood vessels that carry blood away from the heart

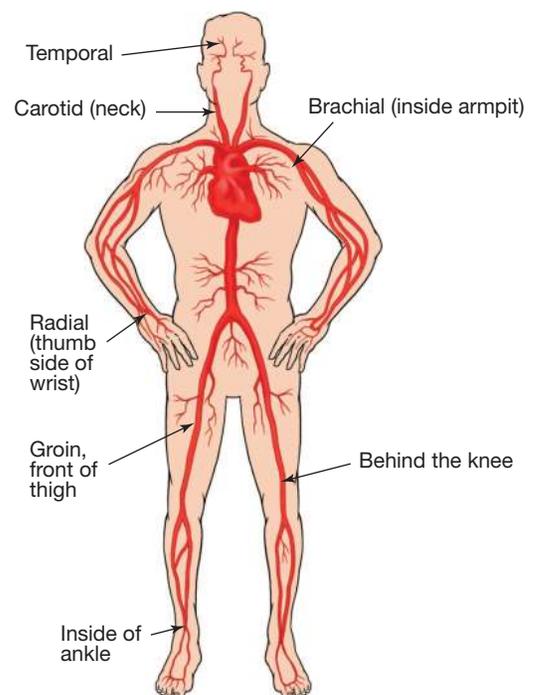There are three types of blood vessels:
- arteries
- capillaries
- veins.

Arteries

Arteries are blood vessels that carry blood away from the heart (see figure 7.35). They have thick, strong, elastic walls containing smooth muscle to withstand the pressure of the blood forced through them.

The blood pumped under pressure from the left ventricle passes through the aorta (the largest artery) and throughout the body. At the same time, blood from the right ventricle passes through the pulmonary artery to the lungs, where it collects oxygen and then returns to the heart. These large exit arteries branch into smaller arteries that eventually divide into tiny branches called arterioles. Arterioles in turn divide into microscopic vessels (capillaries).

FIGURE 7.35 The arteries deliver oxygen-rich blood to tissues of the body.

Temporal

Carotid (neck)

Brachial (inside armpit)

Radial (thumb side of wrist)

Groin, front of thigh

Behind the knee

Inside of ankle

Capillaries

The **capillaries** are the smallest of all blood vessels. They function to exchange oxygen and nutrients for waste. They are a link between the arterioles and the veins. They re-join to form tiny veins called venules.

In active tissue such as the muscles and brain, the capillary network is particularly dense with much branching of very fine structured vessels. This provides a large surface area for the exchange of materials between the blood and the fluid surrounding the cells (interstitial fluid).

Capillary walls are extremely thin, consisting of a single layer of flattened cells. These walls allow oxygen, nutrients and **hormones** from the blood to pass easily through to the interstitial fluid, then into the cells of the body's tissues. The blood pressure (due to the pumping action of the heart) helps to force fluid out of the capillaries.

capillaries the smallest of all blood vessels; they function to exchange oxygen and nutrients for waste

hormone chemical substance produced in the body that controls and regulates the activity of certain cells or organs

FIGURE 7.36 An artery has a thick, elastic wall, covering layers of smooth muscle.

Thick elastic wall

Muscle layer
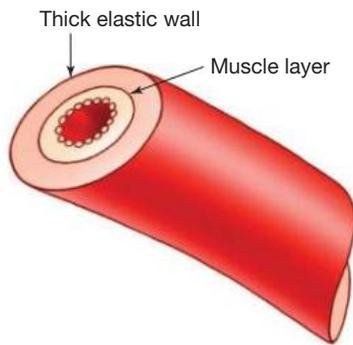
FIGURE 7.37 Arteries branch into arterioles, which divide into capillaries.

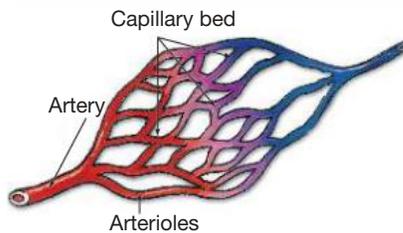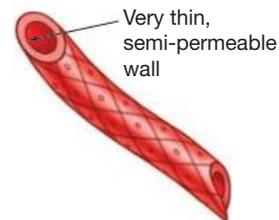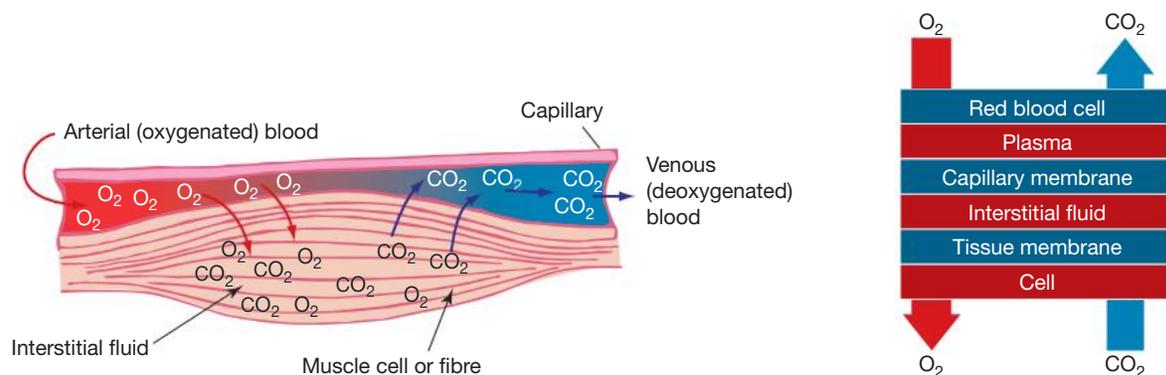Capillary bed

Artery

Arterioles

FIGURE 7.38 A capillary has a very thin wall that allows oxygen and nutrients to pass into the cells and carbon dioxide to move from the cells to the blood.

Very thin, semi-permeable wall

Meanwhile, carbon dioxide and cell wastes are received back into the capillaries. This diffusion of oxygen and other nutrients from the capillaries into the cells and carbon dioxide and wastes from the cells into the capillaries is known as *capillary exchange* (see figure 7.39). This content is further explored in section 7.7.2.

FIGURE 7.39 Capillary exchange at the muscle cell

Arterial (oxygenated) blood

Capillary

Venous (deoxygenated) blood

Interstitial fluid

Muscle cell or fibre

O_2 CO_2

Red blood cell

Plasma

Capillary membrane

Interstitial fluid

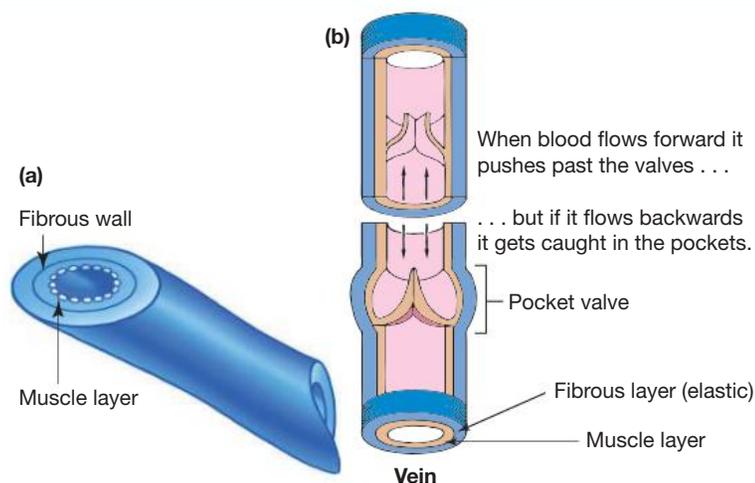Tissue membrane

Cell

O_2 CO_2

Veins

The venules collect deoxygenated (low oxygen content) blood from the capillaries and transfer it to the **veins**. Veins carry deoxygenated blood from the body tissues back to the right atrium.

As pressure in the veins is low, blood flows mainly against gravity (blood flow in the veins above the heart is, however, assisted by gravity). The walls of veins are thinner than those of arteries, with greater 'give' to allow the blood to move more easily. Valves at regular intervals in the veins prevent the backflow of blood during periods when blood pressure changes (see figure 7.40).

Veins allow blood from the body to be returned to the heart and lungs for reoxygenating. They also promote the disposal of waste products such as lactic acid.

veins vessels that carry deoxygenated blood from body tissues back to the right atrium. Pulmonary veins from the lungs differ in that they carry oxygenated blood to the left atrium.

FIGURE 7.40 (a) The wall of a vein is less elastic and thinner than that of an artery. (b) Valves in the veins prevent the backflow of blood.

(b)

When blood flows forward it pushes past the valves . . .

. . . but if it flows backwards it gets caught in the pockets.

Pocket valve

(a)

Fibrous wall

Muscle layer

Fibrous layer (elastic)

Muscle layer

Vein

DEPTH STUDY IDEA

Investigate the size of the human heart in various population groups and the impact of long-term endurance activities on heart size and its ability to function efficiently.

---

on Resources

Digital document Heart diagram (doc-34764)

Weblink Respiratory system

7.6 Exercises

7.6 Quick quiz **on**	7.6 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4	5, 6, 7	8

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Revise your knowledge

1. Identify the major structures of the respiratory system.
2. What are the major functions of the respiratory system?
3. Download the **Heart diagram** document (doc-34764) from the Resources panel. Label the structures of the heart. Indicate the direction of blood flow through the heart.
4. What is haemoglobin?

Apply your knowledge

5. Explain the differences between arteries, veins and capillaries.
6. Use a flow chart to identify the path that air takes from outside the body right through to the alveoli in the lungs. Ensure that you list the structures in the correct order and describe the role of each one.
7. Examine figure 7.41, representing the body's cardiovascular and respiratory systems. Imagine you are a drop of blood. Describe your passage through the entire circulatory system, beginning with entry into the right atrium. How would the oxygen level vary on reaching the capillaries, pulmonary artery, pulmonary vein and aorta?
8. Explain how the structures of the respiratory and circulatory system interrelate in order to allow movement to occur.

FIGURE 7.41 Interaction of the respiratory and cardiovascular systems
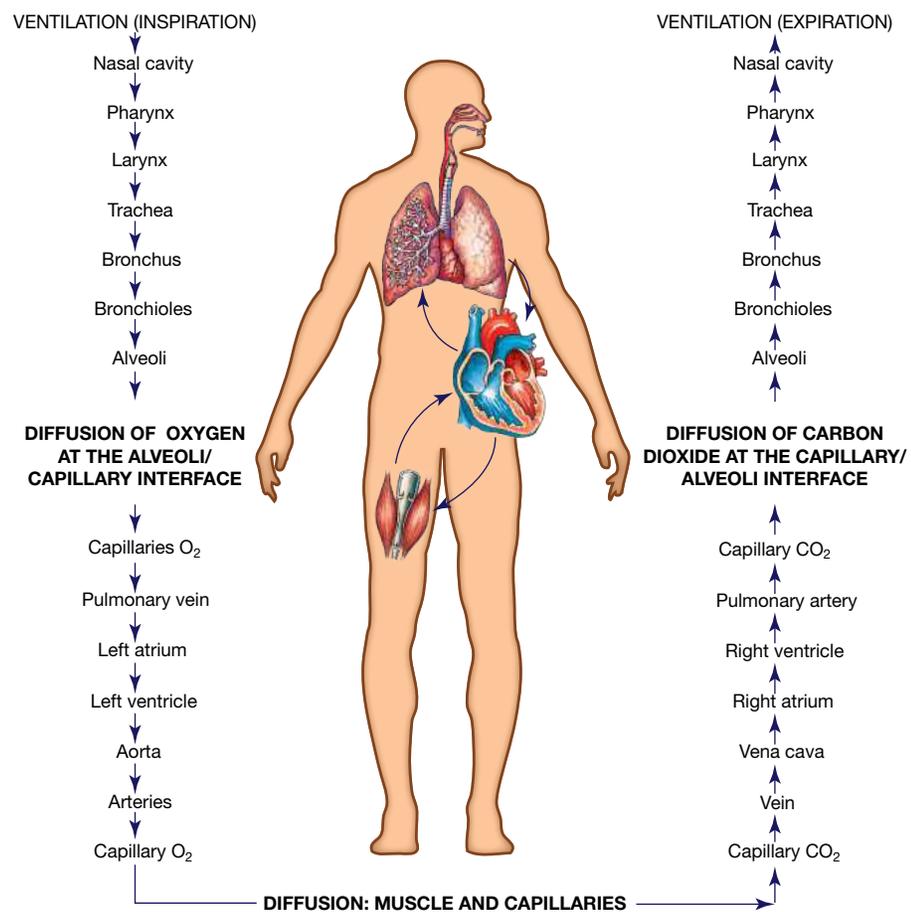
VENTILATION (INSPIRATION)
Nasal cavity → Pharynx → Larynx → Trachea → Bronchus → Bronchioles → Alveoli

DIFFUSION OF OXYGEN AT THE ALVEOLI/ CAPILLARY INTERFACE
Capillaries O_2 → Pulmonary vein → Left atrium → Left ventricle → Aorta → Arteries → Capillary O_2

VENTILATION (EXPIRATION)
Nasal cavity ← Pharynx ← Larynx ← Trachea ← Bronchus ← Bronchioles ← Alveoli

DIFFUSION OF CARBON DIOXIDE AT THE CAPILLARY/ ALVEOLI INTERFACE
Capillary CO_2 ← Pulmonary artery ← Right ventricle ← Right atrium ← Vena cava ← Vein ← Capillary CO_2

DIFFUSION: MUSCLE AND CAPILLARIES

7.7 Blood circulation and the exchange of gases

7.7.1 Pulmonary and systemic circulation

Both sides of the heart work together like two pumps with overlapping circuits. The right side of the heart receives blood from the veins that is low in oxygen content (deoxygenated) from all parts of the body. The right side of the heart then delivers this deoxygenated blood to the lungs, where carbon dioxide is dropped off and oxygen is picked up. This process of circulation is called **pulmonary circulation**. The left side of the heart receives blood high in oxygen content (oxygenated) from the lungs and delivers the oxygenated blood via the arteries to the rest of the body. This process of circulation is called **systemic circulation**.

pulmonary circulation the flow of blood from the heart to the lungs and back to the heart

systemic circulation the flow of blood from the heart to body tissue and back to the heart

FIGURE 7.42 The circulation of blood: pulmonary and systemic
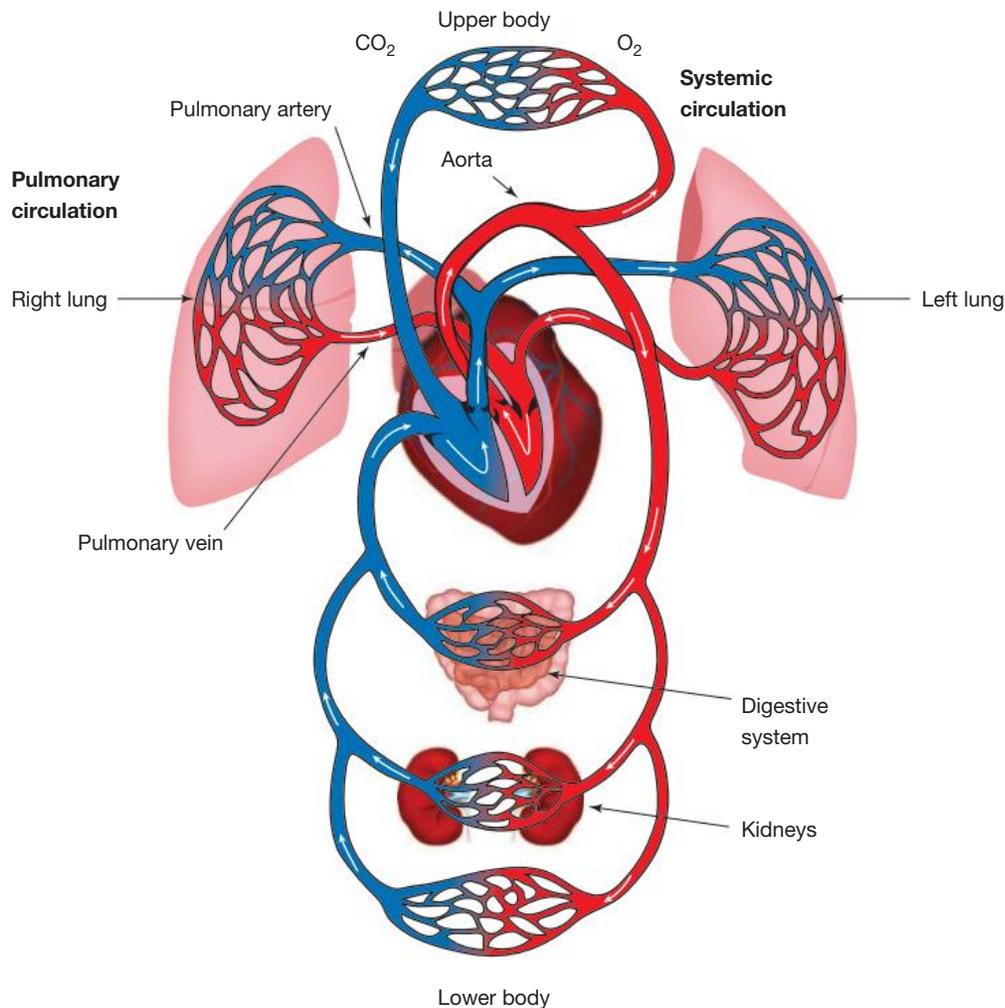
7.7.2 Gaseous exchange

During inspiration, the alveoli are supplied with fresh air that is high in oxygen content and low in carbon dioxide. On the other hand, blood in the capillaries arriving at the alveoli via pulmonary circulation is low in oxygen and high in carbon dioxide content, as shown in table 7.7. The different concentrations of oxygen and carbon dioxide between the blood and the air result in a pressure difference.

TABLE 7.7 The composition of inspired and expired air by percentage at rest

Gas	Inhaled air (per cent)	Exhaled air (per cent)
Oxygen (O_2)	20.93	16.4
Carbon dioxide (CO_2)	0.03	4.1
Nitrogen (N) and other gases	79.04	79.5

Gases such as oxygen and carbon dioxide move from areas of high concentration or pressure to areas of low concentration or pressure. Oxygen therefore moves from the air in the alveoli across the alveolar–capillary wall into the blood, where it attaches itself to haemoglobin in the red blood cells. At the same time, carbon dioxide is unloaded from the blood into the alveoli across the alveolar–capillary wall to be breathed out. This two-way diffusion is known as gaseous exchange and is illustrated in figure 7.43.

FIGURE 7.43 As blood goes past an alveolus, the blood gives up carbon dioxide and picks up oxygen. These gases move in and out by diffusion through the thin alveolar walls.
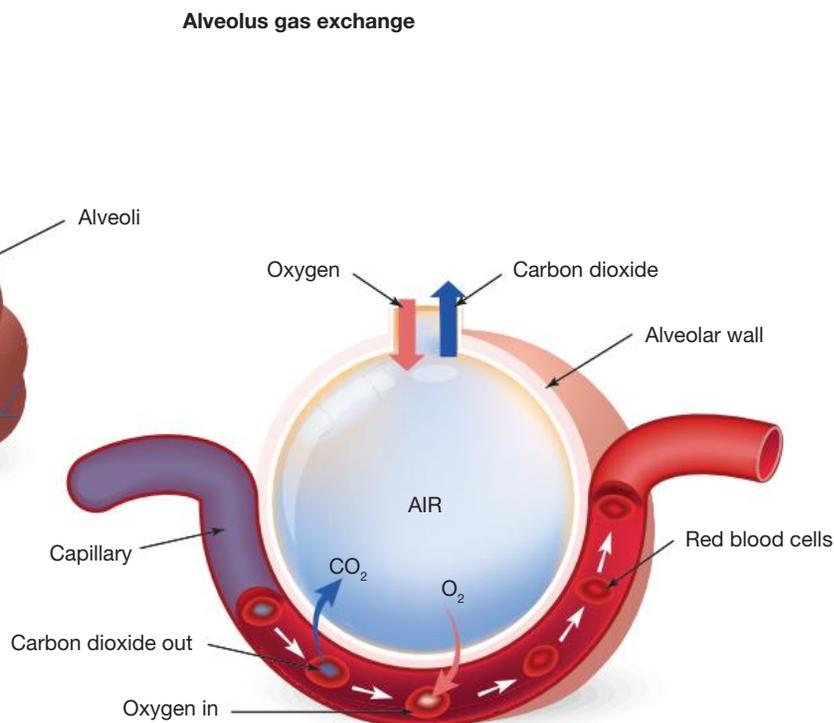
Gaseous exchange also occurs during systemic circulation. Using the same principle outlined above, the gas exchange occurs between blood in the capillaries of the arteries and the cells of the body; for example, the muscle cells. Here, oxygen is unloaded to the cells while carbon dioxide is given up to the blood. Blood that is high in carbon dioxide content (deoxygenated blood) is carried back to the lungs, where it unloads carbon dioxide.

During physical activity, the body's higher demand for oxygen triggers a response from the circulatory and respiratory system. The demand for oxygen is much higher than at rest, so the heart and lungs respond by increasing pulmonary circulation and systemic circulation along with gaseous exchange. Increased rates of breathing, combined with an increased heart rate, result in the delivery of more oxygen to the body and the removal of wastes, which enables the person to continue to move efficiently.

FIGURE 7.44 Heavy breathing is a necessary response to physical activity.

DEPTH STUDY IDEA

Conduct a practical laboratory investigation looking at the importance of respiration and athletic performance. Different populations could be tested, such as beginners through to elite athletes, to determine respiration differences and the impact on athletic performance.

7.7 ACTIVITY

Role-playing blood circulation and exchange of gases

a. Form a small group to role-play a red blood cell's journey through the body.
b. You need to represent parts of the circulatory and respiratory systems, such as lungs, heart chambers and blood vessels.
c. Begin with the blood cell entering the heart through the vena cava, then move around the room to mimic blood flow.
d. Your role-play also needs to explain gaseous exchange during pulmonary and systemic circulation.

7.7 Exercises

7.7 Quick quiz on	7.7 Exercise

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Revise your knowledge

1. Outline what pulmonary circulation is.
2. Outline what systemic circulation is.
3. Describe how gaseous exchange occurs in pulmonary circulation.
4. Describe how gaseous exchange occurs in systemic circulation.

Apply your knowledge

5. What role do veins and arteries play in pulmonary and systemic circulation?
6. Explain the process of how oxygen enters the bloodstream and carbon dioxide leaves via the alveolar–capillary wall.
7. Explain what happens to the respiratory and circulatory systems once exercise begins.
8. Analyse why an efficient respiratory and circulatory system is important for optimal performance in physical activity.

7.8 Factors that impact the cardiovascular system

> **Syllabus:** Explain the interrelationship between the respiratory and circulatory systems and movement
>
> **Including:**
> - factors that impact on the efficiency of the cardiovascular system
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Cardiovascular efficiency is the most important factor that determines overall aerobic fitness. High cardiorespiratory efficiency also significantly reduces the risk of cardiovascular disease. There are a number of factors that can be both advantageous or detrimental to the efficiency of the cardiovascular system. Some of the major factors include:
- altitude
- haemoglobin levels
- vascular disease.

7.8.1 Altitude

Altitude (height above sea level) can have either a positive or negative impact on the efficiency with which the cardiovascular system operates. At an altitude of 1500 m or higher above sea level, the air is thinner and so the lungs struggle to extract sufficient amounts of oxygen to deliver to the muscles and tissues. As altitude increases, oxygen in the atmosphere further decreases. If a person is not used to these conditions, they can get a condition known as acute hypoxia, which is characterised by decreased oxygen in the blood, leaving insufficient levels for normal bodily function. Acute hypoxia, will have a detrimental impact on the ability of the cardiovascular systems to function efficiently. Effects range from mild, such as shortness of breath and rapid breathing, through to severe, such as coma and even death.

However, gradual **acclimatisation** can have a positive impact on the functioning of the cardiovascular system. This is because hypoxia produced at altitude stimulates physiological adaptations that improve cardiovascular functioning both at rest and during exercise. Due to the air being thinner at altitude, less oxygen is inhaled with each breath; to counter that, the body produces more red blood cells and hence haemoglobin. If acclimatisation at altitude is done gradually and safely, improvements in endurance performances at sea level are well documented, along with improvements in cardiovascular efficiency. Many endurance athletes and sports teams now include altitude training in their programs, either by training in a high-altitude environment, gradually increasing the altitude usually over a few weeks, or in a prefabricated environment such as a training room that simulates the conditions experienced at altitude and hence brings about the positive adaptations.

acclimatisation the process of becoming accustomed to a new environment

Read the case study 'Running on thin air' to clearly understand the impact that altitude can have on athletic performance and answer the questions that follow.

FIGURE 7.45 Athletes train at altitude, or in altitude rooms, in an attempt to increase the oxygen–carrying capacity of their blood.

CASE STUDY

Running on thin air

The 1968 Mexico City Olympic Games have had sport scientists' minds racing for decades. It was an Olympics where some records were smashed beyond comprehension, and others were completely untouchable.

Why? The answer is up in the air. Literally. Mexico City sits 2240 metres above sea level where the high altitude and thin air can wreak havoc on the human body.

For Professor Chris Gore, Head of Physiology at the Australian Institute of Sport (AIS), understanding the effects of altitude has become a fixation.

'It's been my passion for 15 years. I think it's fascinating and I'm always trying to find new ways to help athletes and coaches use altitude training more effectively.'

So what happens to the air at high altitudes to affect our bodies so much?

This is due to the effects of gravity (which keeps air close to the ground) and heat (as you get closer to the sun) which cause molecules to bounce off one other and expand. So as you reach higher altitudes, the air expands.

▶

Any given volume of air is comprised of 79 per cent nitrogen, 20.9 per cent oxygen and 0.1 per cent other gases such as argon and krypton. But as you get higher and higher above sea level, the pressure of the atmosphere decreases.

While the composition of the air stays the same, the expansion means that the air is 'thinner' — so in essence, at higher altitudes you inhale less oxygen and nitrogen molecules than you would at sea level.

This drives a cascade of physiological responses in the human body. To begin with, your body increases its heart rate and respiratory rate to increase the amount of oxygen taken in and circulated around the body. So for example, while an athlete might normally run with a heart rate of 150 beats per minute, at high altitude it might increase to 165.

Then the body begins to respond and adapt to the altitude (a process called acclimatisation). More than 200 genes are turned on in response to altitude, and one that is most commonly thought of is that which induces the creation of more red blood cells thereby increasing the amount of haemoglobin in the blood.

Haemoglobin is the protein that binds oxygen molecules to red blood cells. The more haemoglobin in the blood cells, the more efficient the cells will be at carrying oxygen around the body. This means that even though less oxygen is taken into the lungs, it is more easily transported to the muscles.

Finally, as you breathe faster and faster, the amount of carbon dioxide in the blood is reduced, which leads to the blood becoming less acidic. To counter this, the kidneys release blood bicarbonate to try to balance the PH level. For athletes, this is a big advantage since blood bicarbonate is the primary source of protection for muscles against lactic acid — the waste that builds up during exercise and leaves muscles feeling stiff and sore.

While most of the scientific world has focused on the benefits of more haemoglobin following altitude training, Professor Gore and his colleagues have looked at the range of other effects.

His work has proven that muscle buffering capacity is improved and that blood lactate levels during exercise are lowered. Additionally, the AIS scientists have found that athletes become more efficient after altitude exposure. Just like high altitude natives, athletes are able to use less oxygen to do the same amount of work after they have been at simulated altitude.

The down side, however, is that many of these physiological responses do not occur straight away. It can take days, even weeks for the human body to fully adapt to the effects of altitude and for athletes to reap the benefits of better muscle protection and more efficient oxygen transportation.

Scientists have determined that at high altitudes of 2400 meters plus, we inhale approximately three quarters of the amount of oxygen molecules that we would at sea level. This decreases as you go higher. As a reference, on the summit of Mount Everest (8848 m above sea level) we inhale only a third of the amount of oxygen we would at sea level, which is not enough to sustain human life.

Altitude training at the AIS

To simulate this low atmospheric pressure, enabling athletes to get the benefits of altitude training without having to travel to high altitude areas, scientists at the Australian Institute of Sport have developed an 'altitude house'.

This house, comprised of 12 beds, bathroom, kitchen and a lounge, simulates what it would be like to live at high altitude. The AIS recreate the low pressure atmosphere of 2500 metres by changing the composition of the air within the house to approximately 85 per cent nitrogen and 15 per cent oxygen. The air is not thinner, but the presence of less oxygen is physiologically equivalent to being at altitude.

Athletes from endurance sports like cycling, rowing, race walking and swimming live in the house for 3–4 weeks at a time, a couple of times a year. At the same time, they maintain their standard training regime in the normal atmosphere in Canberra, which is 600 metres above sea level.

According to Professor Gore, this 'live high, train low' program enables athletes to reap the benefits of high altitude living, while still enabling them to train with the same intensity and frequency.

'Australia is at a disadvantage to other countries because we don't really have big mountains for our athletes to live or train on, so the altitude house allows us to simulate what other countries have already,' Professor Gore said.

'And this way we get similar benefits from the altitude house that we would get from natural altitude by flying the athletes to train in say Europe, but without having to sacrifice their access to their physios, doctors, nutritionists, friends and family.'

Some athletes use the house as preparation for events where they will be competing at high altitudes. Mainly however, coaches are using the 'altitude' house as a way to improve performance at sea-level events.

'By living in the house for 12 hours or so a day, the athlete's red blood cell counts increase, their haemoglobin increases. As well, their muscle buffering capacity, ability to handle lactic acid and their efficiency also improves. They can then use these factors to their advantage in training and competitions.

'Overall, we're talking about a 1–2 per cent increase in performance, which mightn't sound like much, but can be the difference between a medal and failing to qualify,' Professor Gore said.

But the effects don't last forever. For example, Professor Gore quotes a study where Kenyan runners who lived and trained in high altitude all their lives were taken to a low-altitude region of Germany to train. After six weeks the runners had lost 5 per cent of their haemoglobin showing a relatively fast de-adaptation.

'The verdict is still out, but we're looking at benefits lasting for between 2–4 weeks for sea-level athletes who return to normal sea-level training.'

For Professor Gore, one of the most interesting things about altitude is its ability to both hinder and help athletes, depending on their event.

'In cycling for example, the thin air means there is less drag, and in short stints in particular, athletes' ability to absorb oxygen is not badly affected. This is true of almost all explosive events, including sprints, long jump and triple jump.

'But for endurance events, like the ones our altitude training athletes compete in, kayaking, rowing and race walking, they are hit hard by the lack of oxygen and the lack of air resistance means little,' Professor Gore concluded.

Source: Australia's Chief Scientist 2012, https://www.chiefscientist.gov.au/2011/05/running-on-thin-air/

Case study questions

1. What is meant by 'air is thinner' at higher altitudes?
2. Describe how the body acclimatises to air at high altitudes.
3. How does Australia's 'altitude house' function to improve acclimatisation?
4. How long do the benefits of altitude training last?
5. Explain how altitude training impacts the efficiency of the cardiovascular system.
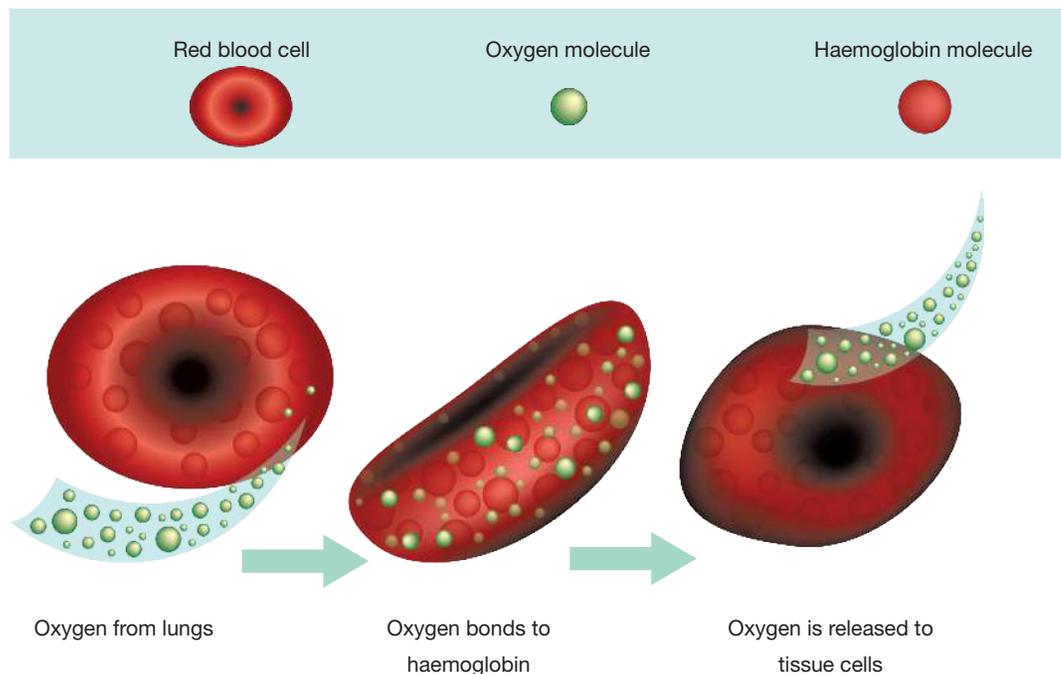
7.8.2 Haemoglobin levels

Haemoglobin is the oxygen-carrying component of the blood. Higher levels of haemoglobin increase the amount of oxygen that can be delivered to the muscles and organs both at rest and during exercise. This is a significant advantage for athletes. However, conditions such as **anaemia** and **iron deficiency** reduce the amount of haemoglobin in the blood and reduce the body's ability to deliver oxygen both at rest and during exercise.

anaemia a medical term to describe a low red blood cell count

iron deficiency a lack of iron in the body reducing haemoglobin production in the blood

Higher haemoglobin levels in the blood mean that more oxygen can be absorbed from the lungs and carried to the muscles and tissues, which has a positive impact on the efficiency of the cardiovascular system and overall health. Higher levels of haemoglobin in the blood also benefits endurance athletes by allowing them to exercise at greater intensities for longer periods of time before fatiguing. It is therefore a desirable physiological adaptation that many athletes seek to obtain.

FIGURE 7.46 Haemoglobin — the oxygen-carrying component of the blood

Red blood cell   Oxygen molecule   Haemoglobin molecule

Oxygen from lungs   Oxygen bonds to haemoglobin   Oxygen is released to tissue cells

Low levels of haemoglobin can have a negative impact on the cardiovascular system by reducing the amount of oxygen being delivered around the body. When a person has low levels of haemoglobin, their cardiovascular system does not work efficiently because the heart has to work harder to ensure that the muscles and organs get the oxygen they require both at rest and during exercise. During heavy exercise, lower haemoglobin levels in the blood means inadequate oxygen is being delivered to meet the body's needs and the person can become exhausted and feel unwell. Iron deficiency and anaemia reduce the levels of haemoglobin in the blood and therefore have a negative impact on the ability of the cardiovascular system to work effectively.

7.8.3 Vascular disease

Vascular disease is caused by a number of conditions that affect the blood vessels of the circulatory system. It has a negative impact on the ability of the cardiovascular system to function because the blood vessels cannot perform their role effectively. This leads to insufficient oxygen and nutrient delivery as well as poor waste removal

atherosclerosis the build-up of fatty and/or fibrous material on the interior walls of arteries

from the body. The main cause of vascular disease is **atherosclerosis**, which is the build-up of fatty and/or fibrous material, known as plaque, on the interior walls of arteries. The build-up of these deposits causes the arteries to become narrow. This hinders blood flow to the body's tissues, increases blood pressure and decreases the elasticity of the artery walls. Figure 7.47 shows the impact that atherosclerosis has on an artery's structure; it can cause a complete blockage to occur. Depending on the artery affected, this can cause heart attacks, stroke or peripheral vascular disease. Accumulation of plaque happens over a long period of time and can be symptomless until atherosclerosis is advanced and the blood flow to the organs and muscles is compromised due to the narrowing of the artery.
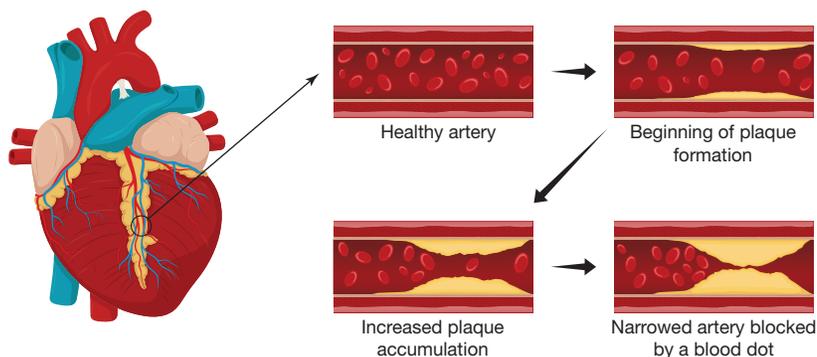
Once this occurs, individuals will begin to experience the following symptoms:

- shortness of breath and fatigue due to insufficient supply of oxygenated blood
- **angina**, which is a medical term used to describe the chest pain that occurs when the heart has an insufficient supply of oxygenated blood
- blood clots due to plaque rapturing in the wall of the artery and causing platelets to form clots at the site of the rupture. This forms blockages in the artery or, if the clot enters the bloodstream, it can cause further serious health issues.

angina chest pain that occurs when the heart has an insufficient supply of oxygenated blood

When performing exercise, the heart requires an increased supply of oxygenated blood. The presence of atherosclerosis in the arteries reduces the much-needed supply of blood, depriving the working muscles of the oxygen they require and hindering the functioning of the heart and hence performance in aerobic activities. Exercise is one of the main protective factors that reduces the risk of a person developing atherosclerosis and subsequent vascular disease.

FIGURE 7.47 Stages of atherosclerosis and the impact on the structure of an artery

Healthy artery

Beginning of plaque formation

Increased plaque accumulation

Narrowed artery blocked by a blood dot

DEPTH STUDY IDEA

Research and collect data on the benefits of altitude training in the real environment as well as a simulated environment to analyse the pros and cons of each.

7.8 Exercises

learn on

7.8 Quick quiz **on**	7.8 Exercise

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Revise your knowledge

1. What is haemoglobin?
2. Outline the importance of haemoglobin during physical activity.
3. Define 'altitude'.
4. What is vascular disease?

Apply your knowledge

5. Explain why low levels of haemoglobin can negatively impact the efficiency of the cardiovascular system.
6. How can altitude be both beneficial and detrimental to athletic performance?
7. Describe the impact that atherosclerosis has on the structure and function of the cardiovascular system.
8. Research and provide an overview of another factor that has either a positive or negative impact on the efficiency of the cardiovascular system.

7.9 Interrelationship, structure and function of the digestive and endocrine systems

When we move, our muscles require energy in order to function efficiently and meet the increased demands that are being placed upon them. Both the digestive and endocrine systems work together to break down the food and fluids we consume into nutrients that can be absorbed into our bloodstream and transported around the body. These nutrients serve to fuel us with energy and assist with the growth and repair of our muscle tissues. The digestive system consists of the **digestive tract** (also known as the gastrointestinal tract) and the accessory organs. (These are not part of the digestive tract but help with digestion.) Their main function is to break down the food we eat into substances that can be transported around the body. The endocrine system is made up of glands that secrete hormones. These hormones control the functions of the digestive system and are released to aid in the process of converting food into energy. It is through the coordination of these two systems that our body receives adequate nutrition both when at rest and during exercise, along with aiding in recovery through the growth and repair of cells.

FIGURE 7.48 The digestive system breaks down food into substances that can be transported around the body.

7.9.1 Digestive system

The digestive system has an important role in contributing to movement. Through the process of digestion, the body extracts key nutrients from the food that we eat. Nutrients are needed by the body for growth, maintenance, repair, reproduction and of course for energy so that we can move. It is the digestive system that converts the food we put into our mouth into energy that our body and muscles require in order to move. When we exercise, our muscles require more energy in order to function effectively. The carbohydrates, fats and protein that have been eaten, digested and absorbed by the small intestine are then delivered to the working muscles as fuel in order to produce the energy that enables them to work.

The digestive system is made up of a series of hollow organs joined in a long, twisting tube from the mouth where food and fluid enter, through to the anus where waste is removed. When we eat something, the body must break it down into smaller molecules of nutrients that can enter the bloodstream and be used. The components of the digestive tract include the mouth, oesophagus, stomach, small intestine and large intestine, which includes the rectum and anus. The pancreas, liver and gallbladder are accessory organs that all help with the process of digestion.

digestive tract the organs that food and liquids travel through when they are swallowed, digested and absorbed, until they leave the body as faeces

FIGURE 7.49 Structures of the human digestive system

Salivary glands
Mouth
Oesophagus
Liver
Stomach
Gall bladder
Pancreas
Small intestine
Large intestine
Appendix
Rectum
Anus
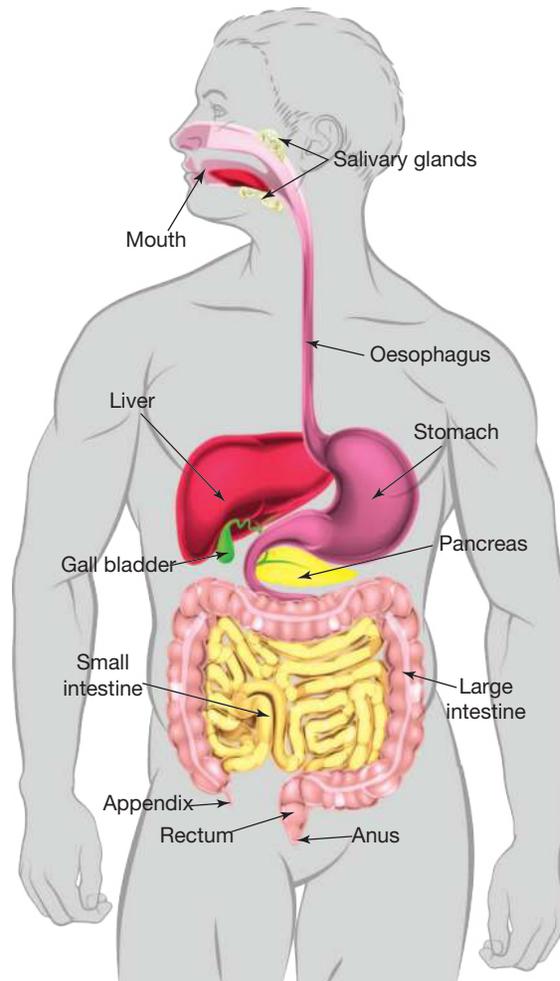
Mouth

The process of digestion begins in the mouth. As the food is broken up by the teeth, and the action of chewing, it is also moistened with saliva. Saliva contains enzymes which start breaking down some of the carbohydrates in our food before it enters our oesophagus.

FIGURE 7.50 The first stage of digestion begins in the mouth.

Oesophagus

When food or liquid is swallowed, it passes down the throat and into the oesophagus. Smooth muscles in the oesophagus involuntarily contract and relax, causing the food and liquid to pass through to the oesophagus and into the stomach.

Stomach

The stomach is a bag-like organ that can hold as much as two litres of food and fluid when fully expanded. When digesting food, the muscles of the upper part of the stomach relax in order to accept the large volumes of swallowed material. The food and liquid we consume is then churned in the stomach by smooth muscles and mixed with digestive juices in order to break it down and produce a mixture called chyme. The final role and function of the stomach during digestion is to empty the chyme into the small intestine.

FIGURE 7.51 The path of food after it has been swallowed

Digestion

1 Swallowed food passes down the oesophagus

2 Gastric acid helps digest food

3 Chyme enters the duodenum

Small intestine

The small intestine has a narrow diameter, but it is very long. If you laid a small intestine out straight, it would be approximately six to seven metres long. It serves a vital role in the process of digestion because this is where the nutrients from the chyme are absorbed into the bloodstream. The key nutrients that we need to be able to move, such as carbohydrates, fats, proteins, vitamins and minerals, enter the bloodstream here through the walls of the small intestine and are delivered to the rest of the body.

Large intestine

The large intestine is also known as the bowel or colon, and includes the rectum and anus. It has a wider diameter than the small intestine but is much shorter; the average adult's large intestine would be 1.5 metres long if laid out in a straight line. By the time the chyme reaches the large intestine, most of the nutrients have been absorbed into the bloodstream. The primary function of the large intestine is to absorb fluid and any remaining nutrients such as electrolytes before changing the leftover waste into stool. The rectum then stores stool until it is ready to push the stool out of the anus during a bowel movement.

FIGURE 7.52 The position of the large intestine in the human body

Accessory organs of digestion

Accessory digestive organs help with digestion but are not part of the digestive tract. Food does not pass into these organs; instead, they produce enzymes to assist in digestion. The accessory digestive organs are the salivary glands, pancreas, liver and gallbladder. It is through these accessory organs that we see the interrelationship of the digestive and endocrine systems. Hormones that form part of the endocrine system control the different digestive enzymes that are secreted from the organs and enable the process of digestion to occur. Without this close coordination between the two systems, digestion would not occur and we would not be able to extract energy from the food we eat and therefore could not fuel the working muscles during movement. Figure 7.53 outlines the various accessory organs and the role they play in digestion.
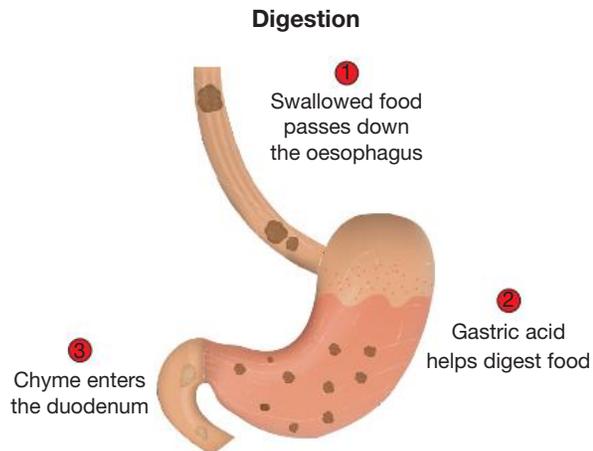
FIGURE 7.53 Accessory digestive organs and their role

Salivary glands

Saliva produced by the salivary glands in the mouth moistens food so that it moves more easily through the oesophagus into the stomach. Saliva also contains an enzyme called amylase that begins to break down the starches from food.

Liver

The liver produces a digestive juice called bile, which is used to digest fat and neutralise stomach acid.

Pancreas

The pancreas produces pancreatic juice, which is delivered to the small intestine via small tubes called ducts. This contains a mixture of digestive enzymes that break down carbohydrates, fats and proteins found in food.

Gall bladder

Bile produced by the liver is stored in the gall bladder until food reaches the small intestine. Bile is then released into the small intestine through the bile duct, where the bile acids dissolve fat into a watery content so that it can be digested by enzymes from the pancreas.

7.9.2 Endocrine system

The endocrine system is made up of glands that secrete hormones and, coupled with the nervous system, functions as the control system of the human body. Hormones are discrete chemical substances that are secreted by the endocrine glands in order to have a specific effect on the activities of cells, tissues and organs of the human body. The endocrine system coordinates the body's functions to maintain **homeostasis** (stability, balance or equilibrium within a cell or the body) during rest and exercise.

Some of the main functions of the endocrine system in the human body include:
- regulating the growth of many tissues such as bone and muscle
- regulating water balance in the body
- regulating iron in the blood
- regulating heart rate and blood pressure, helping prepare the body for physical activity
- regulating blood glucose
- regulating immune system
- reproduction.

FIGURE 7.54 The endocrine system helps to maintain homeostasis in the body.
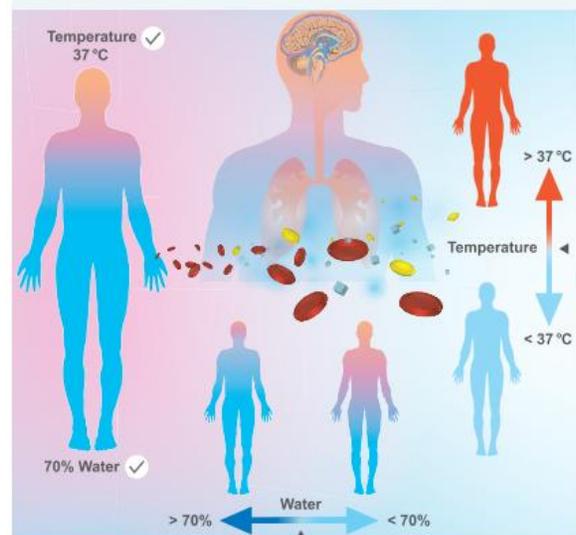
Temperature 37 °C

> 37 °C

Temperature

< 37 °C

70% Water

Water
> 70%   < 70%

homeostasis the tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes

The glands that make and release hormones are located in different areas throughout the body. Figure 7.55 indicates where each gland or organ of the endocrine system can be found. Glands are responsible for producing hormones that are then secreted into the bloodstream where they travel to arrive at the target tissue. All have different purposes for bodily functions, and some of those that are linked to movement efficiency are outlined in table 7.8.

FIGURE 7.55 Glands of the endocrine system

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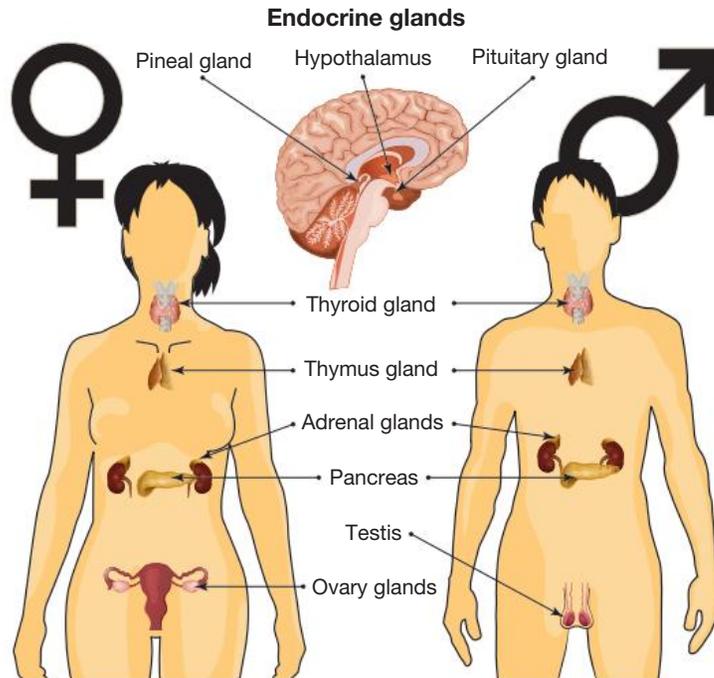
Endocrine glands

TABLE 7.8 Major glands and hormones that assist movement efficiency

Gland/Organ	Hormone released	Target tissue	Response
Hypothalamus	Wide range of releasing and inhibiting hormones	Pituitary gland	Links nervous system to endocrine system to control many internal conditions such as hunger and sleep patterns
Pituitary gland	Growth hormone	Bones and muscles	Stimulates muscle growth and controls the size of bones
	Endorphins	Throughout the body	Blocks pain
Adrenal glands	Adrenalin	Body cells	Increases body metabolism in 'fight-or-flight' response
	Cortisol	Body cells	Increases blood sugar levels, aids the metabolism of fats, carbohydrates and proteins, suppresses the immune system, has an anti-inflammatory action
Pancreas	Glucagon	Liver	Raises blood glucose levels

The endocrine system has a clear relationship with both the digestive system and movement efficiency. Hormones enable the process of digestion to be completed through controlling the enzymes required for this process. When glands secrete hormones into the bloodstream, they have a specific effect on the target tissue. This effect can take seconds or hours to occur and is characterised by increasing or decreasing cellular processes rather than by initiating new ones. For example, when we exercise, the hormone glucagon is released by the pancreas in order to increase blood glucose so that the muscles can receive the energy they require to function efficiently. Other key hormones that play an important role in movement are:

- adrenaline — helps to enhance cardiac function by increasing heart rate and blood pressure in order to deliver oxygen and nutrients to active tissues
- growth hormone — assists the growth and repair of muscle tissue and results in *muscle hypertrophy* (an increase in muscle mass)
- cortisol — increases blood glucose levels by aiding in the metabolism of carbohydrates, fats, and protein to provide quick bursts of energy
- endorphins — reduce pain and increase feelings of pleasure.

During movement, the endocrine system ensures that all hormones with a positive impact on performance are released in order to meet the greater demands placed upon body systems. The endocrine system also suppresses certain hormones that will not aid in performance; for example, insulin levels are suppressed during exercise because insulin inhibits glucose release from the liver and fatty acid and therefore would result in inadequate energy supply if not suppressed.

FIGURE 7.56 Exercise releases beneficial hormones into the bloodstream.

Digestion and the endocrine systems work hand in hand. Hormones released by the endocrine system control appetite, the digestion of food, the regulation of energy balance and the maintenance of blood glucose levels. Without hormones, the food we eat would not be digested and would remain in the same form as when it first entered the mouth, meaning the nutrients would not enter the bloodstream and be delivered around the body.

Hormones released by the various glands of the endocrine system enable digestion to occur and key nutrients to be available for bodily functions. For example, consider what happens when we eat a carbohydrate such as an apple a couple of hours before exercising. Our digestive system digests the apple with the help of hormones from the endocrine system, and glucose from the apple can then be utilised to form ATP and hence energy. It is the coordination of the two systems that allows the food we consume to fulfil essential roles in everyday functioning and survival.

FIGURE 7.57 The growth hormone enables muscle hypertrophy to occur.

7.9 ACTIVITY

Matching game

In pairs, create a matching game focusing on the digestive and endocrine systems. Create one set of cards showing components of the digestive and endocrine systems, such as the mouth, stomach and various hormones, and another set with corresponding descriptions. Players match components with descriptions, then share and play with other pairs.

7.9 Exercises

learn**on**

7.9 Quick quiz **on**	7.9 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3, 4, 5, 8	6, 7

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Revise your knowledge

1. Outline all the structures and organs that make up the digestive system.
2. Outline the main functions of the endocrine system.
3. What are hormones and why are they important?
4. Which part of the digestive system has the most important role in enabling movement to occur?

Apply your knowledge

5. Imagine you are about to eat an apple. Explain the path and process that the apple will take through your body in order to be used as energy by the muscles when moving.
6. Explain how the digestive system and endocrine system work together.
7. Describe how hormones contribute to movement efficiency.
8. Choose one gland or organ in the body that plays a role in movement efficiency, then answer the following questions.
   a. What hormone does the gland secrete?
   b. What is the role of the hormone?
   c. How does this hormone improve movement efficiency in a sport or physical activity of your choice?

7.10 Factors that impact the efficiency of the digestive and endocrine systems

Macro- and micronutrients along with stress have an impact on the efficiency of the digestive and endocrine systems. Nutrients that are required for movement fall into two categories:

- **macronutrients**, which include carbohydrates, fats and proteins. These provide the body with the main nutrients required for energy, and are often consumed in large quantities.
- **micronutrients**, which include vitamins and minerals. These are needed by the body for growth and development, and are often consumed in small quantities.

The presence of both macro- and micronutrients in the correct quantities within the human body enables both the digestive and endocrine systems to work efficiently and allows us to move and recover adequately during and after physical activity.

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body; these include carbohydrates, fats, and proteins

micronutrients one of the major groups of nutrients needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance, among other functions; also known as vitamins

7.10.1 Macronutrients

Carbohydrates

Carbohydrates are the body's main and preferred source of fuel and energy. One gram of carbohydrate consumed provides four calories of energy. There are two major types of carbohydrates:

- *Simple carbohydrates.* These are small carbohydrate molecules such as those found in some fruits, dairy products, sugar, honey, lollies, soft drinks, biscuits, cakes and other high-sugar foods
- *Complex carbohydrates.* These are long chains of simple carbohydrates linked together and are found in foods such as breads, cereals, pasta, rice, grains, legumes and starchy vegetables such as potato and sweet potato.

FIGURE 7.58 Examples of simple carbohydrates

FIGURE 7.59 Examples of complex carbohydrates

When we consume carbohydrates, the digestive and endocrine systems processes them so that they can be absorbed from the small intestine into the bloodstream in the form of **glucose**. Cells then remove glucose from the blood and use it as an energy source for the production of **adenosine triphosphate** (ATP). If a person consumes more carbohydrates than the cells need, the excess is stored in the muscles and liver in the form of glycogen. If we eat less, or are more active, our body will draw on these glycogen reserves in order to produce ATP. Carbohydrates therefore have a vital role in supporting healthy functioning of the human body because they:

- provide energy for immediate use
- provide stored energy
- help preserve muscle mass
- promote digestive health and assist with hormone balance.

glucose broken down from stored glycogen and transported in the blood to provide energy for working muscles during training

adenosine triphosphate (ATP) a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction

Fats

Fats are consumed in the food we eat, but once they enter the body we refer to these fats as *lipids*. Fats are an essential part of our diet and are important for good health and functioning. There are different types of fats found in foods and some are healthier than others. Fats provide more energy than carbohydrates. One gram of fat consumed provides nine calories of energy. Fats are often grouped into four categories:

FIGURE 7.60 Examples of foods that contain fats

- *Saturated fats.* These fats are linked to increased inflammation in the body and increase the risk of heart disease and high cholesterol when eaten in large amounts. They are found in red meat, dairy products such as cream, butter, cheese and full-fat milk, palm oil and coconut oil.
- *Monounsaturated fats.* These are often referred to as 'good fats' because they help protect the heart and support insulin sensitivity, fat storage, weight loss, and healthy energy levels. They are found in canola oil, olive oil, peanut oil, avocados and some nuts and seeds such as almonds.
- *Polyunsaturated fats.* These are also known as 'good fats', and include omega-3 and omega-6 fatty acids. Omega-3 reduces inflammation and supports healthy hormone levels and cell membranes. Omega-6 fatty acids help support healthy brain and muscle functions, but can also promote inflammation, which can have a negative impact. These fats are found in foods such as salmon.
- *Trans fats.* These are unsaturated fats that have been processed and, as a result, behave like saturated fats. Trans fats are found in many packaged foods such as potato chips, deep-fried foods, baked goods and some margarines. They cause the body to increase levels of cholesterol, which is a risk factor for heart disease.

When at rest or during light to moderate physical activity, the body uses fat as the predominant fuel source for producing ATP. Like carbohydrates, fats circulate in the blood and can also be stored in the body. Although fats contain a large quantity of available energy, they provide this energy at a much slower rate than carbohydrates. This is why carbohydrates are the preferred fuel source for energy production.

Proteins

Proteins are more complex and larger than either carbohydrate or fat molecules. They are often referred to as the body's building blocks, because they are found in every cell and are required to build and repair tissue. We need protein to make muscles, tendons, organs and skin. Protein can be found in foods such as meat, poultry, fish, eggs, dairy products, legumes and beans, nuts and seeds, soy products and some grain- and cereal-based foods such as quinoa. Like carbohydrates, one gram of protein provides four calories of energy. When we exercise, proteins are not often used to produce energy unless it is an extreme circumstance; for example, when competing in an ultra-endurance event such as a triathlon, if other energy sources such as carbohydrates and fats have become depleted then the body will have to resort to using its own muscle to produce ATP. The main role that protein plays in body functioning is enabling the growth and repair of body tissue such as muscles.

FIGURE 7.61 Examples of foods that contain protein

7.10.2 Micronutrients

Micronutrients include vitamins and minerals. Although not directly used as energy, micronutrients are needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance among other things. Without the presence of micronutrients in the body, we would not be able to move efficiently because they serve a key role in energy production as well as growth and repair of the muscles. While vitamins and minerals are only needed in small amounts, the consequences of their absence are severe and can lead to nutrient deficiencies that can cause acute and chronic health problems.

FIGURE 7.62 Various vitamins found in different foods

Vitamins

Vitamins are essential organic nutrients, most of which are not made in the body or are made only in insufficient amounts and therefore need to be obtained through the food we eat. Some vitamins, such as vitamin C and the B-complex vitamins, cannot be stored by the body and therefore must form a regular part of our dietary intake. The role of key vitamins and the foods they can be found in are outlined in table 7.9.

TABLE 7.9 Major vitamins found in food and their role

Vitamin	Function	Food source
A	• Supports the immune system, eyesight, moist skin	• Orange, yellow and green fruits and vegetables • Egg yolks • Full-cream dairy products • Oily fish
B1 (thiamine)	• Promotes growth • Important for the heart, digestive and nervous systems • Helps release energy from carbohydrates	• Wholemeal flour and cereals • Yeast extracts (e.g. Vegemite) • Seeds and nuts • Wheat germ and wheat bran • Fortified bread and breakfast cereals • Lean pork
B2 (riboflavin)	• Promotes growth and the repair of tissues	• Dairy products • Green vegetables • Egg whites • Almonds • Mushrooms • Wholemeal flour and cereals
B3 (niacin)	• Promotes growth • Helps release energy from food • Supports the nervous and digestive systems	• Lean meat • Peanuts • Eggs • Vegetables • Milk • Fortified cereals
B6	• Good for brain function and the immune system • Helps make red blood cells • Supports the nervous and digestive systems	• Fish • Lean meat • Soybeans • Nuts • Green, leafy vegetables
B12	• Along with folate, works to produce new blood cells, nerve cells and DNA	• Found in animal products (e.g. lean meat, chicken, fish, seafood, eggs and milk) • Fortified soy products • Fortified cereals • Fortified breads
Folate (folic acid)	• Supports the nervous system • Helps make red blood cells and DNA • Prevents neural tube defects in pregnancy	• Peas • Nuts • Avocado • Green, leafy vegetables • Whole grains
C	• Promotes healthy skin, bones and cartilage • Helps body absorb iron • Helps wound healing and infection resistance	• Fruit and vegetables
D	• Along with calcium, helps keep bones and teeth strong	• Eggs • Fortified margarine
E	• Acts as an antioxidant	• Fruit and vegetables • Eggs • Whole grains • Nuts and seeds

Minerals

Minerals are inorganic nutrients that play a vital role in proper bodily function and wellbeing. They include calcium, magnesium, potassium and sodium along with smaller trace elements such as copper, iodine, iron, manganese, selenium and zinc. Like vitamins, minerals are only found in small quantities in the body and need to be consumed through a wide variety of foods in the diet. Table 7.10 outlines the role that some key minerals play in supporting healthy functioning of the body.

TABLE 7.10 Key minerals and their role in the body

Mineral	Role in the body
Calcium	• Builds strong bones and teeth • Important for nerve function and muscle contraction • Helps with blood clotting
Fluoride	• Supports healthy bones and teeth • Helps prevent cavities in teeth and osteoporosis
Potassium	• Controls nerve impulses and muscle contractions • Helps with fluid balance
Sodium	• Helps with fluid balance • Helps absorb other nutrients • Important for nerve impulse transmission
Magnesium and phosphorous	• Supports healthy bones and teeth • Helps with release of energy from food • Essential for nerve and muscle function
Iron	• Helps red blood cells move oxygen around the body
Zinc	• Promotes immunity and wound healing • Helps build strong bones
Copper	• Helps nervous system function • Helps in formation of red blood cells
Iodine	• Important for thyroid functioning • Helps brain function and growth

FIGURE 7.63 Various minerals found in different foods

7.10.3 Stress

Stress can have both a positive and negative impact on the body. Short-term stress, such as that which occurs during the fight-or-flight response, causes more adrenaline to be released into the bloodstream in order to fight or flee from a potential threat. The increased adrenaline results in increased breathing rate, heart rate and blood pressure and increased conversion of glycogen into glucose, all so that the muscles are provided with more oxygen and energy in order to respond efficiently to the situation. A very similar response occurs when we initiate exercise as the hormones kick in to meet the body's demands, all of which have a positive impact on functioning.

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FIGURE 7.64 The body's immediate responses to stress
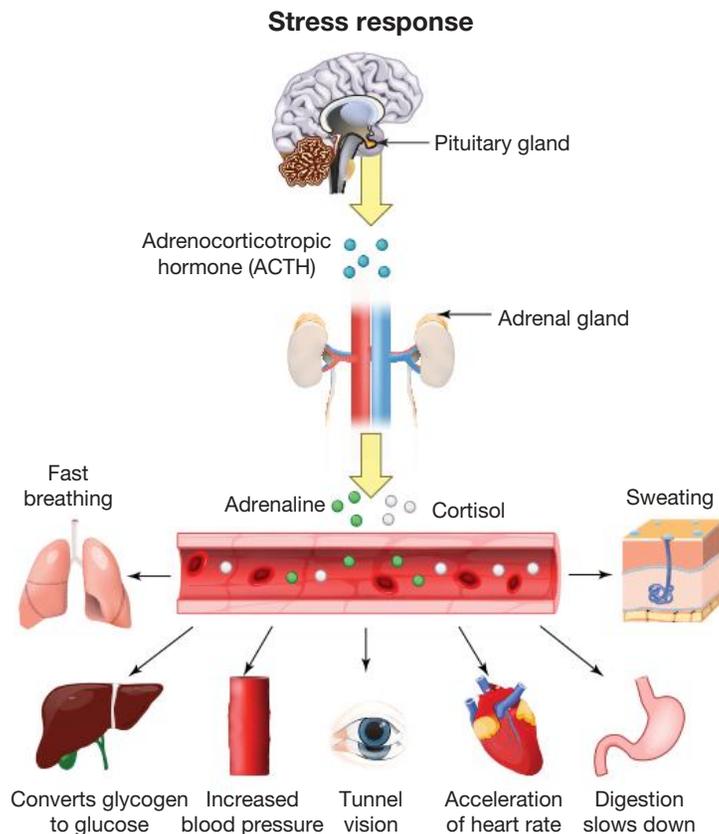
Another hormone that responds to stress is cortisol. Small increases of cortisol have a positive impact on body systems and can improve performance in physical activity, but prolonged elevated levels have negative effects. This is why cortisol is known as the *stress hormone*. In small amounts, cortisol (like adrenaline) provides quick energy and lowers pain sensitivity via anti-inflammatory action. Intense exercise or stress — including financial, relationship, study or work — result in increased levels of cortisol being released. Elevated cortisol levels over a prolonged period of time have a negative impact on the function of the endocrine system and therefore the functioning of all the other body systems. Prolonged elevated cortisol levels resulting from long-term stress can result in the following:

- hypertension — caused by elevated blood pressure and strain on the heart, which can lead to heart disease
- inhibited immune system functioning — resulting in an increased likelihood of illness and disease

- imbalances in blood glucose levels — starving the other cells throughout the body of the glucose they require for normal functioning because the glucose instead remains in the blood so it is readily available for the muscles
- weight gain — particularly around the abdomen, because the excess glucose in the blood is converted to fat and stored around the organs (also known as visceral fat). In addition, elevated cortisol sends false signals to the brain, making us feel that we are hungry and need to eat in order to produce more glucose for the muscles. Because this glucose is not actually being used, it gets stored as fat and this causes weight gain to occur.

FIGURE 7.65 Long-term stress can have a negative impact on the body.

Many people are exposed to stressors in their life, resulting in prolonged elevated cortisol that leads to poor health. Engaging in stress-releasing activities will help lower levels of cortisol. Exercise has been scientifically proven to be one of the most effective ways to do this because:
- it enables the glucose circulating through the bloodstream to be used effectively during movement
- it increases the production of endorphins that make the person feel good
- it allows the other body systems to function efficiently.

FIGURE 7.66 Exercise releases endorphins and reduces stress.
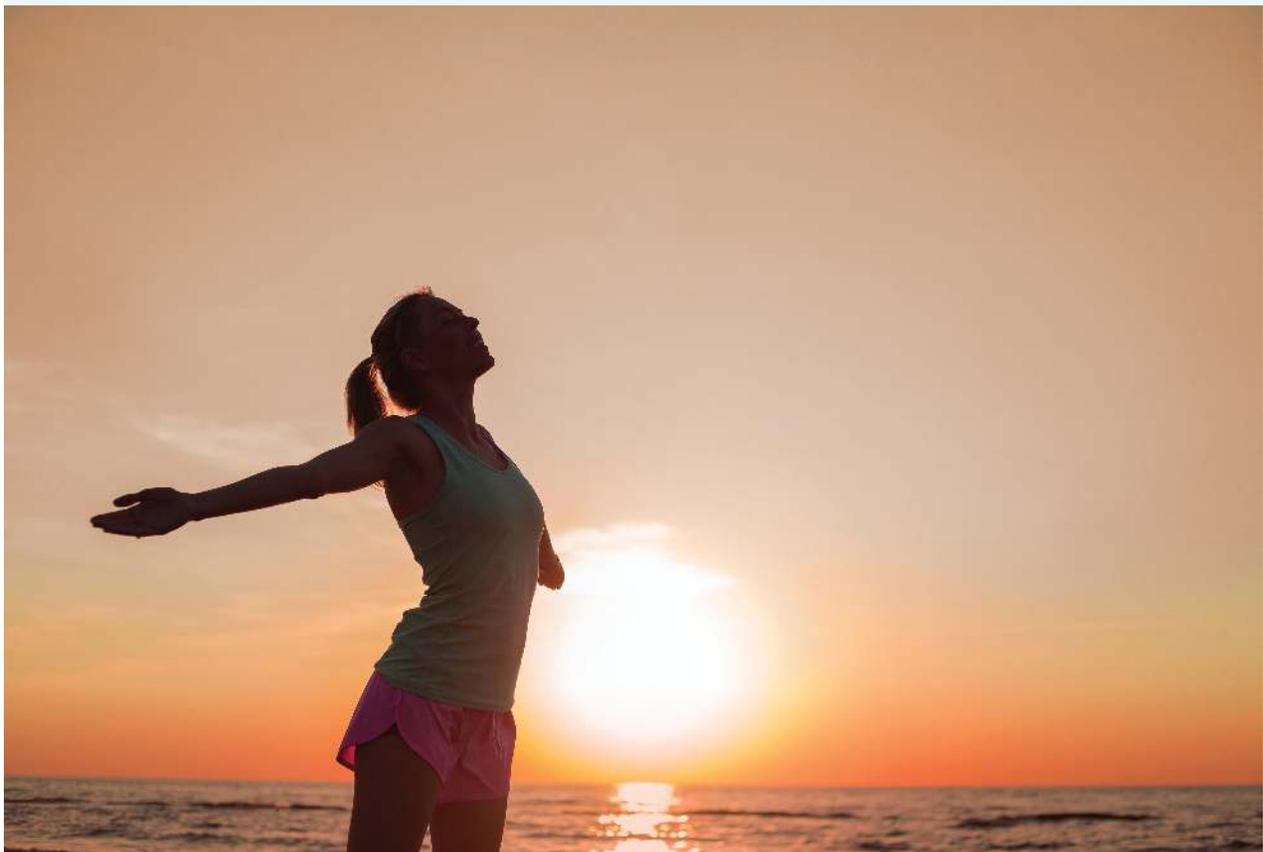
DEPTH STUDY IDEAS

1. Analyse the literature on how DNA testing and nutrigenomics can affect the efficiency of the digestive and endocrine system.
2. Research the various conditions that affect health in relation to hormone imbalances, such as diabetes, cancer and growth disorders.

7.10 ACTIVITY

Your daily dietary intake

1. Record your dietary intake for one day using an app or website such as MyFitnessPal. Ensure you record all the things you eat as well as drink. Which foods and fluids did you consume that contained:
   a. carbohydrates
   b. fats
   c. proteins
   d. vitamins
   e. minerals
2. Overall, did the foods and fluids you consumed provide your body with enough energy? Why or why not?

7.10 Exercises

learn on

7.10 Quick quiz on	7.10 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3	4, 5, 6	7, 8

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Revise your knowledge

1. Outline the difference between macronutrients and micronutrients.
2. What is glucose and why is it important for movement?
3. Outline what the 'fight-or-flight response' is.
4. Explain the impact that long-term stress can have on the body.

Apply your knowledge

5. Explain why carbohydrates are the preferred energy source to fuel the body.
6. Why are micronutrients vital for overall health and wellbeing?
7. When we start physical activity, our body responds in a similar way to when we face short-term stress. Discuss why this might have a positive impact on athletic performance.
8. Analyse why the interrelationship between the digestive and endocrine systems is important for survival.

7.11 Interrelationship, structure and function of the nervous system

The nervous system includes the brain, spinal cord and nerves. It is the control system of a human and integral in controlling every function that occurs within the body. It is also by far the most complex body system both structurally and functionally. Its main roles are to:

- control voluntary and involuntary movement. Skeletal muscles contract when stimulated by the nervous system, such as the biceps contracting to enable us to lift a weight. The nervous system also participates in controlling involuntary movements such as those performed by the cardiac muscle and smooth muscles.
- maintain homeostasis. The nervous system detects, interprets and responds to changes in internal and external conditions in order to maintain a constant internal environment; for example, maintaining our body temperature during physical activity ensuring that we do not overheat.
- support memory and learning. The brain is the centre for mental activity, so the nervous system allows us to learn and remember new things such as how to perform new movement skills in sport.
- monitor sensory input and control response. Sensory receptors monitor and respond to internal and external stimuli that may be interpreted through touch, taste, smell, sound, blood pressure, temperature and body position; for example, hearing the start gun go off in a running race and responding by pushing off the blocks.

The nervous system can be divided into two main parts: the central nervous system (CNS) and the peripheral nervous system (PNS). In order to complete all bodily functions and move efficiently, these two parts closely coordinate to detect, process and respond to internal and external stimuli.

FIGURE 7.67 The nervous system is made up of the brain, spinal cord and nerves
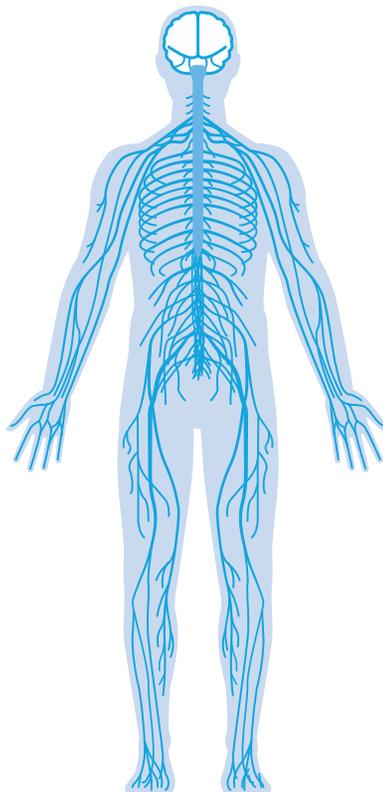
7.11.1 Nerves

The nerve cells or *neurons* are the basic components of the nervous system responsible for receiving and sending messages throughout the entire body. Neurons are connected in bundles called nerves. Neurons connect and receive information from other neurons and in some cases also from sensory receptors. They allow voluntary movements during physical activity to occur because the neurons are connected directly to the muscles and cause them to contract; neurons sending the messages required therefore enable the skeletal and muscular systems to function efficiently to produce the required movements.

There are three main types of neurons with specialised roles, but they work together in order to process and transmit messages as well as produce movement. These are explained in table 7.11.

FIGURE 7.68 Structure of a neuron
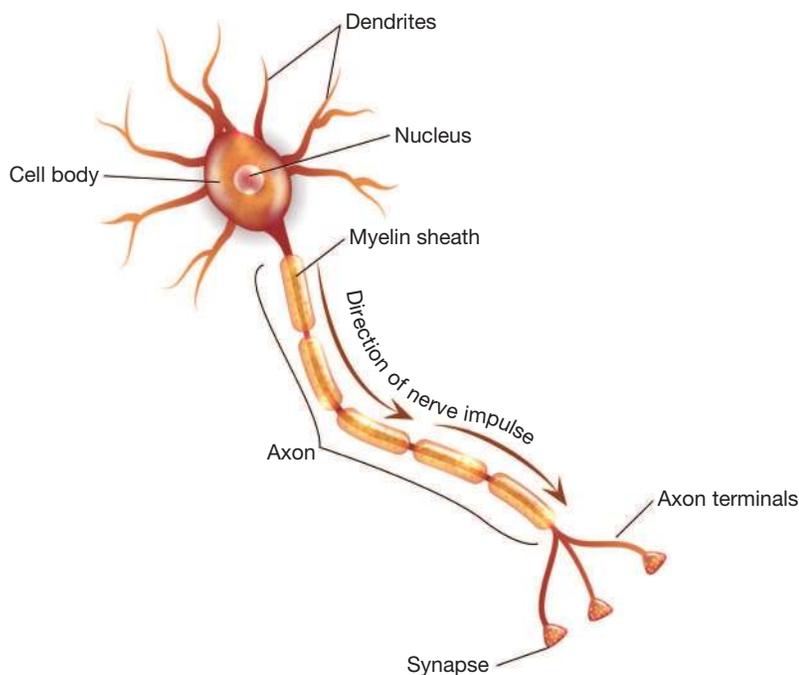
TABLE 7.11 Main types of neurons

Name	Location	Function
Sensory neuron	Peripheral nervous system	Connected to sensory organs, they detect stimuli and transmit messages to the central nervous system
Interneuron	Central nervous system	Receive messages from the sensory neurons, process this information and send a response to the motor neurons
Motor neuron	Peripheral nervous system	Receive messages from the central nervous system and connect with effectors to carry out the response

7.11.2 Central nervous system

The central nervous system (CNS) includes the brain and spinal cord and is responsible for processing the information received from the peripheral nervous system. Both the brain and spinal cord play a vital role in all aspects of movement. They are carefully protected by bone, particularly the skull and vertebrae, as well as layers of connective tissue because even a minor injury to either of them can have devastating effects on the ability to function.

The brain

The brain is our most complex organ. Even the most intricate computer does not rival the complexity of the human brain. At any moment, millions of messages are flashing through the brain. These include internal information such as regulating heart rate, blood pressure, respiration rate, temperature, blood chemistry, digestion and much more, as well as receiving and responding to hundreds of messages from the external environment such as hearing a whistle to start a game, seeing and responding to a ball being passed, smelling the freshly cut grass of the field, and feeling the ball between your hands.

The brain is a soft, wrinkled mass of tissue that weighs 1.3–1.4 kg and is made up of billions of neurons. It is divided into different parts, each of which has a specific function, but they operate simultaneously to allow efficient functioning and movement to occur. Figure 7.69 depicts the structure and function of the different parts of the human brain.

FIGURE 7.69 Brain lobes and their function

int-9282

Touch perception
Movement control
Manipulation of objects

Visual reception
Local orientation
Shape perception

Coordination
Balance
Reflex motor acts

Parietal lobe

Frontal lobe

Occipital lobe

Cerebellum

Temporal lobe

Brain stem

Voluntary movement
Planning
Intellect
Problem solving
Abstract reasoning

Long-term memory
Speech comprehension
Objects perception
Problem solving
Face recognition
Hearing

Conduction
Tract for pain,
temperature and
pressure sensations

Brain lobes

The spinal cord

The spinal cord is an integrated structure that links the peripheral nervous system to the brain. It is a compact structure that contains neurons, and its diameter is about the size of a little finger. It starts at the base of the skull and extends down to the region of the first lumbar vertebra then branches out into 31 pairs of spinal nerves (see figure 7.70).

The spinal cord has two main functions:
- It controls many reflex activities of the body.
- It transmits information back and forth from peripheral nerves to the brain via its ascending and descending tracts.

The spinal cord plays a vital role for movements or reflexes that require speed. Reflexes are initiated at the spinal cord rather than the brain. The time it would take to send a message to the brain and back again is too long, so instead the message is quickly transmitted to the spinal cord and a reflex initiated. The spinal cord therefore plays a major role in allowing all movement due to its ability to rapidly allow us to process messages and respond appropriately; for example, seeing a ball traveling towards you and lifting your hands up to catch it.

FIGURE 7.70
Spinal cord and
spinal nerves
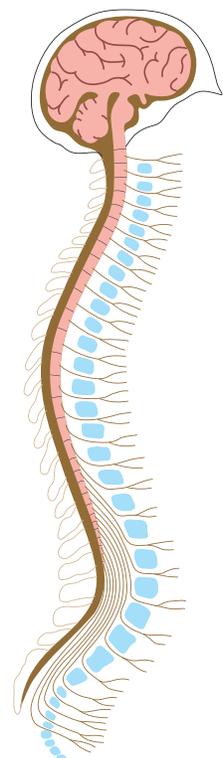
7.11.3 Peripheral nervous system

The peripheral nervous system (PNS) comprises all the sensory receptors, the nerves that link receptors with the CNS and the nerves that link the CNS with the effectors (a structure that responds to a stimulus, such as a muscle or gland). It is responsible for detecting stimuli and initiating a response that comes from the central nervous system. For example, in boxing the eyes detect the opponent's punch coming towards their face and send a message to the CNS, which responds by sending messages to the muscles and joints to move so that the person can move their head and avoid a connection of the punch with their head.

The PNS is responsible for controlling voluntary skeletal muscle movements such as those required to run, walk and jump. These actions occur as a response to our conscious control and allow movements to occur via the skeletal muscle contractions. The PNS also controls all involuntary movements such as those required to keep the heart beating, and to maintain digestion and respiration; all of which are essential for efficient movement to occur.

The nervous system is essentially the system that allows all other body systems to function efficiently. It is responsible for stimulating every tissue and organ in the body, whether it be a voluntary or involuntary reaction. Movement would not occur if it was not for the nervous system. We know that muscles contract to allow us to move, but it is the nervous system that is responsible for sending the message to muscles via neurons. The nervous system helps maintain the body's internal environment, which is particularly important for **thermoregulation** (the body's ability to maintain a core temperature). When exercising, the body produces heat as a by-product of the chemical reactions that are occurring to allow for movement. The nervous system sends messages to the blood vessels to dilate (expand) in order to increase blood flow to the skin, generating sweat to help disperse the heat and cool the person down. Without this response the person could suffer hyperthermia, which can be life threatening.

> **thermoregulation** the maintenance of a stable internal temperature independent of the temperature of the environment

The nervous system enables respiration and blood circulation not only when we are exercising but also when we are sleeping. Without this involuntary action occurring, we would not get the blood and oxygen we need delivered around the body and our muscles and organs would die. The nervous system is also responsible for memory. When we learn new movement skills such as how to do a layup in basketball or how to ride a bike, the nervous system stores the information about how to complete the movement or movement sequence in the brain so that we can draw on those memories in the future to replicate the movement. It is the coordinated action of the nervous and endocrine systems that allows digestion to occur so that our body can have the fuel to perform movement tasks such as running a marathon or completing a triathlon.

FIGURE 7.71 The nervous system allows movement to occur efficiently.

The importance of the nervous system becomes apparent when there is damage to it. For example, when someone suffers a spinal cord injury, messages to and from the brain and the body cannot occur properly because the path has been damaged. In severe cases, the spinal cord can be severed and all body parts below the injured area of the spine become 'cut off' from the brain. Messages travelling from the central and peripheral nervous systems cannot pass beyond that injured point. This means the person cannot control any of their muscles and cannot move any body part beyond that point of injury, and the body cannot send any sensory messages, including pain, back to the brain from beyond that injured point.

DEPTH STUDY IDEA

Conduct a literature review that explores the question 'Can you strengthen your central and peripheral nervous systems to perform better in physical activity?'

7.11 ACTIVITY

Function of the brain lobes

Working in pairs, use a sport or physical activity of your choice to explain how the different lobes of the brain allow movement and performance to be successful. Use specific examples to demonstrate your understanding of the function of each of the brain lobes and their contribution in your sport or physical activity. Present your information on a poster and share with the class.

7.11 Exercises

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7.11 Quick quiz on	**7.11 Exercise**

Select your pathway

■ **LEVEL 1**	■ **LEVEL 2**	■ **LEVEL 3**
1, 2, 3	4, 5	6, 7

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Revise your knowledge

1. Outline three main functions of the nervous system.
2. Outline the structures that form the CNS and those that form the PNS.
3. Identify the names and roles of the three different types of neurons.
4. Discuss why a serious injury that damages the spinal cord results in a person not being able to move body parts beyond the injured area.

Apply your knowledge

5. Explain the role of the brain in enabling movement to occur.
6. Thermoregulation is particularly important when exercising. Research what would happen if an athlete was not able to regulate their temperature in cool or hot environments.
7. Create a flow chart that outlines the process taking place when a nerve receives and then sends a message to a part of the body.

7.12 How the systems of the body interrelate to produce movement

The interrelation of the body's systems is crucial for producing movement as it allows for efficient coordination, energy delivery and control during physical activities. The following figures provide an analysis of how the systems of the body work together in a variety of movements.

FIGURE 7.72 How the systems of the body interrelate when completing a marathon run

Nervous system
- The nervous system controls muscle contractions, balance and coordination.
- The brain receives sensory feedback from muscles and joints, adjusting stride and pace as needed to optimise efficiency and reduce the risk of injury.

Skeletal system
- The skeletal system provides structural support and stability during running. Muscles pull on the bones to allow the running action.
- Synovial joints, such as the hip, knee and ankle, enable joint actions such as flexion and extension and the necessary range of motion for the running stride.

Endocrine system
- The endocrine system releases hormones such as adrenaline, which increase heart rate, dilate airways and provide an energy boost during the race.
- Cortisol levels rise to regulate metabolism and manage stress during prolonged exercise.

Marathon running

Muscular system
- The muscles, particularly in the legs (quadriceps, hamstrings, gastrocnemius, tibialis anterior, abductors and adductors), are heavily engaged. Isotonic contractions occur in these muscles in a coordinated manner to maintain a steady gait and propel the runner forward.
- Other major muscles such as the gluteus maximus, rectus abdominis and erector spinae serve as stabilising muscles during the run.

Digestive system
- The digestive system provides energy by breaking down carbohydrates, fats and proteins from food.
- Runners need to maintain proper nutrition and hydration before and during a marathon to sustain energy levels and prevent dehydration.

Respiratory system
- The respiratory system supplies oxygen to the muscles and removes carbon dioxide, crucial for energy production.
- During a marathon, the rate and depth of breathing increase to meet the elevated oxygen demand.

Circulatory system
- The heart pumps oxygenated blood via the arteries to the muscles and organs, and it also carries away waste products such as carbon dioxide and lactic acid via the veins.
- Blood vessels dilate to deliver more blood to working muscles, and the cardiac output increases to meet the heightened demand.

FIGURE 7.73 How the systems of the body interrelate when weightlifting

Nervous system
- The nervous system controls voluntary muscle contractions and coordination during weightlifting.
- It also plays a crucial role in maintaining balance and posture during complex lifts.

Endocrine system
- The endocrine system releases hormones such as adrenaline and cortisol in response to the physical stress of weightlifting.
- These hormones increase heart rate, mobilise energy stores and enhance focus and alertness.

Skeletal system
- The skeletal system provides the framework for muscle attachment and movement.
- Synovial joints, including those found in the elbow, knee, hip and shoulder, allow for controlled movements during lifts.

Weightlifting

Digestive system
- The digestive system provides the necessary energy for weightlifting through the breakdown of carbohydrates, fats and proteins from food.
- Proper nutrition is essential for muscle recovery, such as protein for muscle repair.

Muscular system
- The primary focus of weightlifting is on the muscular system. Weightlifting utilises most major muscles in the legs, core and arms. They contract to lift and control the weights.
- Muscles work in pairs, with some (agonists) contracting to generate force, while others (antagonists) relax to allow the weightlifting movement.

Circulatory system
- The circulatory system plays a crucial role in delivering oxygen and nutrients to the working muscles.
- Stroke volume might rise briefly during heavy lifting to meet the increased demand for blood flow to the muscles.

Respiratory system
- Proper breathing is essential for maintaining stability and exerting force. Weightlifters typically use a specific breathing technique to brace their core and stabilise their spine.
- The respiratory rate may increase as demand for oxygen rises during intense lifting.

FIGURE 7.74 How the systems of the body interrelate when taking a penalty shot in soccer

Nervous system
- The nervous system plays a central role in coordinating the kick. The player's brain calculates the angle, power and placement of the shot, taking into account the goalkeeper's position.
- Motor neurons send signals to the leg muscles to execute the kick accurately.

Endocrine system
- The endocrine system releases hormones such as adrenaline in response to the high-stress situation of taking a penalty shot.
- Adrenaline increases heart rate, enhances focus and provides a burst of energy prior to the kick.

Skeletal system
- The skeletal system provides the structural framework for the body, and synovial joints such as the hip, knee and ankle are essential for executing the shot.
- Proper alignment and coordination of these joints are crucial for accuracy and power.

Taking a penalty shot in soccer

Digestive system
- The digestive system provides the necessary energy for the kick through the breakdown of carbohydrates and fats from food.
- Proper nutrition and hydration leading up to the game are critical for maintaining energy levels.

Muscular system
- The kicking leg's muscles, particularly the quadriceps, hamstrings and calf muscles, play a crucial role in generating the force required for the shot through isotonic contractions.
- The muscles in the non-kicking leg provide balance and stability during the kick.

Circulatory system
- The circulatory system delivers oxygenated blood to the muscles engaged in the kick.
- The heart rate might increase as the player anticipates and prepares for the shot, ensuring efficient oxygen delivery.

Respiratory system
- The respiratory system ensures an adequate supply of oxygen to the muscles involved in the kick.
- Before taking the shot, the player may take a deep breath to maximise oxygen uptake for the effort.

FIGURE 7.75 How the systems of the body interrelate when participating in archery

Nervous system
- The nervous system is central to the precision and control required in archery. The brain processes visual information, calculates distance and target location, and coordinates muscle movements.
- Fine motor skills and hand–eye coordination are crucial for aiming and releasing the arrow accurately.

Skeletal system
- The skeletal system provides the structural support necessary for maintaining proper posture and aiming.
- Synovial joints in the shoulders, elbows, wrists and fingers enable precise movements during the shot.

Endocrine system
- The endocrine system regulates hormones that influence focus and stress management.
- Cortisol and adrenaline levels may vary depending on the archer's level of anxiety or arousal during the shot.

Archery

Muscular system
- The muscular system is vital for drawing the bowstring and holding it steady while aiming.
- Muscles of the back (e.g. rhomboids, latissimus dorsi) and arm (e.g. biceps and triceps) are actively engaged in an isometric contraction when holding the bow and string steady prior to releasing the arrow.

Digestive system
- The digestive system provides energy for the shot through the breakdown of carbohydrates and fats from food.
- Maintaining stable blood sugar levels is essential for consistent performance.

Circulatory system
- The circulatory system ensures a steady supply of oxygenated blood to the muscles involved in the shot.
- Heart rate and blood pressure remain relatively low compared to more physically demanding activities, because muscles are engaged.

Respiratory system
- Proper control of breathing is crucial for stability and accuracy.
- Archers often employ a specific breathing pattern, inhaling and exhaling during specific phases of the shot to minimise movement.

7.12 ACTIVITIES

1. Investigating models of the body

Use the **3D models of the body** weblink in the Resources panel to navigate through 3D models of the body, zooming in on specific organs and systems to understand their structure and function during exercise.

2. How the body systems interrelate

1. Select one movement from a sport of your choice, such as pitching in baseball, shooting in basketball or kicking in AFL.
2. Design a flowchart that illustrates the involvement of the different body systems to allow for that movement to occur.

on Resources

Digital documents How the systems of the body interrelate when completing a marathon run (doc-41605)
How the systems of the body interrelate when weightlifting (doc-41606)
How the systems of the body interrelate when taking a penalty shot in soccer (doc-41607)
How the systems of the body interrelate when participating in archery (doc-41608)

Weblink 3D models of the body

7.12 Exercises

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3, 4, 5	6, 7

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Revise your knowledge

1. Outline the systems of the body that influence and respond to movement.
2. Outline the two gases that are used by both the respiratory and circulatory systems.
3. Describe why it is important that hormones from the endocrine system are released in order to aid in the digestion of food.

Apply your knowledge

4. Explain how the skeletal and muscular systems interrelate when doing a squat.
5. Explain how a person's nervous system contributes to the movement of a squat.
6. Which system of the body do you believe has the most important role in influencing movement? Provide examples to support your answer.
7. Using a sport or physical activity of your choice, explain how each system of the body — skeletal, muscular, respiratory, circulatory, digestive, endocrine and nervous — influences and responds to movement in that sport or activity. Draw on specific examples to show your understanding of the nervous system's interrelationship and its contribution to efficient movement.

7.13 Sample exam question response

Question

Compare the elbow and the shoulder joints. **(4 marks)**

Criteria	Marks
• Identifies similarities and differences of the elbow and shoulder joint in relation to the types of joint and joint actions. • Provides relevant examples	4
• Provides characteristics and features of the elbow and shoulder joint in relation to the types of joint and joint actions. • Provides examples	3
• Sketches in general terms the types of joint and/or joint actions of the elbow and/or shoulder joint	2
• Provides some relevant information about the elbow or shoulder joint	1

Sample response

eles-5018

Breaking down the question

Compare the elbow and the shoulder joints.

Identify the action word/s: Compare — show how things are similar or different

Syllabus terminology: types of joints and joint actions

Mark allocation: 4 marks — according to HSC past papers, questions worth 4 marks require answers addressing the action word and providing clear examples. Responses should be concise, using syllabus terminology.

Answering question using PEEL structure

P Identify the *Point* being raised/state topic sentence/what this paragraph is going to be about[1]

E *Expand/Elaborate* on the point and provide a strong link to what the question is asking[2]

E Apply *Examples*/that are relevant and specific[3]

L *Linking* sentence that relates back to the question[4]

Sample annotated response

The elbow and shoulder joints are similar[1] as they are both freely moveable and classified as synovial joints. The differences are shown [1] in the types of synovial joints and joint actions[2] as the hinge joint (elbow) allows movement in only one direction, flexion and extension, whereas the ball-and-socket (shoulder) joint allows a range of movements such as flexion, extension, abduction, adduction and rotation.[3] Therefore, the elbow and shoulder joints have similarities in that they are freely movable synovial joints, but differences because they each allow different ranges of movement.[4]

7.14 Review

7.14.1 Topic summary

7.2 Structure and function of the skeletal system including major bones, synovial joints and joint actions

- The body has 206 bones of varying shapes and sizes. They provide important functions such as protecting vital organs and enabling movement. Muscles surrounding these joints pull on bones, making many different types of movement possible.
- Joints are places where two or more bones meet. Some joints allow more movement than others. Synovial joints allow maximum movement.
- Two joint actions used in most sporting movements are flexion and extension. Flexion refers to decreasing the angle of a joint, and extension involves an increase in the angle within a joint.

7.3 Structure and function of the muscular system including major muscles and interrelationship with the skeletal system

- There are three different types of muscles: skeletal, smooth and cardiac. Skeletal muscles enable us to move. There are more than 600 skeletal muscles in the body.
- The most important muscles that enable us to move include the deltoid, biceps brachii, triceps, latissimus dorsi, trapezius, pectorals, erector spinae, gluteus maximus, hamstrings, quadriceps, gastrocnemius, soleus, tibialis anterior, rectus abdominis and external obliques.

7.4 Characteristics and functions of muscle fibres

- Each muscle is made up of thousands of muscle fibres that allow movement to occur.
- There are two main types of muscle fibres: slow-twitch and fast-twitch. Slow-twitch fibres are red and used for endurance-type activities. Fast-twitch fibres are white and used for power and explosive movements.

7.5 Types of muscle contractions, and muscle relationships

- The types of muscle contractions are concentric, eccentric and isometric. In a concentric contraction, the muscle shortens while under tension; in an eccentric contraction it lengthens while under tension; in an isometric contraction, there is no change in length despite the muscle being under tension.
- Muscles perform roles according to the movement required. They can act as agonists (prime movers), antagonists (the lengthening muscle on the opposing side), or stabilisers (muscles that fix a joint while other actions are occurring). During movements such as running, the roles are constantly being reversed.

7.6 Interrelationship, structure and function of the respiratory and circulatory systems

- The circulatory and respiratory (cardiorespiratory) systems work together to enable our body to move. The main function of the respiratory system is to deliver oxygen to the muscles and organs of the body and remove waste products.
- The major components of the respiratory system include the bronchi, bronchioles, lungs and alveoli.
- The role of circulation is to transport oxygen and nutrients to the body's cells, carry hormones to target sites and collect carbon dioxide and waste.
- The circulatory system consists of the blood, heart and blood vessels.
- Respiration enables the human body to take in oxygen from the atmosphere and deliver it to the muscles and body tissues while also removing carbon dioxide.

7.7 Blood circulation and the exchange of gases

- Pulmonary circulation refers to the circulation of blood from the heart to the lungs and back to the heart again. Systemic circulation is circulation from the heart to the body tissues and back to the heart.
- The alveoli are microscopic sacs in the lungs, surrounded by capillaries. It is here that oxygen is exchanged for carbon dioxide.
- During physical activity the demand for oxygen is higher than at rest, so the heart and lungs respond by increasing pulmonary circulation and systemic circulation along with gaseous exchange. Increased rates of breathing, combined with increased heart rate, deliver more oxygen to the body and increase the removal of wastes, which helps efficient movement.

7.8 Factors that impact the cardiovascular system

- Cardiovascular efficiency is the most important factor that determines overall aerobic fitness.
- Some factors benefit the cardiovascular system so that it can perform more efficiently, whereas others have a negative impact.
- Haemoglobin and training at altitude can have a positive impact on the cardiovascular system and therefore can be advantageous to athletic performance. Vascular disease has a negative impact on the cardiovascular system and can have a detrimental impact on athletic performance.

7.9 Interrelationship, structure and function of the digestive and endocrine systems

- The digestive system is made up of a series of hollow organs joined in a long, twisting tube from the mouth, where food and fluid enter, through to the anus, where waste is removed.
- The mouth, oesophagus, stomach, small intestine, large intestine, pancreas, liver and gallbladder all assist with the process of digestion.
- The endocrine system consists of glands and the hormones that are secreted from the glands.
- Hormones play a vital role in movement because they allow digestion to occur, enable muscle growth and repair, and allow the body to be physically ready to perform.

7.10 Factors that impact the digestive and endocrine systems

- Through the process of digestion, the body extracts key nutrients and micronutrients from the food we eat and uses them for growth, maintenance, repair, reproduction and energy.
- Stress can impact the body both positively and negatively. Short-term stress helps prepare the body for exercise or in threatening situations. Long-term stress is detrimental to the body's functioning and results in many health concerns.

7.11 Interrelationship, structure and function of the nervous system

- The nervous system is made up of the brain, spinal cord and nerves. It is the control system of the body and is integral to every function in the body.
- It consists of two main parts: the central nervous system (CNS) and the peripheral nervous system (PNS).

7.12 How the systems of the body interrelate to produce movement

- The body systems work together to produce all movements.
- The skeletal and muscular (musculoskeletal) systems work together to create motion, while the nervous system provides precise control.
- Simultaneously, the circulatory, respiratory, digestive and endocrine systems ensure oxygen supply, nutrient delivery and energy regulation, collectively optimising movement performance.

---

on Resources

Digital document Topic 7 summary (doc-35909)

7.14.2 Key terms

acclimatisation the process of becoming accustomed to a new environment

adenosine triphosphate (ATP) a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction

anaemia a medical term to describe a low red blood cell count

angina chest pain that occurs when the heart has an insufficient supply of oxygenated blood

arteries blood vessels that carry blood away from the heart

atherosclerosis the build-up of fatty and/or fibrous material on the interior walls of arteries

capillaries the smallest of all blood vessels; they function to exchange oxygen and nutrients for waste

cardiac muscle involuntary muscle responsible for keeping the heart beating

circulatory or **cardiovascular system** a network that distributes blood containing oxygen and nutrients and collects wastes; it comprises the heart, arteries, blood and veins

digestive tract the organs that food and liquids travel through when they are swallowed, digested and absorbed, until they leave the body as faeces

expiration air movement from the lungs to the atmosphere; breathing out

fast-twitch muscle fibres muscle fibres that contract quickly and are used during fast, explosive activities; referred to as 'white' as they contain less blood

freely movable or **synovial joint** a joint that allows maximum movement. Most joints in the body are synovial joints; for example, the hip joint.

glucose broken down from stored glycogen and transported in the blood to provide energy for working muscles during training

haemoglobin oxygen-carrying component of the blood

homeostasis the tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes

hormone chemical substance produced in the body that controls and regulates the activity of certain cells or organs

immovable or **fibrous joint** a joint in which no movement is possible. Examples include the bones of the cranium, which are fused in lines called sutures.

inspiration air movement from the atmosphere into the lungs; breathing in

iron deficiency a lack of iron in the body reducing haemoglobin production in the blood

isometric contraction occurs when muscle fibres are activated and develop force but muscle length does not change; that is, movement does not occur

isotonic concentric contraction the most common type of muscular contraction; the muscle shortens, causing movement at the joint

isotonic eccentric contraction occurs when the muscle lengthens while under tension; often happens with the assistance of gravity

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body; these include carbohydrates, fats, and proteins

micronutrients one of the major groups of nutrients needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance, among other functions; also known as vitamins

plasma a straw-coloured liquid component of blood, consisting mainly of water (about 90 per cent)

platelets fragments of cells found in blood and responsible for clotting

pulmonary circulation the flow of blood from the heart to the lungs and back to the heart

respiration the process by which the body takes in oxygen and removes carbon dioxide

slightly movable or **cartilaginous joint** a joint that permits limited movement. Examples exist in the vertebral column, where fibrous cartilage between discs allows a limited range of movement.

slow-twitch muscle fibres muscle fibres that contract slowly and are used during endurance activities; referred to as 'red' as they contain more blood

skeletal muscle voluntary muscles that produce movement

smooth muscle involuntary muscles found in the walls of internal organs

systemic circulation the flow of blood from the heart to body tissue and back to the heart

thermoregulation the maintenance of a stable internal temperature independent of the temperature of the environment

veins vessels that carry deoxygenated blood from body tissues back to the right atrium. Pulmonary veins from the lungs differ in that they carry oxygenated blood to the left atrium.

7.14 Exercises

learnon

7.14 Exam questions

Question 1 (1 mark)

When a person holds a plank position, what type of muscle contraction is occurring in the rectus abdominis? (HM-11-03)

A. Agonist
B. Antagonist
C. Concentric
D. Isometric

Question 2 (1 mark)

Which structure in a synovial joint is primarily responsible for providing stability within the joint? (HM-11-03)

A. Cartilage
B. Synovial fluid
C. Ligaments
D. Tendons

Question 3 (1 mark)

When air is breathed in, which structure does it pass through after the trachea? (HM-11-03)

A. Larynx
B. Alveoli
C. Lungs
D. Bronchus

Question 4 (1 mark)

Which part of the human body is responsible for receiving and sending messages throughout the entire body? (HM-11-03)

A. Nerves
B. Micronutrients
C. Muscles
D. Platelets

Question 5 (2 marks)

Using an example, **outline** the difference between the joint actions of flexion and extension. (HM-11-03)

Question 6 (3 marks)

Using exercises from weight-training programs as examples, **outline** the difference between concentric, eccentric and isometric contractions. (HM-11-06)

Question 7 (3 marks)

Describe the role that hormones play in the process of digestion. (HM-11-09)

Question 8 (4 marks)

Explain how the bones, joints and muscles in the arm allow movement to occur. Use an example to support your answer. (HM-11-03)

Question 9 (4 marks)

Compare and contrast slow-twitch and fast-twitch muscle fibres. (HM-11-06)

Question 10 (5 marks)

Assess the importance of the small intestine in the process of digestion. (HM-11-03)

Question 11 (6 marks)

Justify why minerals should be included in a person's diet. (HM-11-09)

Question 12 (5 marks)

Briefly **describe** how the respiratory and circulatory systems coordinate the supply and transport of oxygen to the cells and the removal of carbon dioxide from the blood. (HM-11-03)

Question 13 (5 marks)

Using the knee joint as an example, **discuss** the role of ligaments, tendons, cartilage and synovial fluid. How do these structures assist movement? (HM-11-03)

Question 14 (6 marks)

Explain how stress can be both advantageous and detrimental to human functioning. (HM-11-09)

Question 15 (8 marks)

To what extent is movement controlled by the nervous system? Provide examples to support your answer. (HM-11-09)

Question 16 (12 marks)

Analyse how the systems of the body work together in a movement or sport of your choice. Provide examples to support your answer. (HM-11-03)

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Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

7.1 How do the systems of the body influence and respond to movement? (tpdf-2181) ☐

📄 Digital documents

7.6 Heart diagram (doc-34764) ☐
7.12 How the systems of the body interrelate when completing a marathon run (doc-41605) ☐
How the systems of the body interrelate when weightlifting (doc-41606) ☐
How the systems of the body interrelate when taking a penalty shot in soccer (doc-41607) ☐
How the systems of the body interrelate when participating in archery (doc-41608) ☐
7.14 Topic 7 summary (doc-35909) ☐
Key terms glossary (doc-36175) ☐
Revision quiz (doc-34736) ☐

▶ Video eLessons

7.13 Sample exam question response (eles-5018) ☐

🧩 Interactivities

7.2 Major bones of the skeletal system (int-6616) ☐
The six types of synovial joints (int-8617) ☐
7.3 Muscles (int-6623) ☐
7.6 The respiratory system (int-8033) ☐
7.9 The digestive system (int-8031) ☐
Glands of the endocrine system (int-9281) ☐
7.10 The body's immediate responses to stress (int-8030) ☐
7.11 Brain lobes and their function (int-9282) ☐
7.14 Missing word interactive quiz (int-8044) ☐

🔗 Weblinks

7.2 The skeletal system ☐
7.3 Muscle anatomy ☐
7.4 Usain Bolt ☐
Eliud Kipchoge ☐
7.6 Respiratory system ☐
7.12 3D models of the body ☐

Teacher resources

There are many resources available exclusively for teachers online.

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8 How are the biomechanical principles applied to human movement?

LEARNING SEQUENCE

8.1 Overview

Key inquiry question

How do the systems of the body influence and respond to movement?

Syllabus

	Syllabus content	Subtopic
○	■ Outline the interrelationship between biomechanical principles and the muscles, bones and joints of the body for safe movement **Including:** • how biomechanical principles are applied to human movement including, motion, balance and stability, fluid mechanics and force • how biomechanical principles can be used to enhance safe movements • how biomechanical principles can be used to increase movement efficiency **Example(s):** **How biomechanical principles can be used to enhance safe movements:** Walking. Squatting. Lifting. **How biomechanical principles can be used to increase movement efficiency:** Movements to reduce injury. People with specific needs such as disability.	**8.2–8.6**
○	■ Discuss the role first aid plays in response to movement **Example(s):** Inefficient movement. Dehydration. Undue stress on the body.	**8.7**

Source: *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Outcomes

- analyses the systems of the body in relation to movement HM-11-03
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to a range of audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents Topic 8 summary (doc-35910)
Key terms glossary (doc-36176)
Revision quiz (doc-34737)

8.2 Motion

8.2.1 Why is the study of biomechanics important?

Biomechanics is the study of human movement. It is a science that investigates the forces acting on the body (kinetics) and the movements of the body (kinematics). This topic will investigate the interrelationship between anatomy, physiology and biomechanics in relation to movement and how biomechanics can be used to improve movement for individuals.

> **biomechanics** a science concerned with forces and the effect of these forces on and within the human body

Biomechanics is very important in understanding techniques used in sport. It is of value to both coaches and players because it is concerned with the efficiency of movement. A knowledge of biomechanics helps us to:
- choose the best technique to achieve the most appropriate movement with consideration of our body shape. For instance, an understanding of the biomechanical principles that affect athletic movements, such as the high jump, discus throw, golf swing and netball shot, can improve the efficiency with which these movements are made. This improves how well we perform the skill.
- reduce the risk of injury by improving the way we move
- design and use equipment that contributes to improved movement.

The biomechanical principles covered in this topic include:
- motion
- balance and stability
- fluid mechanics
- force.

These principles help to develop an understanding about the way biomechanics impacts movement. For example, when an athlete's feet are wider apart and their body is closer to the ground, such as in a rugby player preparing for a scrum, the athlete is more balanced; however, when an athlete's feet are closer together, such as in a ballerina, they are less balanced.

Biomechanical principles help us understand human movement, particularly the interrelationship between muscles, bones and joints and how they work together. They also help us to understand the use of techniques in different sports, and assist in the improvement of movement efficiency.

DEPTH STUDY IDEA

Use the **Newton's laws** weblink in the Resources panel and watch the video. Research the biomechanical principles in a sport of your choice. You can use the other weblinks in the Resources panel to help you. Write a report about the importance of these principles in improving movement for an athlete in the selected sport.

8.2.2 Motion

In biomechanics, the term **motion** is used to describe movement and the path of a body. We see motion in all forms of sport and exercise. Part of a person's body (for example, the arm) may be moved from one position to another. The entire body may be moved from one place to another as in cycling, running and playing basketball.

The different types of motion include *linear, angular* and *general* motion. How motion is classified depends on the path followed by the moving object. We will focus on linear motion in a range of sporting activities and apply the principle to enhancing movement.

motion the movement of a body from one position to another

linear motion takes place when a body and all parts connected to it travel the same distance in the same direction and at the same speed

Linear motion

Linear motion occurs when a body and all parts connected to it travel the same distance in the same direction and at the same speed. An example of linear motion is a person who is standing still on a moving escalator or in a lift. The body (the person) moves from one place to another with all parts moving in the same direction and at the same time.

The easiest way to determine if a body is experiencing linear motion is to draw a line connecting two parts of the body; for example, the neck and hips. If the line remains in the same position when the body moves from one position to another, the motion is linear. For example, a swimmer remains in the same streamlined position when swimming freestyle (see figure 8.2).

Examples of linear motion include swimming and sprint events in which competitors race following a straight line from start to finish. Improving movement in activities that involve linear motion usually focuses on modifying or eliminating technique faults that contribute to any non-linear movements. Excessive up-and-down, rotational and lateral movements are examples of faults that reduce performance directed towards achieving the shortest, most efficient pathway. Sprinters who rotate their arms across their bodies and swimmers who use an irregular arm pull that results in a zigzag movement pattern along the pool surface are examples of poor application of linear motion.

FIGURE 8.1 This skier is experiencing linear motion.

FIGURE 8.2 A swimmer doing freestyle is an example of linear motion.

Interrelationship of the muscles, joints and bones in linear motion

In order for a freestyle swimmer to maintain linear motion, the interrelationship of muscles, bones and joints is essential. For example, the major muscles and bones used include:

- muscles
  - upper body — bicep brachii, triceps, deltoids, pectorals and latissimus dorsi, trapezius, abdominals
  - lower body — quadriceps, hamstrings
- bones
  - upper body — humerus, scapula, radius and ulna, clavicle, carpals, metacarpals and phalanges
  - lower body — pelvis, femur, patella, tibia, fibula, tarsals, metatarsals and phalanges.

For effective arm rotation, it is important that the shoulder joint rotates and the arm stays close to the body during the extension upwards and downwards phases of the stroke. The abdominal muscles will also play a role in stabilising the body in order to maintain position in the water.

Angular motion

Angular motion, also commonly referred to as rotation, occurs when a body moves along a circular path at the same angle, in the same direction, at the same time. Angular motion occurs around some type of **axis**, which can be either external or internal. An example of an external axis in sport would be a gymnast rotating around a high bar, while an internal axis would be a joint in the body around which a body part rotates.

angular motion also commonly referred to as rotation, occurs when a body moves along a circular path at the same angle, in the same direction, at the same time

axis a point around which an object rotates

FIGURE 8.3 A gymnast rotating around a high bar is using an external axis to promote angular motion.

Interrelationship of the muscles, joints and bones in angular motion

An example of the interrelationship of the muscles, joints and bones in angular motion is a gymnast who must ensure that:
- the phalanges, carpals and metacarpals of the hands grip the bar and rotate
- the abdominal muscles remain contracted
- the shoulder muscles (deltoid and trapezius), along with the arm bones and muscles, including the humerus, radius and ulna, biceps and triceps, work together to rotate to initiate and maintain the angular motion around the bar.

General motion

In sport, true linear motion is less common than angular motion, as movement is typically generated by angular motion of body parts or equipment. Far more common, however, is the combination of the two types of motion, referred to as **general motion**. An example of general motion is running in a straight line as in a 100-m sprint, caused by the angular rotation of the arms and legs.

FIGURE 8.4 The angular motion of a runner's arms and legs is an example of general motion.

FIGURE 8.5 Speed in running can be developed through the application of biomechanical principles.

8.2.3 Velocity

Velocity, like speed, refers to the *rate* of positional change of an object. When we run in a straight line, we can calculate it in terms of speed. However, when objects are projected or players move from one place to another on a sporting field, the path taken is rarely straight. Because the movement is not only about how fast we move but also about direction, velocity is a better term to use.

8.2.4 Speed

When an object such as a car moves along a road, or a person runs in a race, we often refer to how fast each is moving.

Speed is important in most sports and team games. A player who can move quickly has a distinct advantage in games such as touch football, rugby and soccer because not only is that player difficult to catch, but they can use their speed to pass opponents quickly in defence.

general motion the combination of both linear and angular motion

velocity the rate of positional change of an object, calculated using displacement divided by time

speed equal to the distance covered divided by the time taken to cover the distance

Much of our potential for speed is genetic and relates to the type of muscle fibre in our bodies (see topic 7). However, individuals can develop their speed as a result of training and technique improvements, the basis of which is the development of power and efficiency of movement. Speed can also be developed in the faster rotation of joints. For example, in the sprinter, the hip and shoulder joints require rotation of the arm and legs. The faster a sprinter moves their arms and legs through the contraction of muscles pulling on the bones to generate movement, the more speed will be generated.

8.2 PRACTICAL ACTIVITIES

Improving speed

Activity 1

1. Perform the 30-m flying speed test. Use the **30-metre flying speed test** weblink in the Resources panel for more information.
2. Record your times for the first 30 m and the entire 60-m sprint. Use the inbuilt calculator to predict your 100-m time.
3. Use the **Momentum sports** and **Want perfect running form?** weblinks in the Resources panel to establish the characteristics of good technique in running.
4. Work in pairs, with one person observing while the other performs short sprints for analysis. You could develop a rating scale using the points listed in table 8.1 to show progress in acquiring better technique through feedback from practice.

TABLE 8.1 Rating scale for progress in acquiring better technique through feedback from practice

Technical point	Excellent	Good	Needs improvement	Advice from observer
Toe up				
Heel up				
Arm swing				
Posture				
Stride length				
Core stability				

Activity 2

When, in the opinion of the observer, technique has improved sufficiently, re-run the test and compare times with the previous effort.
1. Why is it called a speed test? If the test was to measure velocity, how might it differ?
2. Comment on the effect that better running technique had on improvement of speed over a short distance.
3. Discuss the importance of good technique in other sporting activities such as surfing, downhill skiing and speed skating, where speed with stability is crucial to success.

on Resources

🔗 **Weblinks**   30-metre flying speed test
                Momentum sports
                Want perfect running form?

8.2.5 Acceleration

A powerful sprinter, like a car, can increase speed quickly. This is called **acceleration**.

How do we use acceleration to enhance movement? We need to realise that acceleration requires substantial force production, mainly by the gastrocnemius, quadriceps, gluteal and upper body (vigorous arm action) muscles. Programs that focus on developing explosive power in these parts of the body will assist in overcoming **inertia** and getting to full speed in the shortest period.

In the sprint start, the muscles in the legs and feet, particularly the quadriceps, hamstrings, gastrocnemius and gluteal muscles, will contract to apply force to the ground in order to accelerate. The abdominal muscles will be contracted to provide stability, and the hip and shoulder joints will facilitate rotation of the arms and legs in order to generate and maintain acceleration.

Acceleration improvement is reliant partly on technique but also on improving overall strength and strength-related power. Some individuals may have a genetic advantage here with a higher proportion of white muscle fibres relative to red muscle fibres, because acceleration requires explosive force production. Strength and power can be developed through **resistance** training programs that include exercises such as calf raises, squats and lunge walks. Plyometric activities are also important, but are more relevant to the development of a controlled deceleration; for example, following the release of the javelin or following a layup in basketball. In terms of techniques for improving acceleration, emphasis needs to be placed on increasing/strengthening the pushing motion of the foot while keeping the centre of gravity low and forward, all combined with a driving arm action.

FIGURE 8.6 A sprinter aims to develop a technique that enables maximum acceleration.

FIGURE 8.7 A javelin throw using a driving arm action will accelerate the javelin forward upon release.

8.2.6 Momentum

Momentum is a term commonly used in sport. For instance, we sometimes refer to the way in which momentum carried a player over the line in a game of football.

The momentum when a sprinter runs 100 m is called **linear momentum** because the object or person is moving in a straight line. However, there are many instances in sport where bodies generate momentum but do not travel in a straight line; for example, a tennis serve, football kick, discus throw, golf swing or a diver performing a somersault with a full twist. In each of these cases, the body, part of it, or an attachment to it such as a golf club or tennis racquet, is rotating. We call this **angular momentum**.

acceleration the rate at which velocity changes in a given amount of time

inertia the resistance of a body to a change in its state of motion

resistance something opposing a force

momentum the quantity of motion that a body possesses

linear momentum a property of a body that is moving. It is equal to (or a product of) its mass × velocity.

angular momentum the quantity of angular motion in a body or part of a body

A tennis player, for example, will extend the muscles in the arms and shoulder as they reach upwards to serve the ball. The more forceful the muscular contraction, the more momentum will be generated and a more forceful serve will occur. In addition, the muscles in the legs will contract and extend to produce a further driving force and create momentum in the serve. The abdominal muscles and latissimus dorsi will contract in order to create stability and provide rotation for the serve to occur.

FIGURE 8.8 Rugby league players use the principle of momentum—collisions in the form of tackles are part of the game.

FIGURE 8.9 When moving bodies do not travel in a straight line, it is called angular momentum.

DEPTH STUDY IDEA

1. Select a sport/event of your choice.
2. Find a video of the event involving motion and momentum.
3. Create a video analysis of the event including a voiceover describing the biomechanical principle of motion and momentum (including the concepts of motion covered in section 8.2.2).

8.2 Exercises

learnon

8.2 Quick quiz **on**	8.2 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3, 4, 5	6, 7, 8, 9, 10

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Revise your knowledge

1. **a.** Identify the biomechanical principles.
   b. How can a knowledge of the biomechanical principles benefit athletes and coaches?
2. Define the term 'linear motion'. Identify two different sporting activities where players use linear motion for a period of time.
3. Use a sporting example to explain the difference between speed and velocity.
4. How can a tennis player use muscular contractions in order to generate more momentum?
5. What is the difference between linear momentum and angular momentum? Use an example to describe how we would identify each in a sporting situation.

6. **a.** Explain how biomechanical principles can be applied to the movement of Usain Bolt in the 100-m sprint.
   b. Explain how a knowledge of biomechanics can assist improvement of technique for a freestyle swimmer.
7. Choose one athletic event where speed is an advantage. Explain how biomechanical principles could be applied to improve speed in this event.
8. Explain how biomechanical principles can improve acceleration. Provide an example to support your response.
9. Explain how an NRL player uses their body to generate momentum during a tackle. Include the interrelationship of the bones, muscles and joints of the body.
10. Find a video of a gymnast performing a floor routine and discuss how they use their body to generate linear and angular momentum. In your response, refer to the interrelationship between the bones, muscles and joints of the body.

8.3 Balance and stability

> ▶ **Syllabus:** Outline the interrelationship between the biomechanical principles and the muscles, bones and joints of the body for safe movement
> **Including:**
> - how biomechanical principles are applied to human movement, including balance and stability
>
> *Source:* Adapted from *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

8.3.1 Centre of gravity

The **centre of gravity** of an object is the point at which all the weight is evenly distributed and about which the object is balanced. Knowing the position of the centre of gravity is very important to improving movement in sport. In a rigid object such as a cricket ball or billiard ball, the centre of gravity is in the centre of the object. This means that the **mass** is equally distributed around this point; that is, the weight is equally balanced in all directions. If the object has a hollow centre, such as a tennis ball or basketball, the centre of gravity is located in the hollow centre of the ball.

centre of gravity the point at which all the weight of an object is evenly distributed and about which the object is balanced

mass the amount of matter in a body

FIGURE 8.10 The position of the centre of gravity in the human body varies according to the position of the body.

8.3 PRACTICAL ACTIVITY 1

Varying the centre of gravity to enhance movement

Use a range of commonly used starting positions for the 100-m sprint. Vary your centre of gravity so that in some starts it is well forward, in others about centre, and in the remainder well back. Use both crouch starts and upright starts. Time each of the starts over 10 m and record your information.

1. How were the times affected by varying the position of the centre of gravity?
2. Which position was the most successful in terms of time?
3. You are to teach the start to a group of young students. Suggest how varying the centre of gravity can generate a more effective start.

Varying the centre of gravity in the execution of a skill can improve movement. Skilled high jumpers and long jumpers both lower their centre of gravity in the step or steps immediately preceding take-off. This helps them to propel their body over a slightly longer vertical path than would otherwise be possible.

Static balance activities such as headstands and handstands require precise manipulation of the centre of gravity. To balance on your hands in a handstand, or on your head and hands in a headstand, the centre of gravity must be controlled by the base of support. If it moves away from a perpendicular position directly over the base, you will fall.

Most learners find it difficult to assume headstand and handstand positions because when they prepare to kick up, they do not push their centre of gravity far enough forward prior to the kick. As a result, the body falls back in the direction of the centre of gravity unless it is stopped by a push from the legs. As shown in figure 8.12, the centre of gravity, which is located approximately about the waist, needs to be pushed well forward during the kick-up phase and then moved back above the base of support to balance.

FIGURE 8.11 In jumping events, the closer the centre of gravity is kept to the bar while still clearing it, the more efficient the movement.

FIGURE 8.12 Manipulating the centre of gravity is important in balance activities.

Base of support

Fall

Head

Centre of gravity

Stable

Head

The centre of gravity remains inside the base.
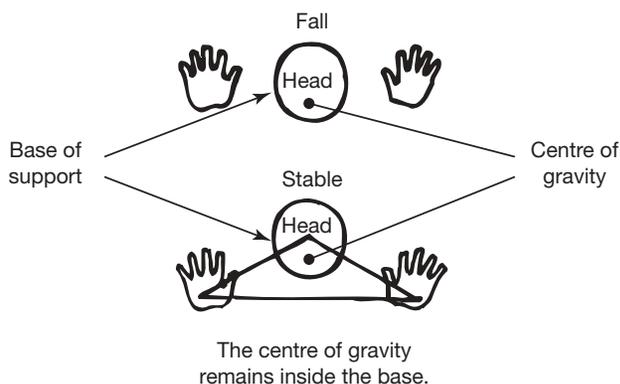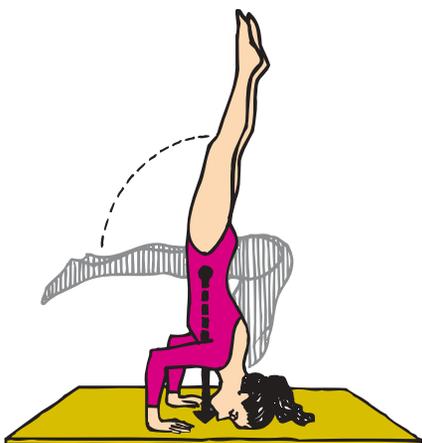
8.3.2 Line of gravity

The **line of gravity** is an imaginary vertical line passing through the centre of gravity and extending to the ground. It indicates the direction in which gravity is acting on the body. When we are standing up straight, the line of gravity bisects the centre of gravity so that we are perfectly balanced over our base of support (see figure 8.13).

Our base of support has a limited area. Widening our stance increases the size of the base of support. However, rules of some sports and competitions limit the size of the base of support; for example, the starting blocks for competitive swimmers. The closer the line of gravity moves to the outer limits of the base of support, the less stable we become.

Movement occurs when the line of gravity changes relative to the base of support. Movement results in a momentary state of imbalance being created, causing the body to move in the direction of the imbalance. In specialised sporting movements, such as the start in athletics, diving and rhythmic gymnastics, the precision with which the line of gravity moves in relation to the base of support directly affects the quantity and quality of movement.

During practice of specialised skills, athletes progressively develop a feel for the line of gravity relative to the base of support, enabling the controlled instability required for movement. This means that less force is required to start the desired movement. For example, swimmers on the blocks bend forward, moving the line of gravity to the edge of the base of support so that less force is required to execute the dive. Springboard divers do likewise by moving the line of gravity to the front edge of their base of support, enabling frontward movement with the take-off. This is illustrated in figure 8.14.

> **line of gravity** an imaginary vertical line passing through the centre of gravity and extending to the ground

FIGURE 8.13 We are perfectly balanced when the line of gravity passes through the centre of gravity.
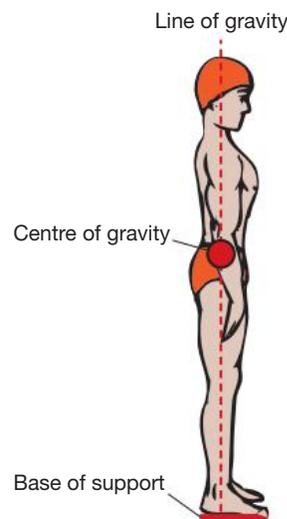
FIGURE 8.14 The line of gravity relative to the base of support moves to initiate movement.
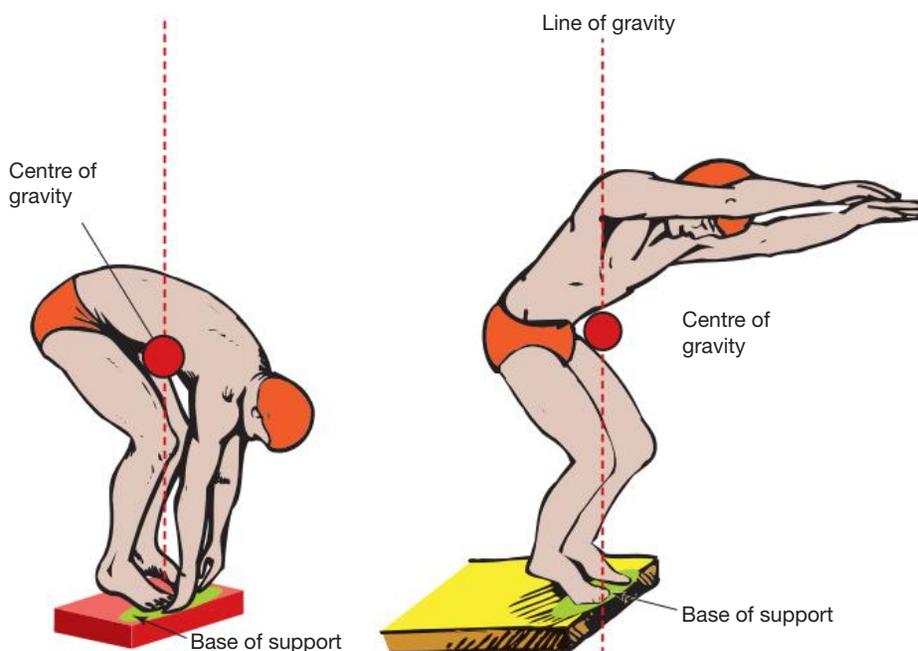
8.3.3 Base of support

Sustaining the balance of all individuals and objects is a **base of support**. The base of support refers to an imaginary area that surrounds the outside edge of the body when it is in contact with a surface. It affects our stability, or our ability to control equilibrium. A narrow base of support allows the centre of gravity to fall close to the edge of the base of support. Only a small force is then needed to make the person lose their balance. A wide base of support is essential for stability because the centre of gravity is located well within the boundaries. An example of this can be seen in figure 8.15.

base of support refers to an imaginary area that surrounds the outside edge of the body when it is in contact with a surface

FIGURE 8.15 A wide base of support promotes stability as seen by the player in the red shirt. The player in the white shirt has positioned his legs closer together, minimising his base of support and his stability.

The relative position of the centre of gravity to the base of support is important for stability. The further the centre of gravity from the base, the more unstable is the body or object. There are many examples where athletes use the base of support to their advantage.

- A gymnast performing a pirouette has a very narrow base of support and must work hard to ensure that their centre of gravity remains within the base.
- Wrestlers widen their base of support to prevent their opponents from moving them into a disadvantageous position.
- Tennis players lower their centre of gravity and widen the base of support in preparation to receive a fast serve. This enhances balance and enables the centre of gravity to be moved in the desired direction more readily.
- Swimmers on the blocks reduce their base of support (place their feet closer together) and move their centre of gravity forward to improve their acceleration.
- Golfers spread their feet to at least the width of their shoulders to enhance balance when they rotate their body during the swing.

Tips for increasing stability and balance

- Lowering an object's centre of gravity
- Ensuring the line of gravity is over the base of support
- Increasing the size of the base of support
- Increasing the friction between two or more bodies
- Increasing the mass of an object
- Extending the base of support in the direction from which a force is coming
- Increasing muscular strength and body alignment

There is movement difficulty with being stable; the more stable an object or person is, the harder it is to shift. Think of a sprinter, or a cricketer (a person batting) facing a fast bowler. In both instances, the person's ability to move quickly is reduced if their body is in a stable position. Instead, people adopt body positions in which there is a degree of stability but from which they can easily shift their body to an unstable (but controlled) position, allowing for quick movement. The cricketer, for example, will reduce their base of support by removing their heels from the ground. This also raises their centre of gravity and shifts their line of gravity closer to being outside their base of support.

A gymnast performing a beam routine will contract their muscles throughout their body, particularly in the legs and torso, in order to keep the body stable and in alignment. The joints, for example the shoulder joints and hip joints, will be extended to maintain balance and stability on the beam, and will be extended further when movement is to occur.

Tips for reducing stability and balance to promote agility

- Raising an object's centre of gravity
- Shifting the line of gravity outside the base of support
- Narrowing the base of support
- Decreasing the friction between two or more bodies
- Decreasing the mass of an object
- Decreasing the contraction of muscles and moving the body out of alignment; for example, a relaxed posture

FIGURE 8.16 Swimmers will shift their line of gravity outside their base of support and decrease their base of support to allow for a quick start into the pool.

8.3 PRACTICAL ACTIVITY 2

Base of support and different positions

Working in groups of five, take turns to assume a range of positions with varying bases of support; for example, standing on one foot, standing with legs apart, crouch balance and boxing stance. Try to move each student from their position. Record the results.
1. Draw the shape and size of the base of support for each activity above. Compare the amount of effort required to displace each person from their position.
2. Discuss the degree to which the mass of the student affected your ability to dislodge each from their position.

DEPTH STUDY IDEA

1. Use the **Fosbury flop** weblink in the Resources panel to watch a video about this high jump technique. Why is this technique more biomechanically efficient than other methods of high jumping?
2. In your response, outline the interrelationship between the biomechanical principle of motion and balance/stability and the muscles, bones and joints of the body.
3. Present your response a visual format.

8.3 ACTIVITY 3

Use the **Why balance and stability training is important** and **The benefits of balance and stability instruction** weblinks in the Resources panel to explain how a tennis player can use balance and stability to improve their movement during a match.

8.3 Exercises

learnon

8.3 Quick quiz **on**	**8.3 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 5	2, 3, 4	6, 7, 8, 9

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Revise your knowledge

1. What is centre of gravity?
2. Discuss how the centre of gravity is controlled to improve movement. Provide examples.
3. Explain how a high jumper can clear the bar without their centre of gravity reaching the height of the bar.
4. What is meant by the term 'base of support'? Describe two activities that have different sizes required for the base of support. How do athletes in these activities control upper body movements from the base of support?

Apply your knowledge

5. Choose any sport or activity. Discuss how knowledge of the centre of gravity and base of support affects movement across a range of skills in that sport.
6. Imagine you are a sumo wrestling coach. Your task is to explain to your sumo wrestler, using the terms *centre of gravity*, *line of gravity* and *base of support*, how they can increase their stability and balance.
7. Explain how a sprinter could effectively use their line of gravity in a 100-m sprint to improve their start off the blocks.
8. Explain how muscles work to generate balance and stability.
9. Discuss the benefits of balance and stability training for athletes. Provide examples to support your response.

8.4 Fluid mechanics

> ▶ **Syllabus:** Outline the interrelationship between the biomechanical principles and the muscles, bones and joints of the body for safe movement
> **Including:**
> - how biomechanical principles are applied to human movement, including fluid mechanics
>
> ***Source:*** Adapted from *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Fluid mechanics is a branch of mechanics that is concerned with properties of gases and liquids. An understanding of fluid mechanics is important for movement because physical activities such as running, throwing and swimming all take place in fluid environments, be it air, water or a combination of both.

> **fluid mechanics** a branch of mechanics that is concerned with properties of gases and liquids

The type of fluid environment we experience affects our movement. For example, when we throw a javelin, hit a golf ball or swim in a pool, forces are exerted on the body or object and the body or object exerts forces on the surrounding fluid. Knowledge about how to equip ourselves and better execute movements in specific fluid environments improves safety and can significantly enhance movement.

FIGURE 8.17 Examples of fluid environments in which we move: water, air and snow

8.4.1 Flotation

You have probably observed that some people appear to float better in water than others. Many people are able to push and glide from the pool wall, floating momentarily but then sinking, usually feet first. Others have difficulty getting under the surface of the water during a 'duck dive', their feet kicking and splashing on the surface as they try to submerge.

The ability to float — to maintain a stationary position on the surface of the water — varies from one person to another. Flotation has an impact on swimming, survival in water and even our ability to learn to swim. To better understand flotation, we need to understand the impact of forces that act on a floating body or object.

8.4.2 Centre of buoyancy

If our **average total body density** is higher than that of water, we sink; but this does not happen uniformly. To understand why this happens we need to understand the link between the body's centre of gravity and its centre of buoyancy.

average total body density percentage of body fat. The higher the percentage of body fat, the more buoyant a person will be.

Every floating object has a centre of gravity and centre of buoyancy. We know that the centre of gravity is the point around which the body's weight is equally balanced in all directions. Even when floating the centre of gravity is generally found about the waist, as illustrated in figure 8.18, although differing body shapes contribute to variations in the exact location of the human body's centre of gravity (see figure 8.19).

FIGURE 8.18 The centre of gravity of the human body is located about the waist.
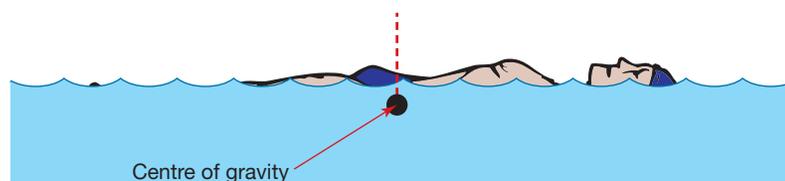
Centre of gravity

The centre of buoyancy is the centre of gravity of the fluid displaced by a floating object. Around this point, all the buoyancy forces are balanced.

To maintain the ability to float, the swimmer must maintain a streamlined position. This occurs when the muscles are contracted, particularly the abdominal muscles, which keeps the swimmer's core (naval region) on the surface of the water. The action of the muscles pulling on bones and rotation of the joints will also assist in maintaining buoyancy. The degree of the joint angle in the shoulders and hips should be limited, as the swimmer will need to keep their arms and legs close to the centre of the body to maintain the streamlined position.

FIGURE 8.19 Body composition influences the relationship between centre of mass and centre of buoyancy, changing the depth and angle of flotation.
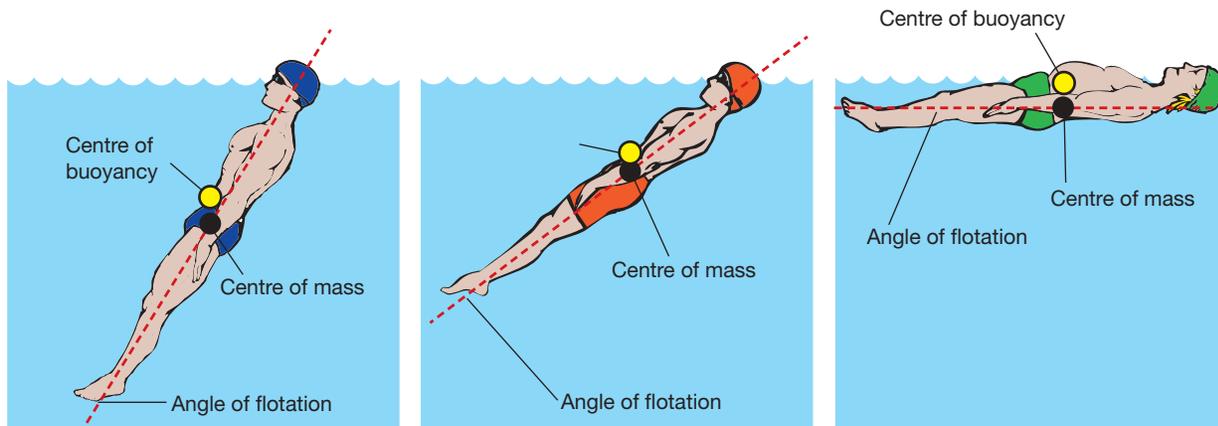
8.4 PRACTICAL ACTIVITY 1

Centre of buoyancy

Work in pairs at a swimming pool with one person observing and the other recording the observations. During the course of the exercise, the person in the water needs to assume the positions listed in table 8.2 and hold each for a period of 10–15 seconds. The recorder observes what happens to the unassisted floating body in terms of buoyancy and rotation and records the information in the second column of the table.

TABLE 8.2 Buoyancy and rotation of unassisted floating body

Position in water	Flotation and body position changes	Why it happened
Prone float		
Back float		
Knees to chest		
Prone float with arms and legs spread		
Prone float with legs supported by kickboard		
Body vertical, arms by side, feet together		
Side float		
Duck dive (unassisted by hands and feet kick)		

1. In pairs, use the third column in table 8.2 to explain flotation and body position changes.
2. As a class, discuss the movement involved in swimming.

8.4.3 Fluid resistance

When a body or object moves, whether it be in air or water, it exerts a force and simultaneously encounters a resisting force from that medium. In sporting competitions such as swimming and athletics, **drag** and **lift** forces are constantly responding to the object's or body's thrust.

drag the force that opposes the forward motion of a body or object, reducing its speed or velocity

lift the component of a force that acts at right angles to the drag

Drag is the force that opposes the forward motion of a body or object, reducing its speed or velocity. It is a resisting force because it acts in opposition to whatever is moving through it. Drag forces run parallel to flow direction (airflow, water), exerting a force on the body in the direction of the stream. An example of where we find drag forces in sport is to watch a swimmer push off the pool wall following a turn. The swimmer's forward motion gradually decreases due to resisting forces applied by the water, which makes the swimmer stop unless arm or leg action begins. A body that is streamlined (contoured to reduce resistance) and technically efficient moves through the medium, creating less drag than a body that is not as streamlined. This difference in the amount of drag created by non-streamlined and streamlined bodies is illustrated in figures 8.20 and 8.21.

FIGURE 8.20 When a body is not streamlined, considerable drag is created, making it more difficult to move through the fluid.

Drag

Drag

Water flow
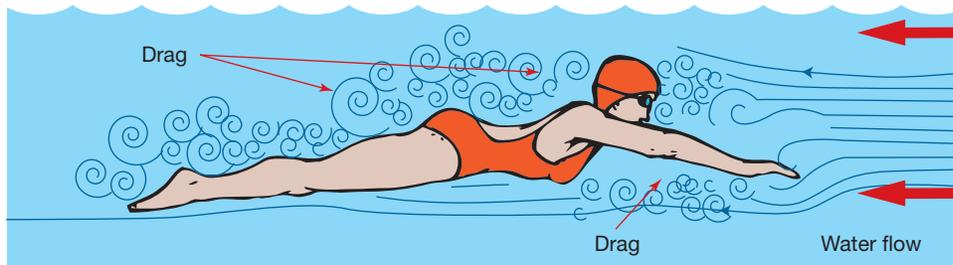
FIGURE 8.21 A streamlined body creates less drag, allowing it to move more efficiently through the medium.

Drag

Drag

Drag

Water flow
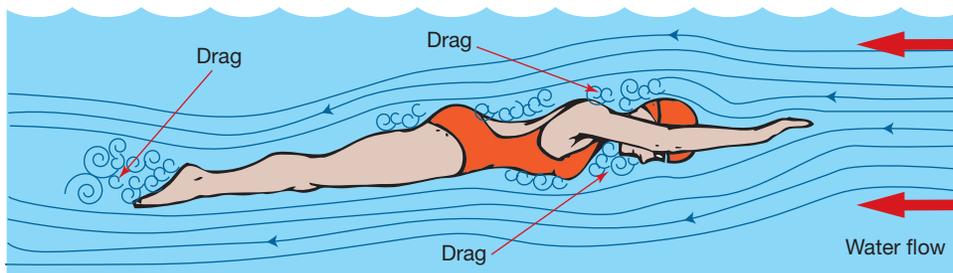
A swimmer can reduce drag by keeping:
- the body aligned, as further drag is created if the body is not streamlined as shown in figure 8.21
- the abdominal muscles engaged and hips lifted to help promote buoyancy and reduce drag
- the arms and legs close to the centre of the body through reducing the joint angle of the shoulder and hip joints
- the kick tight, which can be achieved by not bending the knees too much and allowing the kicking action to be driven by the ankles and feet
- the toes pointed to help to reduce drag, as this creates less splash.

Lift is an essential force required for movement and performance, particularly in the sport of swimming. Lift propels swimmers forward in the water and, with the correct technique, swimmers can use this force to improve their movement in the water. To create lift in the water, the swimmer should:
- maintain a streamlined position with the head in a neutral position and in line with the body
- engage the core (abdominal muscles), which will help keep the body in a streamlined position and lifted in the water; hips should be high, sitting at the surface of the water
- maintain a continuous kicking position with the legs and feet high at the surface of the water
- keep the hands in a *sculling* (slightly cupped) position, which acts to 'catch' the water and push it past the swimmer. This technique helps reduce drag, which would slow the swimmer down.

The above techniques will assist the swimmer in gaining lift, reducing drag and creating momentum to propel them through the water. Combined with movement speed, the swimmer will move through the water at a faster rate, which will enhance their performance during a race and minimise fatigue during competition or training.

DEPTH STUDY IDEA

1. Choose a sport to research.
2. Research the technology that has been used over time to improve movement in relation to fluid mechanics.
3. Compose a one-page journal article about your sport to explain how the principles of fluid mechanics have influenced changes designed to improve movement.

8.4 ACTIVITY 2

Use the **How is fluid mechanics helping competitive swimmers?** weblink in the Resources panel to explain how applying fluid mechanics can improve movement.

on Resources

🔗 **Weblinks** How is fluid mechanics helping competitive swimmers?
Reducing drag when cycling

8.4 Exercises

learn**on**

8.4 Quick quiz **on**	8.4 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
2, 4	1, 3	5, 6, 7, 8

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Revise your knowledge

1. Describe the relationship between the body's centre of gravity and centre of buoyancy in terms of flotation position.
2. Outline how drag and lift can affect a swimmer's movement through the water.
3. Describe how a streamlined position improves swimming efficiency.
4. Outline the factors that decrease drag for a swimmer.

Apply your knowledge

5. Refer to figure 8.22 and explain the effect each position would have on movement through the water.

FIGURE 8.22 Effects of drag on movement

Movement 1A	Movement 1B
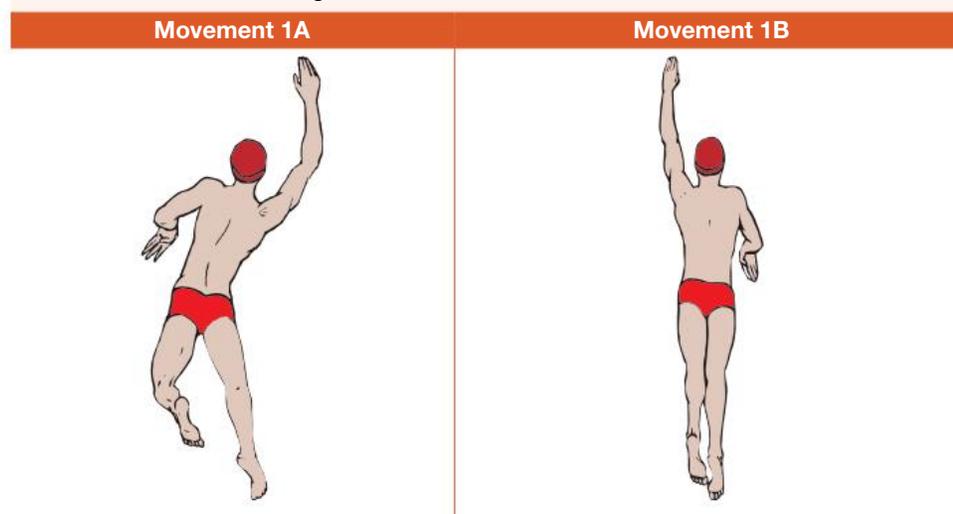
6. Explain how a swimmer uses their muscles and joint position in order to apply the principles of fluid mechanics.
7. Research the current Speedo swimsuits and explain how they address the principles of fluid mechanics to improve movement while still keeping within the FINA guidelines.
8. Explain how a cyclist uses their body to address the principles of fluid mechanics, for example, drag. You can use the **Reducing drag when cycling** weblink to help you.

8.5 Force

8.5.1 How the body applies force

Athletes can apply **forces** to objects such as the ground to enable them to run faster, or a tennis racquet to help them to hit the ball harder. In doing this, the athletes are confronted with opposing forces such as gravity, air resistance and friction. *Kinetics* is the study of forces acting on the body to produce movement.

Forces can be internal or external. Internal forces are those that develop within the body; that is, by the contraction of a muscle group causing a joint angle to decrease (for example, the contraction of the quadriceps when kicking a football). External forces come from outside the body and act on it in one way or another. For example, when a volleyball player jumps vertically upwards, their internal forces push down on the ground while equal and opposite external forces push up on the player (see figure 8.23). Another example is gravity, which is an external force that acts to prevent objects from leaving the ground.

There are two types of forces — **applied forces** and **reaction forces** (see figure 8.24). Applied forces are forces applied to surfaces such as a running track or to equipment such as a barbell. When this happens, a similar force opposes it from outside the body. This is called a reaction force. The result is that the runner is able to propel their body along the track surface because the applied force generated by the legs is being matched equally by the reaction force coming from the track surface. The greater the force the runner can produce, the greater is the resistance from the track. The result is a faster time for the distance.

We see evidence of the application of force in all physical activity. Consider the following examples: a high jumper, discus thrower, cricket bowler and basketball player all exert forces when executing movement skills. How effective would they be if they were suspended and had nothing to push against?

An increase in strength (force) or an increase in the speed at which muscles shorten results in an increase in power. While an increase in both causes an increase in overall power, the athlete must decide which component (strength or speed of muscular contraction) is of greatest benefit. Jumpers and runners need to focus on rapid muscular contraction while controlling the strength aspect. This is called *speed-dominated* power. In contrast, a weightlifter needs power and must be able

FIGURE 8.23 Athletes experience both internal and external forces.

Internal force

External force

forces the push or pull acting on a body
applied forces forces generated by muscles working on joints
reaction forces equal and opposite forces exerted in response to applied forces

to lift the weight. They need to develop *strength-dominated* power. By identifying the specific requirements of the sport, the athlete can be better prepared by developing the type of power required.

FIGURE 8.24 Every reaction force is matched equally by an applied force.
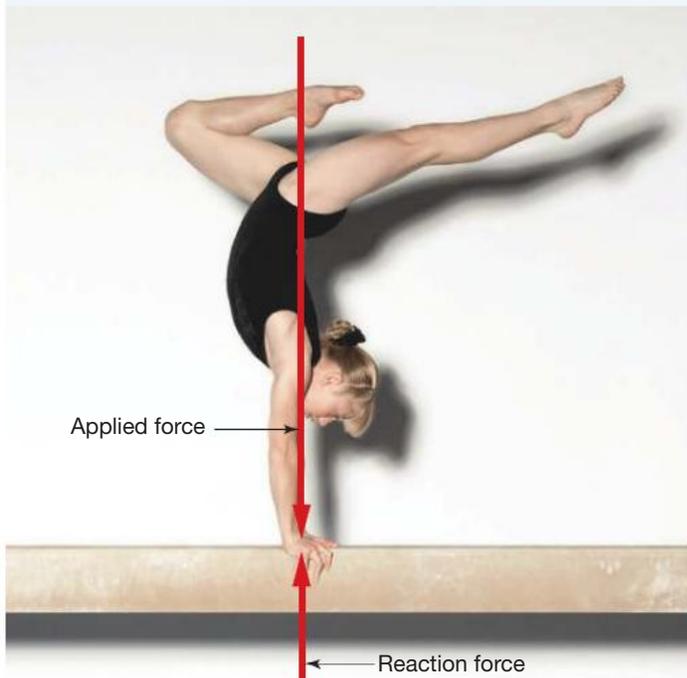
FIGURE 8.25 Applied and reaction forces increase during the delivery stage of bowling.

8.5.2 How the body absorbs force

Forces exerted on the body are absorbed through the joints, which bend or flex in response to the impact. We see evidence of the body absorbing forces in activities such as rebounding in basketball, landing in high jump and stopping the bounce while on a trampoline.

When the body lands on a floor or similar surface, it exerts a force on the surface. In response, the surface exerts a force on the body. If we did not bend the knees and allow a slow, controlled release of the forces by the muscles, the risk of injury to the joint would be increased. In an activity such as the landing phase of a long jump, the muscles in the front of the thigh (quadriceps) lengthen while absorbing the force (see figure 8.26). Joint flexion helps prevent injury to surrounding tissue (see figure 8.27).

FIGURE 8.26 There are many instances in sport where the body must absorb force.

FIGURE 8.27 Joint flexion in absorbing forces helps prevent injury to muscles, tendons and ligaments.

8.5 PRACTICAL ACTIVITY 1

Observing forces being absorbed

Perform two long jumps — make sure you record both jumps.
1. The first long jump should be performed prior to watching the video.
2. Use the **Long jump technique: landing for maximum distance** weblink in the Resources panel to watch a video before performing the second long jump.
3. Review the recordings of your two jumps to work out how the body can absorb more force through changing technique.

on Resources

🔗 **Weblink**   Long jump technique: landing for maximum distance

The body also absorbs forces while catching balls or similar objects. In the process of catching, a force is exerted by the ball on the hand and a force is exerted by the hand on the ball. Catching a ball can sting if the force of the ball is not absorbed effectively.

The impact felt by an object being caught is the product of:
- the force of the ball
- the distance through which the hands move while receiving the ball.

Since the force of the ball remains constant, the only variable that can be changed is the distance through which the hands move when catching the ball. To increase the catching distance and thereby absorb the force more effectively, we can use a number of techniques, including:

- the catching arm can be outstretched. When the ball meets the hand, the arm can be drawn quickly to the body.
- smothering the ball with the other hand
- catching with an outstretched arm and moving it past and behind the body to increase the distance over which the ball is caught
- pivoting the body during the catching action.

While some of these principles may help to reduce the impact from objects such as cricket balls, an overemphasis on reducing pain from impact may result in a dropped catch. Correct technique and practice are essential.

8.5 PRACTICAL ACTIVITY 2

Techniques for absorbing forces when catching balls

In pairs and using a range of types of balls (such as cricket balls, softballs and tennis balls), practise catching using the techniques suggested above.

1. Do you think any of the techniques suggested helped absorb the force of the balls?
2. If the techniques helped, from which technique did you find the greatest benefit? Why?

8.5.3 Application of force on an object

When applying force to objects, such as to a barbell, cricket bat or netball, there are several considerations. The quantity of force applied to the object is important. The greater the force, the greater is the acceleration of the object. A small soccer player whose mass and technique allows only small effort production applies little force to the ball in comparison to the same ball being kicked by a bigger player (other factors being equal) (see figure 8.28).

FIGURE 8.28 The greater the force, the more we are able to accelerate the object.
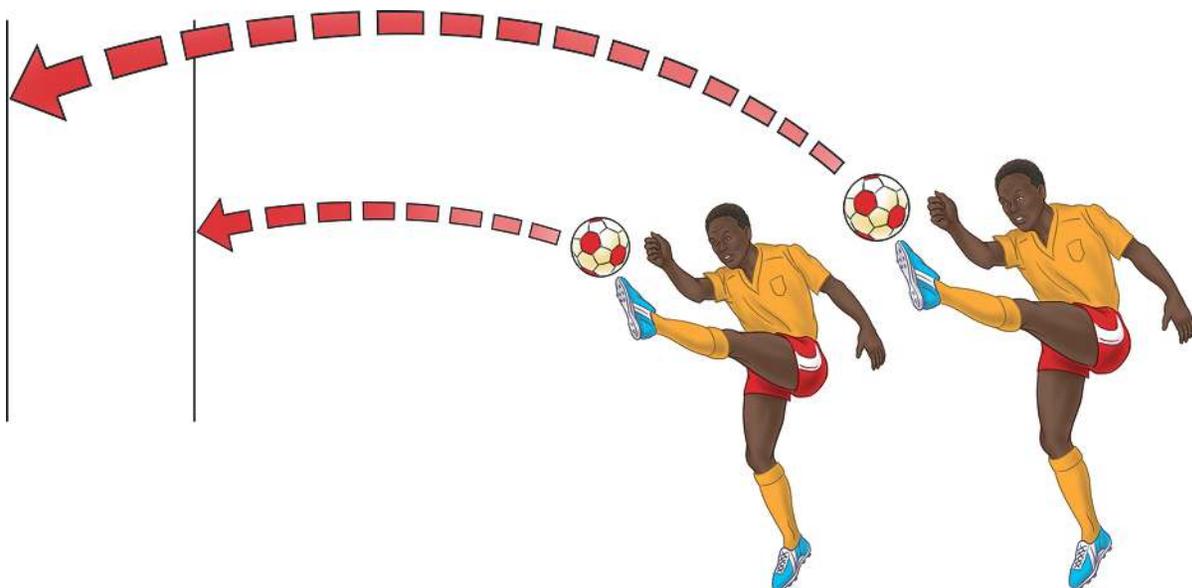
FIGURE 8.29 If mass increases, for example if a ball becomes wet, more force must be applied to move the object the same distance.
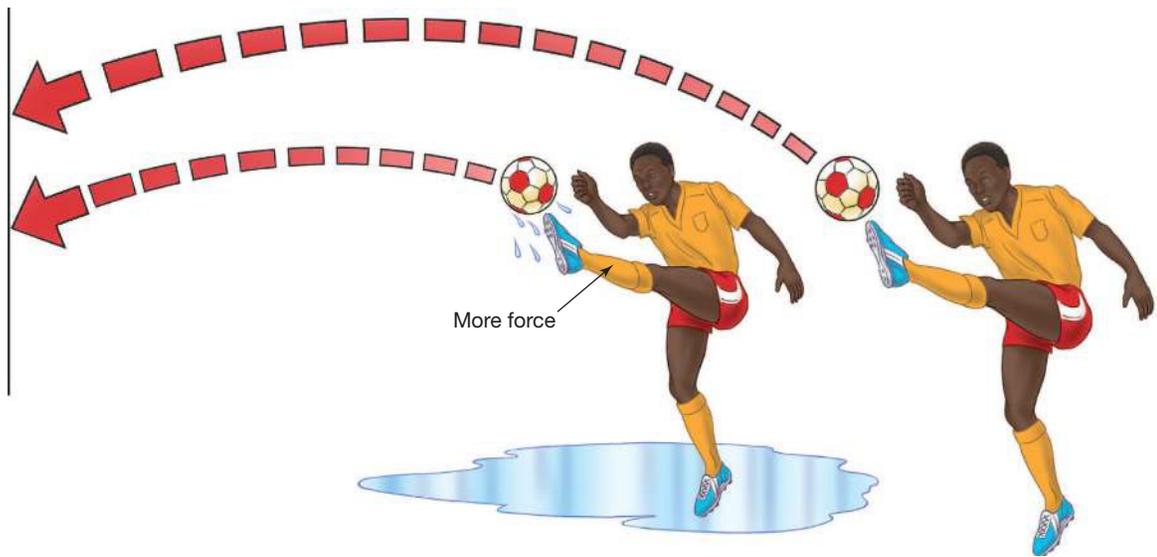
More force

FIGURE 8.30 As the size of an object increases, more force is required to move it.

More force
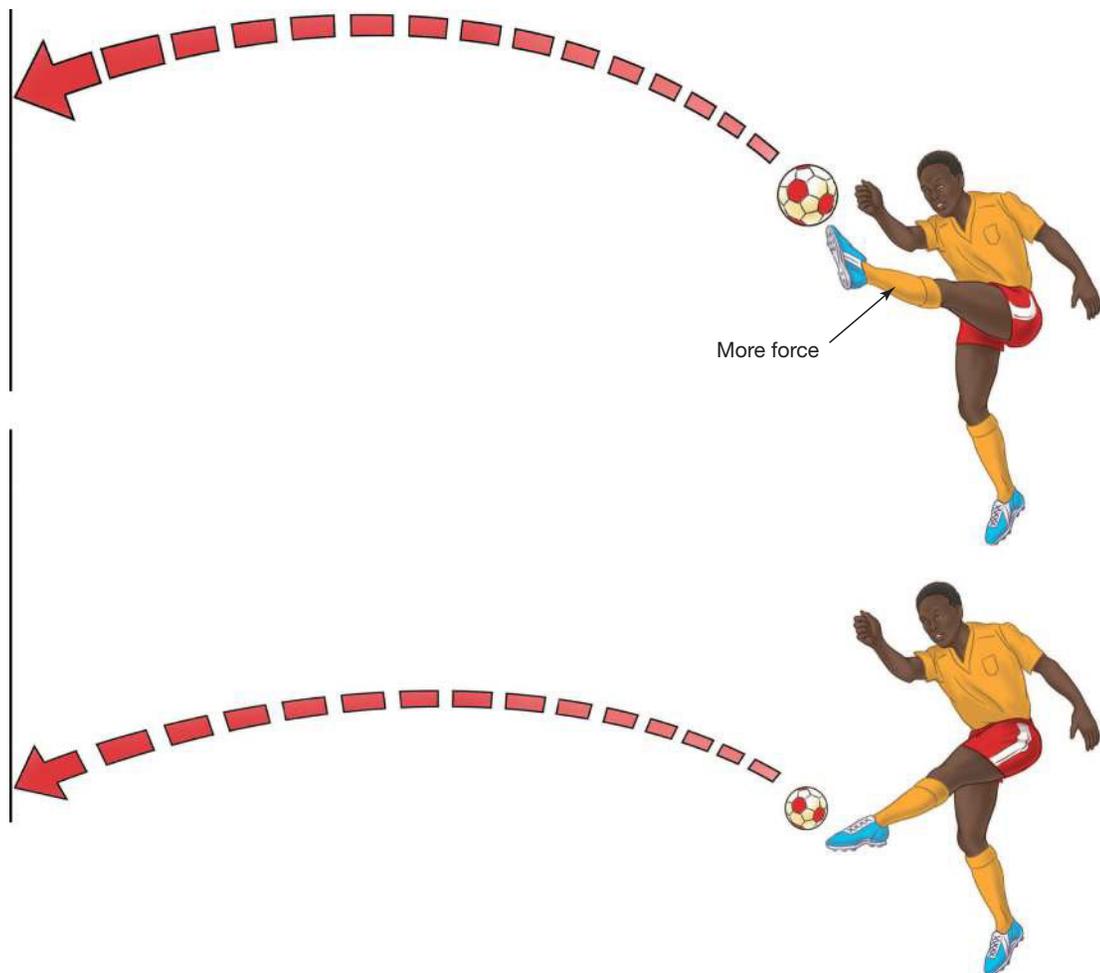
8.5 PRACTICAL ACTIVITIES 3

Applying forces

Place two objects of varying mass (for example, a shotput and a tennis ball) on the classroom floor. Move each using a similar force, such as a finger flick.
1. Which object could you move the furthest?
2. Explain the differences in distance in terms of application of force to the masses of the respective objects.

Applying forces when changing direction

Set up two lines of markers approximately 5 metres apart as shown in figure 8.31.

Run to each marker, then change direction by pushing off the foot nearer that marker. Keep your pattern of directional changes to the finish.
1. Explain how forces work in changing direction.
2. In what activities might more effective changes of direction improve movement?

FIGURE 8.31 Apply forces when changing directions
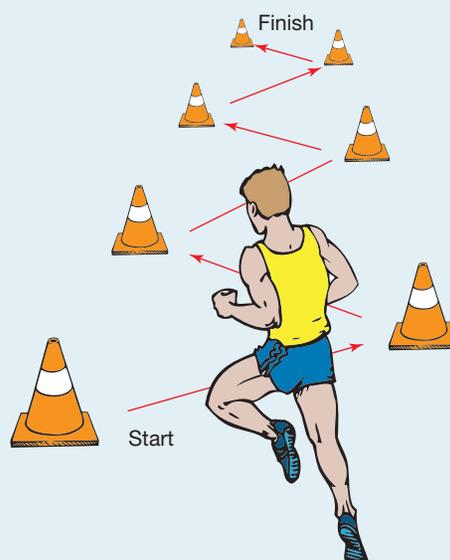
DEPTH STUDY IDEA

Investigate the technology and/or equipment that is currently used to absorb force for the athlete in one of the following sports:
- tennis
- NRL
- hockey
- cricket.

Address how the technology has targeted the following:
- minimising injury
- improving movement efficiency.

Deliver your findings in an oral presentation to the class. Include a visual stimulus.

8.5 ACTIVITIES 4

1. Use the **Roger Federer serve analysis** weblink in the Resources panel to view the video, or find another video online of Roger Federer serving.
   Roger Federer's first serve is around 185–200 km/h. How does his serving technique assist him in applying force to the ball?
2. Use the **Force Reduction courts** weblink in the Resources panel to help you answer the following questions.
   a. What are some of the differences between traditional hard courts and the Force Reduction hard courts?
   b. How is force reduced for the athlete and what effect does this have in terms of injuries?
   c. What are the effects of the new courts in terms of performance?
   d. What are the benefits for young athletes of the new hard courts using Force Reduction?

8.5 Exercises

learnon

8.5 Quick quiz on	8.5 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 6	3, 4, 7	5, 8

Revise your knowledge

1. Outline internal and external forces.
2. Using examples, distinguish between applied and reaction forces.
3. Explain how the body absorbs force.
4. Explain the relationship between power and force.
5. How can a cricket player adjust their technique to catch the ball and absorb the force of the ball more effectively?

Apply your knowledge

6. Use arrows to indicate the direction of the applied force and the direction of the reaction force in figure 8.32.
7. What would be the effect on the runner's movement in figure 8.32 if the applied force was increased?

FIGURE 8.32 Direction of forces

8. Suggest how the principle of forces could be applied to the start in running, generating a more powerful long jump or winning a scrum in rugby with a lower pack weight.

8.6 How can biomechanical principles be applied for safe and efficient movement?

8.6.1 Biomechanical principles to enhance safe movements

An understanding of biomechanics and human movement not only helps athletes and sport performance but it can also enhance safety in everyday activities such as walking, squatting and lifting. Biomechanics is also important when working out what causes injuries that may occur due to incorrect movement or technique, and how injuries can be prevented. For example, when walking, force is applied between the foot and the ground with each step. Injuries associated with walking are relatively minor; however, correct walking gait and foot action can help prevent injuries. Taking light, easy steps and making sure the heel touches down before the toes on each step can help absorb impact. Correct footwear can also assist in absorbing force between the foot and the ground when each step is taken. Poor choice of footwear when walking long distances or on uneven terrain can cause foot or shin pain, blisters and soft tissue injuries.

FIGURE 8.33 Walking correctly can assist in injury prevention.

Biomechanics can also be applied when squatting, such as when lifting something heavy. When lifting something heavy, body positioning and joint alignment is important to enable safe movement and help prevent injuries. For example, when lifting and carrying something heavy such as a box or a barbell, incorrect technique may result in unnecessary injury, particularly to the lower back. When lifting something heavy, the weight should be close to the body as less muscular effort is needed to lift it. Knees should be bent and feet should be wider apart for a wider base of support. Keeping your back straight is also important when squatting and lifting something heavy.

Squats are one of the primary exercises for developing lower body strength; however, incorrect technique may cause significant injuries for the individual. Applying the biomechanical principles of balance and stability is essential for correct squatting technique to avoid common injuries such as knee and back pain.

When performing a squat, such as a barbell squat or a deadlift, biomechanical principles such as correct body positioning ensure that balance and weight are evenly distributed. A wide base of support is also essential to help in preventing injury. Lowering the centre of gravity increases balance and stability and allows greater weight to be lifted as the legs work to generate force. In a barbell squat, if the feet are too close together the individual will become unstable and possibly fall over, causing injury. Likewise, if the angle of the shoulder joint is too small, which moves the arms close to the body, it is likely to cause the individual to become unstable.

During a barbell squat, the knees should be kept soft throughout the movement to avoid stress on the knee joint, which could cause damage to the cartilage and tendons.

FIGURE 8.34 Correct technique when performing a barbell squat is essential in preventing injury.

8.6.2 Biomechanical principles to increase movement efficiency and reduce injury

Understanding biomechanics can assist in injury prevention. How the body moves, correct technique and the forces acting upon the body are all factors that need to be considered when analysing movement.

The biomechanical principle of force is one of the major principles that can help prevent injury and make movements safer. Force, and in particular learning ways to absorb force in movement, can assist athletes in efficient movement and preventing injury.

Some examples of biomechanics assisting movement include:
- using protective equipment such as gloves and pads wherever possible; for example, wearing pads in cricket to absorb some of the force of the ball if the player is hit in the legs. The same can be applied for a hockey player who wears shin guards.
- slowing the speed of the object gradually by 'giving' with impact, for example, when catching in cricket or water polo, which will reduce the force of the ball when caught
- creating a broad base by widening the stance, which helps rugby players to absorb the force of another player in an oncoming tackle and avoid becoming unstable and falling over, causing injury
- absorbing forces such as tackles on the largest surface areas of the body; that is, the larger muscle groups such as the quadriceps and pectoralis muscles
- bending the knees when absorbing forces produced from landings, such as from rebounds in basketball and landing in a long jump pit.

8.6.3 Movements for athletes with specific needs such as disability

Biomechanics can assist athletes with disabilities to develop better movement efficiency, technique and performance. This area of research helps athletes with a disability to perform to their best abilities and assists in closing the gap between able-bodied athletes and those with a disability.

An example of how biomechanics can be applied is in wheelchair racing. In order to obtain maximum momentum, the athlete must be able to apply a large force through the arms to the rim of the wheels, which will generate speed. The development of upper body strength is important for wheelchair athletes to help with their movement. Biomechanics is also applied to athletes who require prosthetic limbs. While the muscles of the legs and feet generally produce movement in a sprinter, for an athlete who is missing their lower leg, these muscles are missing. A prosthetic limb acts as an object to which the weight of the muscles in the upper legs (quadriceps and hamstrings) can apply force in order to produce movement.

FIGURE 8.35 Cricket players wear protective equipment to help absorb the force of the cricket ball.

FIGURE 8.36 Wheelchair athletes must apply a large amount of force to generate speed.

DEPTH STUDY IDEA

Choose a skill in a sport of your choice; for example, a tennis serve.
1. Video yourself performing the skill.
2. Provide an analysis to show the interrelationship between the muscles, bones and joints of the body.
3. Explain how biomechanical principles can be applied to increase movement efficiency.
4. Create a multimodal report about how prosthetic limbs are assisting athletes with their movement efficiency. In your report, include links to the biomechanical principles.

8.6 ACTIVITIES

1. Use the **How to avoid injuries when lifting** and **How to avoid injuries when squatting** weblinks in the Resources panel to create a fact sheet to inform people about the importance of safe technique when lifting weights and squatting in order to avoid injuries.
2. Use the **Pain when walking** weblink in the Resources panel to answer the following questions.
   a. Choose three causes of pain when walking.
   b. Identify the signs and symptoms of each.
   c. How can biomechanical principles be applied to enhance safe movement when walking?

on Resources

🔗 **Weblinks**   How to avoid injuries when lifting
                 How to avoid injuries when squatting
                 Pain when walking

8.6 Exercises   learn on

8.6 Quick quiz on	**8.6 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2	3, 4, 5	6, 7

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Revise your knowledge

1. How can biomechanics contribute to safe movements?
2. Outline how biomechanics assists athletes with disabilities.
3. Identify what happens if the feet are too close together in a barbell squat.
4. Describe the technique of a barbell squat to ensure safe movement.

Apply your knowledge

5. Discuss how the biomechanical principles can be applied to increase movement efficiency in a sport of your choice.
6. Explain the biomechanical principles that can enhance safe movements for a 800-m race walker.
7. Choose a skill in a sport of your choice. Find a video and explain the biomechanical principles that can be used to increase movement efficiency and reduce injury for the individual.

8.7 The role of first aid in movement

First aid has an important role in response to movement. While most injuries do not require surgery, some do require hospitalisation and can prevent the individual from training and playing for some time. However, many of these injuries are preventable through preparation. Therefore, first aid has an important role in aiding efficient movement in sport and physical activity.

first aid the initial care of the ill or injured, usually given by someone who is on the scene when a person becomes ill or injured

8.7.1 Inefficient movement

The following factors can affect the movement of athletes during training and competition. They should be considered in order to maximise movement while minimising the risk of injury.

Skill and technique

Skill and technique relate to the efficiency with which we perform the required activities. Skilful athletes perform difficult movements with ease and precision. They display a high degree of temporal patterning (the smaller parts of the movement are executed in sequence), pacing (movements are precisely timed) and control. These features are acquired and developed through effort and practice. Correct skill development is essential to prevent injury. The footballer who is unsure of correct tackling technique is at risk each time they make a tackle. The basketballer who is unable to rebound competently places their knees at risk of injury with each landing. Incorrect techniques can over time cause injuries such as stress fractures for aerobic athletes. Correct technique and skill acquisition is important to improved performance, as well as in the prevention of injury.

Core strength and posture play an important role. Good posture occurs when the musculoskeletal system is in balance, which protects the supporting structures of the body against injury. For many sports such as hockey, tennis and skiing, in which the individual is not always standing upright, they will need to develop core strength in order to prevent injury. In sports such as gymnastics, good posture is important in performing various positions and movements, including landings.

Many athletes supplement their training with yoga and Pilates to improve posture, strengthen their core and assist their body in maximising movement and preventing injury. It is important to ensure that quality of movement is prioritised in sport, particularly when learning a new skill.

FIGURE 8.37 Gymnasts need to ensure their posture is optimal for effective movement and minimisation of injuries.
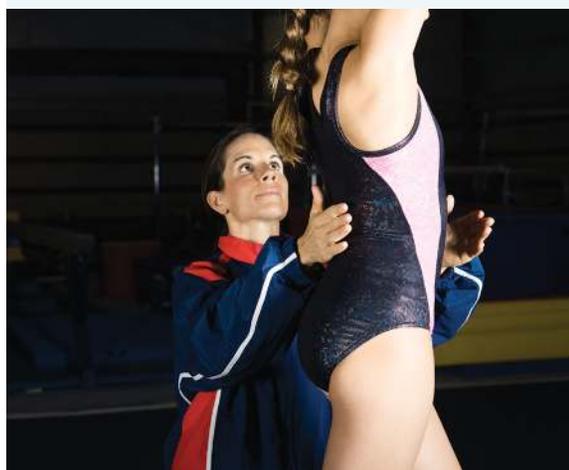
FIGURE 8.38 Yoga can help athletes develop good posture

Stretching and preventative taping

Stretching programs must be specific to the needs of the sport. The muscle groups that have the greatest demands placed on them during the movement require specific attention. For example, a high jumper will stretch all major muscle groups in preparation for competition, but will give additional and specific attention to the calf and thigh muscle groups as the demands on these are greatest.

Preventative taping involves the application of adhesive or non-adhesive strapping or bandages to a joint area to protect, support or strengthen the joint during movement. It is thought to improve movement efficiency for an athlete and reduce injury. It does this through the sensation of the tape providing feedback to the athlete when movement occurs to stimulate the muscles around the joint and to reduce the movement; for example, preventing overextension of a joint. The most common joints taped in sport include the ankles, knees, shoulders and wrists.

FIGURE 8.39 Taping can help prevent injury.

8.7.2 Dehydration

Dehydration is an excessive loss of water and occurs when there is loss of fluid from the body and not enough fluid has been consumed to replace it; for example, an athlete sweating during competition who does not drink enough water to maintain hydration. Dehydration can affect movement during physical activity for athletes. Signs of dehydration can include fatigue, decreased performance, nausea, headache and thirst. In addition, muscle cramps may occur along with weakness and dizziness. It is important that the athlete drinks before, during and after training or competition to maintain optimal levels of hydration.

dehydration an excessive loss of water

To treat dehydration, stopping activity and sipping water or sports drinks can assist the body to rehydrate. Sports drinks are often recommended because they contain electrolytes, which are needed to replace lost sodium levels. If water alone is consumed, this can lead to a condition known as hyponatremia which occurs when sodium levels are below normal levels. Symptoms of hyponatremia include nausea, headaches, fatigue, low blood pressure, muscle weakness, loss of energy and occasionally seizures and coma. Stretching can assist with muscle cramps, and providing reassurance to the athlete is important. Monitoring the athlete is important to ensure they are recovering and the signs and symptoms of dehydration are reducing.

FIGURE 8.40 Drinking water or sports drinks can help prevent dehydration.
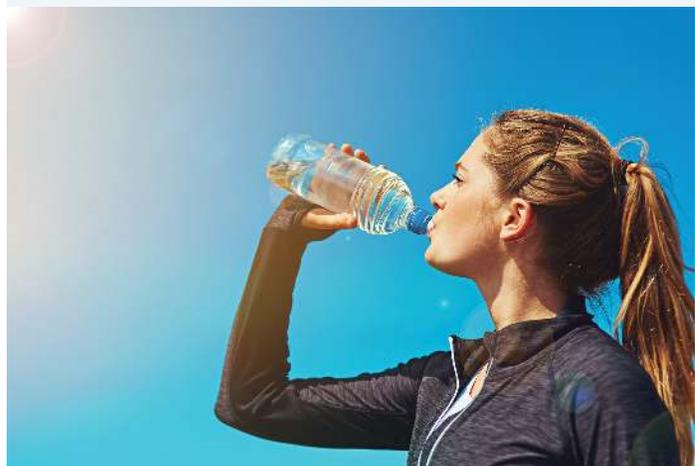
8.7.3 Undue stress on the body

Undue stress on the body may occur when athletes overexert themselves during training or competition. This can lead to extreme fatigue, poor movement and possible injury such as strains, sprains and fractures. To treat overexertion, athletes should stop the activity and rest immediately. An extended period of rest may also be recommended in order for the body to fully recover.

Overtraining

Sometimes, because of poor scheduling or high levels of training, an athlete can suffer chronic training stress, which leads to a deterioration in performance. In the early stages, it might be recognised as fatigue. However, fatigue can progress to a more chronic condition known as overtraining, which leads to burnout. **Overtraining** is a chronic psychological and physiological condition caused by training loads that are too demanding.

overtraining a chronic psychological and physiological condition caused by training loads that are too demanding

Overtraining develops as a result of subjecting athletes to high-intensity training practices when they are in a stage of fatigue. High-intensity training requires a longer period of regeneration and refreshment than does moderate training. When there is too much work and not enough time for recovery, the athlete becomes physically fatigued and mentally drained in what is called the overtraining state. The onset of the overtraining state can be recognised by lack of motivation and poorer movements. Skill and technique are compromised due to fatigue, which may lead to injuries.

Overtraining is primarily caused by too much training, so adjustment to the amount and intensity of training needs to be made. The level of intensity needs to be varied from one activity to the next and from one training session to the next. Athletes need not overload in every training session. Recovery strategies need to be an integral part of training. For game players, recovery sessions might focus on strategies, skill building, team talks or watching videos of opposition plays. Volume or the amount of training can be varied by manipulating frequency and duration of sessions. Fewer and shorter training sessions may be needed and may even achieve the same or better results.

While the poorer movement in overtraining is obvious, the exact causes might be more difficult to identify. Two important physiological considerations include lethargy and injury. Lethargy is characterised by feelings of slowness, tiredness and lack of energy. Athletes in a lethargic state do not train or perform to their best ability, leading to a gradual deterioration in performance. Even simple tasks appear difficult, while concentration and focusing skills appear to be reduced. As lethargy is usually the result of excessive training volume and intensity without sufficient rest and relaxation periods, measures need to be taken to address the problem. Injury comes in many forms, such as bone breakages and pain associated with overuse. Training volume may cause injury, as might be the case for endurance runners affected by shin splints. Use the **Overtraining** weblink in the Resources panel for further information about the effects of overtraining.

FIGURE 8.41 Overtraining can cause undue stress on the body.

8.7 PHYSICAL ACTIVITY 1

In groups of two or three, prepare a yoga or Pilates routine that consists of five movements. Your group will lead the class, focusing on the following:
- addressing inefficient movement
- demonstrating good posture in each movement.

DEPTH STUDY IDEA

In groups of three, for a sport of your choice, create a multimodal presentation to show the role that first aid plays in response to movement. You must demonstrate how first aid manages the following:
- inefficient movement
- dehydration
- undue stress on the body.

8.7 ACTIVITY 2

Use the **Tennis Australia (hydration)** weblink in the Resources panel to investigate Tennis Australia and explain the first aid measures taken to:
a. prevent dehydration
b. treat dehydration.

on Resources

🔗 **Weblinks** Overtraining
Tennis Australia (hydration)

8.7 Exercises   learn on

8.7 Quick quiz on	**8.7 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3	4, 5	6, 7, 8

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Revise your knowledge

1. Identify the factors contributing to injury in movement.
2. State two ways in which movement efficiency can be improved.
3. Identify the signs of overtraining.
4. Outline the effects of dehydration.

Apply your knowledge

5. Explain why athletes with higher movement efficiency are less likely to be injured than those with lower levels of movement efficiency.
6. Discuss how an athlete can recover from the effects of undue stress on the body.
7. Explain the importance of avoiding overtraining in athletes.
8. Explain the role of first aid in response to undue stress on the body.

8.8 Sample exam question response

Question

For a sport of your choice, **outline** the interrelationship between balance and the muscles, bones and joints of the body. **(3 marks)**

Criteria	Marks
• Sketches in general terms the interrelationship between balance and the muscles, bones and joints of the body • Provides relevant examples	3
• Sketches in general terms the interrelationship between balance and/or the muscles, bones and joints of the body • May provide an example	2
• Provide some relevant information about balance and/or the muscles, bones and joints of the body	1

Sample response

eles-5019

Breaking down the question

For a sport of your choice, outline the interrelationship between balance and the muscles, bones and joints of the body.

Identify the action word/s: outline — sketch in general terms; indicate the main features of

Syllabus terminology: interrelationship, balance and muscles, bones and joints of the body

Mark allocation: 3 marks — according to HSC past papers, questions worth 3 marks require answers approaching a quarter of a page length. This requires one to two brief paragraphs, addressing the action word and providing clear examples. Responses should be specific and concise.

Answering question using PEEL structure

P Identify the *Point* being raised/state topic sentence/what this paragraph is going to be about[1]

E *Expand/Elaborate* on the point and provide a strong link to what the question is asking[2]

E Apply *Examples* that are relevant and specific[3]

L *Linking* sentence that relates back to the question[4]

Sample annotated response

A gymnast will use various muscles, bones and joints to maintain balance during a beam routine.[1] Balance is a biomechanical principle that is essential in a beam routine. If the gymnast does not use the muscles, bones and joints efficiently, balance may be hard to achieve.[2] For example, a gymnast performing a beam routine will contract their muscles throughout their body, particularly in the legs and torso, in order to keep the body stable and in alignment. The degree in the joint angles, for example the shoulder joints and hip joints, will be extended to maintain balance. This extension of the joint angles will bring the bones of the arm (radius, ulna and humerus) further away from the body, creating balance on the beam.[3] It is this interrelationship of muscles, bones and joints that allows the gymnast to balance.[4]

8.9 Review

8.9.1 Topic summary

8.2 Motion

- Biomechanics is a science concerned with forces and the effect of these forces on the human body. A knowledge of biomechanics helps us choose appropriate equipment, improve technique and reduce the risk of injury.
- Application of biomechanical principles can assist coaches and athletes to improve movement.
- Biomechanical principles assist in developing an understanding about how the interrelationship between muscles, bones and joints works to impact movement.
- Motion is the movement of a body from one position to another.
- There are three types of motion — linear, angular and general.
- Velocity, like speed, refers to the rate of positional change of an object.
- When an object such as a car moves along a road, or a person runs in a race, we often refer to how fast each is moving. This is called speed. Speed can also be developed by faster rotation of joints; for example, in a sprinter, faster rotation of the hip and shoulder joints is achieved by moving the arm and legs more quickly.
- Acceleration is the rate at which velocity changes in a given amount of time. It is very important in short distance events.
- Momentum is the quantity of motion a body possesses. It is most apparent in collision situations. When this happens, momentum continues in the direction of the body with the greater mass (as long as other factors are equal).
- Momentum can be linear (in a straight line) or angular (moving around a point). Angular momentum can be seen in most activities, particularly when we use equipment such as sticks, bats and clubs.

8.3 Balance and stability

- The centre of gravity of an object is the point about which all the weight is evenly distributed. The centre of gravity in humans is located approximately at waist height and in the middle between the front and back of the trunk.
- Knowledge of the location of the centre of gravity has important implications for sporting events such as high jump.
- The line of gravity is an imaginary vertical line passing through the centre of gravity and extending to the ground.
- The base of support refers to an imaginary line that surrounds the outside of the body when it is in contact with a surface. We improve balance by using a wide base of support. It becomes increasingly difficult to balance as we narrow the base of support.

8.4 Fluid mechanics

- Fluid mechanics is a branch of mechanics concerned with properties of gases and liquids.
- Body density affects the ability to float. A body or object floats if its density is less than that of the fluid.
- The weight and distribution of organs and tissues throughout the body influences flotation and the way the body floats (or sinks).
- The centre of buoyancy is the centre of gravity of a volume of water displaced by an object when it is immersed in that water.
- Drag is the force that opposes the forward motion of a body or object, reducing its speed or velocity.
- Lift is the component of a force that acts at right angles to the drag.

8.5 Force

- Force is the push or pull acting on a body. The body applies force in movements such as running and jumping. These applied forces are met equally by reaction forces.
- Power is the application of force applied rapidly. Power is important to most activities, particularly those of short duration such as jumping, starting in athletics and throwing.
- In both landing and ball-catching situations, forces can cause pain and sometimes injury. A knowledge of biomechanical principles helps us learn to absorb these forces effectively.

8.6 How can biomechanical principles be applied for safe and efficient movement?

- Biomechanical principles when applied can assist with enhancing safety in sport and exercise.
- When walking, correct stepping technique, light force, upright position and correct footwear can all assist with safe and efficient movement.
- When squatting and lifting such as in weightlifting, the principles of force and balance/stability are applied to help achieve safe and efficient movement.
- For athletes with a disability, biomechanics can assist in improving movement efficiency.

8.7 The role of first aid in movement

- Most people appreciate the importance of skill acquisition to increase movement efficiency. It is equally important in the prevention of serious injury.
- Core strength and posture play an important role. Good posture occurs when the musculoskeletal system is in balance, which protects the supporting structures of the body against injury.
- Preventative taping refers to the application of adhesive or non-adhesive strapping or bandages to a joint area to protect, support or strengthen the joint during movement.
- Overtraining develops as a result of subjecting athletes to high-intensity training practices when they are in a stage of fatigue, leading to undue stress being placed on the body.
- To treat undue stress on the body, for example the effects of overtraining, athletes should stop the activity and rest immediately. An extended period of rest may also be recommended in order for the body to fully recover.
- Overtraining is primarily caused by too much training, so adjustment to the amount and intensity of training needs to be made.
- It is important that an athlete drinks before, during and after training or competition to maintain optimal levels of hydration.

on Resources

📄 **Digital document** Topic 8 summary (doc-35910)

8.9.2 Key terms

acceleration the rate at which velocity changes in a given amount of time

angular momentum the quantity of angular motion in a body or part of a body

angular motion also commonly referred to as rotation, occurs when a body moves along a circular path at the same angle, in the same direction, at the same time

applied forces forces generated by muscles working on joints

average total body density percentage of body fat. The higher the percentage of body fat, the more buoyant a person will be.

axis a point around which an object rotates

base of support refers to an imaginary area that surrounds the outside edge of the body when it is in contact with a surface

biomechanics a science concerned with forces and the effect of these forces on and within the human body

centre of gravity the point at which all the weight of an object is evenly distributed and about which the object is balanced

dehydration an excessive loss of water

drag the force that opposes the forward motion of a body or object, reducing its speed or velocity

first aid the initial care of the ill or injured, usually given by someone who is on the scene when a person becomes ill or injured

fluid mechanics a branch of mechanics that is concerned with properties of gases and liquids

forces the push or pull acting on a body

general motion the combination of both linear and angular motion

inertia the resistance of a body to a change in its state of motion

lift the component of a force that acts at right angles to the drag

line of gravity an imaginary vertical line passing through the centre of gravity and extending to the ground

linear momentum a property of a body that is moving. It is equal to (or a product of) its mass × velocity.

linear motion takes place when a body and all parts connected to it travel the same distance in the same direction and at the same speed

mass the amount of matter in a body

momentum the quantity of motion that a body possesses

motion the movement of a body from one position to another

overtraining a chronic psychological and physiological condition caused by training loads that are too demanding

reaction forces equal and opposite forces exerted in response to applied forces

resistance something opposing a force

speed equal to the distance covered divided by the time taken to cover the distance

velocity the rate of positional change of an object, calculated using displacement divided by time

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on Resources

Digital documents	Key terms glossary (doc-36176)
	Revision quiz (doc-34737)
Interactivity	Missing word interactive quiz (int-8045)

8.9 Exercises

| 8.9 Revision quiz on | 8.9 Exam questions |

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8.9 Exam questions

Question 1 (1 mark)

Which muscles are primarily responsible for keeping a swimmer in a streamlined position? (HM-11-03)

A. Latissimus dorsi and pectorals
B. Rectus abdominus and biceps
C. Rectus abdominus and quadriceps
D. Latissimus dorsi and rectus abdominus

Question 2 (1 mark)

Which of the following is an example of internal force? (HM-11-03)

A. Tackle in rugby
B. Hitting a tennis ball
C. Performing a sit-up
D. Receiving a pass in basketball

Question 3 (1 mark)

Which of the following is not a strategy to absorb force when catching a cricket ball? (HM-11-03)

A. Using protective gloves
B. Standing with arms extended
C. Bending the arms in towards the body
D. Walking backwards in the direction of the ball

Question 4 (1 mark)

Which of the following is the correct technique for performing a barbell squat? (HM-11-03)

A. Feet hip-width apart, barbell slightly lower than shoulders, posture tall, straight knees, chin tucked in, engage the core
B. Feet hip-width apart, barbell slightly lower than shoulders, straight knees, head tilted down, relaxed core
C. Feet shoulder-width apart, barbell slightly higher than shoulders, posture tall, slight bend in the knees, chin tilted up, engage the core
D. Feet shoulder-width apart, barbell slightly lower than shoulders, posture tall, slight bend in the knees, chin tucked in, engage the core

Question 5 (3 marks)

Describe how the body applies AND absorbs forces when throwing and catching a ball. (HM-11-03)

Question 6 (6 marks)

Discuss the importance of efficient movement in sport. Provide examples to support your response. (HM-11-03)

Question 7 (6 marks)

An NRL player keeps losing balance when being tackled. **Discuss** how the player can use their base of support and line of gravity to improve their tackling technique. (HM-11-06)

Question 8 (5 marks)

Discuss the technique a swimmer can use to minimise drag when swimming freestyle. (HM-11-06)

Question 9 (5 marks)

Discuss the difference between speed and velocity, providing examples. (HM-11-06)

Question 10 (6 marks)

Discuss how forces are absorbed in the body. Using a catch in cricket as an example, explain how the absorption of forces can be more effective and less painful. (HM-11-03)

Question 11 (6 marks)

Discuss how wheelchair racing can use the biochemical principles to improve movement efficiency. (HM-11-06)

Question 12 (6 marks)

Outline the correct technique in a barbell squat and **discuss** the importance of technique in preventing injury. (HM-11-03)

Question 13 (8 marks)

Refer to the following statistics from the Australian Open 2024 Women's Final.

Player	Set 1	Set 2
Q. Zheng	3	2
A. Sabalenka	6	6

	Q. Zheng	A. Sabalenka
Fastest serve (km/h)	183	189
First serve average (km/h)	166	175
Second serve average (km/h)	134	137

Discuss how Q. Zheng could apply the biomechanical principles for a faster serve. (HM-11-06)

▶ Question 14 (8 marks)

A triathlete is showing signs and symptoms of dehydration and their performance is starting to be affected.

a. **Outline** the signs and symptoms of dehydration.
b. **Explain** how the triathlete can avoid dehydration in their event.

(HM-11-09)

▶ Question 15 (8 marks)

Explain how the biomechanical principles can be used to increase movement efficiency for athletes in a sport of your choice. (HM-11-09)

▶ Question 16 (8 marks)

Explain how the biomechanical principles can be used to enhance safety in a variety of sports. (HM-11-06)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

8.1 How are the biomechanical principles applied to human
     movement? (tpdf-2182) ☐

📄 Digital documents

8.9 Topic 8 summary (doc-35910) ☐
     Key terms glossary (doc-36176) ☐
     Revision quiz (doc-34737) ☐

▶ Video eLessons

8.8 Sample exam question response (eles-5019) ☐

🧩 Interactivities

8.9 Missing word interactive quiz (int-8045) ☐

🔗 Weblinks

8.2 Newton's laws ☐
     Basic biomechanics ☐
     Usain Bolt's biomechanics ☐
     Freestyle swimming technique ☐
     Sports biomechanics ☐
     30-metre flying speed test ☐
     Momentum sports ☐
     Want perfect running form? ☐
8.3 Fosbury flop ☐
     Why balance and stability training is important ☐
     The benefits of balance and stability instruction ☐
     Balance exercises to improve athletic performance ☐
8.4 How is fluid mechanics helping competitive swimmers?
     Reducing drag when cycling ☐
8.5 Long jump technique: landing for maximum distance
     Roger Federer serve analysis ☐
     Force Reduction courts ☐
8.6 How to avoid injuries when lifting ☐
     How to avoid injuries when squatting ☐
     Pain when walking ☐
8.7 Overtraining
     Tennis Australia (hydration) ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

9 What factors influence movement and performance?

LEARNING SEQUENCE

9.1 Overview

Key inquiry question

What factors influence movement and performance?

Syllabus

	Syllabus content	Subtopic
○	■ Analyse the ATP-PCr, Glycolytic (Lactic Acid) and Aerobic energy systems of the body including fuel source and efficiency of ATP production, duration, intensity and rate of recovery, causes of fatigue and interplay of the energy systems	**9.2**
○	■ Explain the role nutrition plays in enabling the energy systems to function efficiently, including macronutrients and micronutrient requirements of active people **Example(s):** Predominantly anaerobic versus predominantly aerobic activities.	**9.3**
○	■ Compare the difference between aerobic and anaerobic training for individuals and group sports, including differentiated training programs and contemporary methods of training **Example(s):** *Aerobic training:* continuous. *Anaerobic training:* anaerobic interval. *Contemporary methods of training:* High Intensity Interval Training (HIIT) and Sprint Interval Training (SIT).	**9.4**
○	■ Design an aerobic or anaerobic training program based on the FITT principle	**9.5**
○	■ Explain the immediate physiological responses to training, heart rate, ventilation rate, stroke volume, cardiac output and lactate levels	**9.6**
○	■ Investigate the physiological responses in relation to aerobic training **Including:** • creating a research question • selecting a method to collect data • discussing the ethical considerations of the methods chosen • discussing the validity, reliability and credibility of data collection • presenting findings and drawing conclusions • identifying further research questions that could be explored **Example(s):** **Selecting a method to collect data:** Observation. Survey. Interview.	**9.7**
○	■ Debate the purpose and outcomes of testing physical fitness for different groups in the population	**9.8**

Source: *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Outcomes

- analyses the systems of the body in relation to movement HM-11-03
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
- Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

Digital documents   Topic 9 summary (doc-35911)
Key terms glossary (doc-36177)
Revision quiz (doc-34738)

9.2 Energy systems

9.2.1 How energy systems work

The human body requires a continuous supply of energy both to meet the needs of its systems and organs and to power muscular contractions for movement. The transformation of food (chemical energy) to energy that the muscles can use (mechanical energy) supports the function of the energy systems.

FIGURE 9.1 Energy systems power all parts of the body, including muscular contraction.

When food is digested, it is broken down into sugars, amino acids and fatty acids, and substances that become available as a usable form of energy. From these, ATP or **adenosine triphosphate** is produced and represents the most important substance in energy production. ATP is a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction. The ATP compound consists of a large molecule called adenosine (A) and three smaller molecules called phosphates (P). Each of the phosphates is held together by high-energy bonds. The chemical structure of ATP is shown in figure 9.2. Large amounts of fuel in the form of carbohydrates (glucose or sugars), fats and protein (amino acids) lie in storage in the body, waiting to be used. ATP can be likened to a spark plug in an engine. It enables the release of energy from these substances where it can be used for muscular contraction and essential body processes such as digestion, blood circulation and tissue building.

adenosine triphosphate a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction

FIGURE 9.2 The chemical structure of ATP.
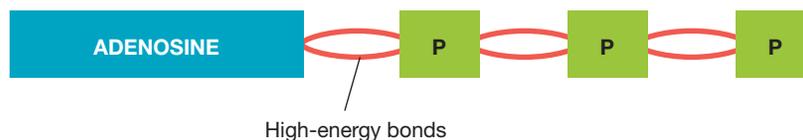
In the muscle cells, the energy from ATP allows the fibres to contract and make movement possible. This is represented in figure 9.3.

FIGURE 9.3 The breakdown of ATP: heat and energy are released as the bond between the two end phosphates breaks.
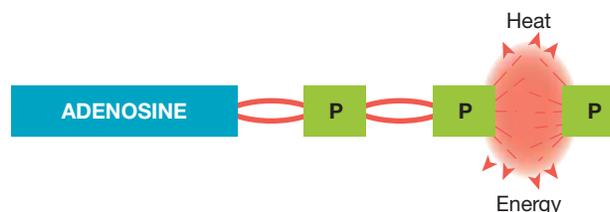
Once energy has been released, ATP then has only two phosphates attached. In this state it is referred to as ADP (adenosine diphosphate) and is powerless to provide energy. This is represented in figure 9.4.

FIGURE 9.4 Adenosine diphosphate is unable to supply energy.

High-energy bonds
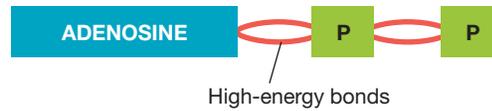
Unlike food that has had the nutrition extracted for use by the cells, used ATP does not become a waste product that is eliminated from the body. Rather, it has the ability to be quickly rebuilt or resynthesised, allowing us to continue to function while still using the limited amount we have. Resynthesis is the process of restoring ATP to its former state. Your body would struggle to carry all the ATP needed to supply energy for a day. In fact, it has been estimated that the body turns over ATP to the equivalent of 75 per cent of its weight during a 24-hour period (see figure 9.5) and much more if the person exercises intensely.

ATP needs to be continually rebuilt to enable an energy flow. Under normal conditions such as sitting, lying down or reading, only sufficient ATP is produced to enable basic functions to be sustained. The body uses fats and glucose almost entirely as sources of fuel while at rest, as sufficient ATP is being produced by metabolism of these energy sources through the aerobic energy system (see figure 9.6). However, if intense physical demands such as cycling, swimming or running are placed on the body, the systems respond by producing much higher levels of ATP to ensure that our immediate energy needs are met.

FIGURE 9.5 We turn over about three-quarters of our bodyweight in ATP each day, and much more if we engage in sustained physical activity.

ATP average daily turnover
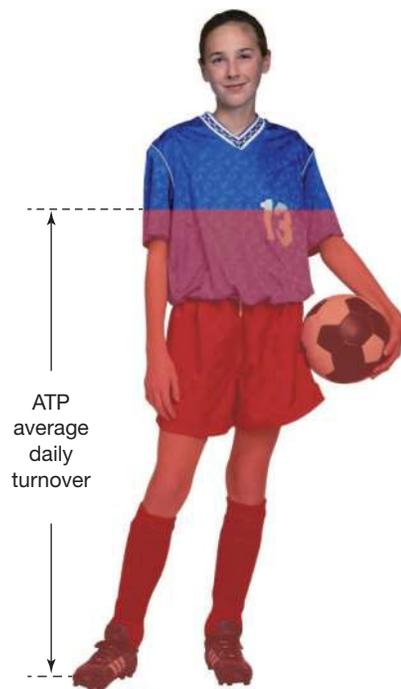
FIGURE 9.6 ATP is replenished from the breakdown of fats and glucose if the body is at rest.

Anaerobic → ATP + Lactic acid

Glucose $\frac{1}{3}$

Fats $\frac{2}{3}$

+ O_2
Aerobic → ATP + CO_2 + H_2O
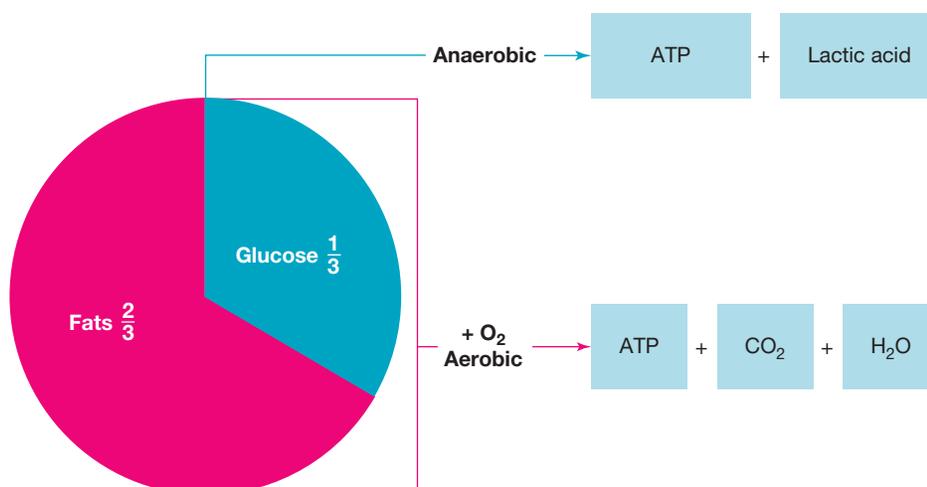
The three systems that make ATP available are:

- the ATP-PCr system
- the **glycolytic (lactic acid)** system
- the aerobic energy system.

The ATP-PCr and glycolytic systems are both called anaerobic pathways because they do not require oxygen for the resynthesis of ATP. Lactic acid is a by-product of the incomplete breakdown of carbohydrate in the absence of oxygen. However, the aerobic system is oxygen dependent; that is, ATP produced using this system relies on the availability of sufficient oxygen in the cells.

glycolytic (lactic acid) a by-product of the incomplete breakdown of carbohydrate in the absence of oxygen

phosphocreatine (PCr) a chemical compound found in muscle cells that is capable of storing and releasing energy that can be used to resynthesise ATP from ADP and Pi

FIGURE 9.7 The body's energy systems
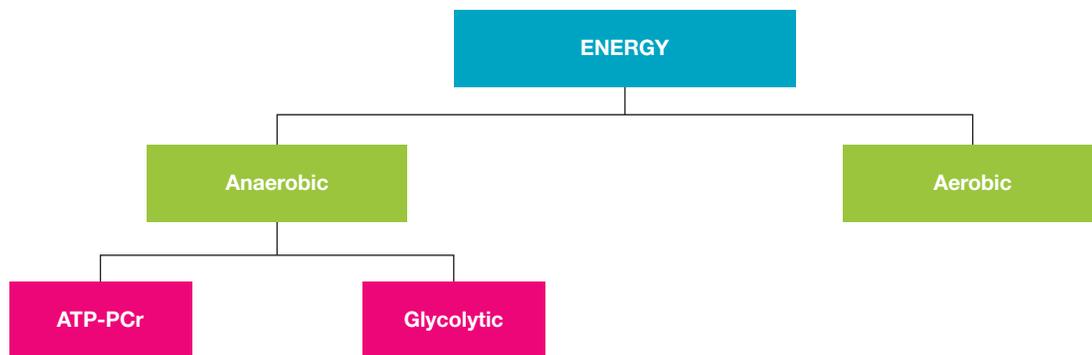
The systems are commonly called energy pathways because they each supply ATP, but they use different processes to do so. Each system has a way of resynthesising (rebuilding) the partly destroyed ATP molecule. How well each system resynthesises ATP determines its efficiency in energy production.

9.2.2 ATP-PCr system

As mentioned, residual supplies of ATP in the body are very limited. In fact, we have sufficient for only one explosive muscular contraction; for example, a standing long jump or sprint start lasting 1 to 2 seconds. An explosive movement causes the ATP molecule to 'split', providing energy for muscular contraction. Further muscular work relies on **phosphocreatine (PCr)** breaking down to creatine and phosphate, and releasing energy in the process. PCr is an energy-rich compound that serves as an alternative energy source for muscular contraction. The energy is used to drive free phosphate back to ADP so it can once again become

FIGURE 9.8 A long jump is an example of an explosive muscular contraction that uses the ATP-PCr system.

a triple phosphate. Once reformed, ATP can break down again — and so the process goes on. The problem, however, is that PCr supplies are exhausted within 10–12 seconds and take 2 minutes to be restored. The sequence is shown in figure 9.9.

FIGURE 9.9 The breakdown and resynthesis of adenosine triphosphate.

Adenosine triphosphate consists of adenosine (A) and three phosphates (P).

$$ADENOSINE = P = P = P$$

The phosphates are held together by high-energy bonds.

$$ADENOSINE = P = P = P$$

ATP 'splitting' occurs when the end phosphate is detached, providing energy for muscular contraction and heat.

$$ADENOSINE = P = P \quad P \quad Heat \quad Energy$$

Having lost a phosphate, ATP is now reduced to ADP (adenosine diphosphate).

$$ADENOSINE = P = P$$

Phosphocreatine (PCr) consists of creatine and phosphate. It becomes available to help in the process of resynthesis — that is, reforming ATP which has been partly destroyed.

$$(Creatine) \quad Cr = P$$

Like ATP, creatine and phosphate are also held together by high-energy bonds.

$$Cr = P$$

The bond between creatine and phosphate breaks down, releasing energy.

$$Cr \quad P \quad Energy$$

The energy released drives the free phosphate (Pi) back to join ATP.

$$ADENOSINE = P = P \quad Pi \quad Energy$$

ATP is reconstituted — that is, brought back to its original form.

$$ADENOSINE = P = P = P$$

The terminal bond between the end phosphate breaks down, releasing energy and heat, and so the process continues until PCr supplies are exhausted.

$$ADENOSINE = P = P \quad P \quad Heat \quad Energy$$

Fuel source

We have about 90 grams (about the same weight as a large egg) of ATP in our body. This is sufficient to power the muscles required in one explosive movement such as a jump, start or throw. That equates to 1 to 2 seconds of hard work. Following that, we rely on the 120 grams of reserve fuel, PCr, stored in our cells. Therefore, phosphocreatine is the fuel of the ATP-PCr system.

Efficiency of ATP-PCr production

The ATP-PCr system functions to make ATP rapidly available. Moreover, this occurs whether or not oxygen is available. This rapid supply is enabled primarily by a concentration of PCr in the muscle cells that is approximately five times greater than that of ATP. However, the supply of ATP is very limited if the demand is high as a result of sustained maximal or near-maximal work; but the system is able to recover quickly. Therefore, the importance of this system to short, explosive movements in activities such as weightlifting, discus throwing and starts in athletics is paramount.

Duration of the system

In the ATP-PCr system ATP supplies are exhausted after 2 seconds of hard work and PCr supplies are exhausted in a further 10 to 15 seconds. However, at rest, PCr supplies are almost fully restored within 2 minutes.

Intensity

At maximal or near-maximal effort, fatigue is caused by the inability of the system to continually resynthesise ADP from PCr because PCr supplies are quickly exhausted. This is why we are unable to run at maximal effort for distances longer than 100 m. It is particularly evident in an all-out sprint over 150 m, working at an **intensity** of 85–90 per cent of the athletes' maximum heart rate, where the winner will not be the athlete that accelerates most quickly to the finish, but the one who slows down the least in the final metres of the race.

Rate of recovery

The ATP-PCr system recovers quickly from exercise. Within 2 minutes, most of the ATP and PCr supplies have been fully restored, with 50 per cent of phosphocreatine replenishment occurring in the first 30 seconds of rest recovery. This is why high-jumpers, weightlifters and discus-throwers can 'back up' almost immediately after their first and second attempts.

FIGURE 9.10 High-intensity exercise is unsustainable beyond 10–15 seconds as both ATP and PCr supplies are exhausted.
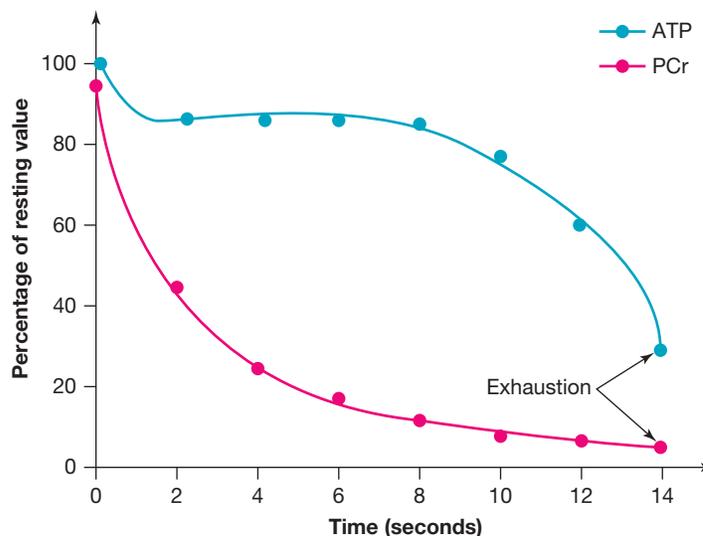
FIGURE 9.11 The ATP-PCr system plays an important role in sports that require explosive movements.

intensity the amount of effort required by an individual to accrue a fitness benefit

Cause of fatigue

While there are no fatiguing by-products of this system, heat is produced during the process of muscular contraction, and fatigue occurs when the supply of PCr runs out.

9.2.3 Glycolytic (lactic acid) system

Following 10–12 seconds of maximal exercise, PCr supplies are exhausted. ATP still needs to be produced to provide energy, assuming that the activity requires effort for longer than this, such as in a 400-m race. The body needs to find a different fuel source because PCr supplies are at a low level. It does this by using the immediate sugar supplies circulating in the blood (glucose), as well as our sugar storage supplies (glycogen) in the muscles and liver.

The process of using **glycogen** or **glucose** as fuel is called **glycolysis**. Glycogen is more abundant than PCr and can be used whether oxygen is available or not. For this reason, the glycolytic system is **anaerobic** (meaning the reaction occurs without oxygen). As sufficient oxygen is not available during intense exercise, lactic acid levels rise and continue to rise as intensity increases.

Lactic acid is produced because insufficient oxygen results in the partial breakdown of glucose, providing quick but limited ATP production, as well as the by-product lactic acid.

glycogen the storage form of glucose and is used for fuel when blood glucose levels decline

glucose broken down from stored glycogen, glucose is transported in the blood to provide energy for working muscles during training

glycolysis the process of using glycogen or glucose as fuel

anaerobic describes a process that takes place in the absence of oxygen

Fuel source

The only fuel that can be used by the glycolytic system is carbohydrate. This exists in two forms:
- glucose (in the blood)
- glycogen (stored in the muscles).

Glycogen is broken down, producing ATP and energy for muscular contraction. This is illustrated in figure 9.12.

FIGURE 9.12 The glycolytic system uses glycogen to produce energy.
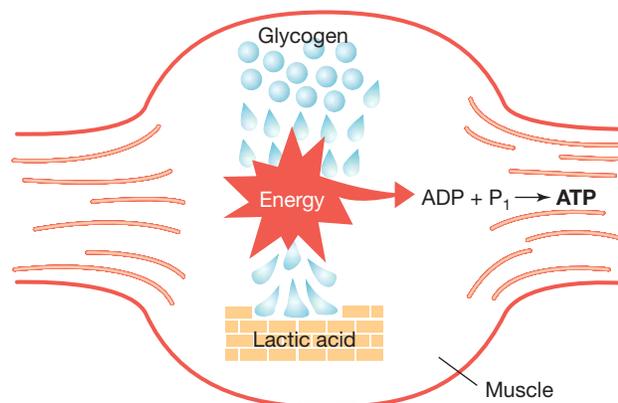
Efficiency of ATP production

The glycolytic system provides ATP quickly, but this requires large quantities of glucose. In other words, ATP is rapidly available but does not last for long durations of activity.

Duration of the system

The glycolytic system is the dominant system for all maximal activity performed between 30 seconds and 2 minutes — for example, 200-m sprint, 400-m running, 200-m freestyle swimming or gymnastic routines.

Intensity

The duration (work span) of the system depends on the intensity of the activity. Whereas a near-maximal effort causes exhaustion in 30 seconds, an effort of 70–80 per cent of an athlete's maximum heart rate will not cause exhaustion for 3 to 4 minutes, and much longer for moderate-intensity activity. Generally speaking, the glycolytic system produces energy for high-intensity activities lasting from 10 seconds to 1 minute or more depending on the effort involved.

9.2 PRACTICAL ACTIVITY 2

Sensing lactic acid accumulation

As a class, participate in a warm-up followed by a 400-m run. Slowly build up the intensity and increase to maximum intensity during the last 100 m.

After the run, write a brief description of how your body felt when you stopped. Refer to the feeling in your muscles, breathing rate, energy levels and fatigue.

Consider the following questions:
1. Could you run another 400 m straight away? Why or why not?
2. Refer to the glycolytic (lactic acid) energy system and explain how it impacted your performance in the run.

Rate of recovery

During the post-exercise period, lactic acid diffuses from the muscle and into the bloodstream where its use as a by-product is important. In the liver, lactic acid is reconverted to glycogen and can once again be used as a source of fuel (see figure 9.13). The process takes about 30 to 60 minutes. This further contributes to the body's efficiency by resynthesising waste for use at a later stage.

Cause of fatigue

Fatigue occurs when lactic acid levels build up within the muscle cells. The cause of fatigue in this system is predominantly the accumulation of lactic acid in quantities faster than it can be removed.

The speed of lactic acid production depends on exercise intensity. The faster you work, the more rapidly lactic acid accumulates. Excessively high levels of lactic acid prevent the muscle fibres from contracting and result in a rapid deterioration in performance.

However, while high lactic acid levels cause fatigue, tolerable levels can, in fact, enhance performance, because lactate is a fuel source. Finding the balance between the levels comes with training, together with the individual's awareness of the presence of lactic acid accumulation. Lactic acid tolerance improves with training, as do removal rates. Even though production rates may be high during intense exercise, high removal rates may ensure that performance is not affected.

FIGURE 9.13 Not only does the liver store glycogen, but it is also able to reconvert lactate back to glycogen to be once again used as fuel.

Lactate returning from body

Glucose supplied to body

Glucose stored as glycogen

Liver
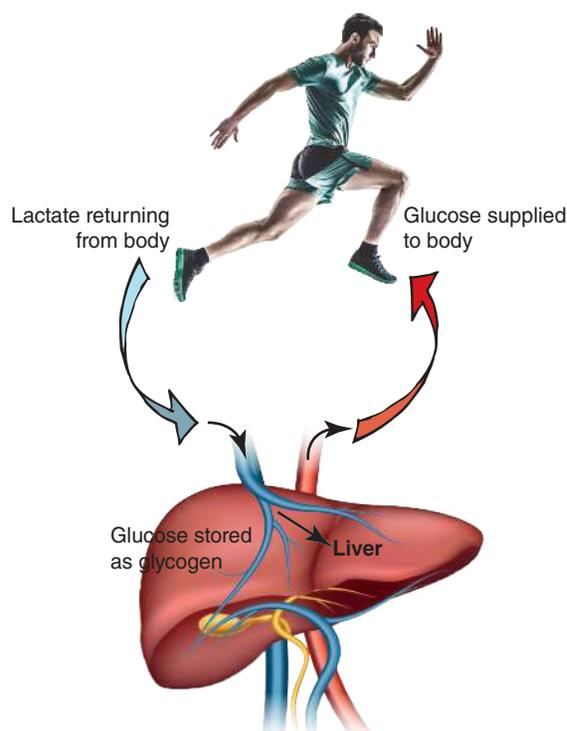
FIGURE 9.14 An athlete's effort in a 100-m hurdles race produces high levels of lactate.

9.2.4 Aerobic energy system

Physical activity lasting more than a few minutes requires the presence of oxygen to ensure the continuation of muscular contraction. Oxygen is not immediately abundant to the muscles when we begin exercise; rather, it gradually becomes available as the oxygen-rich blood fills the muscle cells. Lactic acid does not accumulate during **aerobic metabolism** because oxygen is present. This is in contrast to **anaerobic glycolysis**.

aerobic metabolism the breakdown of fuel in the presence of oxygen to produce energy (ATP)

anaerobic glycolysis process in which glucose is broken down in the absence of oxygen to produce energy

FIGURE 9.15 The aerobic system can use many sources of fuel to produce ATP.
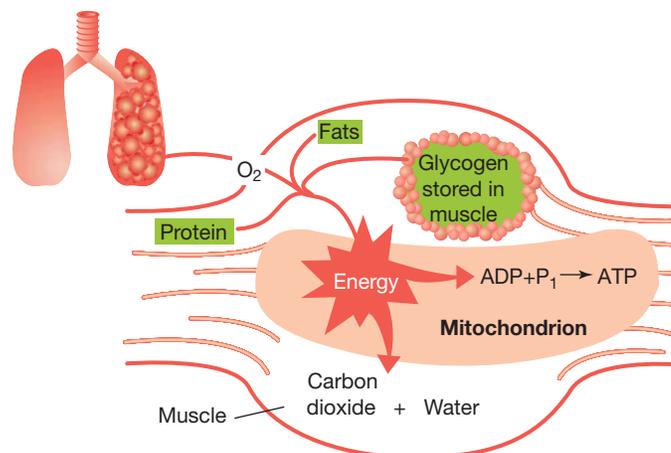
Fuel source

Whereas the glycolytic system can use only glucose as fuel, the aerobic system can use carbohydrate, fat and even protein (figure 9.15). During the early stages of endurance work, carbohydrate is the preferred fuel. However, if exercise continues beyond an hour or so, fat becomes increasingly important as a fuel and becomes the dominant energy source if glycogen supplies become exhausted.

Efficiency of ATP production

The aerobic system is extremely efficient in the metabolism of fuel and provision of energy.

As with most fuels that are burnt, by-products are produced, in this case carbon dioxide and water. The carbon dioxide is breathed out through the process of respiration and the water is available to the cells. These by-products are not harmful to performance.

Duration of the system

The total amount of glycogen in the body is approximately 350 grams. This is sufficient for 12 hours of rest or 1 hour of hard work. In intermittent exercise, such as football or netball, glycogen supplies last for approximately 4 to 6 hours. However, in the case of marathon runners, supplies could be exhausted in about 2 hours.

FIGURE 9.16 Efficiency of production of ATP

The body has virtually unlimited supplies of fat and this is used as a fuel source once glycogen supplies are depleted. In well-trained athletes, the body uses carbohydrate and fat in endurance events. This process, called glycogen sparing, results in some fat fuel being used earlier so that glycogen can be available at a later stage, such as for a sprint finish. These fuels used jointly, yet sparingly, ensure that the body can operate using this system for long periods of time. The aerobic energy system is the predominant system for use during extended endurance events such as marathons and low-demand activities such as walking or sitting. During aerobic activity, oxygen is required to burn the fuels in the body (carbohydrate and fat).

Intensity

The aerobic energy system usually occurs at low levels of intensity, which enables the body to be able to work for longer durations. The aerobic system typically works at a rate of 65–70 per cent of the body's maximum heart rate.

Rate of recovery

The recovery rate of the aerobic system depends on the duration of use. If used for a short period of time, the system recovers quickly because glycogen stores have not been depleted. However, if used for hours, glycogen storage areas could well be exhausted. In this case, it may take days to fully replenish glycogen reserves.

Cause of fatigue

Because the aerobic energy system is so versatile in fuel usage (remember, it can use carbohydrate, fat and even protein to produce energy), it is not a lack of fuel but other factors that contribute to fatigue while this system predominates. During endurance work, slow-twitch muscle fibres will do most of the work. These fibres have many capillaries and a rich oxygen supply. Before a run, these fibres may be saturated with glucose. However, activity beyond an hour or so results in the depletion of glucose and, although some is replaced from the liver, glycogen is exhausted. Glycogen is premium fuel for the muscles in the aerobic energy system; when it runs out, this leads to fatigue.
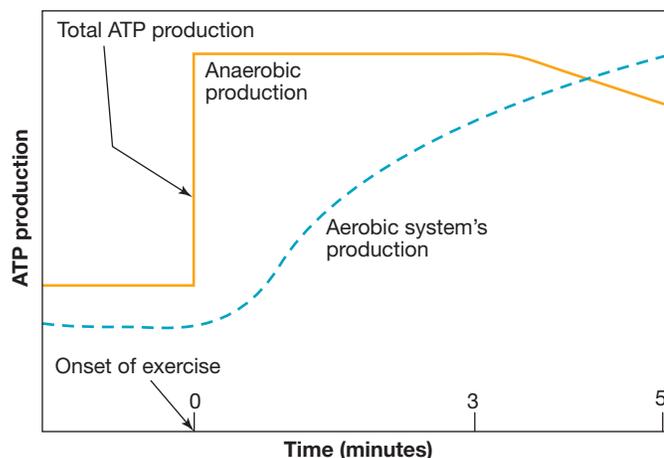
A second cause of fatigue is the exhaustion of carbohydrate and subsequent reliance on the secondary fuel, fat. Although fat is much higher in energy than carbohydrate, its use as a sole fuel can cause problems. The point at which the body changes its main fuel supply from glycogen to fat is called 'hitting the wall'. Fatigue occurs because fat requires more oxygen for metabolism than does carbohydrate. In a marathon, for example, when fat is used for fuel, an athlete's temperature and rate of respiration (breathing) will increase to try to sustain movement.

9.2.5 Energy systems summary

The energy systems should not be thought of as individual metabolic units that operate independently of one another. Although the systems have been referred to individually, they actually function together, which will be discussed in subtopic 9.3. This gives rise to the term *predominant energy system*, or the system that is being most used at that point in time. The characteristics of each energy system are shown in table 9.1 below.

TABLE 9.1 Characteristics of the three energy systems

Characteristic	ATP-PCr	Glycolytic (lactic acid)	Aerobic
1. Energy source for ATP production	Phosphocreatine	Carbohydrate Glycogen	Carbohydrate Fat Protein
2. Duration of peak energy production	5–10 seconds	30–45 seconds	3–7 minutes
3. Percentage contribution at rest	Less than 5%	Approximately 15%	Approximately 80%
4. Percentage contribution at maximum intensity	55%	40%	5%
5. Recovery time until repeat effort	Phosphocreatine replenishment: 3–5 minutes with 50% recovery in first 30 seconds	Depends on time above lactate threshold. Removal of lactic acid to rest levels: *With active recovery* 50% removal: 15 minutes 95% removal: 30 minutes *Without active recovery* 50% removal: 30 minutes 95% removal: 60 minutes	Restoration of body glycogen stores: After competition of more than 1 hour: 24–48 hours After hard interval training: 6–24 hours
6. Intensity and duration of activity where the system is dominant ATP provider	Maximal intensity (>95%) and duration of 1–10 seconds	High, sub-maximal intensity (85–95%) and duration of 10–30 seconds	Sub-maximal intensity (85%) and duration of >30 seconds
7. Specific sporting examples	• Any athletic field event • Elite 100-m sprint • Golf drive • Gymnastic vault • Volleyball spike • Tennis serve	• 200-400-m run • 50-m swim • Consecutive basketball fast breaks • High-intensity 15–20-second squash rally • Elite netball Centre in close game	• Marathon run • Cross-country skiing • Triathlon • AFL midfield play • 2000-m rowing race • Water polo game

9.2 PRACTICAL ACTIVITY 3

Experiencing the energy systems

1. Perform a recognised field test of aerobic fitness such as the 20 metre multistage fitness test (beep test). Use the **20m Multistage Fitness Test (Beep Test)** weblink in the Resources panel to view the procedure. Try to be aware of changes in energy systems as you run.
2. Briefly describe your feelings (muscles, breathing rate, fatigue) once your body changed to the aerobic system to supply energy. Describe how you felt as you neared your upper limit and could not continue.
3. Examine figure 9.17. Do you think the diagram illustrates the energy contribution from each system during your fitness run? How would the diagram alter if you walked the entire distance? Discuss your response with the class.

int-9283

FIGURE 9.17 Relationship between running time and energy systems
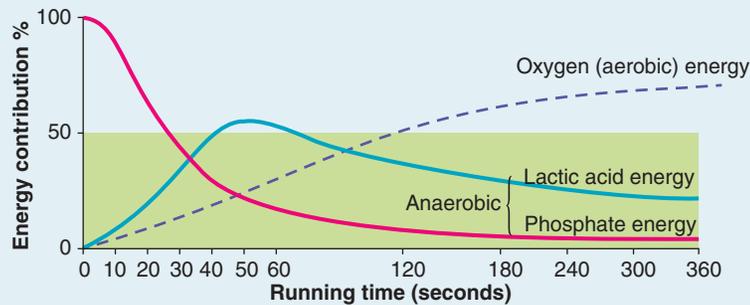
9.2.6 Interplay of the energy systems

Energy systems do not act in isolation of each other and will be used at different points during sport or exercise. When energy systems function together during different activities, this is known as the **interplay of energy systems**. Which energy system is used is dependent on the intensity and the duration of the exercise. Figure 9.18 shows that after 10 seconds the ATP-PCr system is contributing little to no energy supply and by 30 seconds the lactic acid system is in decline, although is still assisting to some extent. The contribution of the aerobic energy system at this point is predominant and rising gradually.

interplay of energy systems energy systems working together, but at different rates, to supply the ATP required for an activity

int-8622

FIGURE 9.18 Approximate relative contributions of the three energy systems to energy production at maximum sustainable exercise intensity of varying durations
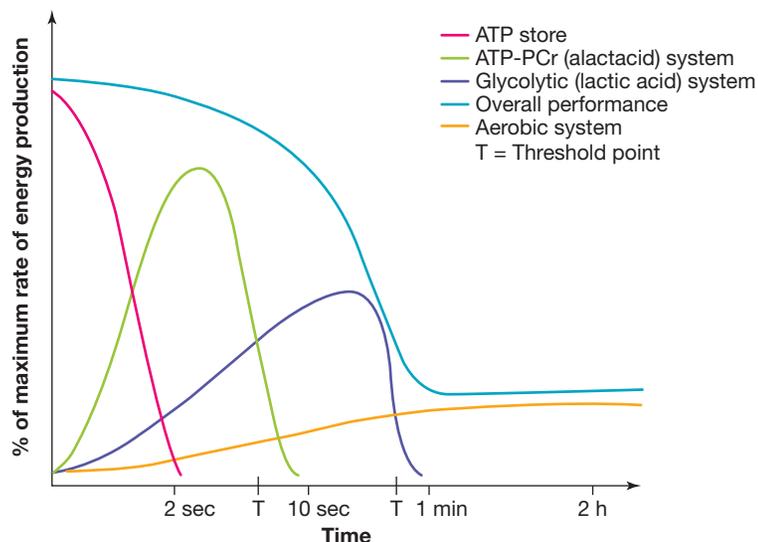
The interplay of energy systems can be seen during a game of hockey. Throughout the duration of the game, the aerobic energy system will mostly be dominant because the game lasts for 60 minutes and requires a continual supply of energy. When the aerobic system is in use, the exercise intensity is below 70 per cent of the athlete's maximum heart rate. This system is used throughout, during periods of rest such as when a player substitutes another player by coming off the field or during times of low-intensity activity such jogging into position to restart the game after a goal has been scored. In addition, periods of the game which are low intensity, such as when jogging into position or waiting for a short corner to be played, will call on the aerobic system. At other times during the game, the glycolytic (lactic acid) system will be dominant, such as when an attacker needs to sprint up the field with the ball. Examples of when the ATP-PCr system is used include quick accelerations to receive the ball or a sprint out of a short corner. The reason why the ATP-PCr and lactic acid systems are used is because these systems involve heart rates of 85 per cent maximum heart rate and above, and can only be sustained for a short duration due to their fast rates of fatigue.

Another sporting example where the interplay of energy systems is seen is triathlon. Here the aerobic energy system is the system predominantly used, as this is physical activity lasting more than a few minutes that requires the presence of oxygen to ensure the continuation of muscular contractions throughout the duration of the event. However, there are parts of the event when the other systems are used to provide energy. As intensities change during this type of event, both the aerobic and anaerobic energy systems will be used.

In a triathlon, a sprint to start the race or to overtake a competitor will mean that the ATP-PCr system comes into play. This system is used due to the high intensity and short duration of the sprint. This will be exhausted within 10 seconds and will lead the athlete to be short of breath and have burning in the chest and legs. This is known as the *lactate inflection point*, and when this is reached the muscles start to become acidic, decreasing their ability to contract. Energy is now being produced anaerobically and shortly the athlete will not be able to maintain their performance and will require rest and recovery. Sudden accelerations or bike changes and diving off the blocks into the pool are all components of the triathlon event that engage this system, as they are activities requiring a burst of energy for up to 10 seconds. The glycolytic (lactic acid) system is also used for energy production of approximately 60–120 seconds, for example in a triathlon during the first 100–200 m of the swim. However, these intensities cannot be sustained and will require the athlete to lower the intensity in order for the body to engage the aerobic energy system, which will be the predominant system for the duration of the event.

FIGURE 9.19 Sudden accelerations during triathlon events, such as overtaking an opponent, engage the ATP-PCr system.

DEPTH STUDY IDEA

Choose a sport or sporting event, for example a 100-m swim.
1. Select the energy system(s) used during the event.
2. Create a visual presentation of your choice to represent the following:
   • Fuel source and efficiency of ATP production, duration, intensity and rate of recovery
   • Cause of fatigue
   • Interplay of energy systems
   The above points should be applied to your specific sport or event to show how energy is provided for the athlete.
3. Using information from your presentation, write a two-page report answering the following: 'Analyse how movement and performance are influenced by the energy systems for your chosen sport.'

9.2 ACTIVITY 4

Use the **Energy systems interplay** weblink in the Resources panel to further investigate the interplay of the energy systems.

on Resources

🔗 **Weblinks**   20m Multistage Fitness Test (Beep Test)
Energy systems interplay
Energy systems
Energy systems 2
Lactate threshold

9.2 Exercises

learn on

9.2 Quick quiz **on**	9.2 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3	4, 5, 6	7, 8, 9

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Revise your knowledge

1. Identify the three energy systems.
2. Describe the role of the glycolytic (lactic acid) system during exercise.
3. Identify a range of sports or activities in which the ATP-PCr system is the predominant energy system.
4. Discuss the interplay of energy systems during a hockey game.
5. Make a copy of the following table in your workbook. Analyse each energy system in terms of the points listed. Sources of information could include:
   • content within this topic
   • the **Energy systems** weblinks in the Resources panel.

Criteria for analysis	ATP-PCr	Glycolytic (lactic acid)	Aerobic
Fuel source			
Efficiency of ATP production			
Duration of system			
Intensity			
Rate of recovery			
Causes of fatigue			

6. Identify a sport or activity in which the aerobic system is the predominant energy system. Discuss the strategies that could be used to ensure that the athlete has sufficient fuel for the duration of the activity.

7. Suggest how use of an interchange/substitution rule in some team sports could improve player performance on the field in terms of energy system recovery.

8. List three sports or activities in which the glycolytic (lactic acid) system is the predominant energy system. Analyse strategies an athlete could use to help overcome the build-up of lactic acid in an 800-m event.

9. Select a sport and, using aspects of the game, provide examples of when and why each energy system is used. You can use the **Energy systems interplay** weblink in the Resources panel to watch an example.

	ATP-PCr	Glycolytic (lactic acid)	Aerobic
When is the energy system used?			
Why is the energy system used?			

9.3 Nutrition and energy systems

> **Syllabus:** Explain the role nutrition plays in enabling the energy systems to function efficiently, including macronutrient and micronutrient requirements of active people
>
> *Source:* *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

9.3.1 Nutrition

Nutrition plays an essential role in enabling the energy systems to function efficiently. It is important that athletes have an understanding of the energy systems dominant in their sport to be able to make the best nutritional decisions to meet their energy requirements.

As discussed previously, we get our energy from the food we eat. Food is broken down into sugars, amino acids and fatty acids, which become available as a usable form of energy.

This section will further explain the role of nutrition, including the role of macronutrients and micronutrients for the energy systems.

FIGURE 9.20 A nutritious diet is essential for athletes.
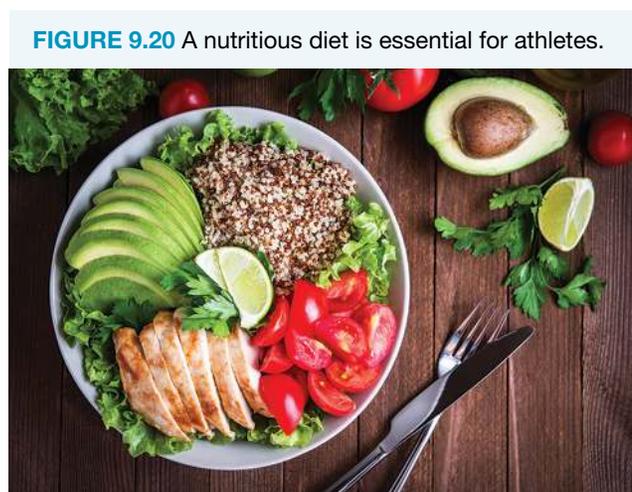
9.3.2 Macronutrients and micronutrients

Macronutrients are the main nutrients in the foods we eat and are the main fuel sources for the energy systems. These macronutrients are:

- carbohydrates
- protein
- fat.

Micronutrients include chemical elements that are required in small amounts for healthy growth and living of cells. These are referred to in the diet as vitamins and minerals. When people have deficiencies in certain micronutrients, it can have a significant and sometimes severe impact on the body's health.

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body; these include carbohydrates, fats and proteins

micronutrients one of the major groups of nutrients needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance among other functions. Also known as vitamins.

TABLE 9.2 Examples of macronutrients and micronutrients

Macronutrients	Micronutrients
- Carbohydrates — wholegrain cereals (oats, brown rice, pasta, grainy bread), root vegetables - Protein — fish, chicken, lean meat, eggs, legumes, nuts, seeds, dairy products, tofu - Unsaturated fats — nuts, seeds, fish, olive oil, avocado	- Vitamin A — milk, cheese, eggs (yolk), orange and yellow fruits and vegetables - Vitamin B — legumes, wholegrain cereals, nuts, seeds, green leafy vegetables - Vitamin C — citrus fruits, broccoli, strawberry, parsley, cabbage - Vitamin D — citrus fruits, broccoli, strawberry, parsley, cabbage - Vitamin E — olives and olive oil, avocado, wholegrain cereals - Iron — lean meat, green leafy vegetables, legumes - Calcium — dairy products, almonds, tahini, green leafy vegetables - Magnesium — nuts, seeds, wholegrains, legumes, green leafy vegetables - Zinc — lean meat, chicken, fish, sunflower and pumpkin seeds - Selenium — Brazil nuts, wheatgerm, sunflower seeds, oats

CASE STUDY

Exercise nutrition: whether you should eat before or after a workout depends on your fitness goals

By Justin Roberts, Associate Professor, Health and Exercise Nutrition, Anglia Ruskin University

17 November 2020

There's plenty of evidence showing how important nutrition is for exercise, from aiding performance to enhancing recovery. But it's often confusing to know whether it's best to eat before or after you exercise.

To answer this, you should first consider what you're training for, as your goal could influence whether to eat before or not. Second, you need to consider the level that you're at. An elite athlete's needs are different from a beginner and probably influences how much energy from food is needed — and even the number of meals eaten. Third, you need to think about what works for you. Some people thrive when training in a fasted state, while for others, it's the opposite.

Eating before

When we exercise, our bodies need energy. This energy is supplied by fuel, either stored in our bodies (as carbohydrate in our liver and muscles, or from fat stores), or from the food we eat. If the exercise is demanding or if we exercise for a long time, we use more stored carbohydrate (known as glycogen).

Studies show that carbohydrates in our diet are important in topping up our glycogen stores between bouts of exercise and also when eaten before exercise sessions.

So if your energy is somewhat low, or you're doing a longer or more demanding session, consuming carbohydrate-rich foods – such as pasta, rice, cereals or fruit – around three to four hours before exercise can help provide the energy you need to keep moving.

There's also evidence that carbohydrate type can help improve metabolic responses to exercise. While this may not necessarily affect performance, eating lower glycemic index foods (foods that produce a slower-releasing carbohydrate effect, such as porridge oats or wholegrain bread) can better sustain energy and provide benefits (such as lower use of glycogen stores) during exercise for some.

But eating right before exercising could cause indigestion, cramps or nausea. Consuming an easily digestible, carbohydrate-rich meal (for example, porridge with blueberries) around three hours before a training session may help sustain energy and improve training quality without necessarily leading to gut issues. Pre-fuelling also helps sustain blood sugar levels during exercise, which can positively affect performance.

If your goal is building strength or muscle, evidence also suggests that eating protein before exercise may improve overall recovery responses. By providing essential amino acids before they're needed, this could support early recovery and may be relevant for those undertaking intensive workouts.

Eating after

On the flip side, however, recent research has demonstrated that training in a fasted state — for example, first thing in the morning before breakfast — can actually lead to positive adaptations linked with efficient fuel use and fat burning.

This could optimise fuel efficiency, which may be important for those training for a marathon, for example, to help delay fatigue. Fasted training could also have other health benefits such as improved blood sugar and hormone regulation.

But if we think about the point of training, it's all down to how we recover and adapt from it. This is where nutrition has a significant role to play. Early research has shown the benefits of eating carbohydrates after exercise to restore muscle glycogen. Not only does this affect our ability to train many times a week by helping muscles recover faster, it's also shown to affect how well we perform.

Studies have also demonstrated that eating soon after finishing exercise (as opposed to waiting for a few hours) can help maximise recovery, particularly if a carbohydrate intake of about 1.3 grams per kilogram of body weight per hour is consumed during the two-to-six hour short-term recovery phase. This could be useful to know if you are doing another session that day or within eight hours.

If your exercise sessions are more spread out, then early refuelling of carbohydrate is less important, so long as you aim to meet suggested guidelines, which, for moderate activity, is around five to seven grams of carbohydrates per kilogram of body weight a day.

But there's also an overwhelming amount of evidence pointing towards the importance of protein feeding during recovery from exercise, both for maximising muscle growth, and supporting glycogen replenishment (if protein is consumed with carbohydrates). Research also shows that if training is done later in the day, then consuming a small protein meal (such as a shake) before bed can also help with acute recovery leading to muscle growth.

Before and after

Unless training in a fasted state for a particular reason (such as for metabolic adaptations or personal preference), there does appear to be clear advantages for eating before (and during) longer duration exercise. This may also be the case for more trained athletes looking to gain a performance edge. But using nutrition to strategically recover should be a must for those who are serious about maximising their workouts.

But what about both? In the case of resistance training, such as weight lifting, research shows consuming a combination of mainly carbohydrate, protein, and creatine immediately before and after training provided better muscle and strength gains over ten weeks compared with consuming these nutrients away from training.

While eating after exercise is important for building muscle and recovering between workouts, eating before a workout may be equally important for those doing demanding or long workouts. But no matter the type of exercise, it's important to make sure you're eating enough carbohydrates, protein and other key nutrients to fuel yourself.

Source: https://theconversation.com/exercise-nutrition-whether-you-should-eat-before-or-after-a-workout-depends-on-your-fitness-goals-150098.

Case study questions
1. What factors should be considered when planning your nutrition for exercise?
2. Explain the benefits of carbohydrates for endurance exercise.
3. Identify the nutritional needs for an active person participating in strength training.
4. Suggest what the effects on exercise might be for an active person engaging in endurance training who is not consuming the correct nutrition.

9.3.3 Nutritional requirements of the aerobic energy system

The types and amounts of foods consumed are determined by whether the activity is anaerobic or aerobic.

As mentioned previously, endurance athletes predominantly use the aerobic system. The main sources of fuel are macronutrients including carbohydrates (low **glycaemic index**), fats (unsaturated) and protein.

Anaerobic sports such as sprints, field athletics or weight training require different amounts and types of carbohydrates, less fat and more protein for muscle repair. Unlike aerobic activities where the body has time to convert stored glycogen into fuel, in anaerobic events quick energy is needed and the types of carbohydrates needed have a high glycaemic index; for example, white bread, fruits and lollies. During short bursts of high-intensity work, your body quickly converts stored glycogen and recently consumed carbohydrates into ATP (adenosine triphosphate) and phosphocreatine.

glycaemic index a ranking system for carbohydrates based on how they affect blood sugar level

resynthesis the process of restoring ATP to its former state

carbohydrate loading the manipulation of training and nutrition prior to endurance events to maximise muscle glycogen (carbohydrate) stores

tapering a reduction in training that allows the athlete time for extra recovery and for their energy stores to be fully restored

Carbohydrates

Carbohydrates are the most versatile fuel source available to supply energy for ATP **resynthesis.** Carbohydrates in the form of glycogen can provide the energy for ATP resynthesis under both anaerobic (no oxygen required) and aerobic (oxygen required) conditions. For example, glycogen can supply energy for ATP resynthesis during both high-intensity, short-duration activities, such as sprinting 200 m or repeated work periods during a game of football (anaerobic activities), as well as being able to provide energy during submaximal, longer-duration activities, such as a 1500-m swim or 5-km jog (aerobic activities). At rest and during low-intensity exercise, carbohydrates contribute approximately one-third of the body's energy requirements, with fats providing the other two-thirds. Carbohydrates are essential in endurance events such as marathon running. Without sufficient carbohydrate intake, glycogen stores will be low and performance will be affected.

Carbohydrate loading is a technique used to maximise the body's storage of glycogen in preparation for a high-intensity endurance activity of more than 90 minutes. This is an important technique as glycogen is the most important fuel for endurance events and for fuelling the aerobic energy system. **Tapering** or reducing training for two to four days before competition maximises glycogen supplied.

Fats are the most concentrated form of energy for ATP resynthesis. Gram for gram, fats provide more energy than carbohydrates, with fats providing about 9 kilocalories per gram while carbohydrates provide about 4 kilocalories per gram. Despite this, fats are primarily used during rest and low-intensity exercise. At rest, fats provide approximately two-thirds of the energy needs of the body, with carbohydrates contributing the remaining one-third. During exercise, the percentage of fats being used as an energy source decreases as the exercise intensity increases. This is because, metabolically speaking, fats are more difficult to break down and, therefore, their rate of energy release is too slow (considerably slower than that from carbohydrates) during high-intensity activity where ATP resynthesis must keep pace with the rapid rate of ATP use. However, fats as an energy source become increasingly important when stores of carbohydrate start to deplete during endurance exercise (usually after 90–120 minutes of continuous activity).

FIGURE 9.21 Choosing sources of good fats are essential for athletes in assisting energy supplies.

Protein

Protein's primary importance to the body is its structural role in holding the cells together and in the growth, repair and maintenance of body tissue. It also has a functional role in hormone production and nervous system transmissions. Protein is composed of various types of amino acids. It can be a source of energy under extreme conditions, when carbohydrate and fat supplies are in very short supply or exhausted. This occurs in endurance based activities such as ultra-marathons, which predominately uses the aerobic energy system. Protein would be used to fuel the body in the last stages of the event once carbohydrate and fat stores have been depleted. Most people need to consume about 1 gram of protein for each kilogram of body weight. Well-balanced diets containing fish, chicken, red meat, cheese, breads, cereals and some types of beans or pulses contain sufficient amounts of protein.

Under normal circumstances protein contributes only minimal energy for ATP resynthesis (estimates put this figure at no more than 5–10 per cent). However, in extreme circumstances (such as starvation or ultra-endurance events), when the body has severely depleted its supplies of carbohydrate and fat, proteins can become a viable source of energy for the replenishment of ATP. Due to complex reactions required to break down the food fuels of fats and protein, energy is produced at a slower rate than when produced from carbohydrate.

TABLE 9.3 Energy systems and their source of fuel

Energy system	Source of fuel
ATP-PCr system	Phosphocreatine
Glycolytic (lactic acid) system	Carbohydrate/glycogen
Aerobic energy system	Carbohydrate, fats, protein

Vitamins

Vitamins are inorganic compounds that are essential in maintaining bodily functions. They are required in only very small quantities in the body. They do not contain energy, but they function as catalysts that help the body use energy nutrients. In this capacity they assist such functions as energy release, metabolic regulation and tissue building. Consumption of vitamins for energy production is essential for both the aerobic and anaerobic energy systems. B vitamins in particular assist the body in converting carbohydrates to energy, which is important for the aerobic energy system as carbohydrates are its main fuel source.

vitamins inorganic compounds that are essential to maintaining bodily functions

The body is unable to manufacture vitamins, so they must be supplied in the diet. A balanced diet is important because food is the main source of vitamins.

Minerals

Minerals are inorganic substances found in the body that are necessary for it to function adequately. Like vitamins, minerals belong to the group of micronutrients that are essential for the body to function properly, but do not provide energy. Iron and calcium are the two minerals that are most commonly deficient in athletes, and inadequate supplies will affect performance and contribute to health problems.

Iron is found in haemoglobin, which makes up the majority of the red blood cells in the body. These cells collect and transport oxygen, delivering it to where it is needed. Diminished haemoglobin levels affect performance because the muscle cells are deprived of oxygen, which is needed to break down the nutrients and produce energy. Iron is involved in the production of ATP in the aerobic energy system and is particularly important in endurance-based activities such as triathlon and marathon events that rely on the aerobic energy system to sustain performance. If iron levels are low, this can lead to a decrease in haemoglobin and the transportation of oxygen, resulting in fatigue.

Water

Water is essential in transporting oxygen and nutrients around the body. Water is important for both aerobic and anaerobic energy systems, but in particular the aerobic energy system. If the body becomes dehydrated, the blood becomes thicker and is harder for the body to transport to working muscles. This means that glucose, which is broken down from stored glycogen and transported as glucose in the blood, is slower at reaching the working muscles to provide energy for performance. Low water levels in the blood also make it difficult for haemoglobin to transport oxygen to working muscles. Both effects of **dehydration** can lead to fatigue and poor performance in athletes who rely on the aerobic energy system.

dehydration an excessive loss of water

Athletes, in particular endurance athletes who rely on the aerobic energy system, will often replace lost water with sports drinks, which contain carbohydrates. Marathon runners and triathletes will use these carbohydrate sports drinks to rehydrate and top up their glycogen stores to provide the aerobic system with energy to fuel their performance for the duration of the event.

CASE STUDY

Planning on running a marathon? A sports dietitian on what to eat for long-distance running

By Evangeline Mantzioris, Program Director of Nutrition and Food Sciences, University of South Australia

29 January 2021

Did you make a New Year's resolution to run a marathon? Or perhaps you've conquered a marathon and want to take on an even longer event?

Your diet is crucial in long-distance running. If you don't eat the right foods in the right amounts, you might not get enough energy to train and compete properly.

…
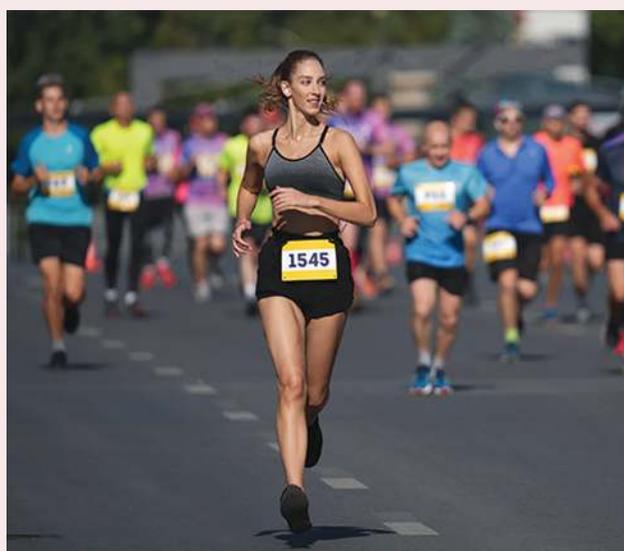
Carbs are your best friend

Carbohydrates provide most of the energy used during any length of exercise.

The International Olympic Committee on Nutrition for Sport recommends endurance athletes, who compete or train up to three hours a day, consume at least 6–10 grams of carbs per kilogram of body weight each day.

For a 70 kg person, this equates to 420–700 g a day. For ultra-endurance athletes (people who train or compete for more than four or five hours per day) it's 8–12 g per kilogram. For a 70 kg athlete, that's 560–840 g a day.

About 50 g of carbs can be found in each of the following foods: five Weetbix biscuits, four slices of bread, two large bananas, three medium-sized potatoes, 600 ml flavoured milk, a cup of rice, or one-and-a-third cups of pasta. As you can see, you would have to eat quite a lot of carbs throughout the day to reach the recommendation!

The committee also recommends you eat 1–4 g of carbs per kilogram of body weight in the four hours before exercise.

So for a 70 kg runner, that means 70–280 g of carbs before an event. There's roughly 70 g of carbs in each of the following: two slices of fruit toast with a large banana, one-and-a-half cups of cooked pasta, or 600 ml of flavoured milk plus an apple.

You also need to keep up your carb intake during endurance events. You'll need to consume 30–60 g per hour, and during ultra-endurance events up to 90 g per hour, regardless of your weight. Ideally, the foods would be high in carbohydrates and low in fibre to minimise gastrointestinal discomfort such as bloating or runner's diarrhoea.

A total of 60 g of carbs would be three slices of white bread with jam, or two energy gels (small packets of high-carbohydrate gel). Sports drinks are also useful if you don't feel like eating. A 600 ml bottle would help with rehydration and provide about 40 g of carbs.

These recommendations are only guides. Athletes should consider their current diet along with training intensity, whether they're meeting training goals, how quickly they tire during training or competition, recovery between training sessions, and weight changes.

Also consider fat and protein

More fat is used as the duration of exercise increases, and if the exercise lasts more than four hours, your body will begin to use small amounts of protein. It's hard to determine the exact levels of fat and protein used, as this depends on the intensity of exercise and level of training.

Nevertheless, as fat contributes to energy, it's important to include healthy fat sources such as olive oil, nuts, seeds and dairy products in your diet, although there are no set guidelines for how much fat you need to eat.

There's also some evidence omega-3 fats, found in fish, may support muscle growth and reduce muscle soreness.

Protein is needed for muscle repair. The International Society of Sports Nutrition Guidelines recommend endurance athletes consume 1.4 g of protein per kilogram of body weight, every day. This equates to 98 g for a 70 kg runner. Each of these foods contains about 10 g of protein: two small eggs, 30 g cheese, 40 g lean chicken, 250 ml dairy milk, three-quarters of a cup of lentils, 120 g tofu, 60 g nuts or 300 ml soy milk.

Consuming 20 g of protein in the 1–2 hours after exercise helps maximise muscle repair and gain. This amount of protein can be found in one small tin of tuna, 600 ml of milk, or 80 g of chicken.

Drink plenty of water (but don't go overboard)

You can lose a significant amount of water via sweat during endurance training and events. Making sure you're hydrated is vital for performance and health. One of the easiest ways to know how hydrated you are is by checking your urine colour — it should be clear or hay-coloured. If it's amber or darker, you need to drink more water.

While dehydration is problematic, you should also be careful not to drink extreme amounts of water, which can cause sodium levels to drop too low. This is rare, but if you gain weight right after a long-distance event, it might mean you're drinking too much water.

And don't forget iron

One of the most important nutrients for endurance athletes is iron. Iron loss occurs during heavy sweating, and women are at increased risk of iron deficiency with menstrual losses.

It's important to include red meat in your diet, or if vegetarian or vegan to consume more beans, lentils and whole grains.

Ultimately, no two athletes have the same requirements to achieve the goals they want from training and competing.

While you may be tempted to buy supplements to improve your performance, this will have little impact unless you get the diet right first. It may be worthwhile talking to an accredited sports dietitian to ensure you're meeting your energy and fluid requirements and are not at risk of relative energy deficiency syndrome.

Source: https://theconversation.com/planning-on-running-a-marathon-a-sports-dietitian-on-what-to-eat-for-long-distance-running-153425.

Case study questions
1. What are the recommended amounts of carbohydrates an active person should consume when training for a marathon?
2. Identify the predominant energy system used when training for a marathon and outline why carbohydrates are required.
3. Explain why it is important to consume protein and fats when training for a marathon.

DEPTH STUDY IDEA

Select a sport or fitness activity of your choice.
1. Research the nutritional requirements for an active person training for this sport or fitness activity. Include macronutrients and micronutrients as well as the energy requirements of the sport, for example aerobic versus anaerobic.
2. Compose a journal article titled 'Nutritional requirements for [insert name of sport or fitness activity]'.
3. Work individually or in pairs to design a sports nutrition bar suitable for your chosen sport. The bar must meet the nutritional requirements of your sport.
4. *Option:* Invite a sports nutritionist to speak to students at your school.

9.3 ACTIVITY

Use the **Food for your sport** weblink in the Resources panel to select one aerobic sport and one anaerobic sport from those listed.
1. Create a table showing pre-performance, during performance and post-performance nutritional requirements of each sport.
2. Explain why there is a difference in the nutritional requirements for each sport. In your response, refer to the energy systems.

on Resources

🔗 **Weblink** Food for your sport

9.3 Exercises

9.3 Quick quiz on	9.3 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 3, 5	2, 4, 7	6, 8

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Revise your knowledge

1. Why are nutrition and hydration important for athletes?
2. Outline how carbohydrates provide fuel for the aerobic energy system.
3. When are fats primarily used for fuel during exercise?
4. The main food fuels used to supply energy for ATP resynthesis are carbohydrates and fats. Identify the conditions under which proteins would be used to supply energy for physical activity.
5. Discuss the differences between macronutrients and micronutrients.

Apply your knowledge

6. The modern pentathlon is an Olympic sport that consists of five different events: fencing, 200-m freestyle swimming, showjumping, laser pistol shooting and a 3200-m cross-country run. All events are completed in one day. Consider the specific nutritional strategies an athlete would require in order to optimise their movement and performance during the competition.
7. Choose one sport and create a dietary plan for an active person.
8. Copy and complete the following table. Show the relationship between food fuels, the broken-down form of these food fuels and the energy system or systems that use each food fuel.

Food fuel	Broken-down form	Associated energy system(s)
Carbohydrates		
Fats		
Protein		

9.4 Aerobic and anaerobic training for individuals and group sports

▶ **Syllabus:** Compare the difference between aerobic and anaerobic training for individuals and group sports, including differentiated training programs and contemporary methods of training

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

To prepare athletes adequately, training is essential. However, the type of training and methods used depends on the type of movements, skill requirements and specific demands of the activity in question.

The two main types of training are:
- aerobic
- anaerobic.

These types of training are used in both individual and group sports; however, one type may be more dominant than the other. This subtopic will refer to training intensities that differ for these types of training. Training thresholds are zones that athletes train in. For improvement to occur, no matter how small, athletes must work at a level of intensity that causes their bodies to respond in a particular way. These changes are called adaptations or fitness gains. Thresholds are determined by work intensity, which can be calculated using heart rate.

A person's maximal heart rate (MHR) is estimated at 220 beats/minute minus age. Therefore, a 20-year-old person would have an MHR of 200 beats per minute. If the aerobic threshold is 70 per cent of MHR, the athlete would be working at a level of intensity that would cause the heart to beat at approximately 140 beats per minute. For most people between 16 and 20 years of age, this is equivalent to a moderately-paced jog.

When a person is working at a level of intensity above the aerobic training threshold and below the anaerobic threshold, they are working in the aerobic training zone. Exercise here is referred to as steady-state exercise and results in improvements in physical condition.

9.4.1 Aerobic training

Aerobic training uses the aerobic system as the main source of energy supply. The main type of aerobic training is continuous training. Other types of aerobic training include:
- fartlek training — a type of running training that involves variations in speed and intensity
- aerobic interval training — involves alternating between moderate and high intensity, with recovery intervals
- circuit training— involves rotating through a variety of exercises.

Continuous training

In continuous aerobic training there is sustained effort — that is, effort without rest intervals. For training to be categorised as continuous, it needs to persist for not less than 20 minutes. During **continuous training**, the **heart rate (HR)** must rise above the **aerobic threshold**. Aerobic threshold refers to a level of exercise intensity that is sufficient to cause a training effect. This is approximately 70 per cent of a person's maximal heart rate (MHR) and should remain within the target zone for the duration of the session. The target zone is the zone in which the athlete needs to work, at an intensity for fitness gains to be made. An example for aerobic training is between 55–85 per cent of maximum heart rate. Examples of continuous training are jogging, cycling and aerobics. In the case of an endurance running program, a period of time in excess of 30 minutes per session is needed for an improvement in fitness to occur.

Continuous training can also be applied to running. Running can be done at any intensity and should be performed for more than 20 minutes in order for it to considered continuous. Likewise, the same principles can be applied to swimming and walking; brisk walking for 30 minutes each day at a pace of around 4 to 6 km/h improves fitness and overall health. Walking at a high intensity can further add to fitness benefits.

Group sports can use continuous training such as running laps of the oval at a steady intensity or doing sprints for a period of time.

The two types of continuous training are:
- *long, slow distance training*. This is standard for those who need to improve general condition. Subjects work at between 60 and 80 per cent of their maximal heart rate and focus on distance rather than speed.

continuous training continuous activity that lasts a minimum of 20 minutes at the required intensity using the aerobic energy system. It is submaximal and requires an intensity of 70–85 per cent of maximum heart rate (also known as long, slow distance training).

heart rate (HR) number of times the heart contracts or beats per minute

aerobic threshold a level of exercise intensity that is sufficient to cause a training effect. This is approximately 70 per cent of a person's maximal heart rate (MHR).

FIGURE 9.22 Continuous training requires sustained effort.

- *high-intensity work of moderate duration*. This is very demanding as the athlete works at 80 to 90 per cent of maximal heart rate. Only well-conditioned athletes use this training and, even then, intervals of relief (rest) are required. High-intensity training requires work at or near competition pace and is essential for developing leg speed.

9.4.2 Anaerobic training — anaerobic interval

Anaerobic training uses high-intensity work coupled with limited recovery to develop systems of energy supply that function in the absence of oxygen. Anaerobic training is shorter in duration than aerobic training, lasting less than 2 minutes. While activity is brief, effort is at high intensity and followed by short rest periods that do not allow full recovery of systems that supply energy. Anaerobic training seeks to enhance systems that supply energy under periods of intense activity while developing greater tolerance for the lactic acid created as a result of the work. It is important that athletes train within the anaerobic threshold, which refers to a level of intensity in physical activity where the accumulation of lactic acid in the blood increases very quickly.

In order to improve performance, athletes must train at a level of intensity approximately 85 per cent of their maximum heart rate. This will help the body adapt to rising lactic acid and maintain energy during times of high anaerobic intensity such as during a 100-m sprint.

There are three types of anaerobic training:
- *short anaerobic training* — lasts less than 25 seconds and develops the ATP-PCr systems of energy supply
- *medium anaerobic training* — lasts from 25 seconds to 1 minute and develops the glycolytic system for energy supply
- *long anaerobic training* — lasts 1 to 2 minutes and develops the glycolytic/aerobic systems.

Anaerobic interval training can best be described as sprint training over short distances using maximal effort. Most anaerobic interval training is directed towards the development of speed as might be required in 100-m sprinting and for short bursts in games such as touch football. Table 9.4 shows differences in anaerobic interval training programs depending on activity type. To develop speed while focusing on technique, the rest period needs to be slightly extended to allow lactate to disperse, as lactate build-up inhibits the development of quality sprinting action.

anaerobic interval training sprint training over short distances using maximal effort

TABLE 9.4 Various types of anaerobic interval training

Interval	Use	Work duration	Rest duration	Work–rest ratio	Repetitions	% of maximum speed	% of maximum heart rate
Long	Anaerobic threshold training	2–5 min	2–5 min	1:1	4–6	70–80	85–90
Medium	Anaerobic training	60–90 sec	120–180 sec	1:2	8–12	80–90	95
Short	High-energy training (anaerobic)	30–60 sec	90–180 sec	1:3	15–20	95	100
Sprint	Speed (anaerobic)	10–30 sec	30–90 sec	1:3	25+	100	100

Source: Reprinted, with permission, from R. Martens, 2004*, Successful Coaching*, 3rd ed. Champaign, IL: Human Kinetics, p. 313, fig. 14.10.

9.4.3 Differentiated training programs

A training program must be designed to meet the needs of the athlete. Training programs will differ depending whether the training is for an individual sport or a group sport.

A quality training program should include fitness activities that directly address the requirements of the selected sport or activity. Some sports require a high level of aerobic fitness and a general level of anaerobic fitness, while the reverse is true of others. Group sports such as touch football, soccer and netball are characterised by periods of moderate intensity interspersed with periods of high intensity.

While the amount of aerobic or anaerobic fitness varies according to the sport, it is also affected by the position of the player, each individual's effort and their base fitness level. The sprint in rugby, rally in tennis and defence in basketball are all highly demanding, causing muscles to use available fuel and then requiring cells to find other sources for energy supply.

The change between aerobic and anaerobic energy supply is gradual rather than abrupt. When engaged in activity, the body switches between systems according to the intensity of exercise, with one system being predominant and the other always working but not being the major supplier of energy. A sprint during a touch football game requires anaerobic energy due to the instant and heavy demands made on the muscles involved in the movement. During this period, the aerobic system is still functioning, but is not the predominant energy supplier. When we consider aerobic or anaerobic training, we therefore need to think in terms of which system will predominate and the time for which it will be engaged.

TABLE 9.5 Differences between aerobic and anaerobic training programs

Feature	Aerobic	Anaerobic
Goals	Improved stamina, endurance, lung capacity, cardiorespiratory endurance	Development of force, power, body mass and speed
Warm-up	General, short, low-intensity exercise; cool-down essential	Sustained (20 minutes or more), gradual increase in intensity, must be specific to muscles required in activity
Activities	Targets endurance-type activities: marathon running, cycling, 1500-m swimming, power walking, kayaking, triathlon and the sustained phases of games	Targets explosive-type activities: 100-m, 200-m and 400-m running, 50-m and 100-m swimming, diving, weightlifting, discus, javelin, shot-put and the sprint phases in games
Targeted fitness components	Cardiorespiratory endurance, muscular endurance, body composition	Speed, power, agility
Resistance training	High repetition, weights with low resistance, circuits	Low repetition, weights with high resistance, fast plyometrics
Physical benefits	Improved cardiovascular system and ability to endure performance	Strength, power and speed gains, increased local muscle recovery ability
Health benefits	High	Low to medium
Liabilities	Possibly decreased muscle mass, speed and power	Possibly decreased cardiorespiratory function unless supported by an aerobic program
Foundation	Does not require anaerobic foundation	Requires an aerobic foundation, but varies according to sport

9.4.4 Contemporary methods of training — HIIT and SIT

There are many types of contemporary training methods such as high-intensity interval training (HIIT), sprint interval training (SIT), Tabata, CrossFit, F45 and functional training.

These contemporary methods aim to increase the intensity of workouts and train athletes towards their anaerobic training threshold.

These workouts are used for individuals and group sports and can be tailored to suit specific requirements; for example, the fitness needs of the individual or group and their sport.

HIIT

One emerging and highly popular fitness activity is **high-intensity interval training (HIIT)** as it is physically demanding yet convenient and highly adaptable to many environments. HIIT is a form of interval training in which repeated periods of intense anaerobic work are alternated with brief periods of recovery. With the inclusion of well-thought-out activities, it can make fitness a fun experience.

> **high-intensity interval training (HIIT)** involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

During this type of interval training, work periods may be as short as 5 seconds and are performed at 80–95 per cent of maximum heart rate (MHR). During this type of training, the system trained will be the anaerobic system. The intensity the athlete will be working at will be towards their anaerobic threshold. The recovery period will depend on the type of exercise but is usually the same as, but certainly not more than, double the work period. Near maximum intensity is a prerequisite for work periods, making it necessary to push the body to its limits during every exercise set. Intensity during the recovery period should drop to around 40–50 per cent MHR. Training sessions last anywhere from 20 minutes to an hour.

If done on a field and with a focus on sprinting, one interval could involve short sprints followed by recovery walking. The type of activity could be changed for each interval — from sprinting to sprinting backwards, sprinting on hands and legs, hopping, and so on. In the gym, an interval could last 30 seconds, the first 20 seconds performing an activity such as squats followed by 10 seconds of rest. After two intervals, the activity may change to lunges, push-ups, jumping jacks, burpees, crunches or whatever else participants like to include in the session.

FIGURE 9.23 HIIT requires near-maximum effort for short periods combined with equally short rest periods. It can be adapted to a range of training types.

HIIT can be adapted to a range of exercise modes including cross-training, swimming, cardio sessions, cycling and sprinting. Whatever the activity, it is important that the work:recovery ratio remains around 1:1. For example, a sprint training program may involve a series of 60-m sprints in 10 seconds with walk/jog recovery taking 30 seconds. A general exercise/cardio program may incorporate a series of exercises such as push-ups and high knee-lifts for 30 seconds with a 60-second rest between sets (see table 9.6). Work phases can vary considerably in time, but must be sustainable while high in intensity without being totally exhausting. The biggest benefits of HIIT relate to its adaptability to most training types, non-reliance on expensive equipment and the possibility of significant fitness/weight loss gains in a short period of time.

TABLE 9.6 Example of a HIIT session

Circuit	Exercise	Duration
Circuit 1	• Body weight squats • Push-ups • Sit-ups	30 seconds for each exercise — as many reps as possible during the time
60-second rest before moving to circuit 2		
Circuit 2	• Alternating lunges • Tricep dips • Sumo squats	30 seconds for each exercise — as many reps as possible during the time
60-second rest before moving to circuit 3		
Circuit 3	• Star jumps • Burpee • Bicycle crunch	30 seconds for each exercise — as many reps as possible during the time

SIT

Sprint interval training (SIT) is another type of high-intensity interval training. Some of the benefits include increased endurance, increase in anaerobic threshold and weight loss. This training involves working at a high intensity followed by intervals of low intensity. Sprint interval training can be used for running, swimming and cycling. Training intensity should be at approximately 80–95 per cent of MHR and recovery at an intensity of 40–50 per cent MHR.

> **sprint interval training (SIT)**
> a form of high-intensity training characterised by repeated, brief intermittent bursts of supramaximal intensity exercise, interspersed by periods of active or passive recovery

Another way to determine training intensity is rate of perceived exertion (RPE). This method uses a scale from 0–10, with level 0 being no exertion, for example sitting, level 5 being moderate exertion such as a light jog, and level 10 being maximal effort which cannot be sustained for long, for example a 100-m sprint.

An example of a SIT session can be seen in table 9.7.

TABLE 9.7 Example of a SIT session

Exercise	Duration
Warm-up	20 minutes jogging
High-intensity sprints x 4 (level 9 RPE)	30 seconds sprinting
Recovery between sprints	3 minutes slow jogging

FIGURE 9.24 Timing intervals of high-intensity sprinting followed by timed intervals of low-intensity exertion is an example of sprint interval training.

Comparison of HIIT versus SIT training

How do individuals know which training sessions will meet their sports, fitness and energy system needs?

HIIT sessions work to provide a high-intensity workout in a short period of time. A range of exercises can be selected that will suit most athletes wanting to develop their strength and anaerobic threshold. All sports can use this type of training as it can be adapted to suit cross-training, swimming, cardio sessions, cycling and sprinting.

SIT training also offers a high-intensity workout; however, the type of exercise is limited. As previously mentioned, SIT training is used for running, swimming and cycling. These sports involve a continuous training method and can be used to train the aerobic energy system and the anaerobic energy system. This method is particularly beneficial for triathletes who rely on a well-functioning aerobic energy system to last the duration of the event, but also require the anaerobic energy system to provide energy during high-intensity periods of work, such as sprinting to overtake a competitor or make up time during a changeover between stages of the event. SIT training will be similar for both individuals and groups due to the limited exercises compared to HIIT training.

A comparison of both methods of training for a swimmer and a hockey player can be seen in table 9.8.

TABLE 9.8 Comparison of HIIT and SIT methods of training for individuals versus group sports

	HIIT	SIT
Swimmer (individual sport)	• 50-m freestyle sprints in 30 seconds at 80–95% intensity • 100-m slow swim freestyle in 60 seconds at 40–50% intensity	• 30-second freestyle sprint at 80–95% intensity or level 9 RPE • 3-minute slow freestyle at 40–50% intensity or level 5 RPE
Hockey player (group sport)	Circuit 1: • Push ups for 30 seconds (80–95% intensity) • High knees for 30 seconds (80–95% intensity) • Slow jog for 60 seconds (40–50% intensity) Repeat the above circuit 3 times.	• 30-second sprinting at 80–95% intensity or level 9 RPE • 3-minute slow jogging at 40–50% intensity or level 5 RPE

Functional fitness is a type of training that is also increasing in popularity. It focuses on strengthening and toning the muscles used in everyday activities such as walking and lifting heavy items. Unlike HIIT, the aim is to develop the muscles used for common actions such as pulling, lifting and squatting. Instead of counting repetitions, the focus of each workout is to assist in keeping the body mobile and preventing injuries.

9.4 ACTIVITY

Use the **Top fitness trends** weblink in the Resources panel to investigate another contemporary method of training.

on Resources

🔗 **Weblink** Top fitness trends

9.4 Exercises

9.4 Quick quiz **on**	9.4 Exercise

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Revise your knowledge

1. Outline the form of exercise known as continuous training.
2. Outline the form of exercise known as anaerobic interval training.
3. How would group sports use anaerobic interval training?
4. Outline the benefits of contemporary training methods such as HIIT and SIT.

Apply your knowledge

5. Explain the difference between continuous training and anerobic interval training. How could they be applied for individuals and group sports training?
6. Compare a training program for a swimmer to that for a hockey player.
7. Explain why training programs need to be differentiated for athletes depending on their sporting needs; for example, for individuals compared with group sports.
8. Research a sample HIIT and SIT training program for both an individual and a group sport of your choosing. Compare both training methods for both the individual and group sports.
9. Investigate another contemporary method of training such as CrossFit, F45 or virtual reality workouts.
10. Select either the HIIT or SIT training method along with your selected contemporary training method from question 8 and research the proven benefits of these training methods for individuals. Compare the selected contemporary method to HIIT and SIT training methods.

9.5 Design a training program

> ▶ **Syllabus:** Design an aerobic or anaerobic training program based on the FITT principle
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Devising and implementing a training program requires a carefully considered, step by-step approach in which the coach and/or athlete incorporates the training principles and **FITT principle** into an overall plan to meet the training and fitness goals. FITT stands for frequency, intensity, time and type. The FITT principle is a fitness principle that makes sure a program has the quantity and quality of movement necessary to produce the desired physical improvement.

FITT principle a framework for developing fitness programs that emphasise the variables Frequency, Intensity, Time or duration of exercise and Type of exercise

9.5.1 FITT principle

Frequency

Frequency refers to how often training occurs. For improvements to occur, individuals must train on at least three occasions per week. This can be increased to five, but the benefit to be gained from sessions in excess of this is minimal. For resistance training, three sessions are sufficient while four is maximal, allowing rest days in between for muscle fibres to regenerate.

The aim is for a training session to sufficiently stress body systems, causing a response called an adaptation. This is an adjustment (for example, better use of oxygen by muscle cells) made by the body as a result of exposure to progressive increases in the intensity of training.

Intensity

Intensity refers to the amount of effort required by an individual to gain a fitness benefit. The most accurate way of measuring intensity during aerobic exercise is by calculating your target heart rate and using this as a guide. The target heart rate together with the level above and below is called the **target heart rate (THR) zone**. When exercising, the level of intensity needs to be sufficient to keep the heart rate within the THR zone for the required period of time. This is illustrated in figure 9.25. Here a person progresses from rest, through a warm-up and into the THR zone, where a steady state level of intensity is maintained for an extended period of time.

target heart rate (THR) zone area surrounding the target heart rate and is calculated using percentages of maximal heart rate

The level of intensity is established in terms of heart rate, which is calculated in beats per minute. There are two important steps that need to be taken to calculate your THR zone.
1. *Determine your maximum heart rate.* To do this, simply subtract your age from 220. Hence, a 20-year-old person would have a maximum heart rate (MHR) of 200 beats per minute (bpm).
2. *Determine the percentage of your maximal heart rate relevant to your fitness.* If your fitness is poor, work at 50 to 70 per cent of your MHR. If your fitness is good, work at 70 to 85 per cent of your MHR. If uncertain, work at the lower level and gradually increase the level of intensity.

FIGURE 9.25 The intensity of exercise when applying FITT is moderate, sustained and within the target heart rate zone.
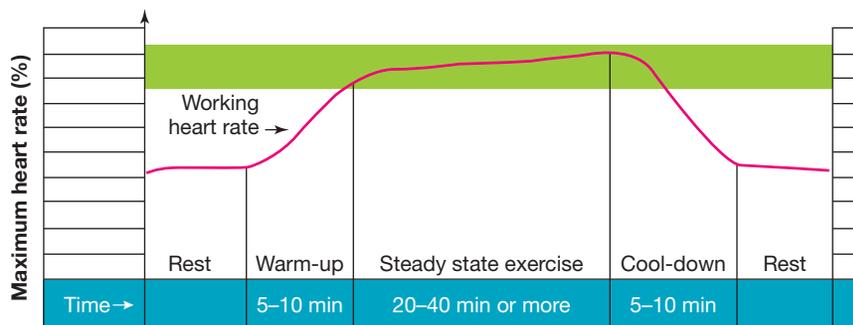
As an example, take a 20-year-old person of average fitness who wants to establish their training zone. Their maximal heart rate is 200 bpm, calculated by subtracting their age from 220. Using the figure 200 bpm, they calculate their lower level of intensity, which is 140 bpm (70 per cent of 200), and an upper level, which is 170 bpm (85 per cent of 200). The training zone is the area in between, which is from 140 bpm to 170 bpm. Figure 9.26 shows the THR zone for various age groups, based on 60 to 75 per cent maximal heart rate.

In resistance training programs, intensity is established in a number of ways but usually by varying the load, the number of times you perform an exercise (repetitions), the number of sets (a number of repetitions in succession) or the rest period.

FIGURE 9.26 The target heart rate zone varies according to age.
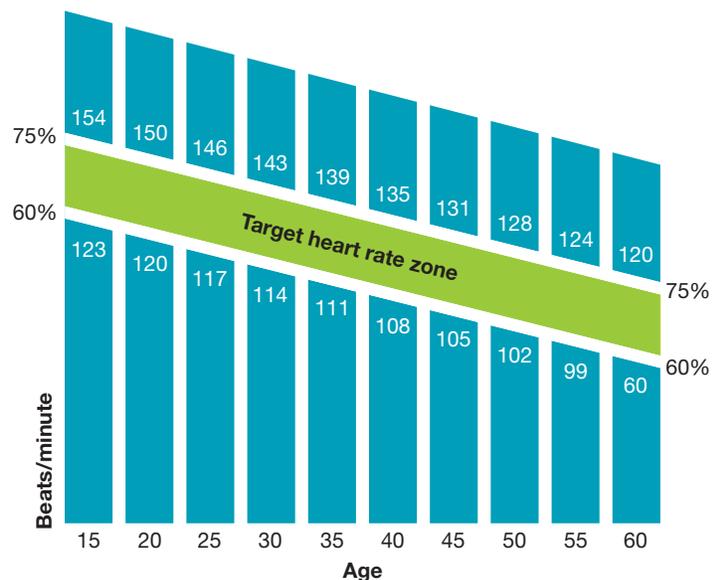
Time

Time refers to the duration of the training session. For people in good health, a session in which the heart rate is held in the THR zone should last from 20 to 30 minutes and increase to 40 minutes or more if possible. There is little benefit in exercising to exhaustion, as this has a risk of overtraining and the possible development of overuse injuries (elite athletes excepted). For those beginning a program or those with lower levels of fitness, the starting point should be around 20 minutes. Note that this does not include the warm-up and cool-down periods. In resistance training programs, 30–45 minutes per session is generally enough and will depend on the intensity of exercise.

In terms of training duration, six weeks is the minimum period to gain a training effect; that is, for adaptations to have taken place.

Type

The most effective type of exercise for aerobic benefits is continuous exercise that uses the large muscle groups; for example, running, cycling, swimming and aerobics. These draw heavily on our oxygen supply, causing an increased breathing rate, heart rate and blood flow to the working muscles. Our aerobic fitness improves as the cardiorespiratory system adapts in response to the demands being made on it.

For resistance training, low resistance with high repetitions is preferable and this can be achieved using many activities such as circuit training and resistance bands.

Use the **FITT Training Guidelines** weblink in the Resources panel for more information about training guidelines for different fitness components.

Table 9.9 shows how the FITT principle is applied to aerobic and anaerobic training

TABLE 9.9 FITT principle for aerobic and anaerobic training

	Frequency	Intensity	Time	Type
Aerobic training	3–5 times a week	50–80% MHR	20 minutes minimum	Continuous training
Anaerobic training	2–3 times a week	80–100% MHR	2–3-minute intervals	Anaerobic interval training

Sample training programs

Athlete: 15-year-old female

Sport: Swimming

Event: 800-m freestyle

Aim: Develop aerobic endurance

FITT principles	Application
Frequency	At least 3 times per week for aerobic training
Intensity	Intensity should be at 70 per cent and include periods towards the ends of sets closer to the anaerobic threshold of 80 per cent for gains to be made
Time	Swimming training should last for 60 minutes or longer
Type	Most activities will be aerobic-based such as swimming, running or cycling

TABLE 9.10 Sample aerobic training program using the FITT principle for a triathlete

Frequency	Intensity	Time	Type
Monday	• 60–85% MHR for intervals • 50-m freestyle high-intensity intervals ×10 • Recovery, low intensity 40–50% MHR for 2 minutes	60 minutes	Swimming (freestyle)
Tuesday	75–85% MHR	20 minutes	• HIIT training (Selection of bodyweight exercises) • 3 circuits of 2 exercises in each
Wednesday	• 60–85% MHR for intervals • 100-m sprint high-intensity intervals × 20 • Recovery (5-minute slow jog, intensity 40–50% MHR)	60 minutes	Running
Thursday	• 80–95% MHR intervals of 30 seconds • 40–50% MHR for 3-minute intervals	60 minutes	• 30 seconds freestyle sprint at 80–95% intensity or level 9 RPE • 3 minutes slow freestyle at 40–50% intensity or level 5 RPE
Friday	• 60–85% MHR for intervals • 400-m sprint, high-intensity intervals × 5 • Recovery (10-minute slow cycle, intensity 40–50% MHR)	60 minutes	Cycling
Saturday	50–60% MHR	30 minutes	Jogging
Sunday			Rest

TABLE 9.11 Sample anaerobic training program using the FITT principle for a sprinter

Frequency	Intensity	Time	Type
Monday	• 90–100% MHR for intervals • 100-m sprints, high-intensity intervals × 10 • Light jog for 2 minutes • Recovery, low intensity 50% MHR	45 minutes	Sprint (anaerobic interval training)
Tuesday			Rest
Wednesday	80–100% MHR for each repetition	30 minutes • 3 sets • 6 reps • (2-minute rest between each set)	Resistance circuit including plyometric exercises, e.g. box jumps
Thursday			Rest

Friday	80–100% MHR	60 minutes • 3 sets • 30 seconds working time	HIIT Training: Circuit 1: • Push ups for 30 seconds (80–95% intensity) • High knees for 30 seconds (80–95% intensity) • Slow jog for 60 seconds (40–50% intensity) Repeat the above circuit × 3
Saturday			Rest
Sunday	• 50–60% MHR • Every 2 minutes, increase the intensity to 80–85% for 30 seconds	45 minutes	Jogging

DEPTH STUDY IDEA

1. Research, using secondary sources, how training methods have changed over time.
2. Write a literature review of your research.
3. The literature review should include at least three sources of information as well as including a bibliography in Harvard style.
4. To guide your research, consider the following:
   • Compare past training methods to contemporary training methods.
   • What are the differences?
   • What factors have influenced the changes in training methods?
5. How are training methods expected to change in the future? Provide reasons for these changes.

The literature review should be handwritten and no more than 2 pages. Use the **Future of Australian Sport** weblink in the Resources panel to assist with your research.

9.5 ACTIVITY

Choose any individual or group sport that you play. Design an aerobic or anaerobic training session for this sport based on the FITT principle. Use the **FITT Training Guidelines** weblink in the Resources panel to help you with your training session design.

Discuss your session with your class. As a class, choose one session that would be challenging, interesting and convenient to participate in. The student(s) who designed this session could facilitate the session for the class.

After the session, evaluate how well you think the session applied the principles of intensity, time and type.

on Resources

Weblinks   FITT Training Guidelines
Future of Australian Sport

9.5 Exercises

9.5 Quick quiz **on**	9.5 Exercise

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Revise your knowledge

1. Outline the key factors that need to be considered when designing a training program.
2. Define the FITT principle.
3. Outline the elements of the FITT principle.
4. Compare the frequency of training for aerobic and anaerobic training.
5. Compare the intensity of training for aerobic and anaerobic training.

Apply your knowledge

6. Compare the FITT principle for aerobic training and anaerobic training.
7. Explain the importance of intensity when designing training programs for aerobic and anaerobic training.
8. Select two weekly training programs for different sports (an individual sport and a group sport). Apply the FITT principle to the weekly training program.
9. Research the benefits of using the FITT principle for training programs. Use aerobic or anaerobic training as your example.

9.6 Immediate physiological responses to training

> **Syllabus:** Explain the immediate physiological responses to training, heart rate, ventilation rate, stroke volume, cardiac output and lactate levels
>
> **Source:** *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

Immediate physiological responses are the changes that take place within specific body organs and tissues as soon as we start to exercise. These changes can been seen in areas directly related to performance.
When we increase our level of activity during training, the body makes specific changes to make sure that enough oxygen and nutrients are being supplied to the muscles to meet the increase in demand. For example, aerobic exercise can require an increase in blood flow of 20 per cent or higher to the working muscles. The important physiological responses to training are heart rate, ventilation rate, stroke volume, cardiac output and lactate levels.

9.6.1 Heart rate

Changes in heart rate are the most obvious and easy to measure. Our resting heart rate (RHR) is our heart rate when we are completely at rest. While the average resting heart rate is 72 beats per minute (bpm), readings of 27 to 28 bpm have been recorded in champion endurance athletes. A low resting heart rate is indicative of a very efficient cardiovascular system.

Heart rate increases with exercise. This is so that the heart can pump blood carrying oxygen and glucose to working muscles for energy. The more efficiently the heart pumps, the more oxygen and glucose that is delivered to working muscles. If the heart rate is too low, the body is unable to reach the intensity of anaerobic activity required. Our heart rate increases according to the intensity of our exercise effort. Maximal heart rates are observed during exhaustive exercise.

FIGURE 9.27 The effect of varying activities on heart rate
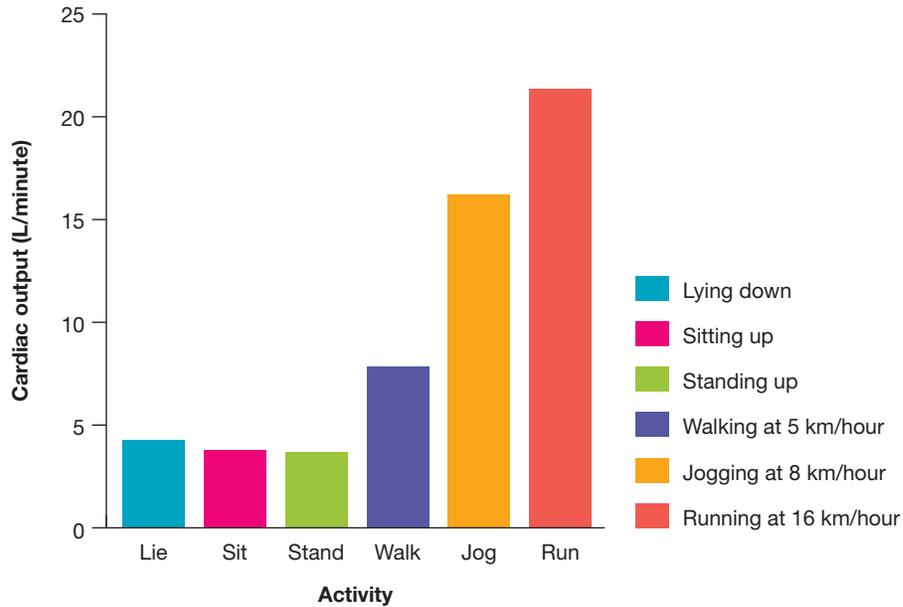
Source: Reprinted with permission from J.H. Wilmore and D.L. Costill, 2004, *Physiology of Sport and Exercise* 3rd ed. Champaign, IL: *Human Kinetics* p. 230, figure 7.15a.

During short-term (5 to 10 minutes) moderate exercise or when moving from an inactive to an active state, our heart rate rises sharply. This is illustrated in figure 9.28, in which heart rate is represented by cardiac output.

In an active person, heart rate levels off during protracted exercise, reaching a **steady state**. Steady state is a period of time during which oxygen uptake remains at a sustained level, such as when swimming at a constant speed. For an inactive person, heart rate continues to rise gradually as exercise continues. For both groups, stopping exercise causes a quick decline in heart rate, followed by a slower decline as it returns to the pre-exercise level. This decline is rapid in an active person. However, for an inactive person, it may take some time, even hours. Heart rate is therefore a good indicator of the intensity of exercise and can be used as a fundamental measure of a person's cardiovascular fitness.

steady state a period of time during which oxygen uptake remains at a sustained level, such as swimming at a constant speed

FIGURE 9.28 Heart rate response before, during and after moderate exercise
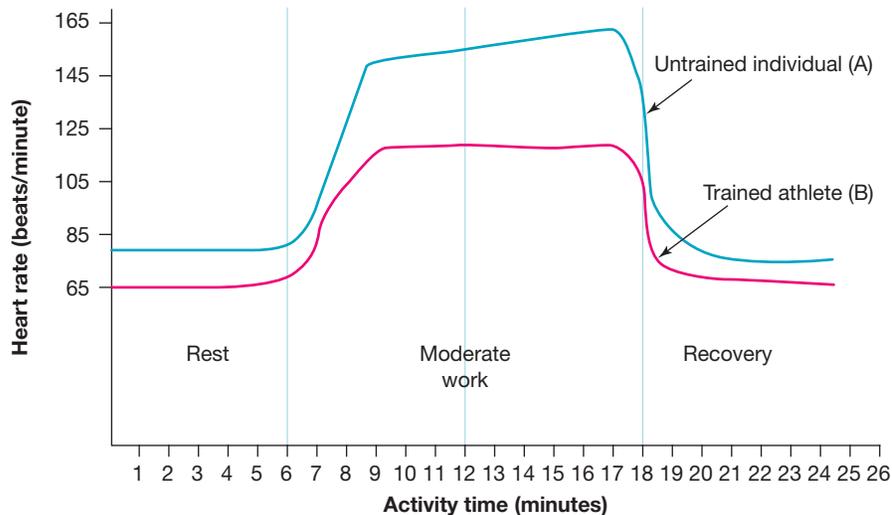
Thinking of using an activity tracker to achieve your exercise goals? Here's where it can help and where it probably won't

16 January 2024

By Corneel Vandelanotte

Why use an activity tracker?

One of the most powerful predictors for being active is whether or not you are monitoring how active you are.

Most people have a vague idea of how active they are, but this is inaccurate a lot of the time. Once people consciously start to keep track of how much activity they do, they often realise it's less than what they thought, and this motivates them to be more active.

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Research has shown the most popular brands of activity trackers are generally reliable when it comes to tracking basic measures such as steps and activity minutes.

But wait, there's more

Many activity trackers on the market nowadays track a range of other measures which their manufacturers promote as important in monitoring health and fitness. But is this really the case? Let's look at some of these.

Resting heart rate

This is your heart rate at rest, which is normally somewhere between 60 and 100 beats per minute. Your resting heart rate will gradually go down as you become fitter, especially if you're doing a lot of high-intensity exercise.

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Activity trackers are pretty good at tracking it, but you can also easily measure your heart rate by monitoring your pulse and using a stopwatch.

Heart rate during exercise

Activity trackers will also measure your heart rate when you're active. To improve fitness efficiently, professional athletes focus on having their heart rate in certain 'zones' when they're exercising – so knowing their heart rate during exercise is important.

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Maximal heart rate

This is the hardest your heart could beat when you're active, not something you could sustain very long. Your maximal heart rate is not influenced by how much exercise you do, or your fitness level.

Most activity trackers don't measure it accurately anyway, so you might as well forget about this one.

VO$_2$ max

Your muscles need oxygen to work. The more oxygen your body can process, the harder you can work, and therefore the fitter you are.

VO$_2$ max is the volume (V) of oxygen (O$_2$) we could breathe maximally (max) over a one-minute interval, expressed as millilitres of oxygen per kilogram of body weight per minute (ml/kg/min). Inactive women and men would have a VO$_2$ max lower than 30 and 40 ml/kg/min, respectively. A reasonably good VO$_2$ max would be mid-thirties and higher for women and mid-forties and higher for men.

…

If you can run fast with a low heart rate your tracker will assume you are relatively fit, resulting in a higher VO_2 max. These estimates are not very accurate as they are based on lots of assumptions. However, the error of the measurement is reasonably consistent. This means if your VO_2 max is gradually increasing, you are likely to be getting fitter.

So what's the take-home message? Focus on how many steps you take every day or the number of activity minutes you achieve. Even a basic activity tracker will measure these factors relatively accurately. There is no real need to track other measures and pay more for an activity tracker that records them, unless you are getting really serious about exercise.

Source: https://theconversation.com/thinking-of-using-an-activity-tracker-to-achieve-your-exercise-goals-heres-where-it-can-help-and-where-it-probably-wont-219235

Case study questions
1. Identify the benefits of using an activity tracker.
2. Why is it important to monitor heart rate during exercise?
3. Describe some ways to measure heart rate during exercise.
4. Explain whether activity trackers are worth the money.

9.6.2 Ventilation rate

When we begin to exercise, the demand for more oxygen by the muscle cells causes a **ventilation** response. Ventilation has two phases — inspiration, or breathing air into the lungs, and expiration, or the expulsion of air from the lungs. Ventilation rates are measured over a time period, usually 1 minute. A term commonly used is minute ventilation — that is, the amount of air that can be breathed in 1 minute. For most people this is around 6 litres.

ventilation refers to our depth and rate of breathing and is expressed in breaths per minute

During rest, the ventilation rate is about 12 breaths per minute, the lungs consuming around 500 millilitres of air per breath. Exercise causes many immediate adjustments in the workings of the respiratory system. The rate and depth of breathing increases moderately, even before exercise begins, as the body's nervous activity heightens in anticipation of exercise. Once exercise starts, the rate and depth of breathing intensifies. This is matched by an increase in oxygen consumption and carbon dioxide production, triggering elevated respiratory activity. At the end of exercise breathing remains rapid for a short period of time, then gradually slows, finally returning to resting levels. Changes in ventilation rates between rest, exercise intensity and recovery are illustrated in figure 9.29.

FIGURE 9.29 Changes in ventilation rate as a result of changes in exercise intensity
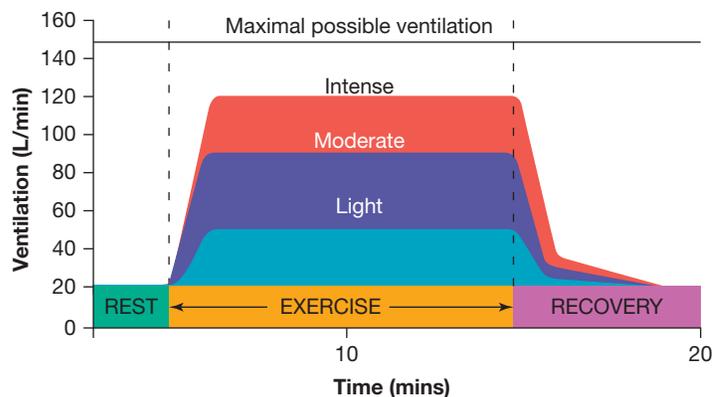
9.6 PRACTICAL ACTIVITY 1

Changing patterns of respiration and heart rate

1. Use the **Home step test** weblink in the Resources panel to download the procedures for the step test.
2. Divide into groups of three. Choose one student to perform the test, the second to monitor and record heart rate and the third to monitor and record ventilation rate. The heart rate and ventilation rates for each student will be required before, at the end of and then 3 minutes after the test. This should be recorded in table 9.12.

3. Students should perform the test on a rotational basis, swapping roles between performer, monitor and recorder. At the required times, measure heart rate and ventilation rate for 15 seconds and multiply by 4 to establish rates per minute.
4. Use the information from the weblink to establish your fitness level.
5. Explain why heart rates and ventilation rates change in response to the different stages of the test.

TABLE 9.12 Heart rate (beats per minute) and ventilation rates (breaths per minute)

		Before test	End of test	3 minutes after test
Student 1	Heart rate			
	Ventilation rate			
Student 2	Heart rate			
	Ventilation rate			
Student 3	Heart rate			
	Ventilation rate			

on Resources

🔗 **Weblink** Home step test

9.6.3 Stroke volume

When exercise increases, the amount of blood that the heart ejects increases considerably. Much of this is due to an increase in **stroke volume**. Stroke volume is the amount of blood that is pumped out of the left ventricle to the body with each heartbeat.

> **stroke volume** the amount of blood ejected by the left ventricle of the heart during a contraction; it is measured in mL/beat

Stroke volume increases at the onset of exercise because the working muscles need more oxygen and glucose, which are both received from the blood.

Stroke volume is determined by:
- the ability to fill the ventricles by blood volume
- the ability to empty the ventricles as a result of ventricular contractions.

Stroke volume increases during exercise, with most of the increase seen as the person progresses from rest to moderate exercise intensity. As intensity increases to a high level, there is less change in stroke volume.

The increase in stroke volume occurs as a result of more blood returning to the heart. This promotes a more forceful contraction and a more complete emptying of the left ventricle with each beat. An active person usually has a greater stroke volume at rest and a significantly greater stroke volume during exercise than an inactive person. The relationship between increases in heart rate (intensity) and stroke volume is illustrated in figure 9.30.

FIGURE 9.30 Stroke volume is significantly improved by training. As heart rate increases, the stroke volume change in untrained athletes is negligible but considerable in trained athletes.
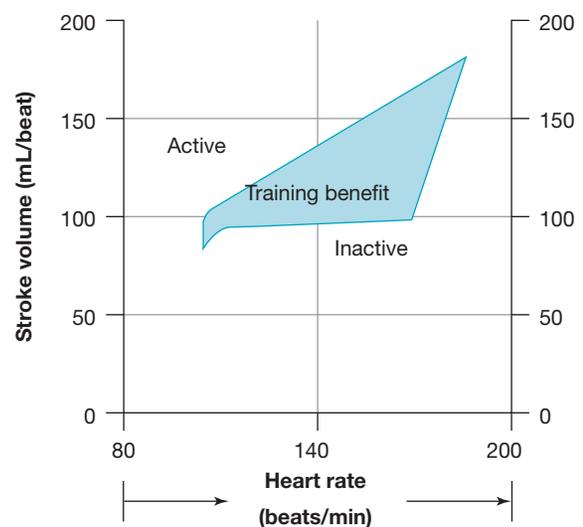
There is a significant difference in stroke volume between active and inactive people. Whereas a sedentary person will maintain a stroke volume of 60 to 80 mL/beat, the well-trained athlete will reach 160 mL/beat at submaximal workloads. This large increase in the availability of oxygenated blood to the working muscles explains their superior performances. The differences are illustrated in table 9.13.

TABLE 9.13 Typical stroke volumes (SV) for different individuals

Subjects	SV at rest (mL)	Maximum SV (mL)
Untrained	50–70	80–110
Trained	70–90	110–150
Highly trained	90–110	150–>200

9.6.4 Cardiac output

Cardiac output (CO) is the volume of blood ejected by the heart per minute. It is determined by multiplying heart rate and stroke volume. A large cardiac output is the major difference between untrained people and elite endurance athletes. Untrained, inactive individuals may have a CO of 15 to 20 litres per minute. For trained, active individuals, CO is 20 to 25 litres per minute. In highly trained endurance athletes, CO may even rise as high as 40 litres per minute. What is more exceptional is that the maximal heart rate of the trained athlete may be slightly lower than that of the untrained individual even when each individual is working to their highest capacity. It follows that the trained individual achieves a considerably higher CO not from heart rate, but as a direct result of a huge increase in stroke volume. This is illustrated in figure 9.31.

> **cardiac output (CO)** the amount of blood pumped by the heart per minute

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FIGURE 9.31 While CO is much the same for trained and untrained individuals at rest, at maximal exercise the trained individual has the advantage of more oxygen being available as a result of a higher cardiac output.
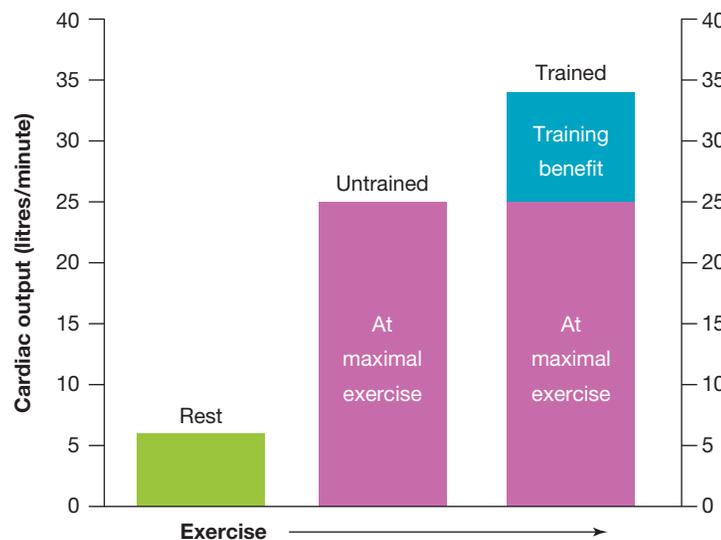
Cardiac output increases in response to physical demands being made on the body. Figure 9.32 shows how progressing from lying down (rest) to running (exercise) causes significant increases in cardiac output.

The working muscles' demand for additional oxygen causes blood flow to be redistributed within the body. While at rest, cardiac output is directed to physically inactive muscles. However, the demands of exercise mean that the body's blood must be redirected to the muscles that are now active. As shown in figure 9.32, muscles can require around 84 per cent of blood flow during exercise.

Examine the data in the table in figure 9.32. While trained and untrained individuals have similar cardiac output, differences are evident in the lower heart rate and higher stroke volumes of trained individuals.

FIGURE 9.32 As we move from (a) rest to (b) exercise, cardiac output is redirected to active muscles.

(a)

Muscles (20%)
1000 mL

Liver (27%)
1350 mL

Heart (4%)
200 mL

Skin (6%)
300 mL

Rest
5000 mL

Brain (14%)
700 mL

Other (7%)
350 mL

Kidneys (22%)
1100 mL

Trained	Untrained
CO = HR × SV	CO = HR × SV
= 50 bpm × 100 mL/beat	= 72 bpm × 70 mL/beat
= 5000 mL/min (5 litres)	= 5040 mL/min (5.04 litres)

(b)

Muscles (84%)
21000 mL

Liver (2%)
500 mL

Kidneys (1%)
250 mL

Other (3%)
780 mL

Brain (4%)
900 mL

Skin (2%)
600 mL

Heart (4%)
1000 mL
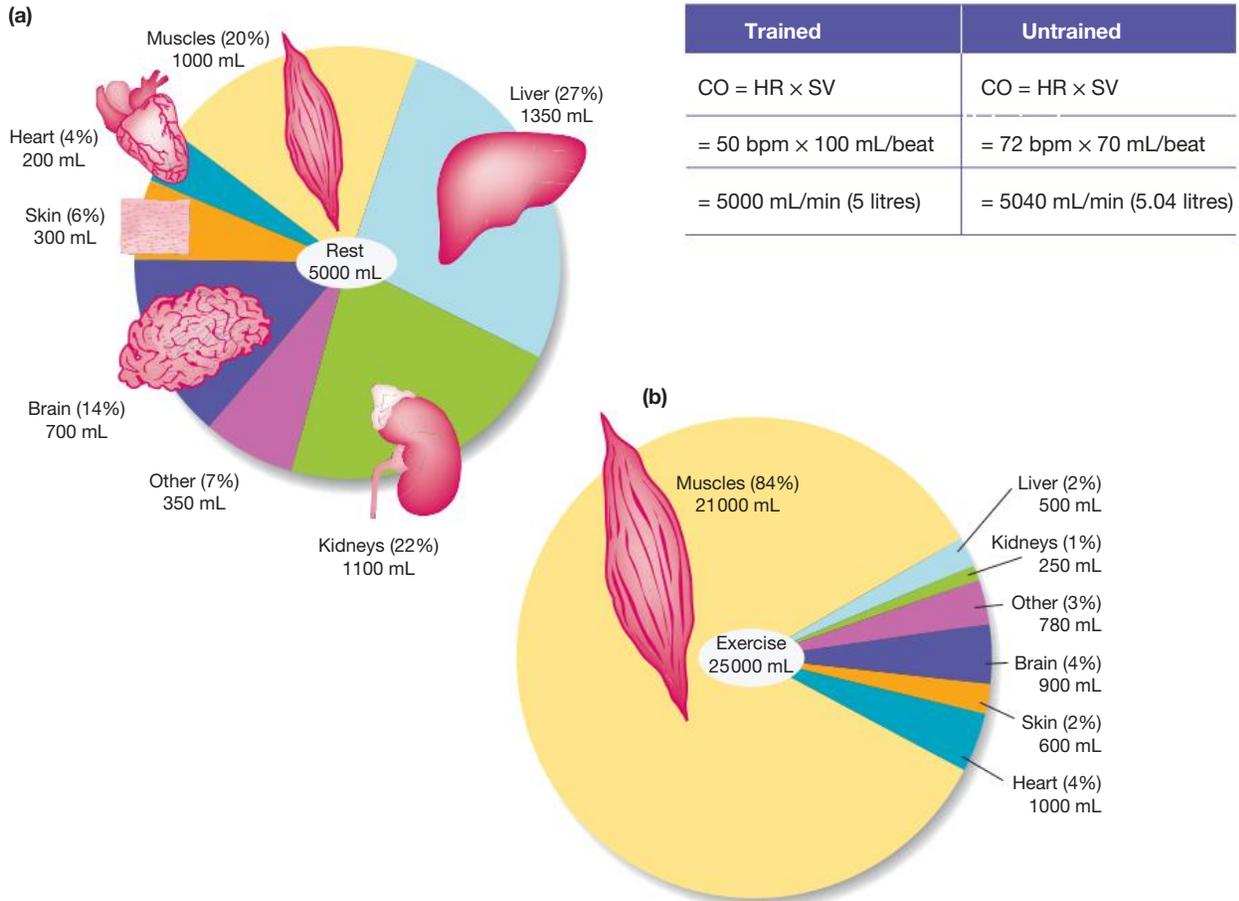
Exercise
25000 mL

Source: W. McArdle, F. Katch and V. Katch, *Exercise Physiology*, Lippincott, Williams and Wilkins, 2006, p. 357. Reproduced by permission.

9.6.5 Lactate levels

Lactate is a chemical formed during the breakdown of carbohydrates in the absence of sufficient oxygen. There is always a small amount of lactate circulating in the blood — about 1–2 millimoles/litre. This lactate is continually being resynthesised by the liver to form glycogen and so is of benefit in providing the body with energy.

Generally, lactate flows freely in the blood and its concentration increases as the workload is increased. With each molecule of lactate formed, one hydrogen ion is also formed. It is the hydrogen, and not lactate, that is responsible for increasing the acidity of blood and subsequently making it difficult for muscles to function properly.

> **lactate** a salt formed from lactic acid that accumulates during intense anaerobic activity
>
> **lactate inflection point (LIP)** the point beyond which a given exercise intensity or power output cannot be maintained by an individual

Vigorous physical exercise causes increases in levels of lactate. Lactate levels relate to the pH value of blood, which is affected by physical activity. Neutral pH is 7.0. A higher reading indicates elevated alkalinity, while readings lower than 7.0 indicate levels of acidity. At rest, blood has a pH value of about 7.4, which means that it is slightly alkaline. However, as exercise intensity increases, the pH level drops and acidification of muscles increases.

High levels of lactate are produced when we exercise and there is insufficient oxygen available to the muscle cells. It accumulates rapidly when we exercise above the **lactate inflection point (LIP)**, which occurs at about 80–90 per cent MHR for trained individuals. The point is much lower for untrained individuals.

Table 9.14 illustrates how lactic acid concentrations increase as exercise intensity is raised. High levels of lactate make it increasingly difficult for muscle fibres to contract. Once the LIP is reached, further exercise results in fatigue and the subsequent inability to maintain the higher work output. If intensity is increased beyond the LIP, such as by a sprint finish at the end of an endurance event, the onset of fatigue will be even more rapid.

TABLE 9.14 The effect of increasing intensity on blood lactate levels

Lactic acid concentrate (mmol)	Training for:	Heart rate	Percentage of maximum intensity
20.0	Maximum anaerobic power	200	
		200	
12.0		200	85–90%
8.0	Lactate inflection point	190–200	80–90%
		180	
		170	
		160	(60)–70–85%
4.0		150	
		140	
2.0	Aerobic threshold	130	60%
		120	50%
	Lactate threshold	110	
		100	
1.1	Resting state	>80	

Source: Adapted from T. Bompa, *Theory and Methodology of Training*, 3rd ed, Kendall/Hunt Publishing, Iowa, 1994, p. 305.

Although present, lactate does not cause fatigue prior to the LIP being reached. Lactate is a source of energy at low to moderate levels of intensity. However, once the LIP is reached, lactate contributes to fatigue because it cannot be removed from the bloodstream faster than it enters. The high concentration of lactate together with other factors, including high levels of hydrogen ions and the physical demands of the work being performed, contribute to fatigue and the subsequent inability to continue to work in the same manner as before the LIP was reached.

DEPTH STUDY IDEA

Choose one of the following events from the 2020 or 2024 Olympics:
- 5000-m Women's final
- Triathlon — Men's
- 100-m Men's final
- Women's 200-m freestyle swimming final.
1. Watch a video of each event and use the **EdPuzzle** weblink in the Resources panel or a similar program to provide a commentary explaining the immediate physiological responses that are occurring during the event. (Focus on the winner in your chosen event.)
2. Ensure you include heart rate, ventilation rate, stroke volume, cardiac output and lactate levels.

9.6 PRACTICAL ACTIVITY 2

Changing patterns of respiration and heart rate

1. Use the information in table 9.12 (9.6 Practical Activity 1) to draw a graph that illustrates your pattern of ventilation and heart rate.
2. Discuss reasons for the changing patterns of respiration and heart rate during this submaximal test.
3. Discuss the relationship between your fitness level as established by the test and how quickly your heart rate and ventilation rate returned to normal.
4. Explain why fitness level affects heart rate and ventilation rate.

9.6 Exercises

learn on

Revise your knowledge

1. Define the following terms.
   a. Heart rate
   b. Ventilation rate
   c. Stroke volume
   d. Cardiac output
   e. Lactate levels
2. Create a mind map to summarise the physiological responses to training.
3. What physiological responses take place in the following areas as a result of aerobic training?
   a. Heart rate
   b. Ventilation rate
   c. Stroke volume
   d. Cardiac output
   e. Lactate levels
4. Outline the effects of increasing exercise intensity on blood lactate levels.
5. Discuss the effects of increasing lactate levels on performance.

Apply your knowledge

6. Examine figure 9.33. Using the information, discuss the effects of an increase in exercise on both heart rate and stroke volume.

FIGURE 9.33 Heart rate and stroke volume responses to exercise
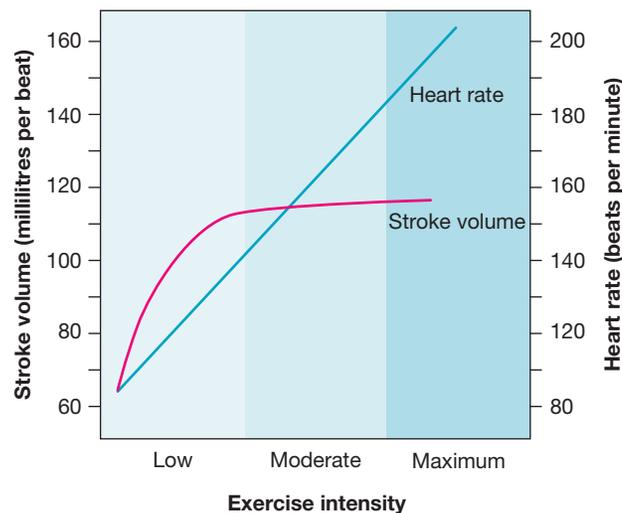
7. On a graph, plot the heart rate (HR) for a 16-year-old with a resting HR of 55 bpm who performs the following activities over one hour: rests for 10 minutes, runs for 30 minutes at 70 per cent maximal heart rate (MHR), followed by three 100-m sprints at 90 per cent MHR with intervals of 5 minutes between each. Using the data you have plotted, describe how the heart responds to changes in exercise intensity.
8. Calculate the cardiac output at maximal exercise for a person with a heart rate of 190 bpm and a stroke volume of 180 mL/beat. Draw a graph to illustrate cardiac output and comment on the lifestyle of the subject. Do they have a sedentary lifestyle or are they a trained athlete?
9. Choose one of the following athletes and suggest the physiological responses that would be occurring during their event. Use table 9.15 to apply your information.

TABLE 9.15 Physiological responses of athletes

Athlete	Physiological adaptation
Gymnast (floor routine)	
Triathlete (10-km event, swim, bike, run)	
Sprinter (200-m run)	

10. In the 2024 Australian Open Men's Singles final, Jannik Sinner defeated Daniil Medvedev. Table 9.16 shows the score, as well as the duration of the match.

TABLE 9.16 2024 Australian Open final: Men's Singles results

	Set 1	Set 2	Set 3	Set 4	Set 5
Sinner	3	3	6	6	6
Medvedev	6	6	4	4	3

Total duration of match: 3 hours 44 minutes.

Using table 9.16, justify two physiological adaptations that you would expect Sinner to develop and outline how each adaptation contributed to his enhanced performance.

9.7 Investigate the physiological responses in relation to aerobic training

> **Syllabus:** Investigate the physiological responses in relation to aerobic training
> **Including:**
> - creating a research question
> - selecting a method to collect data
> - discussing the ethical considerations of the methods chosen
> - discussing the validity, reliability and credibility of data collection
> - presenting findings and drawing conclusions
> - identifying further research questions that could be explored
>
> *Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).*

This subtopic will provide an example of how to investigate the immediate physiological responses to aerobic training, using heart rate as the focus. More detailed information about research skills and the research process can be found in topic 1 and topic 2.

9.7.1 Creating a research question

A research question aims to guide your research about a particular topic or issue.

The immediate physiological responses in response to aerobic training include:
- heart rate
- ventilation rate
- stroke volume
- cardiac output
- lactate levels.

The focus for this example will be heart rate.

Example research question: After 4 weeks of training, which aerobic-based training type (running, cycling or swimming) will have the greatest effect on lowering resting heart rate (RHR)?

Use the **Writing strong research questions** weblink in the Resources panel to further investigate how to write research questions.

on Resources

🔗 **Weblink** Writing strong research questions

9.7.2 Selecting a method to collect data

Before starting the experiment, research needs to be conducted. Information should be gathered from section 9.5.1 as well as further research to gain a deeper understanding about the effects of regular aerobic training on heart rate. Examples of how to collect data include observation, surveys or interviews. In the example below, the method of observation is used.
- Work in groups of four or five students.
- A logbook or online collaboration space may assist in gathering information from research.
- A training session should be created for the student with resting heart rate recorded after each week.
- Record your results in a table like table 9.17.
- Ensure you have a stopwatch for each activity to record information.
- Determine which students will be participating in the training and which students will be performing the study.

TABLE 9.17 Four-week training plan

Sport	Activities per session	Resting heart rate before training (record 1 minute before training)	Resting heart rate after training (record 2 minutes after training)
Running	Activities should include the principle of progressive overload for adaptations to occur. For example: Week 1: 5 × 100-m sprints (2-minute recovery between each) Week 2: 7 × 100-m sprints (2-minute recovery between each) Week 3: 9 × 100-m sprints (1.5-minute recovery between each) Week 4: 10 × 100-m sprints (1-minute recovery between each)		

Cycling	Week 1: Cycle 1 km (Include sprints for 30 seconds every 3 minutes) Week 2: Cycle 1.5 km (Include sprints for 30 seconds every 3 minutes) Week 3: Cycle 2 km (Include sprints for 30 seconds every 2 minutes) Week 4: Cycle 2.5 km (Include sprints for 30 seconds every 2 minutes)		
Swimming	Week 1: 2 laps × 200 m Week 2: 3 laps × 200 m Week 3: 4 laps × 200 m Week 4: 5 laps × 200 m		

9.7.3 Discussing the ethical considerations of the methods chosen

Ethical considerations when choosing methods of data collection must be considered. These factors include:
- seeking permission before taking someone's heart rate
- keeping results private by removing the student's name
- getting permission from the student to be involved in the study
- performing all activities in a safe and respectful manner
- not disclosing information to others without the student's permission.

9.7.4 Discussing the validity, reliability and credibility of data collection

In any experiment it is important to ensure that data is valid, reliable and credible to ensure the research question can be answered comprehensively and accurately.

Factors to consider

Ensure that all information researched comes from reliable and credible sources.

Steps may include:
- *checking the URL*. The ending of a website URL can be useful for assessing the reliability of the source. A URL with a .edu ending is usually from an educational institution such as a school or university. The ending .gov is used for government websites, while a .org ending usually indicates that the web page is associated with a non-profit organisation.
- *looking for information about the author of the web page, the organisation associated with the web page and the date on which the information was last updated*. A web page that provides no such information is less likely to be reliable. If an author's name is provided, what are their qualifications? Do they have expertise in the area they are commenting on? Are they likely to show bias? For websites associated with an organisation, is the organisation likely to benefit from a particular viewpoint about an issue?
- *checking the information against other sources*. Experimental results are considered reliable if the experiment, when repeated a number of times, consistently produces similar results. Similarly, the reliability of information from secondary sources can be assessed by checking it against other sources.

Strategies to ensure the research being conducted is reliable may include the following.
- For each training session, ensure that the conditions are the same. These include:
  - the weather
  - same student performing the training
  - using the same methods of measuring heart rate, for example a heart rate monitor
  - ensuring that heart rate is tested 1 minute before and 2 minutes after training.

Validity refers to how accurate the method is at measuring what it is supposed to measure. In the case of this experiment, the same student should be tested for each of the three sports. As there will be multiple students performing the same experiment in the same sports, results can be gathered from each student which will assist in the validity of the results.

9.7.5 Presenting findings and drawing conclusions

Once the experiment has been completed, results can be collected, presented and analysed to draw conclusions. Some questions to consider in drawing conclusions may include:

1. Did RHR decrease after 4 weeks?
2. Did the results for different sports vary? Provide reasons why or why not.
3. Which sport resulted in the fastest return to RHR? Explain why.

Graphs and tables could be used to present results and provide clear data in order to then draw conclusions in relation to the research question. For example, a line graph such as figure 9.34 or figure 9.35 can show a clear illustration of the results.

FIGURE 9.34 Resting heart rate pre-training after 4 weeks of training
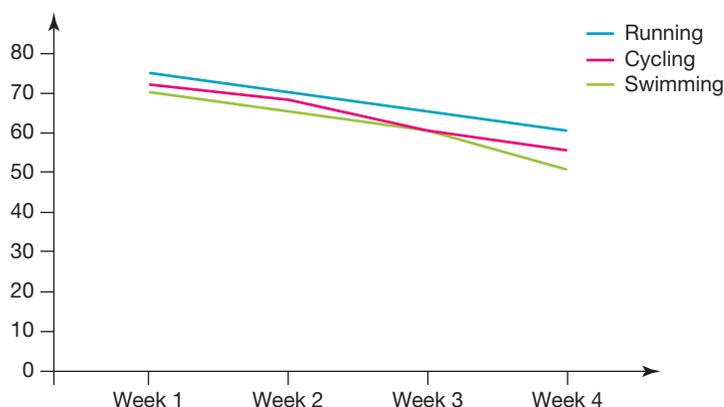
FIGURE 9.35 Resting heart rate post-training after 4 weeks of training
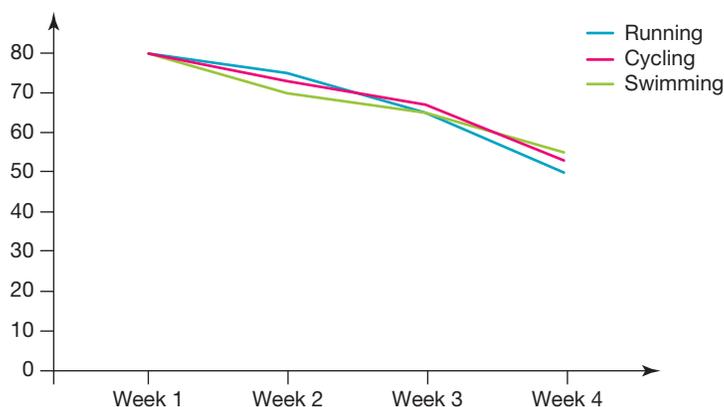
9.7.6 Identifying further research questions that could be explored

Once you've finished your research and drawn your conclusions, consider what other questions your results might have prompted. Possible research questions include:

- What type of aerobic exercise will be most beneficial for improving ventilation rate?
- Will the body's ability to cope with lactate levels decrease after 4 weeks of aerobic training?
- Which type of aerobic training will have the greatest effect on resting heart rate?
- How much training will need to occur over 4 weeks for stroke volume and cardiac output to improve?

9.8 The purpose and outcomes of testing physical fitness

Fitness testing is a way of gaining information about the health-related and skill related components of an individual's fitness.

Fitness testing is important for all individuals, whether elite or recreational athletes, including individuals who are just commencing a fitness program and those who are progressing to higher levels of their fitness program. Without fitness testing, individuals cannot determine whether improvements are being made.

FIGURE 9.36 Fitness testing equipment

9.8.1 Components of fitness

Physical fitness has a number of essential components, all of which contribute to total body fitness. Some fitness components have a direct impact on health. A variation in one or a number of these components can significantly affect our total health and wellbeing.

Health-related fitness components include:
- cardiorespiratory endurance
- muscular strength
- muscular endurance
- flexibility
- body composition.

Other fitness components relate more specifically to skills required for sports performance. These include:
- power
- speed
- agility
- coordination
- balance
- reaction time.

fitness a measure of the body's ability to function efficiently, effectively and without injury in everyday activities, to pursue recreational activities and to cope with emergency situations

physical fitness a set of attributes (health and skill components) which enable an individual to be physically active

There is a range of well-recognised tests available to measure each of the components of fitness. The tests listed in table 9.18 are easy to administer in most school environments and include norms or averages relevant to your age group.

TABLE 9.18 Components of fitness overview

	Component	Definition	Suitable tests
Health-related components	Cardiorespiratory endurance	The ability of the working muscles to take up and use oxygen	Bicycle ergometry Multi-stage fitness test Yo-yo intermittent recovery test
	Muscular strength	The ability to exert force against a resistance	Handgrip dynamometer test
	Muscular endurance	The ability of the muscles to endure physical work for extended periods of time	1-minute sit-up test
	Flexibility	The range of motion about a joint	Sit-and-reach test
	Body composition	The percentage of fat versus lean body mass	Body fat measurements using skin fold callipers
Skill-related components	Power	The ability to combine strength and speed in an explosive action	Vertical jump
	Speed	The ability to perform body movements quickly	50-m sprint test
	Agility	The ability to move the body from one position and direction to another with speed and precision	Illinois agility run test
	Coordination	The ability to harmonise the messages from the senses with parts of the body to produce movements that are smooth, skillful and well controlled	Stick flip test
	Balance	The ability to maintain equilibrium while either stationary or moving	Balance board test
	Reaction time	The time taken to respond to a stimulus	Ruler drop test

9.8.2 Purpose of fitness testing

Testing an athlete's physical fitness provides many benefits for both the individual and trainer. Testing physical fitness can be done in three stages: pre-training, during training and post-training. Some of the benefits of fitness testing include:

- ability to predict future performance
- easier placing in appropriate training group
- indicates strengths
- indicates weaknesses
- identifies special talents
- monitors progress
- measures improvement
- training program evaluation
- provides incentives
- motivates the individual.

Pre-training testing

The purpose of pre-training testing includes:
- to gain an idea of initial fitness levels at the start of a program, which allows comparisons to work out whether fitness gains are being made
- to identify strengths and weaknesses of individuals in the major components of physical fitness important to a specific sport or activity
- to identify an appropriate training program that can be targeted towards areas of maintaining strengths and improving weaknesses
- to assess an individual's suitability for a sport or position within a team. For example, a hockey player who scores highly in a test for aerobic power may be suited to a position such as wing, involving covering greater distances in the game, rather than a position such as goalkeeper.
- to aid motivation and provide individual with a goal to work towards in order to gain improvement.

Testing during training

The purpose of testing during training includes:
- providing feedback to the trainer and the individual about how the training program is progressing
- to motivate the individual towards achieving their goal(s)
- to evaluate the effectiveness of the program. If improvements have been made then the training program is effective; however, if improvements are not being made then the program may need to be modified.

FIGURE 9.37 Testing during training can help provide feedback to trainers and motivate individuals.

Post-training testing

Testing after completion of a training program allows the individual and trainer to determine whether the program was effective in achieving the goals. The purpose of post-program testing includes:

- evaluating the overall effectiveness of the training program
- reviewing goals to determine whether they have been achieved or whether they require resetting
- motivation of individuals by positive or negative test results.

9.8.3 Outcomes of fitness testing

There are various factors which may impact the outcome of the fitness test. When completing a fitness test, it is important to limit as many variables as possible by ensuring conditions are exactly the same as the previous test.

Tests should be valid and reliable. This means that the test should measure what it claims to measure and be able to be replicated with consistency. Reliability, however, depends on certain factors which can influence the test outcome. The following factors are important in ensuring reliability:

- tests should involve the same warm-up
- conducting the same sequence of tests
- providing the same recovery period between tests
- testing the individual at approximately the same time of day
- testing the individual when they are in a similar hydration and nutritional state
- conducting the tests in similar environmental conditions (heat, humidity and air movement).

Trained and experienced administrators of the tests are also required to ensure reliability. It is important that the person conducting the testing always does so to the best of their ability, under the most stable and reliable conditions.

The results of the selected tests must be interpretable and comparable, and the participant should receive feedback about:

- what the results represent (good, average or poor performance)
- how the results compare with previous results
- how the results compare with those of other participants in the reference group
- the consequences and implications of the results.

CASE STUDY

Why it's time to reconsider fitness testing in health and physical education

29 June 2020

By Dr Laura Alfrey, Monash University

Research shows fitness testing is a regular feature of most secondary health and physical education programs in Australia. And while some students report they enjoy it, others say it is painful and embarrassing. But what educational purpose do these tests serve?

Research in Victoria and internationally suggests that most HPE teachers choose to teach 'fitness education' through fitness testing.

What does the evidence say about fitness testing?

The most common fitness tests include the 'beep test', 'sit and reach test' and the 'Cooper run'

Research shows that:
- most Secondary HPE teachers carry out fitness testing at least once per year with each class/grade.
- some children enjoy participating in fitness testing
- some children find fitness testing painful, embarrassing and shameful, and these feelings can persist into adulthood, to damaging effect
- children's experiences of fitness testing are not always meaningful or educational
- there is no evidence that fitness testing is successful in promoting healthy lifestyles, physical activity, or developing the required knowledge and skills for lifelong physical activity.

In addition, 'school-based challenges' and 'body image' feature in the top four issues of personal concern for young Australians.

If we know that fitness testing is a damaging experience for some students, why do we do it?

Research with 130 Victorian HPE teachers suggested there were multiple reasons why we teach through fitness testing.

Motivation

It is not surprising that we carry out fitness testing on the assumption that it will motivate the students to develop their fitness and health.

We've always done it

For most teachers they taught through fitness testing because they'd always done it because it was a permanent feature of their school HPE curriculum.

…

The future of fitness testing?

If we start by linking to some of the suggestions shared by teachers above, we can begin to envisage fitness testing that:
- has a clear learning intention and educative purpose
- is relevant and meaningful to all students' lives
- is not rushed, and students have the time to explore, critique and learn in, through and about fitness testing
- provides opportunities for students to reflect on the process and identify what they have learned, how they feel, how the experience is meaningful and useful to their day-to-day-lives etc.

In addition, it is also important to ask a series of critical questions about how the tests will be conducted.
- Will students carry out the testing as a group, in a circuit, at home/individually?
- Is the testing carried out in isolation or is it linked to other learning experiences throughout the term/year?
- Can students choose which tests they participate in?
- Do students have to participate in validated tests or can they develop their own?
- How will the data be collected? Who will collect it? For what purpose?
- Do you have a mechanism for knowing how the fitness testing process is making your students feel?

Is fitness testing part of a developmentally appropriate and explicit learning experience within HPE? Are students provided with learning opportunities to practise, create, apply and evaluate the knowledge, understanding and skills related to fitness testing?

Is there an explicit focus on student strengths related to fitness testing, what are they good at? Does your fitness education curriculum recognise that students have varying levels of access to personal and community resources depending on a variety of contextual factors that will impact on their decisions and behaviours related to fitness?

Source: https://www.monash.edu/education/teachspace/articles/why-its-time-to-reconsider-fitness-testing-in-health-and-physical-education.

Case study questions
1. Identify the purpose and outcomes of fitness testing in schools.
2. Argue the purpose and outcomes of fitness testing in schools. Use examples from the article.
3. Do the fitness tests accurately reflect the level of fitness for each student? Why or why not?

9.8.4 Testing physical fitness for different groups in the population

As discussed, fitness testing is useful for all individuals, particularly those participating in regular exercise, to work out whether improvements are being made. However, it is essential the tests are specific to the individual's ability and physical fitness needs. Elite athletes, elderly people, children and people with disabilities are groups who may require different types of fitness tests to accommodate their needs.

Elite athletes

Elite athletes require regular fitness tests to determine whether physiological adaptations are being made, for example increased power or strength. If adaptations are not being made, a review of training is needed to ensure that the training meets the desired fitness outcomes.

For example, an elite freestyle swimmer wanting to improve their speed and power may perform the following tests:
- vertical jump test (power in the legs)
- 1RM bench press (upper body strength)
- timed sprint tests (50-m freestyle to test speed), including lactate testing.

There are also specific fitness tests for swimming, including:
- swimming Beep Test
- swimming Step Test
- swimming VO_2 max test.

FIGURE 9.38 Regular fitness tests help determine whether physiological adaptations are being made.

Older adults

Individuals in this population group need to participate in regular physical fitness activities to maintain bone density, posture, balance and stability, flexibility and strength, as well as aerobic capacity. It is important to seek medical clearance before undergoing a fitness program to ensure the safety of the individual.

Specific fitness tests may include:
- chair stand test (lower body strength)
- arm curl test (upper body strength)
- sitting–rising test (flexibility, balance and muscle strength)
- timed walking tests (aerobic capacity).

FIGURE 9.39 There are specific fitness test for different groups, including those for older adults.

Children

As with adults, it is important to monitor fitness goals and outcomes for children; however, fitness activities and tests must be appropriate for the age of the child. Many of the fitness tests for high-school-aged children can also be used for primary-school-aged children. However, it is important that the weights, distances and times are lower and bodyweight exercises are modified to reduce strain and fatigue on the body.

Specific fitness tests for children may include:
- chair push-up (upper body strength)
- sit-and-reach test (flexibility of the lower back and hamstrings)
- crunch (abdominal strength)
- beep test (aerobic capacity).

FIGURE 9.40 Fitness tests must be suitable for the age of the participant.

People with a disability

It is important for individuals with a disability to engage in regular exercise for gains in fitness elements such as mobility, posture, flexibility, aerobic capacity and strength. However, depending on the nature of the disability, modifications to exercises may be needed. Similarly, when testing physical fitness, some fitness tests may need to be modified to suit the individual.

FIGURE 9.41 Modifications to fitness tests may be required depending on ability.

Specific fitness tests for people with disabilities may include:
- beep test for vision-impaired individuals
- wheelchair shuttle-ride test
- wheelchair VO_2 max test
- 10-m beep test
- 1RM bicep curls (upper body strength)
- wheelchair timed laps (speed).

Physical fitness is essential for all individuals and it is important that regular testing is conducted to ensure that fitness outcomes are being achieved.

9.8 PRACTICAL ACTIVITY 1

Compiling my physical fitness profile

Equipment

Results and classification of each physical fitness component for each of the fitness tests in sections 9.8.5 and 9.8.6 and the recording sheet (figure 9.43 below; a downloadable Word version of the **Recording sheet** is provided as a digital document (doc-36157) in the Resources panel).

FIGURE 9.42 Recording sheet

Physical fitness profile

Name ....   Chosen sport ....

	Very low/very poor	Low/poor	Medium/average	High/very good	Very high/excellent
HEALTH-RELATED FITNESS					
Cardiorespiratory endurance					
Bicycle ergometry					
Multistage fitness					
Muscular strength					
Hand dynamometer					
Muscular endurance					
Sit-up test					
Flexibility					
Sit and reach					
Body composition					
Body fat percentage					
SKILL-RELATED FITNESS					
Power					
Vertical jump test					
Speed					
Sprint test					
Agility					
Agility test					
Coordination					
Stick test					
Balance					
Static balance					
Dynamic balance					
Reaction time					
Reaction time test					

Procedure

1. Using a coloured pen, place a circle in the appropriate column on the recording sheet that best indicates your rating for the physical fitness tests you completed.
2. Once you have completed this topic, use a differently coloured pen to assess your chosen sport or activity and identify its fitness requirements.

on Resources

📄 **Digital document** Recording sheet (doc-36157)

Sections 9.8.5 and 9.8.6 contain a range of fitness tests that focus on different components of fitness. The syllabus does not require you to complete all these tests; however, undertaking a selection of the tests may help you apply your knowledge and understanding of the physical fitness tests to be able to debate their purpose and outcomes.

9.8.5 Health-related components of fitness

Cardiorespiratory endurance

Cardiorespiratory endurance refers to the ability of the working muscles to take up and use the oxygen that has been breathed in during exercise and transferred to muscle cells. It is by far the most important health-related fitness component. The importance of cardiorespiratory endurance is evident in endurance events such as triathlons and marathons. A well-trained cardiorespiratory system ensures:

cardiorespiratory endurance
the ability of the working muscles to take up and use the oxygen that has been breathed in during exercise and transferred to muscle cells

- the delivery of adequate quantities of blood (high cardiac output)
- a functional ventilation system (respiratory system)
- a good transport system (circulatory system) to ensure efficient and speedy delivery of oxygen and nutrients to the cells.

9.8 PRACTICAL ACTIVITIES 2

1. A field test of cardiorespiratory endurance — the multi-stage fitness test

Equipment

Beep test audio (you can use the **Beep test audio** weblink in the Resources panel), firm surface with two lines marked 20 m apart

Procedure

1. Form a group of no more than ten students to one teacher.
2. Divide the group into two. Half the group is to perform the test while the remaining half observes and records the results.
3. Use a general-purpose warm-up including leg-stretching exercises before commencing this test.
4. The students in group one should move to the start line and listen to the introductory remarks on the audio, which will tell them when to start and how to judge pace.

FIGURE 9.43 Lines for multistage fitness test

Start line ┆- - - - - - - - - - - - - - - - - - ←- - ┆ End line

|←———— 20 m ————→|
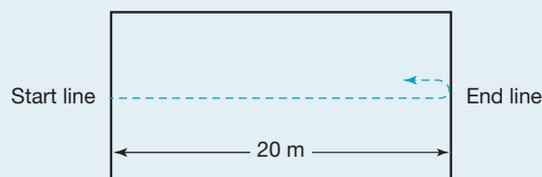
5. Students begin by walking to the end line, aiming to reach it on the 'beep'. Both feet must cross the line. They then turn and walk back aiming to reach the start line on the next 'beep'. Gradually the tempo is increased, necessitating a jog and then a run to reach the other line by the sound of the 'beep'. When students fail to stay in time with the 'beep' they are given a warning. Failure to catch up or a second warning means the student must stop the test.
6. Recorders should note the level at which each student was unable to continue the test. Record the level and note the oxygen uptake norms, using the **Multi-stage VO$_2$ calculator** interactivity (int-6808) in the Resources panel.
7. Relate the oxygen uptake level to the aerobic capacity rating in table 9.19 to establish the rating for your cardiorespiratory endurance.

TABLE 9.19 Maximal oxygen uptake (VO$_2$ max) norms for men and women aged 18–35 (mL/kg/min)

| | Age (years) | | | |
| | Males | | Females | |
Rating	18–25	26–35	18–25	26–35
Excellent	>60	>56	>56	>52
Good	52–60	49–56	47–56	45–52
Above average	47–51	43–48	42–46	39–44
Average	42–46	40–42	38–41	35–38
Below average	37–41	35–39	33–37	31–34
Poor	30–36	30–34	28–32	26–30
Very poor	<30	<30	<28	<26

Source: Topend Sports.

My cardiorespiratory fitness level using the multi-stage fitness test

1. What was your rating for the cardiorespiratory endurance test? If you have completed another of the tests of aerobic capacity, how did your readings compare? Were there any factors that limited your performance?
2. What was your heart rate and breathing rate at the end of the test? Describe how your legs felt during the last few shuttles and immediately following completion of the test. Can you suggest why you felt this way?
3. Discuss the advantages and disadvantages of this test for use in a team training situation.

2. An aerobic field test — the yo-yo intermittent recovery test Level 1 (YYIR1)

Similar to the beep test, yo-yo intermittent tests were originally developed for soccer players, but they are suitable as tests of aerobic power in a range of sports such as basketball, touch football and tennis where short, high-intensity work is often followed by short recovery periods.

This test has several variations, but YYIR1 specifically focuses on an individual's ability to perform high-intensity aerobic work. The YYIR1 begins at 10 km/h and is a good starting point for students, whereas YYIR2 is designed for elite athletes, the difference being the elevated beginning speed of 13km/h.

Equipment

A 30-m measuring tape, markers or cones, phone with YYIR1 audio, an officiator, recording sheets

Procedure

1. On a level area such as a playing field or gymnasium, set rows of markers 20 m apart and then add an additional row 5 m back from the start line as shown in figure 9.44.
2. Divide the group into two. Half the class performs the test while the other half observes and records the results.
3. Students in group 1 move to the start line (B) and wait until instructed to run in accordance with the audio.
4. On the start sound, students move towards line C, arriving just before the beep. They then turn around and jog back to line B and begin a 10-second recovery period. During recovery, students walk or jog to line A and then back to B, arriving just before the beep. On the beep, they repeat the run/recovery shuttle again.

5. When a student fails to make it back to the B line in accordance with the audio, they are given one warning. On a second failure, the student must retire and the score is recorded as the last 2 x 20 m interval achieved. The recorder notes this and establishes the total metres covered by the student.

FIGURE 9.44 Set-up for the yo-yo intermittent recovery test

Recovery area

Running area

Start line

A   5 m   B   20 m   C
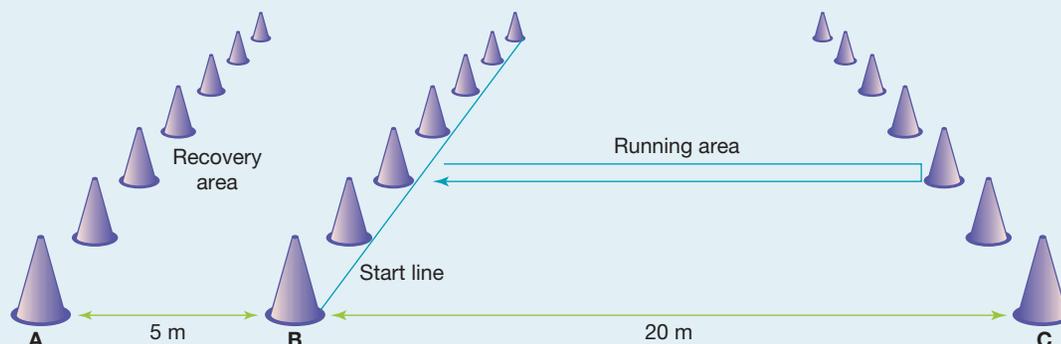
Source: Topend Sports

6. VO_2 max is predicted using the formula: YYIR1 distance (metres) $\times$ 0.0084 + 36.4. See table 9.20 for norms.
7. Establish your yo-yo test rating using tables 9.20 and 9.21.

TABLE 9.20a Yo-yo test Level 1 norms for adult men and women

Rating	Males		Females	
	Metres	Level	Metres	Level
Elite	>2400	>20.0	>1600	>17.5
Excellent	2000–2400	18.7–20.0	1280–1600	16.5–17.5
Good	1520–2000	17.3–18.7	1000–-1280	15.6–16.5
Average	1000–1520	15.6–17.3	680–1000	14.6–15.6
Below average	520–1000	14.2–15.6	320–680	13.1–14.6
Very poor	<520	<14.2	<320	<13.1

TABLE 9.20b Yo-yo test Level 2 norms for adult men and women

Rating	Males		Females	
	Metres	Level	Metres	Level
Elite	>1280	>16.5	>800	>15.1
Excellent	1000–1280	15.6–16.5	720–800	14.7–15.1
Good	720–1000	14.7–15.6	480–720	14.1–14.7
Average	480–720	14.1–14.7	360–480	13.2–14.1
Below average	280–480	12.3–14.1	160–360	11.2–3.2
Very poor	<280	<12.3	<160	<11.2

Source: Topend Sports.

TABLE 9.21 Yo-yo test norms for various sports according to the Australian Institute of Sport

Sport	Sex	Age	Mean level
Netball — national	Female	Under 17	15.7
Soccer — national	Male	Under 17	20.6
Basketball — state	Female	Under 17	15.6
Basketball — state	Male	Under 17	16.2

Muscular strength

Body requirements for **muscular strength** vary between sport, activity and general living. There is considerable variation in strength requirements within particular sports, with some playing positions requiring more strength than others. Strength is particularly important in sports such as weightlifting, gymnastics and rugby.

High levels of overall body strength improve performance and reduce the risk of injury. When we increase our strength, there is also an increase in the size of the muscle. This is referred to as muscular hypertrophy.

FIGURE 9.45 Muscular strength improves performance and reduces the risk of injury.

muscular strength the ability to exert force against a resistance in a single maximal effort

9.8 PRACTICAL ACTIVITY 3

Determining muscular strength using the hand dynamometer test

Equipment

Hand dynamometer

Procedure

1. Pick up the dynamometer and push the arrow back to zero.
2. Let your arm hang vertically with the dynamometer comfortably gripped in the hand.
3. Gradually lift the dynamometer to shoulder height, squeezing the grip as hard as you can with the arm extended.
4. Read the result and record it in table 9.22. Repeat with the left hand.
5. Perform three tests with each hand, and record the best. Determine your rating, using table 9.23.

FIGURE 9.46 Position for grip strength test

TABLE 9.22 Results for muscular strength using a hand dynamometer

	Result (kg)	Rating
Right		
Left		
Best		

TABLE 9.23 Handgrip strength norms and ratings (kilograms)

Rating	Males aged 16–17 years	Males aged 18–19 years	Females aged 16–17 years	Females aged 18–19 years
Strong	>52.4	>55.5	>29.0	>31.0
Normal	32.6–52.4	35.7–55.5	17.2–29.0	19.2–31.0
Weak	<32.6	<35.7	<17.2	<19.2

Source: Adapted from Topend Sports.

Training and muscular strength

1. Is strength important in the type of sport or activity in which you participate?
2. Were you satisfied with your muscular strength rating? Why?
3. Do you feel this test reflected your overall body strength? Explain.
4. Do you use strength training to complement your sport or activity? Explain the strength training program you use.
5. What type of contraction was performed in the hand dynamometer test
6. Why is adequate strength important in daily life? Provide examples of everyday activities that require strength.

Muscular endurance

The development of **muscular endurance** is very important in activities where contraction of the same muscle or group of muscles is repeated for periods of time without rest. It is a measure of the ability of the muscle to contract repeatedly over a period of time, thereby delaying the onset of fatigue.

muscular endurance the ability of the muscles to endure physical work for extended periods of time without undue fatigue

Muscular endurance is local in that it is specific to a muscle or a group of muscles. It depends on the condition of the muscle that is performing the repeated contractions; for example, the rectus abdominis during continuous sit-ups.

Muscular endurance is improved by programs that focus on maximum repetitions with low to moderate levels of resistance. Muscular endurance is important in activities such as cycling, cross-country running, skiing, swimming, bushwalking and rowing. In each of these activities, specific muscle groups must contract repeatedly to perform the skill. If the muscle group tires, the ability to continue to perform the skill is adversely affected.

FIGURE 9.47 Muscular endurance is important in activities where the same muscle group is involved in repetitive movements.

9.8 PRACTICAL ACTIVITY 4

Measuring muscular endurance using the 1-minute sit-up test

Equipment
Stopwatch, recording sheet

Procedure
1. Work in pairs. Nominate who will be the first subject and who will be the first counter.
2. The subject should lie on the floor with knees bent and feet flat on the floor. Arms are folded across the chest. Palms are open and rest on the front of the shoulders. Elbows are close together. The counter should hold their partner's feet firmly on the floor. The angle at the knees should not be less than 60°. In the sit-up, the trunk is raised and the elbows brought to a position between the knees. The body then returns to the floor. The total movement counts for one sit-up.
3. Have a number of practices to warm up and ensure the technique is correct. Disallow any sit-ups performed incorrectly.
4. Perform the test, counting the number of correctly executed sit-ups in one minute.
5. Change roles and repeat the process.
6. Determine the rating for each person, using table 9.24.

FIGURE 9.48 Sit-up test
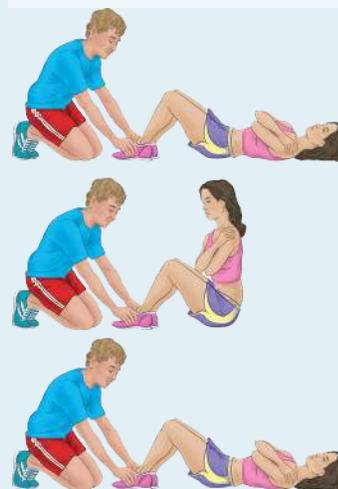
TABLE 9.24 Abdominal muscle endurance ratings (number of sit-ups completed in 60 seconds)

Rating	Males aged 15–19 years	Females aged 15–19 years
Excellent	48 or more	42 or more
Good	42–47	36–41
Average	38–41	32–35
Fair	33–37	27–31
Poor	32 or fewer	26 or fewer

Source: Adapted from Niernan, 1993.

Muscular endurance
1. Are you satisfied with your rating in the sit-up test?
2. What problems did you incur with this type of test?

Flexibility

Flexibility not only helps sport performance but contributes significantly to quality of life. Flexibility is joint specific; that is, the level of flexibility found in one joint will not necessarily be uniform throughout the body. In other words, a person who is quite flexible in, for example, the shoulders may not be quite as flexible in other joints throughout the body.

Flexibility is an important health-related fitness component because it directly affects personal health and athletic performance, both now and in the future. For example, it is known that muscle length decreases with age, progressively decreasing our range of movement. Routine flexibility programs delay and restrict the effects of this process.

FIGURE 9.49 Improved flexibility allows us to participate in a greater range of activity with less discomfort and less chance of injury.

flexibility the range of motion about a joint or the ease of joint movement

Flexibility is improved by safe stretching programs which, in addition to increasing mobility, also:

- help prevent injury
- improve posture
- improve blood circulation
- decrease the chance of lower back pain later in life
- strengthen the muscle if combined with isometric exercises.

9.8 PRACTICAL ACTIVITY 5

Measuring flexibility using the sit-and-reach test

Equipment

Sit-and-reach measuring device, box for mounting (or box and ruler)

Procedure

1. Work in pairs, taking it in turns to be the subject and the tester. The subject should sit on the floor with legs stretched out straight ahead. Shoes should be removed.
2. The soles of the feet are placed flat against the box/bench. Both knees should be locked and pressed flat to the floor — the tester may assist by holding them down.
3. With the palms facing downwards and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other.
4. The subject reaches out and holds that position for at least 1 or 2 seconds while the distance is recorded. Make sure there are no jerky movements.

FIGURE 9.50 Sit-and-reach test for flexibility

5. The best of three attempts should be recorded.
6. Determine the rating for each person, using table 9.25.

TABLE 9.25 Sit-and-reach test norms

Rating	Men (cm)	Women (cm)
Super	> +27	> +30
Excellent	+17 to +27	+21 to +30
Good	+6 to +16	+11 to +20
Average	0 to +5	+1 to +10
Fair	−8 to −1	−7 to 0
Poor	−20 to −9	−15 to −8
Very poor	< −20	< −15

Source: Topend Sports.

Flexibility

1. List three sports or activities that take up a lot of your recreational or training time (for example, surfing).
2. List three joints that undergo a full range of motion in performing the skills associated with the sports or activities listed in question 1 (for example, the shoulder joint).

Body composition

Body composition is an important health-related component because it takes account of the level of storage fuel required for muscle activity. Having too little or too much storage fuel (fat) can significantly affect health and physical performance.

All people need a certain amount of body fat. This is called essential fat and surrounds vital organs such as the kidneys, heart, muscle, liver and nerves. Absence of fat in these areas would lead to chronic health problems because fat in these regions helps to protect, insulate and absorb shock to these organs.

body composition the percentage of fat as opposed to lean body mass in a human being

muscular power the ability to combine strength and speed in an explosive action

Additional fat is called storage fat and it too has an important role, mainly as a source of stored energy. Storage fat is used for fuel during times of rest and sleep and in extended exercise of more than an hour or so, when our supplies of blood glucose are exhausted.

FIGURE 9.51 Exercise patterns and eating habits largely determine our body composition.

Lean body mass is often called fat-free mass and comprises all of the body's non-fat tissue, including bone, muscle, organs and connective tissue. While the characteristics of body tissue are genetically determined, the size of the muscle can change with the use of resistance training (weight training) programs. Body composition can be changed by diet and exercise. For example, a lifestyle that combines regular high activity and resistance training with a well-balanced, but not excessive, food intake will result in a significant decrease in body fat and improved body tone. The recommended amount of body fat as a percentage of body composition is 15 to 20 per cent for men and 20 to 25 per cent for women.

9.8.6 Skill-related components of fitness

Skill-related components of physical fitness do not specifically affect health but are important in the performance of activities, games and recreational pursuits. An improvement in skill-related components improves performance in activities that utilise that skill. For example, effective rebounding in basketball requires an ability to jump high. The fitness component required to jump high is muscular power in the legs.

FIGURE 9.52 Power is important in activities that require explosive movements

Muscular power

Muscular power is determined by the amount of work per unit of time. People who are strong are not necessarily powerful. The amount of power relative to the amount of strength varies according to the type of activity. Speed-dominated power is power generated through a greater emphasis on speed and is essential in activities such as sprinting and throwing. Strength-dominated power is power generated through a greater emphasis on strength. It is important in activities such as weightlifting, shot put, discus or javelin. Effective programs aim to develop the required amounts of strength and power in each individual according to the needs of their sport.

9.8 PRACTICAL ACTIVITY 6

Measuring muscular power using the vertical jump test

Equipment

Vertical jump board or tape measures attached to wall

Procedure

1. Divide into pairs. One person is the subject and the other is the recorder.
2. The subject should dip their middle finger in chalk dust, face the wall, extend both hands upwards and make a mark on the wall. Record the height of the mark in centimetres.
3. The subject should then turn sideways to the wall, spread their feet, take a deep squat and jump vertically (see figure 9.53). No foot movements are allowable in preparation for the jump.
4. At the maximum height of the jump, the subject should mark the wall. Record the difference between the first and second marks.
5. Allow three jumps and record the best.
6. The subject and recorder should then change roles and repeat steps 2–5.
7. Use the best jump for each person to determine their power rating using table 9.26. Compare it with the norms in table 9.27.

FIGURE 9.53 Vertical jump test

TABLE 9.26 Ratings for the vertical jump test (centimetres)

Rating	Males aged 15–17 years	Males aged 18–34 years	Females aged 15–17 years	Females aged 18–34 years
Excellent	59 or more	62 or more	39 or more	32 or more
Good	48–58	48–61	33–28	25–31
Average	30–47	33–47	20–32	15–24
Fair	13–29	20–32	8–19	5–14
Poor	12 or less	19 or less	7 or less	4 or less

TABLE 9.27 AIS norms for the vertical jump test

Sport	Gender	Age	Mean score
Netball — national	Female	Under 17	44 cm
AFL	Male	Approximately 18	60 cm
Basketball — state	Female	Under 17	48 cm
Basketball — state	Male	Under 17	62 cm
Cricket — national	Female	Open	44 cm
Cricket — national	Male	Under 19	56 cm

Speed

Because it is largely an innate quality determined by fibre type, **speed** is not as responsive to training as other fitness components such as cardiorespiratory endurance, strength and power. This explains why some people naturally appear to be 'quick' while others, no matter how much they train, do not make significant gains. Sprinters still need to train to improve speed. However, while some improvements will be made as a result of increased power, considerable changes result from improvements in technique, including reaction time at the start, form, alignment, balance and the utilisation of energy for a powerful finish.

speed the ability to perform body movements quickly

agility the ability to move the body from one position and direction to another with speed and precision

9.8 PRACTICAL ACTIVITY 7

Measuring speed using the 50-m sprint test

Equipment

Tape measures, stopwatches

Procedure

1. Measure a 50-m straight on flat ground.
2. Divide into pairs. Choose who will be the first runner and who will be the first timer.
3. Have a general warm-up with emphasis on leg stretches.
4. Practise 'on the mark', 'set', 'go', allowing about 2 seconds between 'set' and 'go'.
5. Practise starting the stopwatch on the 'go' movement; that is, the first movement forward. As sight is quicker than sound, this will give a more accurate reading.
6. The starters should go to the starting line and the timers to the finish line.
7. Start the runners and time them over the distance.
8. Allow three runs and select the best time.
9. The subjects and recorders should then change roles and repeat steps 4–8.
10. Take the best time for each person and determine their speed rating using table 9.28.

TABLE 9.28 Ratings for the 50-m sprint test (seconds)

Rating	Males aged 16–17 years	Females aged 16–17 years
Excellent	Under 7.1	Under 8.0
Good	7.1–7.3	8.0–8.4
Average	7.4–7.8	8.5–8.9
Fair	7.9–8.2	9.0–9.3
Poor	Over 8.3	Over 9.4

Source: Adapted from Wright 1997.

Agility

Agility combines a number of fitness components including balance, coordination and speed. Because agility includes a number of components, any test that measures agility will be performed at speed and will reflect a degree of balance and coordination. Improved fitness in any one of these aspects subsequently improves agility and the ability to resist fatigue. Elements or aspects of any agility training program should include the ability to be aware of, and control, body parts, to recognise patterns of skills and to react or respond quickly to stimuli. Drills to improve footwork and to start and change direction will also be helpful in developing agility.

FIGURE 9.54 Agility is the ability to move with speed and precision.

Activities that require a high degree of agility include skiing, surfing, most team games and ice-skating. Field hockey and netball, for example, are multi-directional sports, both requiring quick changes of direction and fast acceleration or deceleration. An agile player can respond quickly to an opposing player, making agility equally as or even more important than speed.

9.8 PRACTICAL ACTIVITY 8

Testing agility using the Illinois agility run test

Equipment

Tape measure, 6 markers (chairs or traffic cones), stopwatches, recording sheets

Procedure

1. On a football field or suitable flat surface, mark two parallel lines 10 m apart. Place four traffic cones 3.3 m apart as shown in figure 9.55. Place two traffic cones 1.83 m each side of the first line marker.
2. Divide into pairs. One person is to complete the course and the other is to time and record the results. Ensure that you warm up and stretch before completing the course.
3. The first subject from each pair should lie face-down flat on the ground in a push-up position just behind the line at the start.
4. On the instruction 'go', the first subject runs to the end line and back, then in and out of the markers back to the end line again, then back to the finish (see figure 9.55).
5. During the run, each end line must be crossed. The markers cannot be jumped or knocked.

FIGURE 9.55 Set-up for the Illinois agility run test
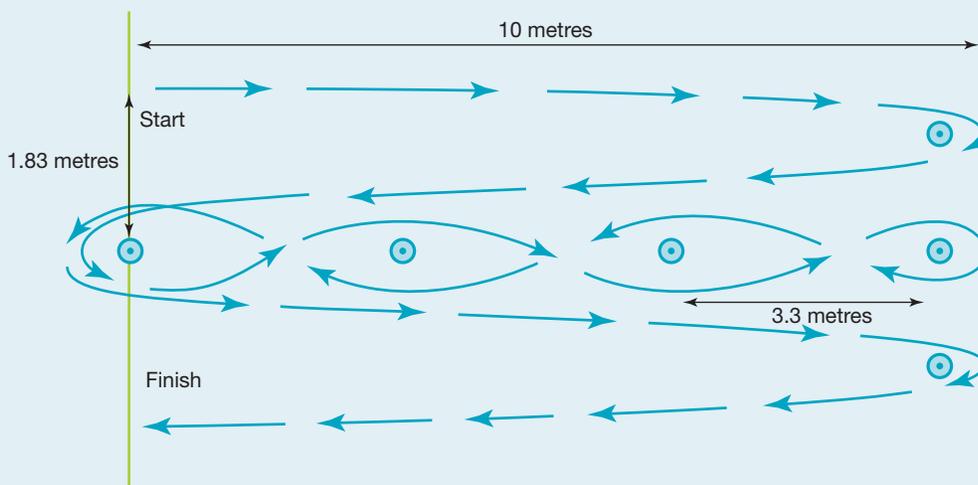
6. The second student records the time for completion of the course.
7. Allow two attempts, with recovery time between each. Then change roles and repeat steps 3–6.
8. Check your agility rating, using table 9.29.

TABLE 9.29 Agility rating

Rating	Males aged 16–17 years	Females aged 16–17 years
Excellent	<15.2	<17.0
Very good	16.1–15.2	17.9–17.0
Average	18.1–16.2	21.7–18.0
Poor	18.3–18.2	23.0–21.8
Very poor	>18.3	>23.0

Coordination

Coordination requires good interaction between the brain and the muscles, resulting in efficient body movement. Coordination is important in games, in movements that require throwing and in activities such as dancing. It is not a specific skill such as power or speed; rather, we see it in the way a motor skill is executed. Performers we consider to be skilled, such as professional tennis players, exhibit excellent coordination. This contributes to the aesthetic quality of movement. People who are well coordinated acquire new movements readily. As a result, they adapt quickly to learning new sports and activities. Well-coordinated players are less prone to accidents and injury when involved in physical activity.

FIGURE 9.56 Good coordination helps us to learn new motor skills quickly.

coordination the ability to use different parts of the body together smoothly and efficiently

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9.8 PRACTICAL ACTIVITY 9

Determining hand–eye coordination using the alternate-hand wall-toss test

Equipment

Tennis ball or baseball, smooth and solid wall, marking tape, stopwatch

Procedure

1. Work in pairs.
2. Place a line on the ground a fixed distance from the wall (for example, 2 metres).
3. One student should stand behind the line and face the wall. They then throw the ball from one hand in an underarm action against the wall, and attempt to catch it with the opposite hand.
4. The test can continue for a nominated number of attempts or for a set time period (for example, 30 seconds).
5. Repeat the test for the second student.
6. Tally your results for the tests and find your coordination rating, using table 9.30.

TABLE 9.30 Ratings for the wall-toss test, based on the number of successful catches in a 30-second period

Classification	Number of successful catches
Excellent	>35
Good	30–35
Average	20–29
Fair	15–19
Poor	<15

Balance

Balance is our ability to maintain equilibrium. It depends on our ability to blend what we see and feel with our balance mechanisms, which are located in the inner ear.

> **balance** the ability to maintain equilibrium while either stationary or moving

There are two types of balance: static and dynamic. Static balance means maintaining equilibrium while the body is stationary. Dynamic balance means maintaining equilibrium while the body is moving. We use balancing skills virtually every moment of our lives. For instance, we are balancing while walking and running. However, in some situations a higher degree of balance is required for the proper execution of a skill. The gymnast performing a handstand, the ballerina on their toes and the skier all need exceptional balance to execute their respective skills.

Balance can be improved by practice. As a person learns to control their centre of gravity both when moving (as in running) and with a narrow base of support (as in a pirouette or handstand), balance improves. When the centre of gravity falls outside the base of support with stationary activities, balance is lost.

FIGURE 9.57 Balance is the ability to maintain equilibrium while standing or moving.

9.8 PRACTICAL ACTIVITY 10

Static balance

Equipment

Stopwatch, recording sheet

Procedure

1. Divide into pairs. One student is to perform the test and the other will time, judge and record the attempt.
2. The first student should remove their shoes and stand straight on a flat surface with their hands on their head.
3. One foot is then lifted and placed behind the calf of the other leg. At this point, the stopwatch is started.
4. The stopwatch is stopped when one or more of the events below occur:
   - the time on one leg exceeds 20 seconds
   - the foot comes away from the calf of the other leg
   - the hands come away from the head
   - the supporting foot changes position on the floor
   - the student jumps.
5. Allow 1 minute's practice. Then record the best of three attempts on the right leg followed by the best of three attempts on the left leg. Record the total time.
6. Repeat the test for the second student.
7. Use the **Static balance** weblink in the Resources panel to find information on static balance ratings.

Reaction time

Reaction time is very important in sports such as sprinting, shooting and swimming. The stimulus could be a sound such as a starter's gun, a movement, or a target fired into the air. In each case, there is a period between the mind realising the presence of the stimulus and the body making the appropriate response.

reaction time the time taken to respond to a stimulus

The time taken between stimulus and response is the reaction time. It will vary from one person to another. Reaction time can be improved with practice and concentration. The average reaction time in human beings is 170 milliseconds. Successful athletes in sprint events will probably have faster reaction times due to practice.

FIGURE 9.58 Reaction time is the time taken to respond to a stimulus.

Interestingly, Usain Bolt, currently the fastest human being ever recorded, had a longer reaction time to the starter's gun than many of his competitors. In the 2016 Olympic Games 100-m sprint final his reaction time was 0.115 seconds, which was the second-slowest reaction time for competitors in that race. He eventually won the race in 9.81 seconds. This suggests that, if he could have reduced his reaction time, he might have been able to achieve even faster world record speeds.

DEPTH STUDY IDEA

PART A

Scenario: The coach of a hockey team needs to test the players' fitness levels. They decide to test the players' agility.

After some thought, the coach decides to time the athletes in a beep test.
1. Is the beep test a valid test in this context? Provide reasons for your answer.
2. Suggest other agility tests the coach could use to better test this component of fitness.
3. Discuss the implications of the agility test for the athlete and the team.

PART B
4. Design a selection of fitness tests to determine the fitness outcomes of the following individuals:
   - a 35-year-old elite athlete in a sport of your choice
   - a 65-year-old male or female who participates in aqua aerobics three times per week
   - a 12-year-old male or female who plays tennis four times per week
   - a 25-year-old wheelchair basketball player.
   Note: The fitness tests should be valid and reliable. They should also reflect the most relevant fitness components for the individual and their sport/activity.

PART C
5. For each of the individuals, discuss your selection of the fitness tests and their suitability for the individual.

9.8 PRACTICAL ACTIVITY 11

Determining reaction time — vision and hearing

TEST ONE

Equipment

One 1-m ruler, desk and chair, recording sheets

Procedure
1. Divide into pairs. One student will be the subject and the other will conduct the experiment and record the result.
2. The subject sits at the desk and places their preferred forearm across the desk so that their hand extends beyond the edge of the desk. Fingers and thumb point away and have a gap between them, approximately 2 cm wide.
3. The recorder stands beside the subject's hand and holds the ruler so it is suspended just beyond the far edge of the desk. The bottom edge of the ruler should be level with the thumb and index finger of the subject.
4. After the recorder says 'ready', the ruler is dropped.
5. The subject should try to catch the ruler. The score is read in centimetres and is the point at which the thumb and index finger grasp the ruler.
6. Allow three trials prior to testing. Then record three attempts and use the average value for assessment.
7. Repeat the test for the second student.
8. Use table 9.31 to determine your reaction time rating.

TABLE 9.31 Reaction time rating

Classification	Ruler reading (cm)
Excellent	<7.5
Very good	7.5–15.9
Satisfactory	15.9–20.4
Fair	20.4–28.0
Poor	>28

TEST TWO

Equipment

As for test one

Procedure

As for test one. However, this time the subject's eyes are closed and the test is performed once for each hand. The recorder should say 'ready' and then 'go' (when they let go of the ruler) within a period of 10 seconds.

TEST THREE

Equipment

As for test one

Procedure

As for test one. However, this time the subject's fingers and thumb are placed just against the side of the ruler with absolutely no pressure on the ruler itself. The recorder drops the ruler as in test one, and the subject responds when the movement is felt.

TEST FOUR

Equipment

As for test one, with the addition of an extra 1-m ruler

Procedure

As for test one. However, this time the subject's eyes are closed, both arms are extended and they respond to the words 'right' or 'left', describing which ruler is to be dropped. The subject has to interpret these data and respond by reacting with the correct hand.

9.8 Exercises

learn on

9.8 Quick quiz **on**	9.8 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
2, 3, 5	1, 4, 6	7, 8, 9

These questions are
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Revise your knowledge

1. Summarise what you have learned about the components of physical fitness by copying and completing a web diagram similar to the one in figure 9.59.
   For each component of physical fitness, give an example illustrating how it applies to a particular physical activity or sport.

FIGURE 9.59 Web diagram of the components of physical fitness
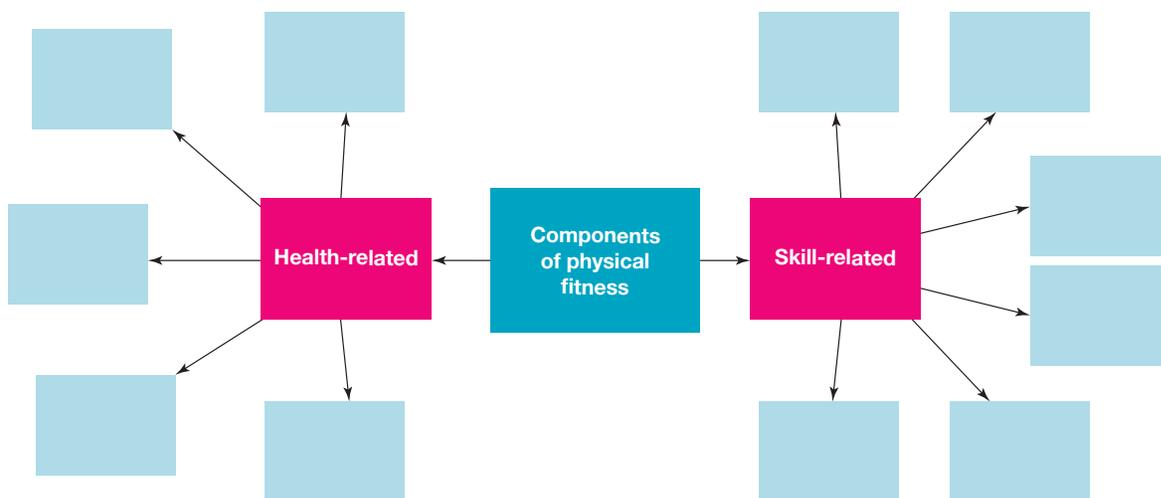
2. Outline the purpose of fitness testing.
3. Discuss the outcomes of fitness testing.
4. Why is having cardiorespiratory endurance important for all sports?
5. Identify the factors that may limit the reliability of the fitness outcomes.

Apply your knowledge

6. Argue the purpose of fitness testing for people in both individual and group sports.
7. Debate the following question: 'Each athlete should perform the same fitness tests regardless of their sport'.
8. To what degree is fitness a predictor of performance?
9. Explain the importance of modifying fitness tests for different groups in the population.

9.9 Sample exam question response

Question

Describe the immediate physiological responses that occur at the onset of aerobic training. Use examples to support your answer. **(4 marks)**

Criteria	Marks
• Provides characteristics and features of the immediate physiological responses that occur at the onset of aerobic training • Provides relevant examples	4
• Sketches in general terms the immediate physiological responses that occur at the onset of aerobic training • Provides examples	3
• Identifies the immediate physiological responses that occur at the onset of aerobic training	2
• Provides some relevant information about physiological responses and/or aerobic training	1

Sample response

eles-5020

Breaking down the question

Describe the immediate physiological responses that occur at the onset of aerobic training. Use examples to support your answer.

Identify the action word/s: Describe — provide characteristics and features of

Syllabus terminology: immediate physiological responses and aerobic training

Mark allocation: 4 marks — according to HSC past papers, questions worth 4 marks require answers addressing the action word and providing clear examples. Responses should be concise, using syllabus terminology.

Answering question using PEEL structure

P Identify the ***Point*** being raised/state topic sentence/what this paragraph is going to be about[1]

E ***Expand/Elaborate*** on the point and provide a strong link to what the question is asking[2]

E Apply ***Examples*** that are relevant and specific[3]

L ***Linking*** sentence that relates back to the question[4]

Sample annotated response

Some of the immediate physiological responses that occur in response to aerobic training include[1] decreased heart rate, decreased ventilation rate, increased stroke volume, increased cardiac output and decreased lactate levels.[3]

A decreased resting heart rate[1] occurs as a response to aerobic training as the heart becomes more efficient at pumping blood around the body. Oxygen is received more effectively through each pump of the heart around the body to the working muscles.[2]

In addition, stroke volume[1] is the amount of blood ejected by the left ventricle in one contraction, which increases as the heart becomes stronger and more efficient.[2] Cardiac output is the amount of blood pumped in one minute[3] and this increases in response to aerobic training as a result of an increase in stroke volume as the heart becomes more efficient.[4]

Ventilation rate also improves as the body becomes more efficient in moving oxygen around the body.[1] In response to aerobic training, ventilation rates decrease as the lungs become more efficient in response to training.[2]

It can be seen that there are many immediate physiological responses that occur in response to aerobic training.[4]

9.10 Review

9.10.1 Topic summary

9.2 Energy systems

- The human body has three systems that provide energy — the ATP-PCr, glycolytic (lactic acid) and aerobic energy systems. They are commonly called energy pathways.
- All energy systems function by converting the chemical energy in food into adenosine triphosphate (ATP), which enables muscular contraction.
- Fuel energy is efficiently stored in high-energy bonds within ATP and its backup energy supply, phosphocreatine (PCr).
- There is limited ATP in the body. ATP breaks down quickly when we move and needs to be resynthesised to once again provide energy.
- The ATP-PCr system provides energy for a maximum of about 10 to 12 seconds. Its fuel source is creatine phosphate and the system does not produce any by-products.
- The glycolytic (lactic acid) system provides energy for anything up to 2 to 3 minutes of moderate to high-intensity exercise and longer for low-intensity exercise. Its fuel source is glycogen. In contrast to the ATP-PCr system, the glycolytic system generates a by-product called lactic acid, which can inhibit performance.
- The aerobic system provides energy for sustained work of moderate intensity. It uses carbohydrate and fat to provide large quantities of ATP. Carbon dioxide and water are the by-products, neither of which are harmful to performance.

9.3 Nutrition and energy systems

- Depending whether exercise and sport is anaerobic or aerobic will determine the optimum types and amounts of foods consumed.
- In aerobic activity, the main source of fuel is carbohydrates (low glycaemic index), fats (unsaturated) and protein.
- Anaerobic sports, such as sprints, field athletics or weight training, require different amounts and types of carbohydrates, less fat and more protein for muscle repair.
- Each individual is different and will have various nutritional requirements depending which foods work best for them.
- Carbohydrate is broken down into glucose. Glucose is stored as glycogen in the muscles and liver. Any excess is stored as fat in adipose tissue around the body.
- Fats provide more energy per gram than other fuels, but the body prefers carbohydrate as an energy source during exercise because it is easier to break down and produces energy at a faster rate.
- Protein is used as an energy source only when carbohydrate and fats are depleted; for example, in extreme conditions such as in ultra-endurance events.
- Macronutrients and micronutrients play a role in fuelling the energy systems.

9.4 Aerobic and anaerobic training for individuals and group sports

- The two basic types of training are aerobic (with oxygen) and anaerobic (without oxygen).
- Aerobic training involves exercise that is sustainable and of low to moderate intensity.
- Anaerobic training involves activities where the level of intensity is high but maintained for short periods of time; for example, sprinting and high-jumping.
- Marathons, 400-m swimming and triathlons are examples of activities that draw their energy from aerobic metabolism.
- Most team sports require energy using both the aerobic and anaerobic pathways. It is therefore important to establish the main sources of energy as a prerequisite in the development of training programs.

9.5 Design a training program

- Aerobic training involves exercise that is sustainable and of low to moderate intensity. The FITT principle (frequency, intensity, time, type) is used to adapt aerobic training programs to individual needs.
- Anaerobic training uses high-intensity work along with limited recovery to develop systems of energy supply that function in the absence of oxygen. Anaerobic training is shorter in duration than aerobic training, lasting less than 2 minutes.
- Frequency refers to how often training occurs.
- Intensity refers to the amount of effort required by an individual to accrue a fitness benefit.
- Time refers to the duration of the training session.
- Type refers to the type(s) of exercise being performed for the training session.

9.6 Immediate physiological responses to training

- Training causes an immediate physiological response seen in changes to heart rate, ventilation rate, stroke volume, cardiac output and lactate levels.
- Heart rate is the number of times the heart beats per minute. When we begin to exercise, our heart rate increases and reaches a steady state during sustained moderate activity such as jogging.
- Breathing or ventilation rate increases during activity to deliver more oxygen to muscles.
- Stroke volume refers to the amount of blood ejected by the heart during a contraction. It increases significantly in response to exercise.
- Cardiac output, the total amount of blood pumped by the heart per minute, increases with exercise. When muscles work, blood is drawn from many parts of the body and redistributed to muscles.
- Lactate or lactic acid increases in the blood during exercise. If exercise is vigorous, lactate increases rapidly and inhibits performance if levels rise too high.

9.7 Investigate the physiological responses in relation to aerobic training

- A research question aims to guide your research about a particular topic or issue.
- Before starting the experiment, research needs to be conducted.
- Ethical considerations when collecting data must be considered.
- In any experiment it is important to ensure that results are reliable, valid and credible in order to effectively support and answer the research question.
- Once completed, results can be collected, presented and analysed to draw conclusions.

9.8 The purpose and outcomes of testing physical fitness

- Fitness testing is a way of gaining information about the health-related and skill-related components of an individual's fitness.
- Without fitness testing, individuals cannot determine whether improvements are being made.
- Various factors may impact the outcome of the fitness test. When completing a fitness test, it is important to limit as many variables as possible by ensuring conditions are exactly the same as in the previous test.

- Health-related components of physical fitness include cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition. An improvement in the health-related components will assist personal health and lifestyle, including lowering the risk of diseases related to lifestyle.
- Skill-related components of physical fitness include power, speed, agility, coordination, balance and reaction time.
- The components of fitness can be measured using simple tests. By compiling the results of testing for each of the components, we gain an overall impression of our level of fitness. We call this a fitness profile.
- The purpose of fitness testing includes benefits such as the ability to predict future performance, indicates the athlete's strengths and weaknesses, monitors progress and measures improvements.
- Fitness testing can occur pre-training, during training and post-training.
- Various factors might affect the outcome of a fitness test. It is important when completing fitness testing to limit variables and ensure conditions are the same throughout all tests.
- It is important that testing for physical fitness is able to be modified to cater for different groups in the population, such as elite athletes, elderly people, children and people with disabilities.

on Resources

📄 **Digital document** Topic 9 summary (doc-35911)

9.10.2 Key terms

adenosine triphosphate a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction
aerobic metabolism the breakdown of fuel in the presence of oxygen to produce energy (ATP)
aerobic threshold a level of exercise intensity that is sufficient to cause a training effect. This is approximately 70 per cent of a person's maximal heart rate (MHR).
agility the ability to move the body from one position and direction to another with speed and precision
anaerobic describes a process that takes place in the absence of oxygen
anaerobic glycolysis process in which glucose is broken down in the absence of oxygen to produce energy
anaerobic interval training sprint training over short distances using maximal effort
balance the ability to maintain equilibrium while either stationary or moving
body composition the percentage of fat as opposed to lean body mass in a human being
carbohydrate loading the manipulation of training and nutrition prior to endurance events to maximise muscle glycogen (carbohydrate) stores
cardiac output (CO) the amount of blood pumped by the heart per minute
cardiorespiratory endurance the ability of the working muscles to take up and use the oxygen that has been breathed in during exercise and transferred to muscle cells
continuous training continuous activity that lasts a minimum of 20 minutes at the required intensity using the aerobic energy system. It is submaximal and requires an intensity of 70–85 per cent of maximum heart rate (also known as long, slow distance training).
coordination the ability to use different parts of the body together smoothly and efficiently
dehydration an excessive loss of water
fitness a measure of the body's ability to function efficiently, effectively and without injury in everyday activities, to pursue recreational activities and to cope with emergency situations
FITT principle a framework for developing fitness programs that emphasise the variables Frequency, Intensity, Time or duration of exercise and Type of exercise
flexibility the range of motion about a joint or the ease of joint movement
glucose broken down from stored glycogen, glucose is transported in the blood to provide energy for working muscles during training
glycaemic index a ranking system for carbohydrates based on how they affect blood sugar level
glycogen the storage form of glucose and is used for fuel when blood glucose levels decline

▶

glycolysis the process of using glycogen or glucose as fuel

glycolytic (lactic acid) a by-product of the incomplete breakdown of carbohydrate in the absence of oxygen

heart rate (HR) number of times the heart contracts or beats per minute

high-intensity interval training (HIIT) involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

intensity the amount of effort required by an individual to accrue a fitness benefit

interplay of energy systems energy systems working together, but at different rates, to supply the ATP required for an activity

lactate a salt formed from lactic acid that accumulates during intense anaerobic activity

lactate inflection point (LIP) the point beyond which a given exercise intensity or power output cannot be maintained by an individual

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body; these include carbohydrates, fats and proteins

micronutrients one of the major groups of nutrients needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance among other functions. Also known as vitamins.

muscular endurance the ability of the muscles to endure physical work for extended periods of time without undue fatigue

muscular power the ability to combine strength and speed in an explosive action

muscular strength the ability to exert force against a resistance in a single maximal effort

phosphocreatine (PCr) a chemical compound found in muscle cells that is capable of storing and releasing energy that can be used to resynthesise ATP from ADP and Pi

physical fitness a set of attributes (health and skill components) which enable an individual to be physically active

reaction time the time taken to respond to a stimulus

resynthesis the process of restoring ATP to its former state

speed the ability to perform body movements quickly

sprint interval training (SIT) a form of high-intensity training characterised by repeated, brief intermittent bursts of supramaximal intensity exercise, interspersed by periods of active or passive recovery

steady state a period of time during which oxygen uptake remains at a sustained level, such as swimming at a constant speed

stroke volume the amount of blood ejected by the left ventricle of the heart during a contraction; it is measured in mL/beat

tapering a reduction in training that allows the athlete time for extra recovery and for their energy stores to be fully restored

target heart rate (THR) zone area surrounding the target heart rate and is calculated using percentages of maximal heart rate

ventilation refers to our depth and rate of breathing and is expressed in breaths per minute

vitamins inorganic compounds that are essential to maintaining bodily functions

on Resources

Digital documents	Key terms glossary (doc-36177)
	Revision quiz (doc-34738)
Interactivity	Missing word interactive quiz (int-8046)

9.10 Exercises

9.10 Revision quiz on	9.10 Exam questions

9.10 Exam questions

Question 1 (1 mark)

What is the predominant energy system used during a 100-m sprint? (HM-11-03)

A. ATP-PCr
B. Aerobic
C. Phosphate
D. Glycolic (lactic acid)

Question 2 (1 mark)

An athlete is using the aerobic energy system. What is the likely duration of their performance while using this system? (HM-11-03)

A. 6 seconds
B. 6 minutes
C. 60 seconds
D. 60 minutes

Question 3 (1 mark)

Macronutrients include which of the following? (HM-11-03)

A. Protein, fats, vitamin D
B. Carbohydrates, fats, protein
C. Carbohydrates, calcium, iron
D. Protein, carbohydrates, vitamin B

Question 4 (1 mark)

Which of the following training plans would an athlete follow if they want to improve their aerobic endurance? (HM-11-03)

	Frequency	Intensity	Time	Type
A.	3–5 times a week	60–80% MHR	60 minutes	Swimming, cycling, running
B.	2–3 times a week	90–100% MHR	2–3-minute intervals	Sprints
C.	3–5 times a week	40–50% MHR	30 minutes	Sprints
D.	1–2 times a week	70–80% MHR	90 minutes	Strength training

▶ Question 5 (3 marks)

Outline three activities that could be included in a fitness session aimed at improving aerobic capacity. (HM-11-08)

▶ Question 6 (3 marks)

Outline the difference in heart rate when sitting, jogging and sprinting. (HM-11-03)

▶ Question 7 (3 marks)

Why does ventilation rate rise with increases in exercise intensity? (HM-11-03)

▶ Question 8 (4 marks)

Outline the difference between aerobic and anaerobic training. (HM-11-03)

▶ Question 9 (4 marks)

Describe the role of ATP in energy supply. (HM-11-03)

▶ Question 10 (4 marks)

Explain how the FITT principle is used to improve aerobic performance. (HM-11-06)

▶ Question 11 (5 marks)

Discuss the difference between stroke volume and cardiac output and the effect of aerobic training on each. (HM-11-03)

▶ Question 12 (6 marks)

Explain the role nutrition plays in enabling the aerobic energy system to function efficiently. (HM-11-06)

▶ Question 13 (6 marks)

Discuss the purpose and outcomes of testing physical fitness. (HM-11-06)

▶ Question 14 (8 marks)

Explain the physiological responses that would occur in a 1500-m swimming event. (HM-11-03)

▶ Question 15 (8 marks)

Analyse how the ATP-PCr system functions to supply energy in a 100-m sprint. (HM-11-03)

▶ Question 16 (12 marks)

Analyse the role of each energy system of the body during a 50-km triathlon. (HM-11-03)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

9.1 What factors influence movement and performance? (tpdf-2183) ☐

🗐 Digital documents

9.8 Recording sheet (doc-36157) ☐
9.9 Topic 9 summary (doc-35911) ☐
Key terms glossary (doc-36177) ☐
Revision quiz (doc-34738) ☐

▶ Video eLessons

9.9 Sample exam question response (eles-5020) ☐

✦ Interactivities

9.2 Relationship between running time and energy systems (int-9283) ☐
Approximate relative contributions of the three energy systems to energy production at maximum sustainable exercise intensity of varying durations (int-8622) ☐
9.6 The effect of varying activities on heart rate (int-8608) ☐
Heart rate response before, during and after moderate exercise (int-8623) ☐
Cardiac output at rest and at maximal exercise (int-8624) ☐
9.8 Multi-stage VO_2 calculator (int-6808) ☐
Yo-yo test calculator (int-6809) ☐
9.9 Missing word interactive quiz (int-8046) ☐

🔗 Weblinks

9.2 20m Multistage Fitness Test (Beep Test) ☐
Energy systems interplay ☐
Energy systems ☐
Energy systems 2 ☐
Lactate threshold ☐
9.3 Food for your sport ☐
9.4 Top fitness trends ☐
9.5 FITT Training Guidelines ☐
Future of Australian Sport ☐
9.6 Home step test ☐
Edpuzzle ☐
9.7 Writing strong research questions ☐
9.8 Beep test audio ☐
Static balance ☐
Fitness tests ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

10 How are movement skills acquired, developed and improved?

LEARNING SEQUENCE

10.1 Overview

Key inquiry question

How are movement skills acquired, developed and improved?

Syllabus

Syllabus content	Subtopic
○ ▪ Apply an understanding of how movement skills are acquired, developed and improved for recreational and elite athletes **Including:** • characteristics of learners • stages of learning/skill acquisition • characteristics of motor skills, including gross and fine, continuous, discrete and serial, open and closed, self-paced and externally paced • practice methods for the different stages of learning, including massed, distributed, whole, part, blocked and random • performance elements, including decision-making, strategic and tactical development • types of feedback for different stages of learning, including task-intrinsic, augmented, concurrent, delayed, knowledge of results, knowledge of performance **Example(s):** **Stages of learning/skill acquisition:** Cognitive, associative and autonomous stages.	 **10.2** **10.3** **10.4** **10.5** **10.6** **10.7**
○ ▪ Research how movement skills are acquired, developed and improved in a sport of choice **Including:** • what does the research tell us about acquiring, developing and improving the movement skill? • how is this applied in practice? • what further research questions can be proposed to further understand skill development?	**10.8**

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Outcomes

• investigates movement skills and psychology to improve participation and performance HM-11-04
• Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
• Analysis: analyses the relationship and implications of health and movement concepts HM-11-06
• Communication: communicates health and movement concepts to audiences and contexts, using a variety of modes HM-11-07
• Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09
• Research: analyses a range of sources to make conclusions about health and movement concepts HM-11-10

on Resources

📄 **Digital documents**　Topic 10 summary (doc-35912)
　　　　　　　　　　　　Key terms glossary (doc-36178)
　　　　　　　　　　　　Revision quiz (doc-34739)

10.2 Characteristics of learners

Skill is the ability to consistently perform movements with control and precision. The **acquisition** of skill is a gradual developmental process that requires that our cognitive (thinking) processes work with our physical abilities to learn how to perform movements that previously were unfamiliar to us. Part of the physical learning process is the gradual development of our sensory awareness, as our ability to execute movement changes from being a conscious to an unconscious effort.

Recreational athletes are those who are physically active but do not train at the same level or intensity as elite athletes. They generally participate in sport or physical activity for fun, social interaction or to maintain their health. **Elite athletes** are those that participate in sport and physical activity competitively, often at a state or national level. These two types of athletes often acquire, develop and improve movement skills at different rates and the factors that influence this will be explored throughout this topic.

The pace of skill acquisition varies from one learner to another. Underlying problems such as lack of coordination, poor acceleration or slow reflexes may make progression from beginner to movement mastery slow and possibly difficult. Again, inherent features (permanent or essential characteristics that can be inherited or inbuilt) and other factors such as age, sex, ability, motivation, environment and our cognitive processes all affect the rate of skill acquisition. Understanding factors that influence skill acquisition is an important step in performance improvement.

FIGURE 10.1 Acquiring skills is not a straightforward process and learners may encounter obstacles along the way.

FIGURE 10.2 Characteristics that affect the performance success of the learner (CHAPP)

Personality

Ability

Heredity

Confidence

Prior experience
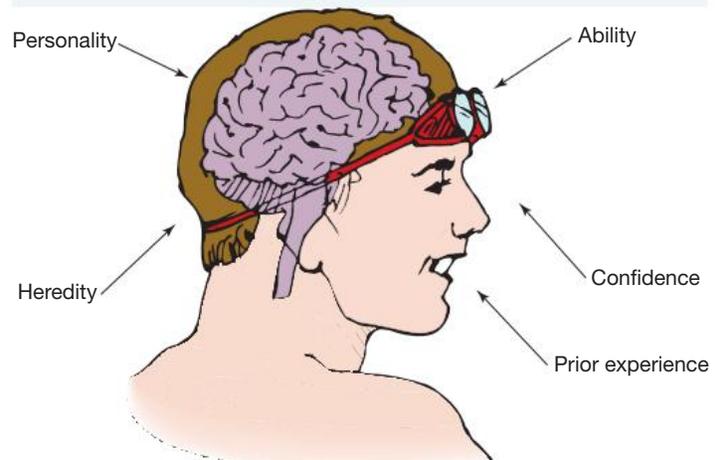
acquisition gaining possession of something

recreational athletes athletes doing sport for fun rather than competitively

elite athletes individuals who have achieved excellence and competed at a high level (usually nationally or internationally) in their event or sport

The speed with which learners are able to acquire certain motor skills depends on a number of factors, of which most are inherent features. These alter considerably from one person to another. Variations in age, height, muscle fibre composition, sex and weight, to mention a few, mean that any two people will not acquire similar skills at the same pace. Some people are better at jumping than running; others display more

talent in gymnastics than in athletics, and so on. Our differences make us unique and we must take them into account when learning motor skills. Some characteristics of learners that affect the rate of learning are:

- confidence
- heredity
- ability
- personality
- prior experience.

CHAPP is a commonly used acronym that can be applied to this content to help remember the five key characteristics of a learner.

10.2.1 Confidence

Self-confidence is critical not only to improvements in skill acquisition, but also to the performance of many tasks faced in everyday life. Confidence develops from experiencing success in learning situations. Incidents that result in successive failures may destroy confidence (unless presented as positive learning opportunities). The elite athlete who has lost confidence in their ability to succeed might choose to give up competition. Instead, they may become a recreational athlete in their chosen sport or event where the pressure is no longer on winning or being the best.

Confidence unlocks energy and creativity. It releases the power of belief — the idea that something worthwhile can be achieved through perseverance and effort. Furthermore, confidence underpins the collaboration process with coaches and other learners. Confident people are able to help others as well as themselves. Confident learners approach skill-learning situations with feelings of being able to rise to the challenge and that the outcome will be favourable regardless of difficulty. Whether the individual is a recreational or an elite athlete, confidence is an important characteristic for skill development, improvement and success. Without confidence, athletes will not be able to perform at their individual best.

FIGURE 10.3 Confidence can be increased by the power of self-belief.

Self-image is a big part of confidence and is powerful in governing our behaviour. Coaches who use skills practices or drills that make it difficult for a learner to achieve can contribute to the learner's development of negative feelings and doubt in their own ability. Coaches need to develop drills and strategies that are sequential, and that make achievement progressive, gradual and within one's ability level. Positive achievement improves confidence, nurtures self-image and provides the foundation for future skill building.

self-confidence a feeling of trust in one's own ability, qualities and judgement

on Resources

🔗 **Weblink** Self-confidence

10.2.2 Heredity

Individuals inherit certain characteristics from their parents. These are unchangeable and influence the dimensions of their potential. **Heredity** factors determine the 'ceiling' for performance. They influence how fast we can run, how high we can jump and possibly our ideal position in a sports team (based on height, build and speed). The environment we are in determines whether we can reach the limits set by heredity.

Some athletes may not be able to achieve the elite level in their sport or event because they do not have the heredity characteristics that allow them to further develop and perfect movement skills and performance. For example, the two prop positions in rugby union are often the two biggest players on the team. They need to use their strength, weight and size to push the scrum and win the ball. A short player with a slim build would not be suited for this position, and even if they trained regularly, they would not be able to reach the elite level in this position because their bigger opponents would overpower them.

FIGURE 10.4 Heredity factors affect performance considerably.

The following important heredity characteristics influence success or otherwise in specific athletic events.

> **heredity** the inheritance of genetic characteristics from our parents
>
> **somatotype** a person's body type or shape (ectomorphic, mesomorphic or endomorphic)

- *The relative percentage of fast-twitch to slow-twitch muscle fibres*. Athletes with a higher percentage of fast-twitch fibres are naturally more suited to sprint and explosive events such as long jump. Those endowed with slow-twitch fibres tend to be more successful at endurance events such as marathon running. For example, an elite sprinter would have a high percentage of fast-twitch muscle fibres.
- *Somatotype*. The tendency towards ectomorphy (linearity), mesomorphy (muscularity) or endomorphy (roundness) determines an individual's suitability for many activities. For example, ectomorphy is favoured for high-jumpers, whereas mesomorphy is more favoured for netball centres and lightweight boxers, and endomorphy is favoured in wrestlers.
- *Gender*. Higher levels of the hormone testosterone in males give them the potential to make greater increases in strength and power than females. Most sports have separate competitions for each gender.
- *Height*. Differences in height (and weight) provide considerable physical and biomechanical advantages to some players and make the learning and execution of required skills a less difficult process. For example, people playing the centre position in basketball are often the tallest players in the team, because their main role is to contest shots from the opposition and get rebounds. Being tall and closer to the ring is a huge advantage for this position and as such, you would not see an elite basketball centre who is not tall. Jockeys, on the other hand, are very small and light because the horse must carry their weight. If they were bigger, they would weigh more and this would slow the horse down.
- *Conceptual ability*. The ability to visualise a movement and make it materialise is a significant factor, particularly in the early stages of learning. For example, being able to visualise what the body is required to do when completing a front somersault helps the learner to complete the movement more efficiently. This is because they are able to feel some familiarity of the movement and what is required before they perform it. This factor often separates elite and recreational athletes. Elite athletes are able to visualise their movements and complete them with accuracy and consistency, often with little practice. Recreational athletes may not have this conceptual ability; this can result in them making errors or having to continuously practice movements to feel some familiarity with them.

An important point to remember is that the ability to learn a skill may or may not be related to success in competition. For example, a small, stocky person may readily learn to high jump using the correct technique, but may be unsuccessful in competition because other competitors are taller, leaner and better suited to jumping. Thus, skill learning and execution for a recreational athlete may be successful and rewarding, but might not lead to the same competitive success as elite athletes who have a heredity advantage.

FIGURE 10.5 The height and weight of an individual can provide considerable physical and biomechanical advantages when acquiring skills.

10.2.3 Ability

Ability is how easily an individual is able to learn, process and implement new skills. Elite athletes have high levels of ability in their chosen event or sport, as they can consistently acquire and refine new skills faster than recreational athletes. Ability incorporates a range of factors, such as sense **acuity**, perception, reaction time and intelligence, which combine to allow the individual to do readily what is intended. Good sense acuity, for example, enables the individual to gather cues from instructional situations quickly.

ability the ease with which an individual is able to perform a movement or routine

acuity sharpness; a sense of being able to hear, see and think clearly and, sometimes, quickly

Learners with good sense acuity grasp key concepts, ideas and movements easily, and move through the early stages of learning promptly. For example, when learning how to shoulder pass in netball, someone with good sense acuity is able to pick up the importance of stepping forward with the opposite foot to the throwing arm when passing so they can generate more power and accuracy in their pass in order for the ball to successfully reach its target.

Elite athletes possess an ability to react quickly to specific stimuli; for example, fast reaction time. This is a considerable advantage in contests such as track events in which response time to the sound of the gun can mean the difference between winning and losing. Others possess an ability to readily understand practical tasks, solve problems, generate solutions and make rational decisions in task application. For example, a basketballer at the elite level is able to see which direction a basketball may rebound off the backboard after a failed shot, based on the trajectory and positioning of the ball during its flight path, then move quickly in that direction so that the rebounded ball can be retrieved successfully. A recreational basketballer would have to wait to see which direction the ball rebounds before moving in that direction, because they lack the ability to process the information in advance and instead rely heavily on visual stimulus to dictate their actions in a game.

FIGURE 10.6 The ability to read the game is an advantage when acquiring movement skills.

10.2.4 Personality

Personality develops as a result of an individual's social interactions and learning experiences throughout life.

The manner in which personality blends with learning is often seen in an athlete's behaviour. Coaches describe athletes in terms of observable **traits** such as consistency, reliability, level of motivation and ability to express feelings. From a motor learning point of view, certain aspects of personality tend to be more favourable with certain learning environments.

personality an individual's characteristic way of behaving

traits characteristics or observable features of a person

FIGURE 10.7 Aspects of personality that contribute to a learner's success

Willingness to learn

Enthusiasm

Cooperativeness

Dedication

Level of motivation

Willingness to listen

Consistency

Reliability

Determination
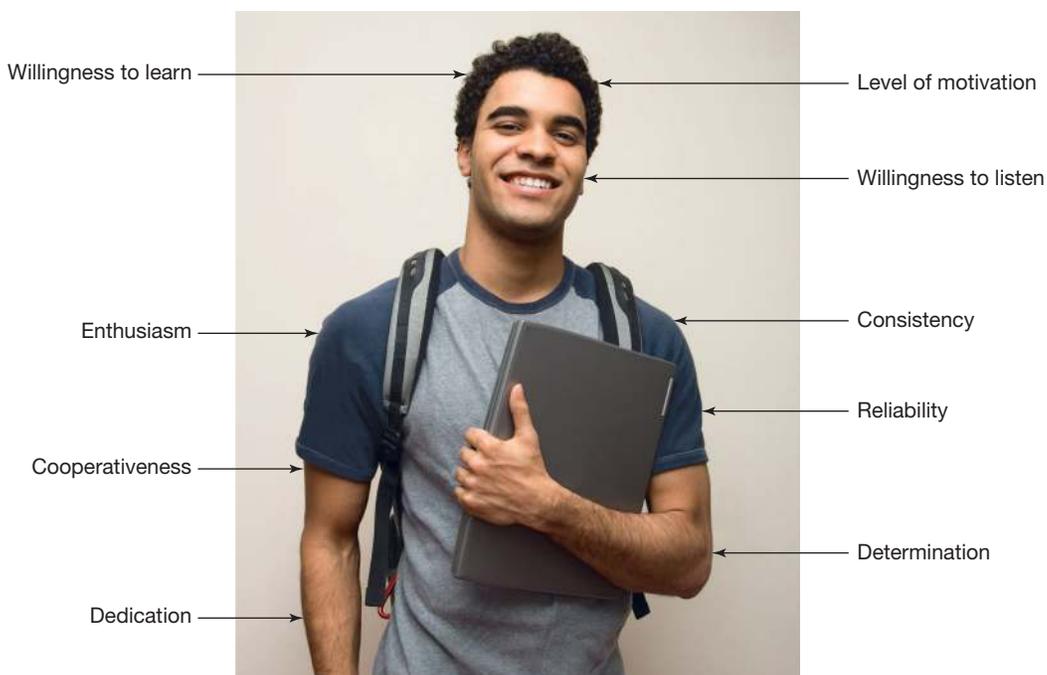
FIGURE 10.8 Elite athletes tend to possess particular personal characteristics.
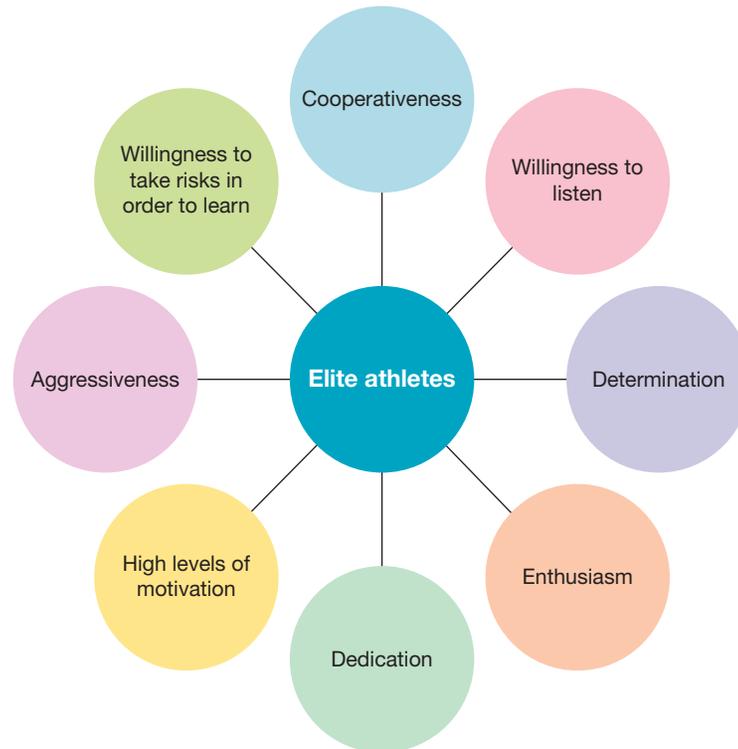
Elite coaches tend to recruit and develop not only those with physical talent, but also those who possess positive learning attributes (see figure 10.8).

These attributes are highly desirable in athletes because it means they can focus both their physical and mental power on developing to the best of their ability. This means they are able to continuously improve and perform at a superior level in their chosen sport or event. For example, an elite male sprinter may be determined to break the 10-second barrier in the 100-m sprint. They will need to have the physical attributes in order to do so; however, they will also need high levels of motivation and dedication to their training, because achieving this result will take discipline and hard work.

Recreational athletes tend to have different personality traits in comparison to elite athletes. For example, a recreational tennis player might play once a week with their friends and not do any specific training or preparation before the game. The scores in the game have little importance to the athlete as their focus is not on winning or losing, but on being active and socialising with their friends.

Learners whose personality reflects positive ways of behaving are:
- more receptive to instruction and advice
- more cooperative in performing set tasks
- more helpful in creating a productive learning environment. This ultimately enables them to develop and refine movement skills more readily than someone who lacks these traits. This applies regardless of whether they are recreational or elite athletes.

FIGURE 10.9 Recreational athletes have different traits compared to elite athletes, as their motivations and goals are different.
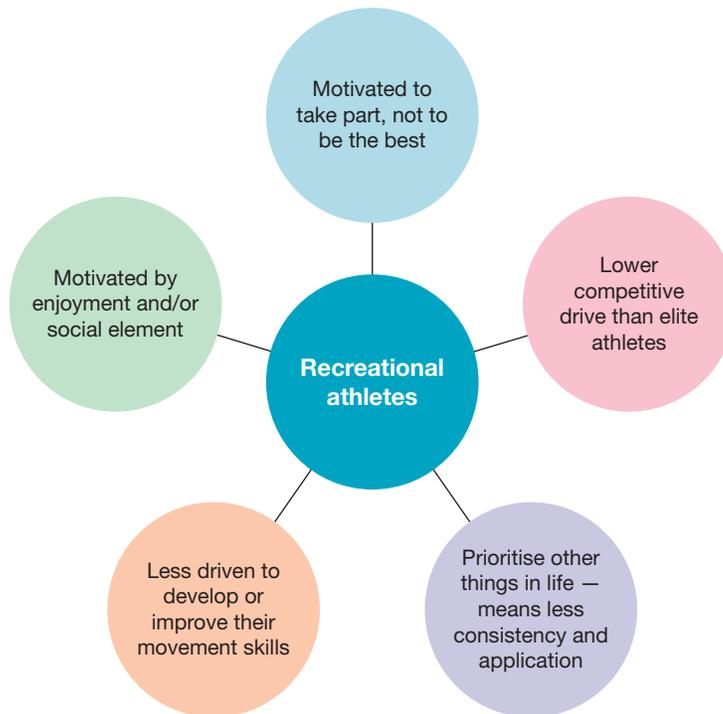
10.2.5 Prior experience

It is often easier to learn a new skill if similar movements have already been successfully acquired. This prior experience has the potential to accelerate the learning process. Some suggest that *transfer of learning* is an important part of the acquisition of new skills. Others suggest that the amount of transfer depends on the learning situation and many other variables such as the learner's perception or ability to make connections between the two.

The degree to which prior experience influences skill acquisition and ultimately performance varies among learners. While not measurable, we see prior experience in a good basketballer quickly adapting to netball, a cricket batsman to golf or a gymnast to diving. Basic motor skills such as coordination, balance, **agility** and speed are systematically developed generally through game-based activity, club sports and school physical education programs.

agility the ability to move the body from one position and direction to another with speed and precision

Elite athletes tend to have high levels of these basic motor skills, which means they are often able to adapt them to different sports and events. For example, a person who has played an invasion game such as touch football understands the importance of spreading out in attack and marking-up in defence, and would have also developed agility skills that enable them to change direction and speed quickly. Even though soccer is a completely different sport that predominately requires foot–eye coordination instead of hand–eye, the attack and defensive skills learned in touch football could be transferable to soccer. Whether at recreational or elite level, prior experience contributes significantly to a learner's general development and represent a platform for building further improvement.

FIGURE 10.10 Prior experience is considered an advantage in learning new skills.

In some cases, prior experience can also be negative. An athlete who has been seriously injured playing a sport may be negatively impacted by that prior experience and therefore change their technique or not play that sport altogether to avoid being injured again. For example, the most effective way to tackle in rugby league is the front-on tackle; that is, to make impact front-on with the shoulder around the opponent's waist area, wrapping the arms around them to bring them down to the ground. A learner who has suffered a shoulder injury when doing this previously may be too cautious to use this same technique. This may lead them to use a less effective technique that allows the opponent to break away; or they may choose to not play rugby league again at all.

Overall, prior experience has a positive impact on performance in most learners and negative impacts from prior experience are far less common.

DEPTH STUDY IDEA

Engage with community experts such as elite coaches to explore which characteristics of athletes have the most significant impact on performance in their sport or event.

10.2 ACTIVITY

Characteristics of elite athletes

Research and explore the specific characteristics of one of your favourite athletes in order to understand why they are successful in their sport or event. Present your information to the class through a medium of your choice.

10.2 Exercises

10.2 Quick quiz **on**	10.2 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 6	4, 5, 7	8, 9

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Revise your knowledge

1. Outline the role of personality when learning a new skill.
2. Describe the heredity characteristics that would be most desirable for the following sports particpants.
   a. Gymnast
   b. Front row prop rugby league player
   c. Goal shooter in netball
   d. Marathon runner
3. Why is confidence an important characteristic to have when learning a new skill?
4. Explain how past experiences can be an advantage when learning new skills.
5. Explain how past experiences could have a negative impact when learning new skills.

Apply your knowledge

6. Analyse the characteristics of the learner and put them in order from those that will have the greatest impact on performance through to those with the least impact when trying to acquire a new skill of your choice.
7. Justify the characteristic that you put in first position in question 6. Why do you think this factor has such an important impact on performance?
8. Discuss some strategies that coaches could use to increase confidence in recreational athletes as well as elite athletes. Do the strategies differ for a recreational athlete in comparison to an elite athlete?
9. Draw a flow diagram like the one below in your workbook. In the first box, identify the characteristics of the learner. Use the middle box to suggest how these characteristics might affect skill acquisition in a sport or event of your choice. Use the third box to suggest how all these factors affect performance.
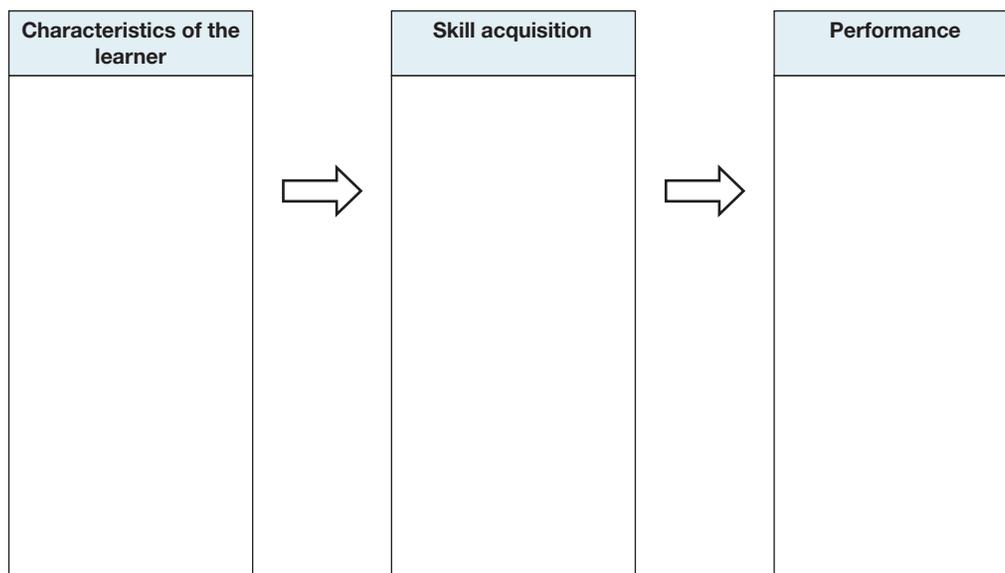
Characteristics of the learner	⇒	Skill acquisition	⇒	Performance

10.3 Stages of learning and skill acquisition

The learning of motor skills has been categorised into a three-stage process:
- *Cognitive stage*. The learner grasps what is required in order to complete the movement skill.
- *Associative stage*. The learner knows what is required to complete the skill and is now practicing the movement to try to acquire it.
- *Autonomous stage*. The learner is able to effectively execute the skill automatically.

10.3.1 Cognitive stage

The first stage of skill learning is the **cognitive stage**. The fundamental requirement here is that the learner gains an understanding of the task required. This means knowing what to do and an insight about how to do it. Conceptualisation — or the generation of clear mental pictures of the task — is essential for good movement reproduction.

Clear explicit instructions from the coach, demonstrations, videos and information highlighting the important points can help guide the learner through the skill. However, coaches must be careful to avoid 'information overload', which would confuse the learner. For example, when teaching a learner how to hit a ball in baseball, the coach may start by using a tee ball stand first. They can give explicit instructions on how to hold the bat, how to stand and how to swing. They could then demonstrate the movement before allowing the learner to try it for themselves.

It is expected that the learner will face problems. How many and how big these challenges are will depend on the difficulty of the skill. The learner may experience error, awkwardness and some disorientation. Thus, learners must receive continuous feedback or information on their progress. For example, following the batting attempt, the coach can give specific feedback such as, 'Well done, your grip on the bat and your body position is really good; this time focus on keeping your eyes directly on the ball throughout the entire movement'.

cognitive stage the mental processing of information, thinking and understanding

If the skill is complex or the learner experiences difficulty, it could be broken into smaller movements or the environment can be modified for practice. In the example in figure 10.11, using a tee ball stand when learning how to bat in baseball instead of having someone pitch a ball to the learner would make the movement less challenging. During this stage, the learner should experience some success in order to improve self-confidence. All positive learning should be reinforced and encouraged. Many coaches give drills at this point to improve the learner's coordination and feel for the desired movement.

FIGURE 10.11 Learning what is involved in batting in baseball is characteristic of the cognitive stage of learning.

Rates of progress through the cognitive stage vary from one individual to another. Elite athletes generally understand new movement skills much faster than recreational athletes. This is because they already have beneficial physical characteristics such as balance, speed and coordination. They also have the mental capabilities to process information quickly, as well as personality traits such as determination to succeed. This means they can acquire, develop and perform movement skills at a fast rate.

For a recreational athlete, much depends on how the sequences of skill building are organised, both physically and in the mind of the learner. Depending on the difficulty of the skill (or complexity of the task), it could be learned in anything from a few minutes to a much longer period. Basic skills such as bouncing a basketball can be learned quickly; however, more difficult skills such as a layup may never be mastered by some learners.

10.3.2 Associative stage

The second stage of skill acquisition is the **associative stage**, which is identified by an emphasis on practice. The learner, having acquired an idea of what the skill is, needs to repeat the movement to enhance the connection between their mind and muscles. Errors still occur, but are smaller and less frequent than in the cognitive stage. For example, the baseballer now understands the technique required to hit balls that are being pitched to them in baseball. However, they often mistime their swing getting strikes, or they hit the ball directly to a defender and get caught out. Feedback is again essential to improve the skill. A sense of fluency or smoothness develops as the learner's **kinaesthetic sense** improves.

associative stage connecting or linking ideas

kinaesthetic sense (or **kinaesthesis)** the system of sensitivity that exists in the muscles and their attachments

Practice improves the way the skill is performed. The learner eventually experiences some success; for example, they hit the ball and make it to first base when batting in baseball. These successes are felt more frequently with additional practice and feedback. Gradually, the learner feels more at ease as their confidence increases.

Recreational athletes can remain at this stage for a long period, even years. Some may never progress to the next stage due to their inability to fully grasp the skill; even though they may practice regularly, they might never become proficient in executing the skill. For example, this can been seen in a recreational beach volleyball player who understands how to dig, set or spike the ball in attack, but struggles to execute those skills effectively in the game because they lack the speed to get the ball, or misjudge the power they need to apply in various situations. However, given enough practice, most elite athletes reach a level at which skill execution is reasonably automatic, enabling them to progress to the final stage of skill acquisition.

FIGURE 10.12 At the associative stage of learning, the learner understands how to perform the movement but might mistime their swing.

10.3.3 Autonomous stage

The third stage of skill acquisition is the **autonomous stage**, which is characterised by the ability to automatically execute the skill. This is evident when watching elite athletes perform movement skills and often allows viewers to see a clear difference between an elite athlete and a recreational athlete. Execution of the movement is now properly sequenced and performed instinctively. The performer has consolidated the many discrete skills (commonly called subroutines) that make up the action. Their movement has a characteristic fluency as the subroutines sequence and blend in aesthetically pleasing motions. This is referred to as *temporal patterning*. The movement looks good because it is efficient, with the muscle groups working in order and producing only the necessary movements at the required time.

> **autonomous stage** being in full control of actions so they become automatic

The most important feature of performers in the autonomous stage is that they are able to attend to other cues while giving little thought to how to perform the skill. When batting in baseball, for example, the problem is not how to hit, but how to read the pitcher's body positioning and wrist movements. This can reveal information about the speed, flight and direction of the ball, as well as where to hit the ball considering the positioning of the opposition's fielders. Elite athletes have the ability to register and then respond to these cues almost instantaneously, which enables them to improve and perfect movement skills.

Practice is still important during the autonomous stage, but mostly involves simulating a competition situation. Unless specifically practised to improve technique, training sessions for an athlete at this stage should incorporate pressure drills. This helps the athlete adapt their skills to the real performance. A recreational athlete would differ in that they may not be worried about being able to perform the skill in a pressured environment or a competition setting, and instead are happy to just be able to perform the skills at an autonomous level. For example, a recreational AFL player may head down to their local AFL oval each week and practice kicking goals from various distances and angles away from the goal posts. They might take pride in the fact that they can successfully perform the movement from varying placements; however, they never simulate a competition situation such as introducing a defender, because they have no intention of actually playing the sport competitively.

FIGURE 10.13 At the autonomous stage of learning, the learner can perform the skill automatically.

TABLE 10.1 The three stages of skill acquisition

Cognitive stage	Associative stage	Autonomous stage
The basic or understanding stage of skill learning	The intermediate or practice stage of skill learning	The advanced stage of skill learning, at which skills are performed reflexively
Focus on *what* to do	Focus on *how* to do the skill	Focus on other tasks
Frequent large errors	Some errors but not so large	Few errors
Learner is often unable to recognise error	Learner is able to recognise errors	Performer is able to detect and correct errors as they occur
Learner needs to see, feel and experience the movement	Learner needs to practice	Performer needs to adapt the movement to pressure situations
An exploratory stage	Kinaesthetic development improved through practice	Movements rehearsed under varying conditions
Demonstration is the best means of communication	Demonstrations are important	Demonstrations are only essential to refine particular movements
Learners must identify subroutines	Emphasis is on temporal patterning. The player will know the subroutines and is competent in assembling them into the required skill	Temporal and sequential patterning of subroutines is automatic
Slow learning speed and inefficient movement	Moderate speed and reasonably efficient movement	Speed and efficiency that relate to the specific requirements of the situation
Support from teaching aids (e.g. demonstrations, pictures, videos) is required to enhance visualisation of the skill. The teaching focus is conceptualisation.	Further improvement requires practice of set patterns of movements in controlled situations	Improvement requires manipulation of the environment (for example, increased game pressure) to ensure the skill is able to be reproduced under varying conditions

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DEPTH STUDY IDEA

Design and implement criteria to assess the level of skill acquisition of a group of learners in a movement skill of your choice.

10.3 PRACTICAL ACTIVITY

Skill acquisition

Choose a skill that you do not know how to do already, such as spinning a basketball on your fingertip, juggling three balls or using small kicks to keep a soccer ball in the air. Research the specific teaching pointers that are required in order to acquire your chosen skill. Spend some time trying to progress through one or more stages of skill acquisition, then answer the questions below.

1. Which were the most important pointers you had to mentally process when you first started trying to learn the skill?
2. Which stage did you get to when trying to acquire your skill? Which specific characteristics did you demonstrate that support your conclusion that you were at this level?
3. What impacted you positively and negatively throughout the process?
4. For your particular skill, how would you know if you were at the autonomous stage? Explain what the performance would look and feel like.
5. Discuss factors that allow some students to progress faster than others when acquiring new learning skills.

10.3 Exercises

learn on

10.3 Quick quiz on	**10.3 Exercise**

Select your pathway

■ **LEVEL 1**	■ **LEVEL 2**	■ **LEVEL 3**
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Revise your knowledge

1. Learning during the cognitive stage largely takes place through 'trial and error'. Explain why this is the case.
2. What are some tips a coach could give an athlete who is at the cognitive stage when learning a new skill?
3. How is the associative stage when acquiring a new skill often characterised?
4. Describe how the autonomous stage differs from the associative stage.
5. Name three movement skills where learners may progress through the stages of learning very quickly, and three where they may never achieve the autonomous stage.

Apply your knowledge

6. Using a skill that you are familiar with, describe how a person would progress from the cognitive stage to the associative stage.
7. Explain why it is recommended that cognitive learners are given only one or two instructions to focus on when practising movement skills.
8. Having knowledge and understanding of the stages of skill acquisition before attempting to learn a new skill can benefit performance. Explain why this is the case.
9. Why do elite athletes often progress through the stages of skill acquisition much faster than recreational athletes?

10.4 Characteristics of motor skills

▶ **Syllabus:** Apply an understanding of how movement skills are acquired, developed and improved for recreational and elite athletes

Including:
- characteristics of motor skills, including gross and fine, continuous, discrete and serial, open and closed, self-paced and externally paced

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

All skills have observable characteristics, so can be grouped according to specific criteria. Skills are commonly classified as:
- gross motor or fine motor
- discrete, serial or continuous
- open or closed
- self-paced or externally paced.

Most skills fit a number of classifications.

10.4.1 Gross motor and fine motor skills

Gross motor skills require the use of large muscle groups for execution. They are commonly found in team games and many competitive and recreational activities such as bushwalking and skiing. Examples of gross motor skills are running, leaping, vaulting, diving, tackling in rugby and surfing; all of these movements use the big muscle groups in our body such as those located in the quadriceps, gluteus maximus, hamstrings, core, biceps and triceps.

Fine motor skills require the use of only small muscle groups to perform the movement. They are found in activities that require finesse and precise movement. Examples of fine motor skills are typing, tying shoelaces and writing, which all use the small muscles found in the hands. Some isolated movements — such as catching in cricket, archery, serving in table tennis and putting in golf — are examples of fine motor movements found in sports.

Fine motor and gross motor skills rarely fit a single classification, and often can be placed along a continuum (see figure 10.15). Those skills requiring the smallest muscle movements appear furthest left on the continuum; for example, tying your shoelaces. Those skills that require the biggest muscle movements appear furthest right on the continuum; for example, tackling in rugby.

FIGURE 10.14 Examples of gross motor and fine motor skills can sometimes be found in one sport. Examples in cricket are batting and fast bowling (gross motor) and the hand movement of catching and spin bowling (fine motor).

FIGURE 10.15 A continuum for illustrating gross motor and fine motor skills

Fine motor skills (small movements)   Gross motor skills (large movements)

Tying shoelaces   Putting in golf   Running   Leaping   Tackling in rugby
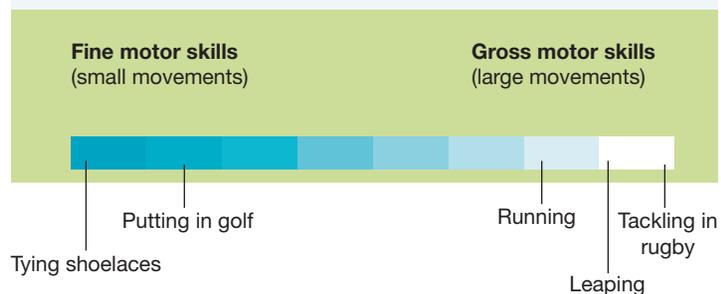
10.4.2 Discrete, serial and continuous skills

Skills can be classified as *discrete, serial* or *continuous* according to where they begin and end. **Discrete skills** have a distinctive beginning and end that can be identified. An example of a discrete skill is a forward roll: it begins with the placement of the hands on the mat, and finishes following a roll to the feet.

An example of a **serial skill** is the place kick in football, as illustrated in figure 10.16. Serial skills involve a sequence of smaller movements that are assembled to make a total skill. Here, a number of discrete skills (forming a mound, placing the ball, moving back, moving forward, kicking the ball and following through) are assembled to form a larger skill. A recreational athlete in the beginning stages of learning the place kick would need to focus on each of these discrete movements separately. Even elite athletes may need to break the serial skill into discrete movements to focus on a particular aspect that is causing concern. Other examples of serial skills are dance routines, a layup in basketball or completing a vault in gymnastics.

gross motor skills skills that require the use of large muscle groups for execution

fine motor skills skills that require the use of only small muscle groups to perform the movement

discrete skills skills that have a distinctive beginning and end that can be identified

serial skills a sequence of smaller movements that are assembled to make a total skill

FIGURE 10.16 A serial skill
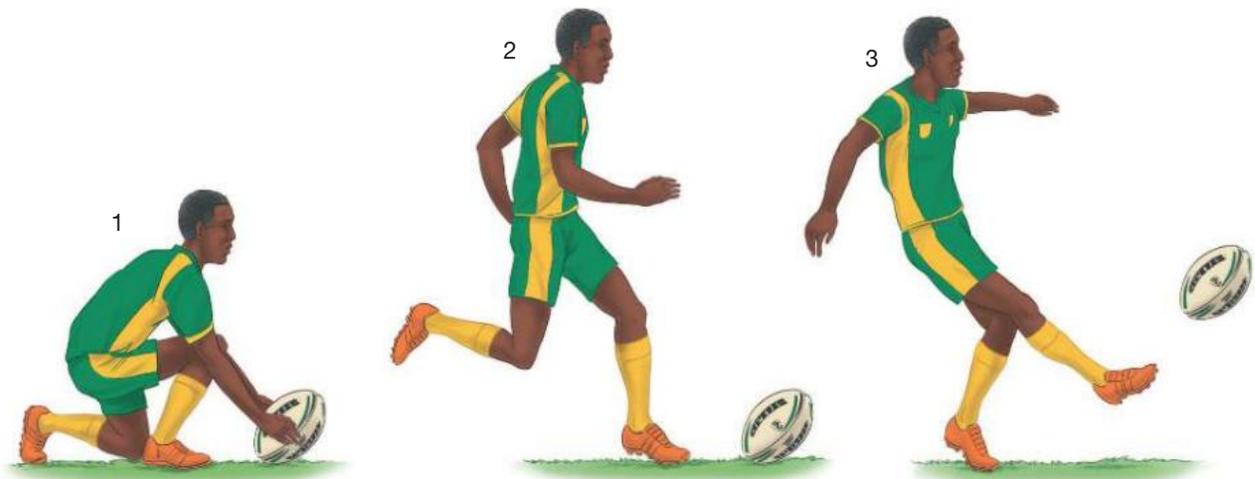
Some skills are repetitive and may appear ongoing and unbroken within a particular period. These are described as **continuous skills**, which generally involve a movement being repeated for several minutes at least. Examples of continuous skills are swimming, jogging, rowing and cycling. The length of these activities is unspecified. Discrete, serial and continuous skills can be categorised on a continuum (see figure 10.17).

continuous skills skills that have no distinct beginning or end

FIGURE 10.17 Discrete, serial and continuous skills
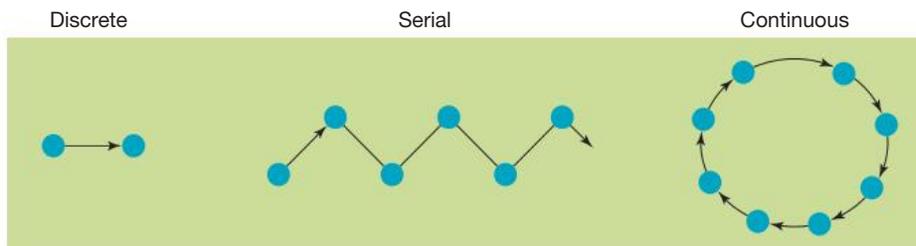
FIGURE 10.18 (a) Discrete, (b) serial and (c) continuous skills in action
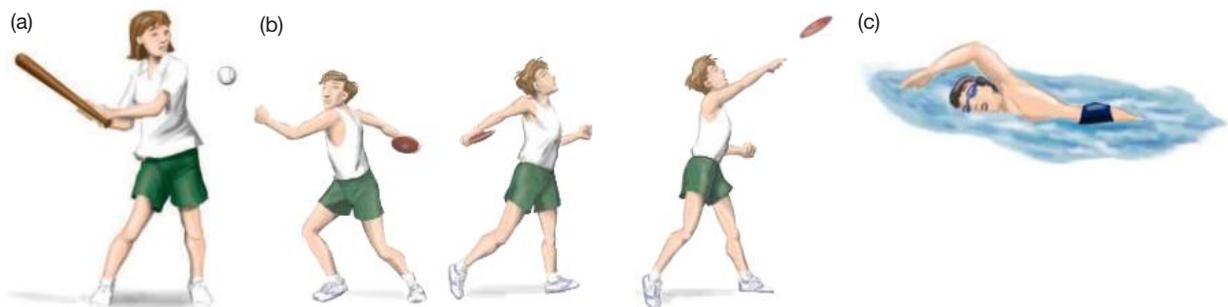
10.4.3 Open and closed skills

Many skills (particularly those associated with team games) are described as **open skills** as a result of where they are learnt. These are executed in unstable environments; for example, surfing is described as an open skill because the environment is constantly changing as waves are unpredictable.

Uncertainty about how to perform the skill can be due to such factors as changing weather, an affected surface (such as a wet court or waterlogged pitch) or even the use of unconventional tactics in a team game. The outcome is that players need to modify their techniques to adapt to the instability. Elite athletes have an advantage in such situations because they are able to draw on knowledge from past experiences. However, open skills can be considerably more difficult for recreational athletes, causing distraction, indecision and even annoyance. This may contribute to inattention and loss of focus for these athletes.

A contrasting environment is evident where **closed skills** are practised. The closed environment encourages skill learning because the learner is not distracted by other factors. Skills performed in a closed environment can be planned well in advance or can be made to fit the predicted environmental setting. Delivering the ball in tenpin bowling is an example of a closed skill, because the environment (the bowling lane, ball, pin placements and weather conditions) are the same each time the movement is executed. However, if a changing environment is part of the competition event, then learners need to be gradually exposed to it in practice.

Closed skills are far easier to acquire, develop and improve than open skills because the learner does not need to complete the skill in unstable, constantly changing environments and can focus their attention on practicing specific elements of the movement. For example, many children learn to swim in an indoor swimming pool instead of an ocean or river, so that they don't have to battle environmental elements such as rips, waves and currents.

FIGURE 10.19 Surfing is an example of an open skill due to the unpredictability of the environment.

FIGURE 10.20 Tenpin bowling is a closed skill because the environment is very stable and predictable

Few skills fit perfectly into open or closed categories. Most can be placed on a continuum that illustrates a progression from closed to open (figure 10.21). Skills that have a constant environment and can be continuously replicated with little change, such as tenpin bowling, would be furthest left on the continuum as they are deemed 'closed'. Skills that have a constantly changing environment would be furthest right as they are deemed 'open'; an example would be swimming in the ocean, due to the fact that tides, currents, rips, and waves make the environment very dynamic and not stable.

open skills skills that occur in an environment that is unpredictable and frequently changing

closed skills skills that occur in an environment that is stable and predictable

FIGURE 10.21 A continuum for illustrating open and closed skills

Closed
(stable)

Open
(unstable)

Ten pin
bowling

Serving
in tennis

Free throw
in basketball

Batting in
cricket

Swimming in
the ocean
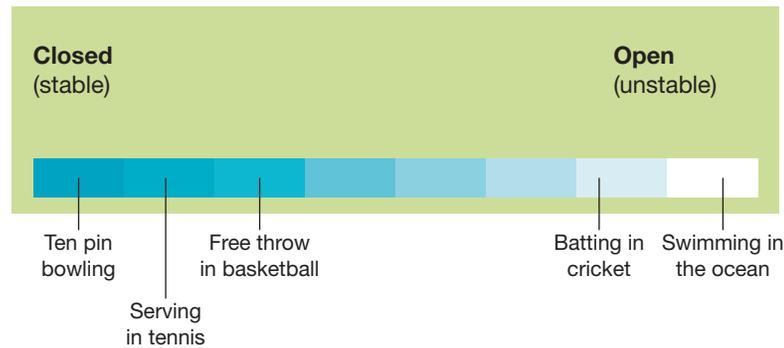
10.4.4 Self-paced and externally paced skills

Pacing refers to the performer's control over the timing of skill execution. Some skills are **self-paced** while others are **externally paced** (see figure 10.22).

Examples of self-paced skills are kicking a football in a penalty shootout and serving in tennis. In each case, the performer themself determines the time and pace of execution. Examples of externally paced skills, in which the time and pace is dictated by an external factor such as another player, are returning a serve in tennis, or dancing and rhythmic gymnastics, because music requires the performer to move in accordance with its rhythm and tempo.

FIGURE 10.22 (a) Self-paced and (b) externally paced skills in action

(a) Self-paced skill

(b) Externally paced skill

Self-paced skills are far easier to acquire and develop than externally paced skills. This is because the athlete chooses when they are ready to conduct the movement rather than being to required do so in response to an external stimulus. This means they can think about exactly what they need to do and then execute the move when they are ready; for example, kicking a penalty shot in soccer.

Externally paced skills are more difficult to grasp, because reaction time along with conceptual ability are key factors in how well the skill will be executed. An example of an externally paced skill that requires good reaction time is saving a penalty shot in soccer. Elite athletes can often perform externally paced skills with accuracy and precision even when under very pressured and difficult situations. For example, elite tennis players can return serves that have been hit at them at over 230 km/h. Recreational athletes, on the other hand, may manipulate the skill to make it self-paced and therefore easier to perform, such as using a tee ball stand in baseball instead of having the ball pitched to the batter.

self-paced skills movements for which the performer determines the timing and speed of execution

externally paced skills movements for which an external source controls the timing

Motor movement skills						
Open	**Closed**	**Fine**	**Gross**	**Discrete**	**Serial**	**Continuous**
Changing environment	Constant environment	Small muscle groups	Large muscle groups	Brief movement	Complicated actions	Flowing movements
Externally paced	Replication of skill	Control of touch	Coordinated movement	Beginning and end	Combination of discrete skills	No beginning and end
Adaptation of skill required						

on Resources

Interactivities Gross and fine motor skills (int-1837)
Discrete motor skills (int-1838)

10.4 Exercises

learn on

10.4 Quick quiz **on**	10.4 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4, 5	6, 7, 8	9, 10

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Revise your knowledge

1. Draw a continuum similar to the one in figure 10.15 with Fine motor skills on the left and Gross motor skills on the right. Identify where you would place the following skills.
   a. Archery
   b. Swimming
   c. Juggling
   d. 100-m sprint
   e. Goal shooting in netball

2. Draw another continuum with Discrete skills on the far left, Serial skills in the middle and Continuous skills on the far right. Identify where you would place the following skills.
   a. Canoeing
   b. Trail-bike riding
   c. Performing a jump shot in basketball
   d. Performing a vault in gymnastics
   e. Throwing a javelin
   f. Performing a gymnastics routine

3. On another continuum with Closed skills on the far left and Open skills on the far right, place the following skills at the positions you feel are appropriate.
   a. Putting in golf
   b. Tackling in football
   c. Surfing
   d. Weightlifting
   e. Indoor trampolining
4. Identify five self-paced skills. Why do your selections fit this classification?
5. Identify five externally paced skills. Why do your selections fit these classification?

Apply your knowledge

6. Using a sport of your choice, explain different movements in the sport that draw upon gross and fine motor skills.
7. Discuss the difference between discrete, serial and continuous movements and give an example of each.
8. Are open skills or closed skills easier to learn? Justify your response.
9. Why is it important for coaches to get athletes to practice open skills in team sports such as netball, soccer and rugby league?
10. Discuss why it is important for learners at the cognitive stage to first practice skills that are self-paced. Use an example to support your answer.

10.5 Practice methods

> **Syllabus:** Apply an understanding of how movement skills are acquired, developed and improved for recreational and elite athletes
>
> **Including:**
> - practice methods for the different stages of learning, including massed, distributed, whole, part, blocked and random
>
> *Source: Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

The learning environment is further affected by the training systems and routines designed to teach particular skills. These are called *practice methods*.

10.5.1 Massed and distributed practice

Massed practice and **distributed practice** methods refer to the whole practice session rather than the practicing of a specific skill. These are approaches that coaches commonly use to teach skills more effectively in the available time.

The choice of practice distribution depends on:
- the amount of time required to teach particular skills
- the stage of learning that the athlete is at
- the nature of the skills being performed.

Massed practice requires infrequent breaks between long periods of instruction and skill development routines, so is good when learning discrete skills. An example would be a gymnast learning a handstand, where the athlete repeats the movement until they are able to replicate efficient movement patterns.

massed practice a continuous practice session, with rest intervals being shorter than practice intervals

distributed practice involves a broken practice session, with intervals of rest or alternative activities being longer than practice intervals

Massed practice works best when:
- the athlete is at an elite level or highly motivated
- the athlete is fresh and not fatigued
- the skill is discrete and non-fatiguing
- the athlete is unable to attend a number of sessions.

However, it is often preferable to spread out the periods of intensive work, as in distributed practice. In a distributed practice situation, the gymnast would practice the handstand over a number of sessions, or perhaps on different occasions during one session. Relief could be gained by either using frequent breaks or alternating between activities; for example, practicing the handstand for 5 minutes, having a 5-minute break then practicing a cartwheel for 5 minutes, having a 5-minute break and then repeating. The breaks allow the learner to mentally process what is required for effective execution, and allows them to restore their energy systems so they are both mentally and physically able to resume practice at optimal levels.

Distributed practice works best when:
- the performer is young or lacks concentration
- the person practicing is a recreational athlete
- the skill is complex
- motivation is low
- the task causes fatigue physically or mentally
- excessive work causes discomfort (for example, heading a soccer ball).

FIGURE 10.24 Massed and distributed practice

Massed practice

PRACTICE

PRACTICE

PRACTICE

Distributed practice

REST

PRACTICE

REST

PRACTICE

REST
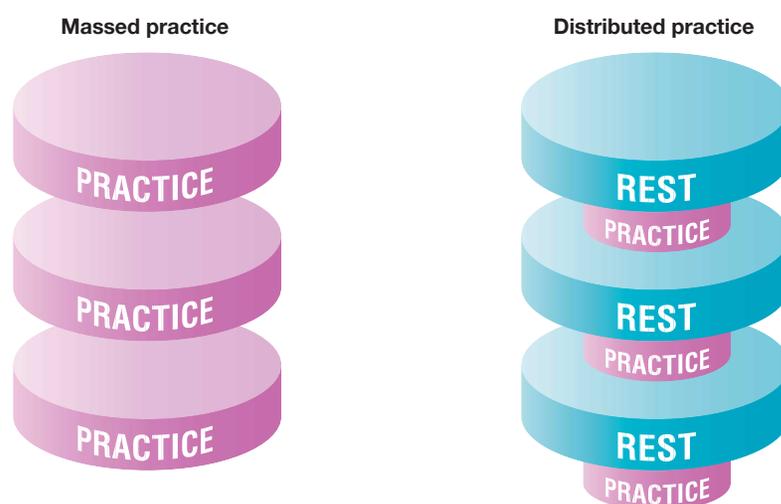
PRACTICE

Determining which type of practice is best for the different stages of learning depends on the nature of the skill. For example, a skill that is highly fatiguing, such as a 100-m sprint, should be practiced using the distributed practice model, regardless of whether the athlete is at the cognitive, associative or autonomous level. This is because without enough rest between each sprint, the athlete would not be able to repeat the movements at the same intensity.

Discrete skills that are not fatiguing are generally best practiced using the massed practice model, because repeating them over a period of time can allow for tweaks to be made in the execution and therefore improvements to be gained. For example, when learning how to shoot in basketball, regardless of the stage of the learner, practicing continuously from various positions on the court can help the athlete refine their technique and improve their accuracy.

The personality of the learner is another crucial factor to consider when deciding which type of practice to use. Both elite and recreational athletes may share similar personality traits that will dictate the type of practice that is best suited to their individual needs. For example, athletes that have short attention spans or are lacking in motivation should complete a training session that is distributed, with different activities and rest breaks throughout. This allows them to direct their attention to various activities throughout the practice and can aid in improving their motivation and focus. Massed practice can be used for athletes at various stages of learning who are highly motivated, cooperative and driven and determined to learn, because they can continuously repeat the skill without getting bored or distracted.

10.5.2 Whole and part practice

The **whole practice method** is applied when a skill is practised in its entirety. The **part practice method** is applied when a skill is broken into smaller components and each discrete subskill (subroutine) is practised separately, before putting it together to form the complete movement. While some skills are relatively easy to learn, others such as somersaults and handstands require considerable practice. It is often difficult for cognitive learners to conceptualise and integrate the smaller parts that need to be put together to form a complex skill. For this reason, coaches may decide to use the whole practice method, part practice method or a mixture of both to assist the performer's learning of a skill.

The layup in basketball is an example of a skill that can be taught effectively using either the part or whole practice method. If using the whole practice method, the coach would demonstrate and teach the skill as a complete unit. If using the part practice method, the coach would break the layup into a series of discrete sub skills:

- catching the basketball
- dribbling the basketball
- stepping on to the opposite foot
- driving up to the basket
- shooting and landing.

whole practice method applied when a skill is practised in its entirety

part practice method applied when a skill is broken into smaller components and each discrete subskill (subroutine) is practised separately

The learner would then practice each movement in isolation and put them together into the complete movement at the end.

A lot of research has been done to work out the best method of practice. Results are still largely inconclusive, but the part practice method is commonly used for teaching both new skills and complex skills. Most researchers feel the method chosen should be adapted to the needs and skill level of the learner, as well as the nature of the skill. Many coaches use a combination of methods, such as whole–part–whole:

- first, the total skill is demonstrated and practised
- second, as difficulties arise, the discrete subskills are extracted from the total movement and analysed separately
- third, as the segments are mastered, the skill is reassembled, practised and again rehearsed as a unit.

FIGURE 10.25 The difference between (a) whole and (b) part methods of practice

(a)

(b)

1. Catching
2. Dribbling
3. Stepping
4. Driving up
5. Shooting
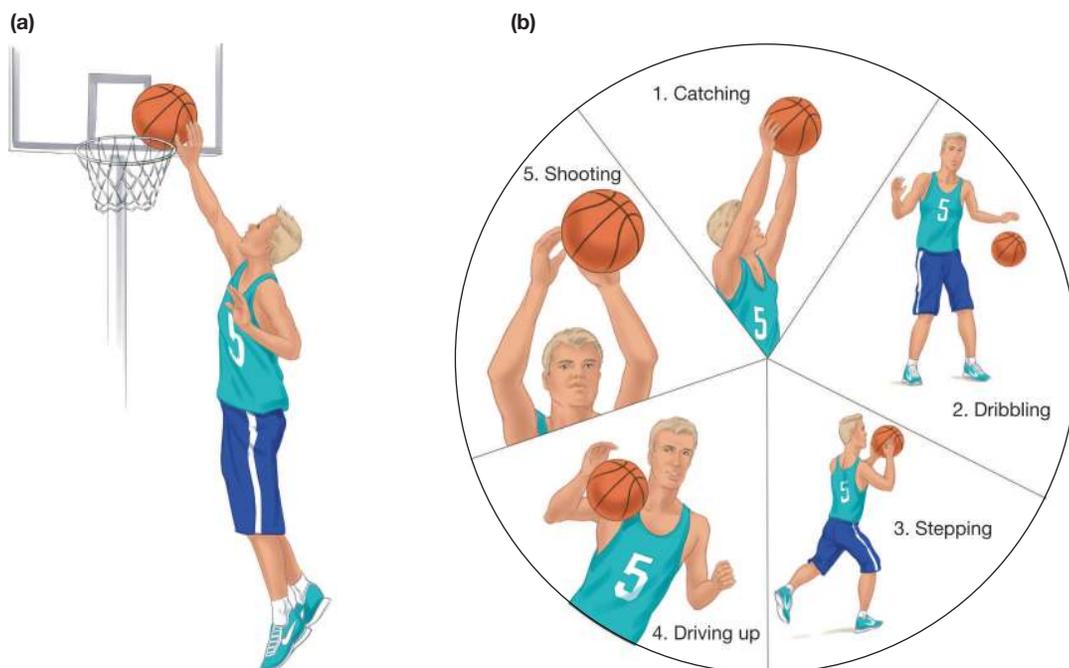
Learners at the cognitive stage of learning will often learn skills in a part practice method. During the associative stage, learners will use a combination of both part and whole practice methods, allowing specific weaknesses to be targeted during the part method. Autonomous learners will practice the skill using the whole practice method, and usually add more complex situations to the movements such as including defenders or opponents.

10.5.3 Blocked and random practice

Blocked practice and **random practice** refer to the variability of the session and whether the conditions or types of skills are varied or kept the same throughout training. In blocked practice, there is very little variability and the athlete will repeat the same skill, in the same environment, before moving on to the next skill. For example, a volleyball player might practice serving continuously for 15 minutes before moving on and practicing digs for 15 minutes. Blocked practice is effective during the cognitive stage of learning, particularly when the skill is complex and the movement patterns need to be learnt. It enables the learner to become familiar with the basic movements of the skill in a controlled environment, allowing them to repeat and refine the skill execution so that they can improve that specific skill before having to contend with other skills. Blocked practice is also effective for skills that are closed in nature. Research indicates that blocked practice results in significant improvements in the execution of the skill during practice sessions; however, these improvements do not necessarily transfer to actual competition or game environments.

> **blocked practice** a type of practice in which each skill component is practised repetitively as an independent block
>
> **random practice** a form of practice that involves rehearsing a number of different skills in an unpredictable sequence

In random practice, a variety of skills are practiced within the same session, or a variety of different drills and games are used when practicing a given skill. Unlike blocked practice, no one drill is worked on for a defined period of time or in a repetitive manner. Rather, skills are practised in combination and rehearsed in random order or under varying conditions. For example, in blocked practice, a boxer may practice uppercut punches for 3 minutes, jab punches for 3 minutes, cross punches for 3 minutes and then hook punches for 3 minutes. In random practice, the boxer may perform four 3-minute rounds in which the coach holds pads and gets the athlete to complete all four types of punches in a variety of different, random combinations.

FIGURE 10.26 The difference between blocked (left) and random (right) methods of practice

Research indicates that random practice has a significant positive impact on both learning the skill and performing it in a game or competition environment. This is because game play is often random and athletes are required to perform various skills in quick succession, as well as solve movement challenges through decisions such as what type of punch to use in order to effectively land a hit. This type of practice suits skills that are open in nature and learners who are at the associative and autonomous stages of learning. They know how to execute the skill, so continuing to practice it in isolation will not bring about the same benefits as practicing it in a variety of situations where decision-making becomes a factor.

Random practice is particularly important for elite athletes because in order to be at their best, their training needs to closely reflect the environment they will face during competition. For example, elite hockey players spending the last 30 minutes of their training sessions playing an actual match, which will reflect random practice as a variety of skills will need to be executed in random order. Recreational athletes may instead complete sessions involving blocked practice, as their goals might be centred on just improving a skill rather than winning an actual game or match. For example, a recreational hockey player might use blocked practice to improve their goal-scoring ability by practicing slap shots for 10 minutes, push shots for 10 minutes and then flick shots for 10 minutes.

During highly random practice sessions, it is common for frequent errors to occur. However, in the long term, random practice leads to greater transfer of learning from practice to performance and substantial improvements in competitions.

DEPTH STUDY IDEA

Conduct an analysis of literature on a particular sport to assess which type of practice methods are proven to yield the best results in competition.

10.5 PRACTICAL ACTIVITY

Practical class

Participate in a practical class that includes the various practice methods so you can have first-hand experience of each of them.

10.5 Exercises

learn on

10.5 Quick quiz **on**	10.5 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 3, 4	2, 5, 8	6, 7, 9, 10

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Revise your knowledge

1. Explain the difference between massed and distributed practice methods.
2. Justify why a 100-m sprinter needs to have distributed practice.
3. Name three movement skills that are best taught using whole practice methods.
4. Name three movement skills that are best taught using part practice methods.
5. Explain why blocked practice is suitable for a learner at the cognitive level.

Apply your knowledge

6. Using a sport or event that you are familiar with, analyse the practice methods that would be suitable for learners at a particular stage (cognitive, associative and autonomous).
7. Give specific examples of what a practice session might involve for a cognitive learner in a chosen sport.
8. Justify the importance of open skills being practiced using the random practice method for learners at the associative level.
9. Explain why training sessions vary for elite athletes in comparison to recreational athletes.
10. The head coach of the Hockeyroos wants to improve the players' dribbling skills, to enhance their ability to dribble around opposition defence, avoid turnovers and maintain their skills throughout a long and physically demanding game. With reference to practice distribution (massed or distributed), discuss, using specific examples, the ideal organisation of a training session in order to achieve the coach's goals.

10.6 Performance elements

Performance elements, including **decision-making skills**, **strategic development** and **tactical development**, are often overshadowed by a focus on teaching and developing skill fundamentals. We sometimes see players demonstrate proficiency in practice sessions, but they are unable to respond successfully to opponents in games because they lack the knowledge, confidence and decision-making skills necessary to take advantage of the situation.

While some elite players appear superior in certain performance elements, such as the ability to 'read' a game, others need to develop this capability through practice. Teaching and coaching strategies that emphasise a **game-centred approach** provide the opportunity to develop performance elements, because tactics, moves and game plans can be analysed following planned stoppages in play. Using this approach, players see the relevance of a skill or move because poor execution, the usual cause of stoppage, has drawn attention to it. The analysis is immediate and the feedback instant, with relevance established to that part of the game. The development of performance elements can be enhanced by the use of technical equipment such as coaching boards, and practical application by way of play drills, small games and match practice to provide experience.

FIGURE 10.27 A games-centred approach to learning provides the opportunity to develop performance elements.

10.6.1 Decision-making

Decision-making is best improved by having to make decisions in performance-like situations. Teaching skills in isolation that do not require athletes to make decisions about when and how to execute skills often results in poor performance when playing an actual game. For example, two netball players standing opposite each other practicing the various passes used in netball, such as shoulder, chest, bounce and lob pass, are not using the decision-making skills required in the game, such as where to pass and aim when the target is moving or which pass is most effective in beating a defender. Instead, practicing the various passes in groups of three and using the 'piggy in the middle' strategy with one person defending is a much more effective strategy to use when practicing; decision-making skills are being developed that closely reflect what will be required during a game. Of course, decision-making needs to be understood within the framework of the rules, playing conditions, agreed team strategies and opposition tactics. Productive decision-making can help both elite and recreational athletes develop and improve their movement skills. It is best achieved through:
- *observation.* Many coaches use coaching boards and demonstrations to show the inner workings of planned strategies to assist learners. They also recommend observation of other players and their movements on the field of play, particularly those of elite performers.

decision-making skills the ability to choose between two or more options to reach the best outcome in the shortest time

strategic development plans of action that an individual or team can use to gain advantage in a single game or a number of games

tactical development enacting decisions and actions that help gain an advantage in a sport or event; built on problem-solving

game-centred approach a focus on the whole game and all components, rather than a sequence of basic skills assembled within a game format. The emphasis is on integrating thinking and learning rather than skill development in isolation.

- *questioning.* Decision-making is improved by highlighting options and having players work through game-like scenarios. For example, when moving objects representing players around on a coaching board, players need to be asked questions like 'what would you do if this opponent moved here?' and 'how do we create space between these two players?'
- *whole, part, whole approach.* A game strategy needs to be taught as a whole so players can see the overall plan. Following that, individuals need to learn their specific roles. Players should walk through moves initially to acquire the feel of where to be, what to do and when to do it. The build-up to game execution speed needs to be gradual, with emphasis on good technique and correct execution. Finally, the strategy should be assembled and practised against a non-invasive opposition.
- *variation.* During training, it is important to explore variations when rehearsing strategies. By changing the defensive alignment, for example, players are encouraged to explore more innovative and imaginative options.
- *creativity.* A democratic approach to strategic development encourages all players to identify with each problematic situation and solve it as a group. This is preferable to following strict, coach-imposed directions all the time because players like to feel they can make a worthwhile contribution. Creativity as opposed to 'paralysis by analysis' is more productive in developing decision-making skills.

FIGURE 10.28 Decision-making skills can be enhanced through coaching boards and questioning.

10.6.2 Strategic and tactical development

Strategy defines long-term goals and plans that athletes or teams put in place in order to achieve success. Tactics are the smaller steps that athletes take in order to achieve the overall strategy. For example, an elite tennis player reviews previous match video footage to study their opponent's strengths and weaknesses. They notice that their opponent is weak in returning shots that are delivered close to the net, so the strategy that they plan to use in the upcoming game is to bring the opponent close to the net. They plan to use tactics such as drop shots and slice shots as much as possible throughout the match in order to execute their strategy.

All athletes aim to develop proficiency in the development of technical skills — that is, ways of moving the body to perform a physical task — along with tactics that help them execute those skills more efficiently. A cut-out pass in rugby league, a layup in basketball and a drag flick in hockey are all examples of tactical skills. Elite athletes tend to be able to manipulate a game to their advantage through reading the game and using appropriate strategies and tactics for success, even during pressured situations. For years, coaches used the traditional approach to learning in which they taught skills in specific practice situations and hoped that players could transfer their learning to game situations. However, factors such as opposition pressure, player movement and a lack of similarity between practice and game situations (closed to open environment) meant that duplication of the learned skill was often unsuccessful.

A games-centred approach is now much more popular, as it focuses on the development of tactical skills within an open environment. The emphasis is on decisions and actions of players within the game with the intention of gaining advantage or superiority. Tactical skill learning leads to better game performance and is important for elite athletes when acquiring, developing and improving their skill acquisition.

FIGURE 10.29 A games-centred approach focuses on the development of tactical skills within an open environment.

There are two steps to tactical skill development:
- understanding
- decision-making.

Players who have an understanding of how a game works and the consequence of error are more likely to be successful. For example, in Oztag, understanding the timing of a pass is a crucial attacking tactic.

Learning technical skills in isolation requires little in the way of *decision-making*. However, tactical skill learning and development includes decision-making as part of the process. Players learn to identify relevant cues and variations within game-like situations and apply tactical options as necessary. These tactical skills can be taught in many situations, such as small grids, limited player games, confined-space games, two-on-three situations and so on. For example, when teaching Oztag players tactics for evading defenders, such as varying speed, side stepping or spinning away from the defender, this should be done in a small-sided game-like situation such as two-on-two so that decisions such as which tactic to use and when can be practised. By manipulating rules, space, time, equipment, numbers and offensive/defensive structures, the desired learning experience can be replicated and the movement skills can be better acquired, developed and improved.

FIGURE 10.30 Tactics enable players to get the upper hand on their opponents.

It is up to coaches to design situations that mimic desired aspects of the game and set up drills where players can develop suitable game-related movements. During these small games, it is important for players to ask questions, have input, suggest solutions and not fear error. This encourages players to develop a sense of responsibility for their actions. If players never practise in a game-like setting, they will never feel confident to make decisions during a game. Of course, players will make mistakes during the game, but they will realise why they happened and learn from them.

Tactical development includes:
- problem-solving, making decisions and taking actions to gain an advantage
- learning from errors and finding creative solutions
- elite athletes diagnosing errors in tactics during games and adjusting their skills accordingly
- observing others, analysing videos and talking to experienced players to understand appropriate actions and responses.

As tactical skills become functional, they can be put together to form the overall strategy that can be used by the player or team to gain advantage in a single game or number of games. Good strategies have inbuilt options so that, if a plan is derailed, there is always an alternative. A common strategy that might apply in a range of sports involves creating multiple options when passing. If you make a pass to a team player, what do you do next? Some options might be to go behind the player to whom you made the pass (wrapping in touch football), move in a different direction altogether (create space for the ball receiver), or even move to block the path of a defensive player (screening in basketball). Strategies involve planning and practice, and might need to change depending on the actions of the opposition.

FIGURE 10.31 Strategic development allows players to read and respond appropriately to varying game environments.

Strategies become more complex as players move from being recreational athletes to elite athletes. For example, in soccer, recreational athletes might have a team strategy of 'keeping position of the ball in attack'. In order to achieve this strategy, their tactics might involve trying to make passes before their opponents get close enough to contest the ball. They might focus on trying to pass to their open team mates rather than those with defenders close by. Elite soccer players will have far more complex attacking strategies that expose their opposition's weaknesses. They will have specific tactical moves that have been well practiced and rehearsed, and each player will be familiar with the role they need to play within the move. They will also have various options they will use within the strategy based on what their defence do in response or where they are positioned on the field. Regardless of whether they are recreational or elite athletes, players who have developed technical and tactical skills will have a solid platform on which they can respond to constantly varying game environments and confidently adapt to changing situations.

Table 10.2 shows areas in which tactical development might be needed. It considers the player, fellow team players and the opposition. The questions are typical of those that need to be considered in strategic and tactical development plans.

TABLE 10.2 Tactical development focus issues

Tactical development area	Team players	Opposition players
Space	• How much space can I use? • Where do I go before the move? • Is the gap big enough? • Where do I go after the move? • Will the player with the ball have enough space?	• How do I confine my opponent's space? • To where do I move to limit my opponent's ability to be involved in the game?
Force	• How much do I apply? • Have I got sufficient energy to do what I want?	• Is force necessary to achieve my goal? • Is there a better way if my opponent is bigger?
Time	• When is the right time to execute a movement? • How do I create enough time to allow me to do what I want?	• How do I take time away? • How can I pressure my opponent to not use time effectively?
Direction	• Will this take me forward? • Will the angle squeeze too much space from my fellow players? • Which direction enables me to evade defenders?	• Which direction will cause biggest problems — straight or angled? • Which direction do I anticipate my opposition will head towards?
Myself	• Have I got the skills and talent to do this? • Do I understand what has to be done? • Am I confident in my ability to pull this off? • Is it part of the team plan? • Is the risk worth it?	• Will this help me get the upper hand over my opponent? • Will my defensive movements contribute to the overall success of my team?
Other players	• Where do others fit in? • Will they understand what I am doing? • Can they do what I am asking of them?	• Do I need to consider more than my immediate opponent? • Am I following the team's defence strategy?

TABLE 10.3 Strategies for invasion games

Attacking strategies	Defensive strategies
• Maintaining possession • Avoiding defensive players • Creating space for teammates • Exposing the opposition's defensive weaknesses such as gaps in their defensive line • Creating multiple opportunities to progress the ball forward	• Marking-up in defence • Reducing the opposition's space • Predicting the opponents' tactics and game strategies • Gaining possession of the ball • Defending the goal or try line

DEPTH STUDY IDEA

Compose an essay that explores specific performance elements used by an athlete of your choice.

10.6 PRACTICAL ACTIVITY

As a class, choose a game such as touch football or netball in which one student, who is a capable player, could act as coach. Play a game using the game-centred approach. Stop the game at least three times and highlight areas of play that could be improved through understanding and implementing performance elements such as shooting goals, spreading out or marking up in defence. Use a game-related drill or walk-through strategy to improve execution of skills, plays or moves during each stoppage.

Evaluate the performance elements used throughout the game by discussing the following questions.
1. Did the approach assist in decision-making?
2. Did players better understand what had to be done using this approach?
3. How could the approach be improved to further develop performance elements?
4. What would a practice session reflecting a more traditional skilled-based approach session look like in comparison to the game-centred approach?

10.6 Exercises

learnon

10.6 Quick quiz on	10.6 Exercise

Select your pathway

LEVEL 1	LEVEL 2	LEVEL 3
1, 2, 3	4, 5, 6, 8	7, 9

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Revise your knowledge

1. Explain some methods that a coach could use to develop decision-making skills in athletes.
2. Why is it important to develop decision-making skills when acquiring, developing and improving movement skills?
3. Discuss how a coach could use questioning to help guide the learning process.
4. Using a sport of your choice, explain three key strategies and tactics that enhance gameplay.

Apply your knowledge

Watch footage of an elite team sport (of your choice or chosen by your teacher) and answer the following questions.
5. Pick a particular player and identify specific decisions, strategy and tactics that they used throughout the game.
6. Explain a situation where you viewed the whole team executing a team strategy to their advantage.

7. Analyse a situation where a mistake was made. What decisions, strategies or tactics led to the error occurring?
8. During the game, what strategies were used by the defensive players in order to try to put pressure on the opposition to force an error?
9. Identify the tactic that you think was most important in this game. Justify why you believe it was the most important.

10.7 Types of feedback

Feedback plays an important role in the learning process because it provides guidance and helps the performer remove movement error. There are many types of feedback that are suitable for the different stages of learning, including:
- task-intrinsic
- augmented
- concurrent
- delayed
- knowledge of results
- knowledge of performance.

All learners receive feedback from performing a particular skill and possibly from other sources such as a coach.

FIGURE 10.32 Feedback is provided following analysis of the output.

10.7.1 Task-intrinsic and augmented feedback

Feedback must be given at the right time. Some feedback is experienced during the execution of a skill. Called **task-intrinsic feedback**, this information is received through the body's proprioceptive mechanisms (senses) and is internal. Internal feedback occurs as a normal process of performing a skill, and is the result of sensory information.

For example, in cricket the batter sees the ball being bowled (visual), adjusts their body so that they are in the right position for the bat to make contact with the ball (proprioception), hears the sound of the ball hitting the bat (auditory) and feels the vibrations in their hands on impact (tactical) — all serve as sources of task-intrinsic feedback.

feedback information provided to the learner about the nature or result of their performance

task-intrinsic feedback feedback that occurs as a normal consequence of performing a skill. It embodies feelings, together with sensory information such as vision and hearing.

Proprioception is made possible by the neuromuscular system sending messages to the brain about how the movement is being performed. It helps us develop a kinaesthetic sense or 'feel' for a movement. Eventually, as an individual progresses through the stages of learning, they are able to tell the difference between skilful application and error. Learners at the cognitive stage or who are recreational athletes often struggle to understand task-intrinsic feedback. This is because they have not yet developed the ability to differentiate and select effective proprioceptive and sensory movements that impact the performance positively.

As a result, this style of feedback is generally only used by learners at the associative or autonomous stage or who are elite athletes. These learners have the ability to use their kinaesthetic sense to detect errors in their movements and fix them so that their execution can be successful. Task-intrinsic feedback should be encouraged as much as possible for learners at the autonomous level or who are elite athletes, so that they do not become heavily reliant on their coach's guidance. Instead, they can detect their own movement errors and put in place strategies to correct them.

FIGURE 10.33 How task-intrinsic feedback functions

int-9284

Information is taken in and interpreted (perception)

Sense organs receive cues

Feedback

Information is processed

Response: the skill is used
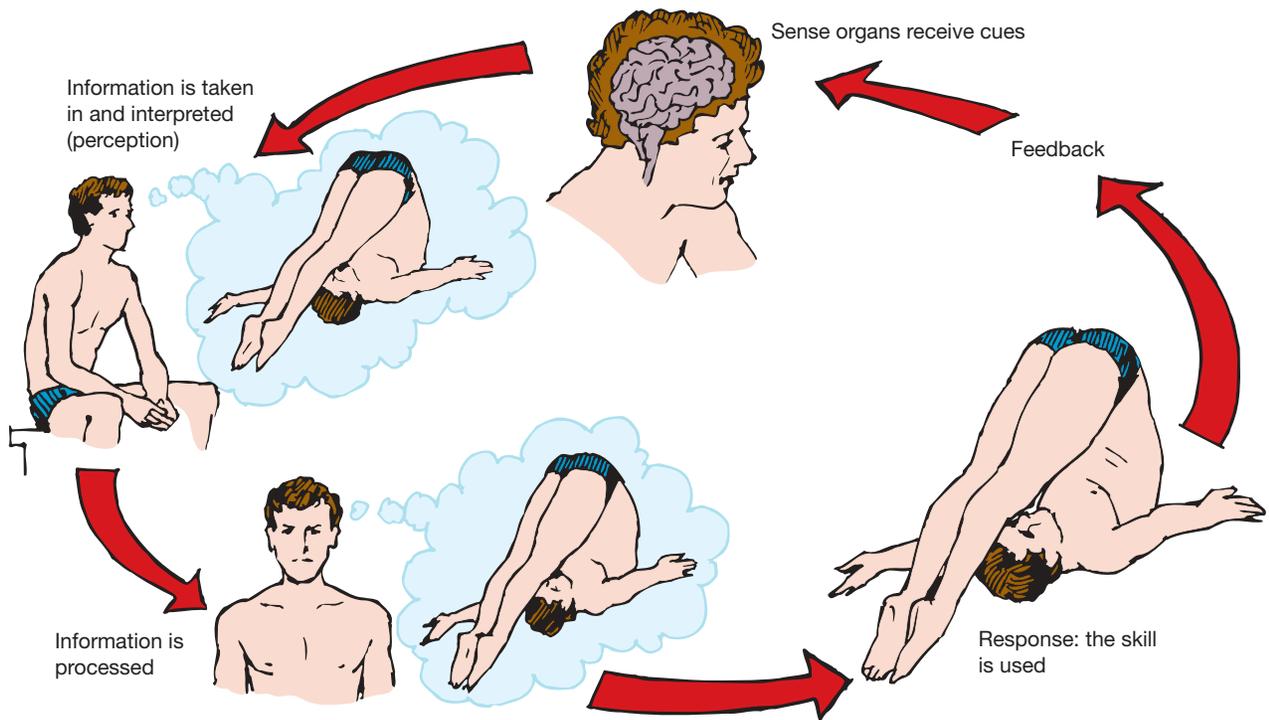
Some feedback comes from outside sources during performance of a skill. Called **augmented feedback**, it includes various forms of external information, such as suggestions from the coach, video replays, judges' scores or race results. While it may vary, its origin or source is outside the body. An example of augmented feedback for the cricket scenario above would be the coach videoing the batter and then analysing various parts of the movement that were done well and those that could be modified in order to improve performance. All stages of learners can benefit from augmented feedback, but it has particular importance for cognitive learners as they often do not yet have the ability to intrinsically identify errors and self-correct without it. Cognitive learners rely heavily on external feedback to help them understand what they are doing wrong and how they can improve. Without this, they may develop bad habits in their skill execution or never actually be able to grasp the skill because they cannot work out what they are doing wrong. Forms of augmented feedback are illustrated in figure 10.34.

augmented feedback all feedback other than that which occurs as a normal consequence of performing a skill; includes various forms of external information, such as suggestions from the coach, video replays, judges' scores and race results

FIGURE 10.34 Some forms of augmented feedback
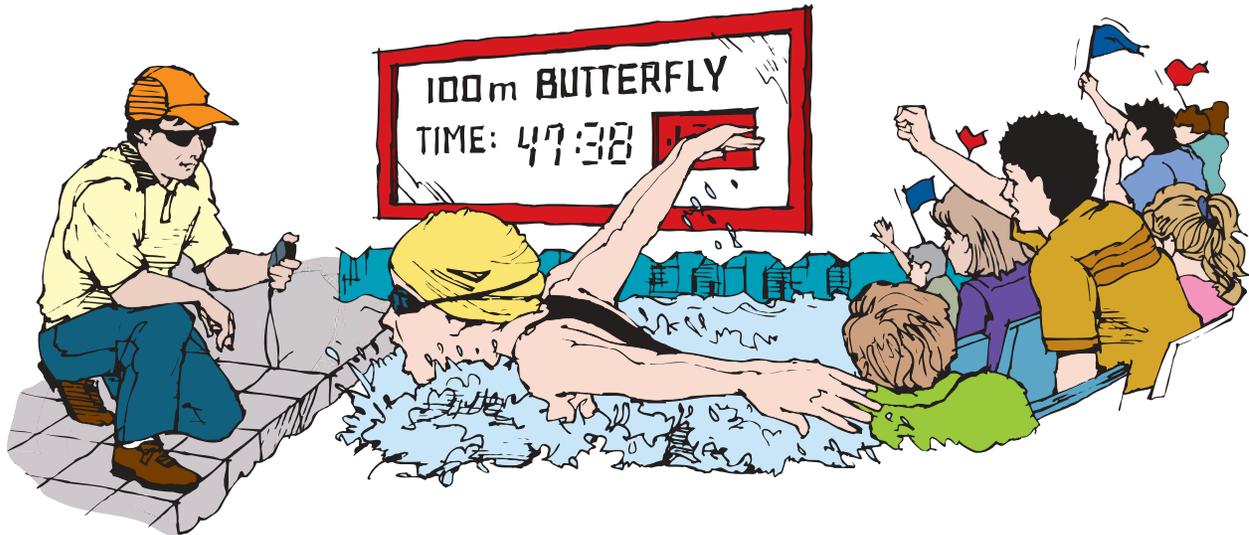
10.7.2 Concurrent and delayed feedback

The timing of feedback is important in skill learning. A certain amount is concurrent, but much feedback may be delayed or withheld until the most appropriate moment.

Concurrent feedback occurs simultaneously with skill execution, and it is relayed throughout the body by the proprioceptive mechanism or externally by a coach or instructor. Generally, this type of feedback is best suited for elite athletes or for those learners at the associative and autonomous stages, because they already have the ability to understand how to complete the movement and can receive feedback while executing the skill without being distracted. Concurrent feedback is not suitable for cognitive learners, because they need to dedicate a substantial amount of attention to understanding and implementing the basic mechanics of the new skill and use trial and error to see what movements create a positive result. Feedback from the coach while they are executing the skill can compromise the learner's ability to focus on a particular element of the skill, or can confuse their thought process.

> **concurrent feedback** feedback received during the performance of a skill
>
> **delayed feedback** received after the skill has been executed

An example of task-intrinsic, concurrent feedback is that a person receives while balancing in a headstand — information from the brain that enables them to maintain the position. Such a skill requires constant readjustment of the centre of gravity to maintain equilibrium, and its success relies on feedback being continuously supplied to the body. Concurrent feedback can also be delivered externally by a coach. For example, a runner competing in an 800-m race may receive feedback from their coach about their running form; for example, that they need to extend their stride and increase their arm drive.

Not all sports or events allow for concurrent feedback to occur and there is often a period of time between skill execution and feedback. Feedback received at a later stage is called **delayed feedback**. An example of delayed feedback is waiting for the result of a basketball shot. The feedback (a successful or unsuccessful shot) is not received until the ball either enters or misses the basket. Delayed feedback is often used during the cognitive stage of learning, as concurrent feedback could distract the athlete or deflect their attention from the task at hand. For example, a gymnastics coach would wait until the athlete completed a vault before providing feedback about the performance, because calling out to them during the movement could result in the athlete being distracted, not completing the movement correctly and injuring themselves. Delayed feedback is often also used by elite athletes after performance by watching video footage and reviewing decisions, strategies and tactics that were helpful to performance outcomes and those that were not so that areas can be worked on and improvements made before the next game is played.

10.7.3 Knowledge of results and knowledge of performance

Knowledge of results and **knowledge of performance** are two varieties of feedback.

Knowledge of results suggests how successfully the skill was performed — for example, how many goals were scored from a number of attempts, or what distance was covered in a long jump. It is always augmented (external) and may come from sources such as a measurement, time, coach or another performer. Generated in response to a performance, knowledge of results is important because it provides information about skill execution. To obtain a different result, the performer may need to execute the skill differently, or perhaps not at all, in a specific situation. This type of feedback is often used in more skilled performers at the later stages of learning. They know how to complete the performance using the right technique and they are perfecting their ability to perform the skill by reflecting on their results. Alternatively, cognitive learners may get the right result, such as the ball going into the basket, but might use incorrect techniques, such as holding the ball in one hand over their head when shooting.

knowledge of results information about the outcome of a movement
knowledge of performance information about the pattern of the movement during execution

Knowledge of performance is more specific to the way in which the skill is performed, and is particularly important for learners during the cognitive stage of skill acquisition. Knowledge of performance gives feedback on the quality of the execution of the skill, and it may come from either internal or external sources. An example is a comment from a coach about the importance of the basketball player holding the ball in two hands and shooting from the chest so that the ball cannot be easily stolen by a defensive player during the game. This puts the focus on the performance of the skill rather than the result so that the skill can be acquired correctly in those initial stages of learning. When defensive players are introduced, the skill can continue to be successively implemented.

FIGURE 10.35 Knowledge of results gives information about how skilful the execution of the skill was.

Recreational athletes may use a combination of both knowledge of results and knowledge of performance, or chose not to focus on either. For example, a recreational runner may use knowledge of results, such as how long it takes them to run 5 kilometres, to assess their running ability. Alternatively, they could use knowledge of their performance to assess their ability, by judging how they felt during the run and whether they were able to maintain their upright running technique and breathe adequately throughout the 5 kilometres. Some recreational athletes may not focus on either of these forms of feedback because improving their running technique or time may not be a priority at all, and instead they might be jogging for social reasons or for stress relief.

DEPTH STUDY IDEA

Collate data from a match or game and construct graphs and tables to analyse an athlete's performance and provide quantitative feedback.

10.7 PRACTICAL ACTIVITY

Experiencing feedback

You will require a number of plastic buckets, tennis balls, blindfolds and recording sheets. Work in pairs.
1. From a distance of 2 metres, each person makes 20 attempts at throwing a tennis ball into a bucket. Tell the thrower their progressive score, and provide coaching to assist their technique. Record the results.
2. Complete a second attempt of 20 throws, but this time blindfold the thrower and do not tell them about the success or otherwise of each throw.

Answer the following questions.
1. Identify the types of feedback that were available to the thrower on each occasion in the above application.
2. Which type of feedback was most effective in the first attempt and why?
3. How could feedback be used more effectively in the second attempt?
4. Discuss why feedback was important in this situation.

10.7 Exercises

learn on

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
3, 4	2, 5, 6, 7	1, 8

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Revise your knowledge

1. Complete the following table identifying the ideal feedback needed for each stage of learning and provide a reason why.

Type of feedback	Cognitive	Associative	Autonomous
Task-intrinsic or augmented			
Concurrent or delayed			
Knowledge of results or knowledge of performance			

2. Using a skill of your choice, explain the different task-intrinsic feedback that you would receive while executing the movement.
3. Why is it important that an athlete does not become overly reliant on their coaches' feedback to facilitate a successful performance?
4. Name three sports or events in which an athlete needs to rely heavily on concurrent feedback in order to execute movements.
5. Why is it important that a learner focuses on knowledge of performance feedback before knowledge of results?

Apply your knowledge

6. Explain how accurate feedback can have a direct influence on improved performance.
7. Using an example, explain how inaccurate feedback could reduce performance and participation in a sport or physical activity.
8. Assess the significance of external feedback in order to increase individual motivation.

10.8 Research activity on movement skill acquisition

Choose a movement skill from a sport you are familiar with, such as a layup in basketball, a long spiral pass in touch football, a serve in tennis or a spin bowl in cricket. The skill should be discrete or serial and reasonably complex; that is, it should contain some subskills that may need to be taught.

Download the template of the following plan from your Resources panel. Research information about the acquisition of the skill and use it to complete the research plan. An example has been provided for you in section 10.8.2, using the movement skill of front-on tackling in rugby league.

10.8.1 Research plan template

Research plan

Skill name:

Description of skill

Diagram or photograph of skill

What is the purpose of the movement skill in the context of the game or event?

How do the characteristics of the learner affect successful acquisition of this skill?

How is the movement skill classified? (gross/fine, discrete/serial/continuous, open/closed, self-paced/externally paced)

How should the environment be modified to allow a learner to acquire the skill?

Why is it important to modify the environment when learning the skills?

What practice methods are best suited for learners at the different stages of learning the skill? (massed/distributed, whole/part, blocked/random)

How are the performance elements applied to this skill? (decision-making, strategy, tactics)

What types of feedback are most effective during the different stages of acquiring, developing and improving the skill? (task-intrinsic/augmented, concurrent/delayed, knowledge of results/knowledge of performance)

What are some of the drills that are most effective when acquiring, developing and improving this movement skill?

What games are most effective when acquiring, developing and improving this movement skill?

What are some other important research questions that can be explored in relation to the skill development?

Reference list

10.8.2 Research plan sample

Research plan

Skill name: Front-on tackle in rugby league

Description of skill

The international rules of rugby league define a tackle as the act of bringing the ball carrier (opposing player) to the ground. The front-on tackle completes the movement from directly in front of the player. Side tackles and tackling from behind are two other types of tackles also used in rugby league; however, research suggests that the front-on tackle is the most effective and frequently used in the game.

Diagram or photograph of skill

FIGURE 10.36 Front-on tackle

> Don't let the ball-carrier come to you.

> Move forward to deny the ball-carrier space and time.

> On approach to tackle, try to remain as upright as possible.

> Drop by bending the knees, keeping shoulders higher than hips.
> Make contact with the shoulder. Keep head to the side.
> Keep chin up and neck in line with the spine.
> Keep feet in close.

> Wrap arms tightly around the ball-carrier.

> Use the ball-carrier's momentum and a strong leg drive to force the ball-carrier to the ground.

> The tackler should finish on top of the ball-carrier.

What is the purpose of the movement skill in the context of the game or event?

van Rooyen *et al.* (2014) state that the purpose of a tackle is to 'limit the forward momentum of the ball carrier and to restrict their possession of the ball'.

How do the characteristics of the learner affect successful acquisition of this skill?

Research suggests that the following characteristics of learners are most desirable when learning how to do a front-on tackle in rugby league:

Personality. Tackling in rugby league can be dangerous if the correct technique is not applied. Therefore, learners whose personality reflects attributes such as cooperativeness, willingness to listen and receptiveness to instruction and feedback are required. Similarly, due to the nature of the skill, learners who are willing to take risks to learn, are determined and can display controlled aggression generally acquire, develop and improve the movement much faster than learners who lack these personality traits.

Heredity. A considerable amount of force needs to be generated in order to make a successful tackle. As such, a mesomorph somatotype with high levels of strength and power in the legs, core and arms are characteristics that are highly favourable heredity attributes when it comes to successfully acquiring the skill of front-on tackling. Higher levels of fast-twitch fibres are more desirable then slow-twitch fibres for this particular skill.

Confidence. Due to rugby league being a contact/collision sport, players must have confidence in their ability to tackle in order to do it effectively. If they lack confidence, they will usually fear the collision and either not utilise the right technique or avoid it all together. Therefore, it is essential that confidence is developed throughout the learning process.

Prior experience. Learners who have practised tackling in other football or rugby codes, such as AFL or rugby union, move through the stages of skill acquisition for a front-on tackle at much faster rates than learners who have not. Similarly, learners who have a background in wrestling or martial arts that require take-downs also grasp the skill much faster due to the transfer of learning from similar movements utilised in both sports.

Ability. This is particularly important in the later stages of skill acquisition. Some learners will never get to the autonomous stage of front-on tackling because they lack the levels of perception and reaction time required to execute the correct technique. During the later stages of skill acquisition, learners will need to perform the movement on a moving target, which is a very open environment. They will need to perceive and react to the stimulus instantaneously, which not all learners can achieve. Therefore, learners who have high levels of ability, particularly perception and reaction time, acquire, develop and improve the skill of front-on tackling at far greater rates than those who do not.

How is the movement skill classified? (gross/fine, discrete/serial/continuous, open/closed, self-paced/externally paced)

The front-on tackle is a gross motor skill because it requires all the big muscle groups of the body, given that it is a very physically demanding skill. It is discrete because it has a clear beginning and end point. It is very open in nature because the environment is constantly changing, due to the fact that the ball carrier being tackled changes regularly, as does their size, speed and counter-force production. The skill is externally paced as the person tackling must react and initiate their movements based on the ball-carrier's movements.

How should the environment be modified to allow a learner to acquire the skill?

The environment must be modified during the initial stages of learning the front-on tackle. The environment should be manipulated so that it is closed as opposed to open, and self-paced instead of externally paced. This can be achieved through having learners tackle a stationary foam tackle bag instead of a person.

Why is it important to modify the environment when learning the skills?

Because the front-on tackle is a risky movement skill and can result in injuries, it is essential that the learner acquires the correct technique in a closed, controlled environment before progressing to a more open environment. It is also essential that learners are given the opportunity to experience success in order to enhance confidence. By manipulating the environment so that the movement skill is more achievable, learners are able to experience success as well as what it feels like to do the movement correctly. This has a vital role in allowing them to acquire, develop and improve the correct technique that is necessary.

What practice methods are best suited for learners at the different stages of learning the skill? (massed/distributed, whole/part, blocked/random)

When learning the front-on tackle, practice should be distributed during all stages of learning. This is because tackling requires gross motor skills and is very physically demanding, so breaks must be given regularly to process information, restore energy and ensure injuries do not occur due to fatigue. Similarly, regardless of the learning stage, the skill should be practiced in its whole form. This is because the movement parts are heavily reliant on and linked to each other, so isolating them would not be helpful. Instead the tackle needs to be completed in one whole movement, so whole practice is required.

Whether the skill needs to taught as blocked or random practice is, however, dependent on the learning stage of the participants. Learners at the cognitive stage need to utilise the blocked method of practice. They need to continue to practice the front-on tackle until they have an understanding of what they need to do along with the correct technique. Random practice is better suited for learners at the associative and autonomous stage; they know how to tackle, but they now need to incorporate it among other skills that they use in the game, such as running the ball, passing and kicking. This reflects the real game and they need to be able to transition between the different skills in random order to replicate this.

How are the performance elements applied to this skill? (decision-making, strategy, tactics)

The performance elements are essential when practicing the front-on tackle. Learning this skill in isolation, within a closed environment, will not allow the learner to effectively execute the skill in a rugby league game. This is because the athlete will need to be able to make decisions such as which player to tackle, whether they should assist a teammate who has initiated a tackle, how much force they will need to apply, and what area of the opponent's body they will need to make contact with based on their size and position. Strategy and tactics are also crucial. For example, tackling an opponent around the mid-section and wrapping the ball up means they cannot offload to a teammate. Tackling an opponent around the legs with efficient technique may still allow the opponent to pass the ball to a teammate while the tackle is taking place, which means that progression of the ball has not been prevented. Therefore, incorporating decision-making, strategy and tactics into the learning environment is very important.

What types of feedback are most effective during the different stages of acquiring, developing and improving the skill? (task-intrinsic/augmented, concurrent/delayed, knowledge of results/knowledge of performance)

Feedback is essential when learning the front-on tackle.

During the cognitive stage, learners will need augmented feedback as they will not have developed the ability to adequately use task-intrinsic feedback. Augmented feedback for this particular skill could involve the coach explaining the key steps of the skill, having someone demonstrate the movement on a foam tackle bag, and then allowing the learner to attempt the skill. Following their attempt, delayed feedback by the coach should be given regarding their performance in relation to their technique and what they did well, along with one or two aspects to focus on in their next attempt. Knowledge of their performance rather than knowledge of results is crucial, as they need to be able to master the correct technique before progressing to tackling an actual person.

During the associative stage the learner can continue to use augmented feedback; however, they can also now begin to use task-intrinsic feedback. Continuous practice allows them to develop their proprioception skills and they can use these senses to adjust their position or amount of force in order to stop the forward momentum of the person they are tackling. Concurrent and delayed feedback will help learners at the associative stage to improve their performance. For example, while they are executing the movement, a coach could tell them to 'get down lower and drive the legs' or 'wrap the ball up', which can help them apply the correct technique at the right time. The coach could also film the learner making tackles and then provide delayed feedback by analysing the footage with the learner. Knowledge of both performance and results is important at the associative stage, because learners can still improve on the performance of the skill, i.e. their technique, but they need to be aware of the result too, such as whether the person they tackled was able to make much forward progression, offload the ball or score a try even though the tackle technique was good.

During the autonomous stage, learners will draw upon task-intrinsic feedback to get into the best position pre-, during and post-movement. Like the associative stage, both delayed and concurrent feedback as well as knowledge of performance and results can be drawn on to further analyse and improve the movement skill in a variety of environments.

What are some of the drills that are most effective when acquiring, developing and improving this movement skill?

- Tackling a foam bag
- tackling multiple foam bags
- 1 v 1 tackling with stationary target
- 1 v 1 tackling drills with moving target
- Grappling/wrestling drills
- Assisting a teammate tackle drills
- Wrapping the ball up drills.

What games are most effective when acquiring, developing and improving this movement skill?

- 2 v 1 tackle games
- 3 v 2 tackle games
- Knee footy
- Small-sided modified games such as 4 v 4 or 6 v 6
- Tackle bullrush
- Tackle stuck-in-the-mud
- Tackle grid games

What are some other important research questions that can be explored in relation to the skill development?

- Does age affect how the front-on tackle should be learnt? Is it the same process for children as it is for adults?
- How should the skill be redeveloped in a learner who was previously injured when tackling an opponent and now has no confidence in their ability and fears the movement?
- How could the front-on tackle be developed in cognitive learners if teaching aids such as tackling bags are not available?
- Does gender affect the rate at which the front-on tackle is acquired, developed and improved?
- Does a higher weight and height ratio affect the rate at which the front-on tackle is learnt?

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10.9 Sample exam question response

Question

Describe the types of feedback an elite soccer player would use while playing a game and **explain** how they would utilise this feedback to enhance their skill performance. **(5 marks)**

Criteria	Marks
• Provides characteristics and features of types of feedback used by an elite soccer player and makes evident the relationship between feedback and enhanced performance • Provides relevant examples	5
• Sketches in general terms the types of feedback used by a soccer player and how it enhances performance • Provides examples	3–4
• Sketches in general terms the types of feedback and/or how it enhances performance	2
• Provides some relevant information about feedback	1

Sample response

eles-5021

Breaking down the question

Describe the types of feedback an elite soccer player would use while playing a game and explain how they would utilise this feedback to enhance their skill performance.

Identify the action word/s: Describe — explain characteristics and features. Explain — relate cause and effect; make the relationships between things evident; provide reasons why and/or how

Syllabus terminology: types of feedback (task-intrinsic, augmented, concurrent, delayed, knowledge of performance, knowledge of results)

Mark allocation: 5 marks — according to HSC past papers, questions worth 5 marks require body paragraphs, each addressing the action word and providing clear examples.

Answering the question using PEEL structure

P Identify the *Point* being raised/state topic sentence/what this paragraph is going to be about[1]

E *Expand/Elaborate* on the point and provide a strong link to what the question is asking[2]

E Apply *Examples* that are they relevant and specific[3]

L *Linking* sentence that relates back to the question[4]

Sample annotated response

An elite soccer player would be reliant[1] on concurrent, augmented feedback[4] from their coach on the sideline,[1] as well as their own[3] task-intrinsic feedback[4] and knowledge of results[4] in order to enhance performance. For example, an elite soccer player can feel when they have or have not struck the ball with the appropriate force and accuracy[3] by drawing on task-intrinsic feedback.[2]   This allows them to use the feedback and respond with the appropriate action instantly.[4] As an experienced soccer player, they can process their coach's instructions while playing[3] through concurrent feedback[2] and further enhance their skill performance and contribution to the team's success;[2] for example, the coach might shout out to the player when they have possession of the ball to pass it to a particular open teammate that they haven't noticed. Knowledge of results[4] is preferable because they know how to perform the skill; their results dictate whether or not they need to execute the skill in the same way or differently in the future.[2] By utilising these different forms of feedback, the athlete can immediately process information about their skill execution and adapt where necessary to enhance their performance.[4]

10.10 Review

10.10.1 Topic summary

10.2 Characteristics of learners

- A learner brings many characteristics to the learning situation.
- Confidence, heredity, ability, personality and prior experience particularly influence the direction of the learning experience.

10.3 Stages of learning and skill acquisition

- Learners progress through three recognisable stages of learning skills: the cognitive (beginning) stage, the associative (practice) stage and the autonomous (automatic) stage.
- Some learners may not reach the autonomous stage in the execution of specific skills.

10.4 Characteristics of motor skills

- The learning environment includes areas such as the nature of the skill, performance element, practice methods and feedback.
- Open skills such as tackling in rugby occur in an unpredictable and frequently changing environment.
- Closed skills such as vaulting in gymnastics occur in an environment that is stable and predictable.
- Gross motor skills such as swimming require the use of large muscle groups for execution.
- Fine motor skills such as catching require the use of only small muscle groups to perform the movement.
- Discrete skills such as throwing have a distinctive beginning and end that can be identified.
- Serial skills such as bowling in cricket involve a sequence of smaller movements that are assembled to make a recognisable skill.
- Continuous skills such as swimming have no distinct beginning or end.
- Self-paced skills are movements for which the performer determines the timing and speed of execution.
- Externally paced skills are movements for which an external source controls the timing.

10.5 Practice methods

- Massed practice involves a continuous practice session, with rest intervals shorter than practice intervals.
- Distributed practice involves a broken practice session, with intervals of rest or alternative activities being longer than practice intervals.
- Whole practice involves learning a skill as a complete movement.
- Part practice involves breaking the skill down and learning each component individually first before putting it all together at the end.
- Blocked practice involves focusing on the same skill under the same conditions for a period of time before moving on to the next skill.
- Random practice involves learning multiple skills in random order with no clear pattern.

10.6 Performance elements

- Performance elements include important game components such as decision-making, strategic development and tactical development.
- Strategic elements refer to long-term goals or plans put in play to achieve successful outcomes; for example, exposing the opposition's defensive weaknesses in Oztag.
- Tactical elements are the smaller steps that help achieve the overall strategy; for example, throwing cut-out passes in Oztag to take advantage of gaps in the opposition's defensive line.

10.7 Types of feedback

- Feedback plays an important role in the learning process because it provides guidance and helps the performer reduce movement error.
- The many types of feedback include task-intrinsic, augmented, concurrent, delayed, knowledge of results and knowledge of performance.

on Resources

📄 **Digital document** Topic 10 summary (doc-35912)

10.10.2 Key terms

ability the ease with which an individual is able to perform a movement or routine

acquisition gaining possession of something

acuity sharpness; a sense of being able to hear, see and think clearly and, sometimes, quickly

agility the ability to move the body from one position and direction to another with speed and precision

associative stage connecting or linking ideas

augmented feedback all feedback other than that which occurs as a normal consequence of performing a skill; includes various forms of external information, such as suggestions from the coach, video replays, judges' scores and race results

autonomous stage being in full control of actions so they become automatic

blocked practice a type of practice in which each skill component is practised repetitively as an independent block

closed skills skills that occur in an environment that is stable and predictable

cognitive stage the mental processing of information, thinking and understanding

concurrent feedback feedback received during the performance of a skill

continuous skills skills that have no distinct beginning or end

decision-making skills the ability to choose between two or more options to reach the best outcome in the shortest time

delayed feedback received after the skill has been executed

discrete skills skills that have a distinctive beginning and end that can be identified

distributed practice involves a broken practice session, with intervals of rest or alternative activities being longer than practice intervals

elite athletes individuals who have achieved excellence and competed at a high level (usually nationally or internationally) in their event or sport

externally paced skills movements for which an external source controls the timing

feedback information provided to the learner about the nature or result of their performance

fine motor skills skills that require the use of only small muscle groups to perform the movement

game-centred approach a focus on the whole game and all components, rather than a sequence of basic skills assembled within a game format. The emphasis is on integrating thinking and learning rather than skill development in isolation.

gross motor skills skills that require the use of large muscle groups for execution

heredity the inheritance of genetic characteristics from our parents

kinaesthetic sense (or **kinaesthesis)** the system of sensitivity that exists in the muscles and their attachments

knowledge of performance information about the pattern of the movement during execution

knowledge of results information about the outcome of a movement

massed practice a continuous practice session, with rest intervals being shorter than practice intervals

open skills skills that occur in an environment that is unpredictable and frequently changing

part practice method applied when a skill is broken into smaller components and each discrete subskill (subroutine) is practised separately

personality an individual's characteristic way of behaving

random practice a form of practice that involves rehearsing a number of different skills in an unpredictable sequence

recreational athletes athletes doing sport for fun rather than competitively

self-confidence a feeling of trust in one's own ability, qualities and judgement

self-paced skills movements for which the performer determines the timing and speed of execution

▶

serial skills a sequence of smaller movements that are assembled to make a total skill

somatotype a person's body type or shape (ectomorphic, mesomorphic or endomorphic)

strategic development plans of action that an individual or team can use to gain advantage in a single game or a number of games

tactical development enacting decisions and actions that help gain an advantage in a sport or event; built on problem-solving

task-intrinsic feedback feedback that occurs as a normal consequence of performing a skill. It embodies feelings, together with sensory information such as vision and hearing.

traits characteristics or observable features of a person

whole practice method applied when a skill is practised in its entirety

on Resources

Digital documents	Key terms glossary (doc-36178)
	Revision quiz (doc-34739)
Interactivity	Missing word interactive quiz (int-8047)

10.10 Exercises

10.10 Revision quiz **on**	10.10 Exam questions

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10.10 Exam questions

▶ Question 1 (1 mark)

Which of the following is NOT a characteristic of a learner? (HM-11-04)

A. Personality
B. Heredity
C. Muscle fibres
D. Ability

▶ Question 2 (1 mark)

Which of the following is an example of discrete, serial and continuous skills, in that order? (HM-11-04)

A. Sprinting, basketball layup, hitting a baseball
B. Passing a ball, triple jump, running
C. Rowing, kicking a ball, sprinting
D. Batting in cricket, running, a dance routine

Question 3 (1 mark)

A national tennis coach records the training session of their elite athlete to review at the conclusion of the session. What type of feedback are they receiving? (HM-11-04)

A. Concurrent
B. Task-intrinsic
C. Knowledge of results
D. Knowledge of performance

Question 4 (1 mark)

Which types of practice methods are most suitable for a cognitive learner? (HM-11-04)

A. Distributed, part and blocked
B. Distributed, part and random
C. Massed, whole and blocked
D. Massed, part and random

Question 5 (3 marks)

Outline the difference between each of the following. (HM-11-06)

a. Open and closed skills
b. Discrete and continuous skills
c. A self-paced and an externally paced skill

Question 6 (4 marks)

Describe the main features of each of the stages of skill acquisition. (HM-11-04)

Question 7 (4 marks)

Choose any complex skill and **describe** how it would be taught using the whole method and the part method. (HM-11-04)

Question 8 (5 marks)

Explain how the specific characteristics of a learner may have an impact on a teaching/learning situation. Use an example in your answer. (HM-11-06)

Question 9 (5 marks)

Explain how an understanding of performance elements can improve performance. (HM-11-04)

Question 10 (6 marks)

To what extent does feedback improve performance? (HM-11-06)

Question 11 (6 marks)

Discuss the importance of knowledge of results and knowledge of performance when learning how to serve in tennis. (HM-11-06)

Question 12 (5 marks)

Draw a table similar to the one below. Use the text (and further research if needed) to **provide two examples** of each of the listed skill classifications. (HM-11-10)

Skill classification	Example 1	Example 2
Gross motor		
Fine motor		
Open		
Closed		
Externally paced		
Internally paced		
Discrete		
Serial		
Continuous		
Massed practice		
Distributed practice		

Question 13 (5 marks)

Justify the need for demonstrations for learners who are in the cognitive stage of skill acquisition. (HM-11-04)

Question 14 (5 marks)

Choose an individual in an elite sport. **Explain** how the athlete's kinaesthetic sense and mental approach make their performance more skilled than that of a non-elite, recreational athlete. (HM-11-07)

Question 15 (7 marks)

Analyse how the characteristics of a learner can influence skill acquisition. (HM-11-06)

Question 16 (12 marks)

Evaluate how the types of feedback can be implemented to improve performance of learners at different stages. (HM-11-06)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

10.1 How are movement skills acquired, developed and improved? (tpdf-2184) ☐

📄 Digital documents

10.3 The three stages of skill acquisition (doc-35903) ☐
10.8 Movement skills research plan template (doc-34765) ☐
10.10 Key terms glossary (doc-36178) ☐
Topic 10 summary (doc-35912) ☐
Revision quiz (doc-34739) ☐

▶ Video eLessons

10.10 Sample exam question response (else-5021) ☐

🧩 Interactivities

10.4 Gross and fine motor skills (int-1837) ☐
Discrete motor skills (int-1838) ☐
10.7 How task-intrinsic feedback functions (int-9284) ☐
10.10 Missing word interactive quiz (int-8047) ☐

🔗 Weblinks

10.2 Self-confidence ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

11 What is the relationship between psychology, movement and performance?

LEARNING SEQUENCE

11.1 Overview

Key inquiry question

What is the relationship between psychology, movement and performance?

Syllabus

	Syllabus content	Subtopic
○	■ Analyse the relationship between psychology, movement and performance for individuals and groups **Including:** • how does personal identity affect an individual's participation and performance in sport? • how does motivation support participation, including positive and negative, intrinsic and extrinsic motivation? • why is self-regulation essential for sports performance and exercise behaviour change?	 11.2 11.3 11.4
○	■ Investigate how communities of exercise motivate individuals and groups to participate in and improve performance **Including:** • what are contemporary forms of exercise? • how do contemporary forms of exercise encourage group dynamics, group cohesion, social interaction and a sense of belonging?	 11.5 11.6

Source: Health and Movement Science Stage 6 Syllabus © 2023 NSW Education Standards Authority (NESA).

Outcomes

- investigates movement skills and psychology to improve participation and performance HM-11-04
- Collaboration: demonstrates strategies to positively interact with others to develop an understanding of health and movement concepts HM-11-05
- Analysis: analyses the relationships and implications of health and movement concepts HM-11-06
- Creative thinking: generates new ideas that are meaningful and relevant to health and movement contexts HM-11-08
- Problem-solving: proposes and evaluates solutions to health and movement issues HM-11-09

on Resources

📄 **Digital documents** Topic 11 summary (doc-35913)
Key terms glossary (doc-36179)
Revision quiz (doc-34740)

11.2 The impact of psychology and personal identity on participation and performance in sport

The importance of **psychology** in sports performance has increased over the past few decades. The ability of the mind to generate thought patterns, influence emotions, stimulate or diminish arousal and create vivid images of a desired action is now better understood. This has changed the way that many of us approach our sporting activities.

psychology the study of the human mind and its functions, especially those affecting behaviour in a given context

Research continues to suggest that there is significant potential to improve performance through mental training. Reasons that people perform differently in sporting activities are commonly related to physical factors, including genetics, fitness level and skill. However, performance is also affected by specific psychological influences, such as:
- characteristics of a person's identity
- their sources of motivation
- their ability to self-regulate.

These are becoming increasingly important, as they can significantly affect performance and participation both positively and negatively.

FIGURE 11.1 Psychological and physical factors affect performance in sport.
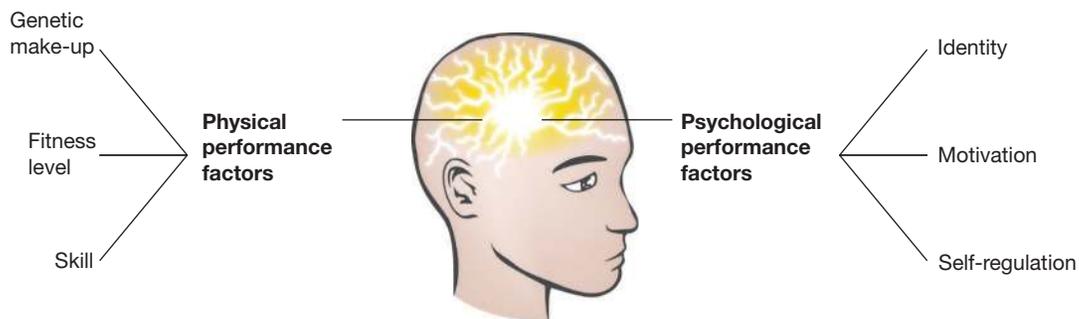
11.2.1 Personal identity and its effect on individual participation and performance in sport

A person's identity plays a vital role in influencing their decisions around sport. The attitudes, values and beliefs a person has will have a significant impact on all decisions they make in life, including those to do with sport. Whether they participate at a recreational or elite level, the personal characteristics they possess will affect which activities they chose to do and how successful they will be in them.

There has been widespread research into the benefits of regularly engaging in sport and the positive impact that it has on physical and psychological wellbeing. However, more recently, researchers have begun to look at why some people chose to engage in sport on a continued basis and others do not. Some people see sport as part of their identity, such as being a runner, skateboarder or dancer. They place a high value on sport because it is a major part of their life and plays an important role in shaping their identity and making them feel whole. There is a clear link between certain characteristics of a person's identity and how they influence both involvement and performance in sport. Some of these include:

- knowledge, values and attitudes towards sport
- influence of family and peers
- personal characteristics.

Knowledge, values and attitudes towards sport

Individuals who are knowledgeable about the benefits of sport will value the contribution it has to their overall health and will be more likely to engage in these activities than those who lack this knowledge. Having knowledge about the various forms of sports available is also an important factor in participation rates. For example, a lack of knowledge of team sports available in a person's area and how to sign up acts a barrier for some people to engage in sport.

FIGURE 11.2 Knowledge of different types of sport available allows individuals to select activities they enjoy.

If an individual has an attitude that they do not have time for sport or that it is not important, it will not be a priority for them. However, if their **sedentary lifestyle** causes them to develop a health complication, their attitude could change and result in participation in sport in order to improve their condition and obtain the many health benefits of being active.

sedentary lifestyle characterised by spending a lot of time sitting and not completing much physical activity

Knowledge, values and attitudes not only influence participation in sport, but also impact the level of performance. Athletes who have the attitude that setbacks and failures are all part of the learning process will value those experiences and learn from them in order to improve. On the other hand, athletes who have the attitude that winning is everything will struggle to see the value in learning and improving from failures and setbacks, and as a result their performance can be negatively affected.

11.2.2 Influence of family and peers

The values and attitudes you have about being physically active are characteristics of your personal identity that are largely shaped during youth. If parents value sport in their own lives and display positive attitudes towards it, they will model these good behaviours for their children to follow. If they regularly encourage their children to be active and provide them with opportunities to engage in sport, then the child will be exposed to the benefits that it can bring to their life and will in turn develop a positive attitude towards it. This results in them being more inclined to live active lives.

FIGURE 11.3 Families have a strong influence on shaping the values and attitudes individuals have about sport.

Young people are also particularly influenced by their peers, especially when they are going through adolescence and establishing their identity. If their peers take part in sports, they may do the same. For instance, a young person from a family less focused on physical activity might not have played sports outside school. But if some friends invite them to join a local basketball team, they would probably join to avoid feeling left out. This could lead them to adopt a more active lifestyle, improving their overall health.

The support of family and peers for elite athletes can also have a strong influence on their performance. If an athlete's family and peers provide ongoing support during their triumphs and failures, they are much more likely to remain committed and driven than if they were unsupported. Elite athletes can train in excess of ten times a week, which can be both physically and mentally draining. Without adequate support from the people around them, their performance can deteriorate. Family and peers have an important role in encouraging them to stay focused, to be there when they face adversities such as injuries or poor results, and to be a source of support and motivation.

FIGURE 11.4 Support from peers during tough times is important for athletes to help them stay focused and motivated.

11.2.3 Personal characteristics

The beliefs an individual has about themselves or their ability and their confidence can have a direct impact on whether they choose to participate in sport, their level of performance and whether they chose to continue to play in the future. There are many characteristics that can influence a person's identity and their involvement and performance in sport. Individuals who are self-confident are more likely to engage in sport and perform well because they:

- view new situations as challenges rather than fears
- are goal centred and commit to achieving what they set out to achieve
- persevere and do not give up even when faced with obstacles
- are resilient and able to bounce back quickly after setbacks.

Individuals who have lower **self-confidence** are less likely to engage in sport because they might:

- avoid new experiences
- doubt their ability
- have low expectations and goals
- give up easily.

Self-confidence is one of the main factors that can influence the performance of an elite athlete. An elite athlete's confidence in their ability can mean they are less likely to be affected by pre-game or pre-race nerves. They are less likely to get 'psyched out' by their opponents and are more able to draw on their training and stay focused in pressured situations.

Self-efficacy is a person's degree of confidence in being able to carry out a particular task. For example, if someone is confident that they will get selected in the representative water polo team if they try out, then their self-efficacy for the task is high. Someone who thinks that they would not even make it past the first selection because their skills are not good enough would have a low self-efficacy for this task.

self-confidence a feeling of trust in one's own ability, qualities and judgement

self-efficacy a person's degree of confidence in being able to carry out a particular task

Self-efficacy determines whether a person attempts to perform a given task, how persistent they are when faced with obstacles within the task, and ultimately how successful they are in performing the task. Most people are hesitant to try behaviours that they do not feel capable of succeeding in or performing well. For example, a person might not join a recreational soccer team because they are worried they are not a good enough player and that they will be the worst player in the team. This results in them not signing up and missing the opportunity, even though it is a recreational team that welcomes players of all ability levels.

Things that can positively influence an individual's self-efficacy include:

- *successful past performances*. For example, a gymnast who masters a front somersault will often have high self-efficacy to attempt a back somersault.
- *observing others*. For example, a skateboarder who watches a peer drop into a bowl in the skate park and stick the landing, and perceived the peer to have a similar skateboarding level to their own, would feel a lot more confident in their own ability to try the move.
- *reinforcement*. For example, a sports teacher who praises a student for their basketball skills and suggests that they try out in the school representative team.

FIGURE 11.5 Characteristics such as self-confidence allow athletes to stay focused even in pressured situations.

FIGURE 11.6 Observing others succeed in a task can have a positive impact on an individual's self-efficacy.
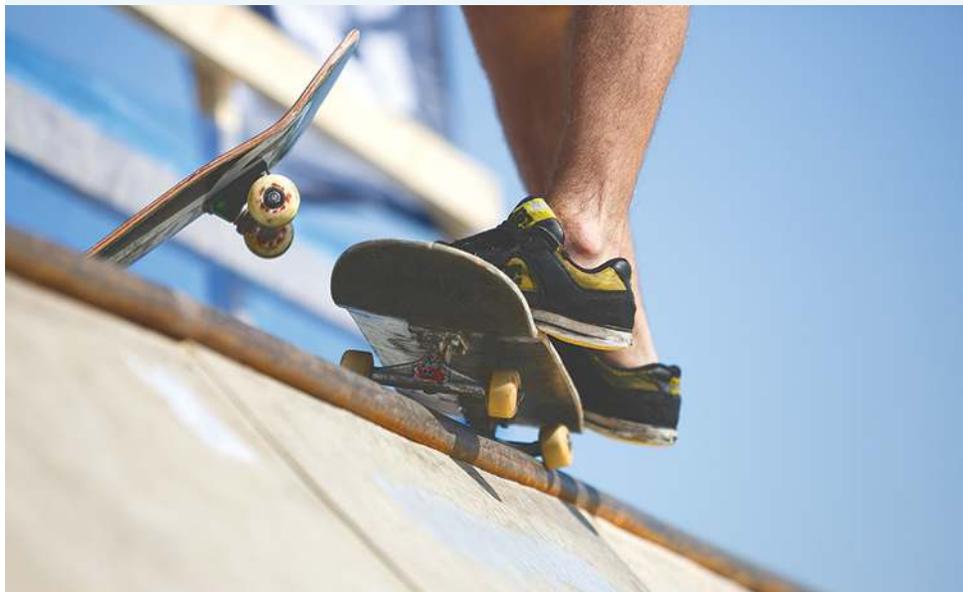
DEPTH STUDY IDEA

Design and conduct a survey of a group (recreational athletes or elite athletes) to attempt to work out the aspects of a person's personal identity that have the biggest influence on their participation and performance in sport.

11.2 Exercises

learn**on**

11.2 Quick quiz **on**	**11.2 Exercise**

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1, 2, 3	4, 5, 6	7, 8

Revise your knowledge

1. Outline a characteristic of a person's identity that has a positive impact on sport performance and one that has a negative impact.
2. Do you value sport in your own life? Why or why not.
3. Describe how your parents or guardians have influenced your attitudes towards sport.
4. Why is a lack of self-confidence often a barrier for people to participate in sport?

Apply your knowledge

5. Explain what self-efficacy is, using an example.
6. Discuss the effect that peers have on an individual's participation and performance in sport.
7. Some athletes value sport so highly that they see it as being part of their identity. What are the positive and negative implications of this?
8. Justify why it is important for elite athletes to have high self-efficacy.

11.3 Motivation to support participation

> ▶ **Syllabus:** Analyse the relationship between psychology, movement and performance for individuals and groups
>
> **Including:**
> - how does motivation support participation, including positive and negative, intrinsic and extrinsic motivation?
>
> ***Source:*** *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

There are four different types of **motivation** that support participation in sport:
- positive motivation
- negative motivation
- intrinsic motivation
- extrinsic motivation.

motivation an internal state that activates, directs and sustains behaviour towards achieving a particular goal

A high level of motivation within an individual is a prized asset because it will have a direct impact on their participation and performance. Understanding the mindset of motivation is difficult because each individual is different and may respond better to internal or external motives. What is accepted is that motivation is not a static phenomenon, but rather a force that can be manipulated to help an athlete achieve their full potential. It is an energy source that has the potential to be harnessed and focused, ultimately influencing attitudes and behaviours and building feelings of self-belief.

FIGURE 11.7 Praise from a coach can increase an athlete's motivation.

Increasing the level of motivation in individuals may be as simple as:

- recognising individual effort
- supporting belief in one's ability
- instilling a good work ethic
- providing positive reinforcement and encouragement.

For example, a coach who praises a player when a correct movement is performed may inspire development of a positive mindset, leading to an increased desire in the player to achieve their performance goals.

11.3.1 Positive motivation

Positive motivation can be internal or external; for example, feeling good about one's performance is internal, and being praised by a coach is external. Sportspeople commonly experience positive motivation, but the degree to which it is experienced varies from one individual to another. It happens when athletes perform well, because they have been rewarded for similar actions before and they understand that continuing to perform as expected will bring them more rewards. For example, a person who has recently started engaging in sport might notice that they are getting fitter, which serves as a positive motivator for them to continue with the training regime.

FIGURE 11.8 Crowd appreciation is a form of positive motivation for players.

Positive motivation relies on continual self-reinforcement and/or reinforcement by others such as a coach, personal trainer, family, friends, spectators and the media. For example, the crowd clapping and cheering when an athlete does something well is an example of external positive motivation. If the coaching situation changes and favourable reinforcement is reduced or not forthcoming, then the athlete's effort will be affected accordingly. To maintain high levels of positive motivation, coaches and trainers must continually strive to find unique ways of reinforcing the desired behaviour in the athlete. This may require techniques such as providing incentives, developing personal progress charts or looking to others for reinforcement. Positive motivation can be further enhanced by recognising achievement, handling mistakes constructively, developing respect for athletes and taking the time to listen when they speak. An athlete feeling proud for being selected in a representative netball team is an example of positive internal motivation.

Positive motivation is more effective than negative motivation such as threats. The simplest way to develop positive motivation is to establish a gradual sequence of achievable challenges for the athlete. Challenges are positive and motivating, whereas threats are negative and destructive in the long term. Further, positive motivation is more sustainable. Some athletes may be responsive to negative motivation on particular occasions, but positive motivation is better on an ongoing basis.

positive motivation occurs when an individual's performance is driven by previous reinforcing behaviours

11.3.2 Negative motivation

Not all motivation is driven by previous gains from performance. In some cases, athletes may be inspired to perform more by a fear of the consequences of not performing than as a result of a motivated behaviour. For example, an athlete may be told that they will be dropped to a lower division if they do not play well in the upcoming game, so they are motivated to play well in order to avoid the negative consequence. This is referred to as **negative motivation** and is characterised by an improvement in performance out of fear of the consequences of not performing to expectations.

FIGURE 11.9 Frightening athletes into performing well is a form of negative motivation.

Threats distract an athlete from their task, because they are confronted with the consequences of failing and, ultimately, fear of being punished. Inspiring an athlete to perform well because they expect to be punished if they fail might work on occasions, but has serious shortfalls. Indecision, lack of creativity and fear of risk taking are some performance-inhibiting behaviours that might surface in high-pressure situations as a result of fear of failure. Negative motivation may cause a player to always opt for the safe play in game situations and not take risks where the the chance of reward is outweighed by the consequence of failure. While some players may respond to negative motivation on an irregular basis, the general long-term effect can be the destruction of confidence, initiative and belief in oneself — the reverse of what motivation is supposed to achieve.

11.3.3 Intrinsic motivation

Intrinsic motivation is motivation that comes from *within* the individual. It is a self-propelling force that encourages athletes to participate and achieve because they have an interest in a task or activity and they enjoy learning and performing the movements. This type of motivation stems from doing things that are their own reward.

FIGURE 11.10 Feeling good about sporting achievement acts as a form of intrinsic motivation.

Intrinsic motivation originates with inner feelings and may serve to drive a need to succeed, accomplish or perform at the best level. It is self-sustaining and self-reinforcing, because effort and personal accomplishment becomes its own reward. An example of intrinsic motivation is a recreational runner who gets up and runs on their own every morning for 10 kilometres but never enters a race or competition. Intrinsic motivation is the preferred type of motivation, because personal reward and self-satisfaction are much stronger driving forces than anything imposed from outside.

negative motivation characterised by an improvement in performance out of fear of the consequences of not performing to expectations

intrinsic motivation motivation that comes from within the individual

Intrinsic motivation generally has a knowledge, achievement or experience foundation. Individuals who are driven predominantly by this form of motivation display high levels of mastery or **task orientation**. In other words, some might be motivated to perform just to know more or to experience something different. Others might be motivated by the need to become competent at the task; for example, to be able to hit the ball further in golf by increasing their technical proficiency. For these athletes, establishing competence is sufficiently challenging and rewarding in itself. They often choose activities that involve a contest, finding enjoyment in rising to the inherent demands of competition.

Studies reveal that most children and adolescents participate further and are rewarded more fully as a result of internal motivation than other factors. The sport or activity provides a continuing source of enjoyment, sufficiently motivating the individual to sustain their effort and interest.

FIGURE 11.11 Children are rewarded more by intrinsic factors when participating in sport than by other factors.

11.3.4 Extrinsic motivation

Extrinsic motivation, also known as external motivation, is motivation that comes from sources outside a person, such as parents, coaches or personal trainers. It tends to have an outcome or **ego orientation**. While intrinsic motivation has a focus on process, such as the development of competence, extrinsic motivation focuses on the product, or what can be gained. Extrinsic motivation is seen in many forms such as praise, material rewards or financial remuneration. Effort and the desire for achievement are related to the expectation of an outside reward or fear of punishment from an outside source.

While rewards or fears may change how hard we work, they do not alter attitudes that underlie our behaviours. In children, quality execution of movement skills, as well as enjoyment and satisfaction, need to be the focus in training and performances. This is why many sports competitions involving young children do not involve matches being scored or finals being held at the end of the season. Attachment to these values of fun and satisfaction ensures that children continue to enjoy sport as they grow older. However, a focus on external rewards such as prizes and monetary incentives, or a fear of retribution if one's performance is not up to standard, can turn the purpose of the activity into an end rather than a means. In the case of elite athletes whose driving force to achieve a good performance stems from intrinsic sources, the use of extrinsic rewards may decrease intrinsic motivation. This is because they may have external pressure placed upon them to achieve a certain result and rather than being able to enjoy the activity their focus may shift to only concentrating on the outcome of their performance.

task orientation focusing on the completion of particular tasks as a measure of success, such as mastering a skill

extrinsic motivation occurs when an individual's internal state is modified by sources originating from outside the person

ego orientation focusing on comparing oneself to others and striving to do better than opponents. The emphasis is on winning rather than skill development.

FIGURE 11.12 Some young athletes are motivated by external rewards such as a trophy.

Additionally, external motivation can be manipulated by those responsible for its making. The use of bribes and coercion to succeed may work temporarily but has little chance of being sustained. External motivation has even less chance of being successful if it challenges the values of the individual, or if their opinion of the reward is that it is not something useful or fulfilling.

While the responsibility for motivation needs to be shared between the athlete and their coaches, parents or peers, sustained motivation relies much more on internal factors than external factors. Athletes who get motivation from satisfaction with quality performances are likely to stay motivated for longer than those who compete in order to gain rewards from external sources. A noticeable characteristic of high achievers is that they seek to match their physical and technical skill against others of similar ability, whereas lower achievers often select competitions in which they know they will be successful.

DEPTH STUDY IDEA

Develop an evidence-based argument in relation to intrinsic motivation being more sustainable than extrinsic motivation in a sport of your choice.

11.3 ACTIVITY

Types of motivation

Form groups of three or four. Copy figure 11.13 onto a large sheet of paper. Each student should write at least two brief motivational statements, such as: 'I will get a certificate of participation if I take part'. Cut each statement out and take turns to place each one on the figure according to where it best fits. Many will fit in an area in between the lines, as they could represent more than one type of motivation. Justify the placement of your statement as you select its position.

FIGURE 11.13 Types of motivation
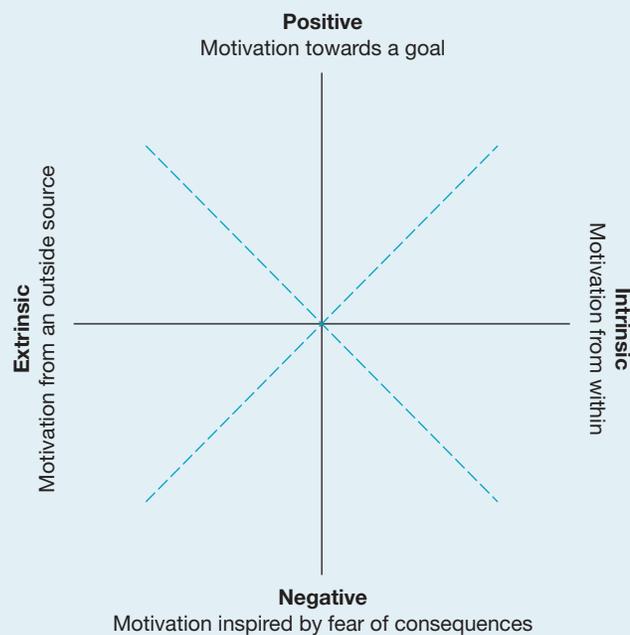
11.3 Exercises

11.3 Quick quiz on	11.3 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 4, 6	3, 5	7, 8

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Revise your knowledge

1. Outline the four different types of motivation.
2. Describe three examples of positive motivation in relation to a sport or event of your choice.
3. Discuss why motivation is important for athletes.
4. Explain why negative motivation is not sustainable.
5. What type of motivation is best for young athletes?

Apply your knowledge

6. Using a table like the one below, choose three sports that are fundamentally different in the type of motivation required to enhance performance. A suggested range of sports includes golf, surfing, boxing, rugby league, tennis and yoga.

   Research a range of performance scenarios that relate to your selected sports and establish the two most appropriate forms of motivation for success in each. Justify your choices. (In the table below, boxing is shown as an example for sport 1 and a relevant type of motivation has been selected and justified.)

	Sport 1: Boxing	Sport 2:	Sport 3:
Form of motivation 1	Intrinsic motivation is important for boxing because the sport is highly competitive and demands superior fitness. The training and performance demands will not be met unless the athlete is inspired by personal belief and commitment.		
Form of motivation 2			

7. Rewards such as the learning of a new skill, or merely being involved in sport with their friends, mean more to young athletes than the extrinsic rewards of receiving trophies or prizes. After thinking about the above statement, reflect on your own sporting history or experiences in relation to one sport or event. Discuss how various forms of motivation have contributed either positively or negatively to your success in that sport or event.
8. Discuss the different types of motivation a netball player would experience prior to and during a game.

11.4 Self-regulation for sports performance and exercise behaviour change

Self-regulation involves individuals consciously constraining unwanted thoughts or behaviours in order to focus on the task at hand and achieve the desired goal or result. Being able to self-regulate contributes positively to performance and behaviour in all aspects of one's life, including sport and exercise.

Regardless of the level of athlete, or the sport in which they compete, all athletes can benefit from self-regulation. For example, a physically active person may need to fight the urge to press the snooze button in the morning when their alarm goes off to work out. They might need to suppress thoughts running through their head that are telling them to sleep in, and instead replace them with **positive self-talk** such as 'get up and work out, you will feel much better afterwards'.

A recreational snowboarder attempting a black run for the first time may need to use self-regulation in order to reduce their feelings of **anxiety** and fear, and replace them with thoughts that they are capable and ready to progress to the black run because they have the skills to take on the challenge.

An elite tennis player may need to draw upon self-regulation during a match when umpire decisions are not going their way, in order to avoid feelings of anger and aggression. They would need to redirect the energy to their goals and remain calm and focused on the task at hand, rather than lash out at the umpire or opposition.

Individuals who can work on goal-directed behaviours in the relative absence of external constraints will be more likely to perform better in sport and adhere to exercise regimes.

FIGURE 11.14 Self-regulation in athletes is essential in order to ensure goal-directed actions are carried out.

11.4.1 Self-regulation and sports performance

Athletes' psychological states are crucial for performance and have a strong influence on the outcome of competitions. Research in sports psychology supports the benefits of self-regulation in athletes, as those who use it effectively are often able to maintain their efforts in their chosen sport or event for longer periods of time. Sports environments frequently give rise to intense emotions and can test a person's ability to regulate behaviour, so the need for self-regulation is a vital aspect of participation and performance in all sports. Failing to self-regulate appropriately may result in poor decisions, emotional outbursts and a reduction in performance.

self-regulation the act of managing thoughts and feelings to enable goal-directed actions

positive self-talk saying positive things about yourself in your mind and having an optimistic voice in your head

anxiety predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening

Elite athletes have a better awareness of their strengths and weaknesses and are able to translate this understanding into appropriate actions that benefit their performance. Their better-developed self-regulatory skills mean they establish a more effective learning environment, which ultimately results in an increased capacity to improve, perform and reflect on their practices. For example, they are better able to manipulate playing situations to suit their strengths and avoid their weaknesses. They can control their thoughts and feelings and direct their energy towards achieving their goals and not allowing obstacles to divert their attention from those goals. They are also able to reflect on their performance and execution of skills without allowing unwanted thoughts and feelings to cloud their judgement. For example, instead of focusing on failure, they reflect on why they might not have performed at their best. They then come up with strategies to address those areas for future performances.

FIGURE 11.15 Failing to self-regulate can result in emotional outbursts.

Although repeated self-regulation experiences increase an athlete's ability to self-regulate, self-regulation is vulnerable to deterioration over time after repeated exertions, much like physical fatigue. It is often conceptualised as a limited resource and its exhaustion is known as *ego depletion*. Ego depletion refers to the idea that self-regulation draws upon mental resources that are limited and can be depleted when they are used a lot, resulting in temporary low levels of self-regulation. For example, an elite basketball player may be anxious before the game and have to use mental resources to manage the unwanted thoughts and feelings they are experiencing. Throughout the game, an opposition player keeps pushing them in the back and they again need to self-regulate in order to suppress feelings and actions to retaliate. As the game progresses, the opposition begins to establish a convincing lead and the pressure to win places further demand on the mental resources to think positively and focus on the process rather than the outcome. Finally, a poorly executed pass causes a breakdown in the ability to control their behaviour and feelings. Frustration gets the better of them, and they begin to foul the other players and talk back to the referee because they are experiencing ego depletion. This leads to an inability to self-regulate their behaviour to align with their goals and normal playing standards. A number of other factors can also have a negative impact on an athlete's ability to self-regulate, including:

- sleep deprivation
- intense training
- travel
- illness and injury
- pressure.

11.4.2 Self-regulation and exercise behaviour change

People choose to engage in exercise for a variety of different reasons, such as athletic performance, health benefits, weight loss or improved body image. Statistics show that the rates of people participating in regular exercise continue to fall for children and adults across Australia, and as a population we are not meeting the recommended guidelines. These guidelines state a requirement of 30–60 minutes of daily exercise (depending on your age), which should include a mix of cardiovascular and strength exercises.

People who do not engage in regular exercise often highlight common barriers such as:

- lack of time
- lack of energy
- the exercise program is too hard
- too expensive
- lack of willpower
- lack of self-efficacy
- lack of access to facilities and services.

People who chose to avoid exercise often do so because they feel bad during the workout and even though they feel better afterwards, those feelings of fatigue and discomfort deter them from attempting the workout again.

FIGURE 11.16 Many factors can affect an athlete's ability to self-regulate, perform and exercise.

Factors affecting self-regulation and performance

- Amount of sleep
- Training schedule
- Travel to and from sport activities
- Illness or injury
- Pressure

Factors affecting self-regulation and behaviour

- Time
- Energy levels
- Intensity of exercise program
- Cost of exercise program
- Levels of willpower
- Levels of self-efficacy
- Access to facilities and services

Engaging in and sticking to exercise provides a good example of a behaviour that requires people to exert self-regulation. In contrast, not self-regulating effectively results in lapses in adherence, resistance, using a barrier as an excuse and ultimately a reduction in physical activity.

Self-regulation in relation to exercise behaviour change often requires a person to adopt and maintain healthy lifestyle changes. These require them to solve problems, engage in goal-directed behaviour, show self-control and limit habitual, sometimes unhealthy, behaviours. For example, exercise behaviour change may involve a person having to override a well-established, desired behaviour such as sitting on the couch watching television and relaxing with a less common, less desirable behaviour such as going to the gym and working out. Self-regulation is essential here, as the thoughts and feelings of the individual will often lean towards engaging in the more desired and familiar task. They will need to use self-regulation techniques to constrain those thoughts in order to focus on the goal.

Many people change their inactive behaviours and start physical activity because of a threat of a health issue such as pre-diabetes, heart issues or obesity.

To successfully maintain physical activity and exercise, individuals may require support from peers or trainers, alongside high self-efficacy and positive self-regulating behaviours. When starting exercise, people can face barriers such as feeling unfit or fatigued. Having positive self-efficacy and self-regulation means acknowledging these feelings without giving up, and recognising with positivity that the journey has just begun. The focus may be on completing the workout at their own pace, rather than being the best or the fastest, thereby improving their self-efficacy because they can achieve clear results.

As with an elite athlete's self-regulation, those incorporating exercise behaviours into their lifestyles can also experience ego depletion when faced with multiple self-regulation situations. For example, people are less likely to engage with exercise programs if they have had a stressful day or have had to use a lot of self-regulation throughout their job. They lack the ability to constrain the thoughts and feelings that might be challenging their fitness goals and find it easier to give into them. This is why self-regulation is essential, as the more experience a person has using it, the easier it becomes. Eventually the exercise behaviour will become a habit, with the action occurring almost automatically, requiring less decision-making and thus increasing the chances of achieving exercise goals.

FIGURE 11.17 Exercise behaviour change requires a person to override a common behaviour such as sitting on the couch to perform the less common behaviour of physical activity.

FIGURE 11.18 Planning, such as goal setting, is an effective strategy that can be utilised to increase self-regulation.

DEPTH STUDY IDEA

Research and apply strategies to enhance self-regulation in a sport of your choice.

11.4 ACTIVITY

Let's get physical

1. Working individually, set yourself one additional exercise challenge to do every day for a week.
   Suggested exercises could include 100 squats, 3-km jog, 10 000 steps or 100 push-ups.
2. Each time you do the exercise, record how long it took you to complete the challenge and how you felt before and after.
3. At the conclusion of the activity, write a 500-word summary of how self-regulation impacted your performance in the challenge.

11.4 Exercises

11.4 Quick quiz **on**	11.4 Exercise

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4	5, 7, 8	6, 9

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Revise your knowledge

1. Define self-regulation and give one sport and one exercise example.
2. Describe ego depletion.
3. What are three factors that can result in a deterioration in a person's ability to self-regulate?
4. What are three factors that can improve a person's ability to self-regulate?
5. Why would intense training cause a reduction in an athlete's ability to self-regulate?

Apply your knowledge

6. Research an athlete who self-regulates well and one who has difficulties in self-regulating. Discuss what impact this has on their sports performance and profile.
7. Explain how failing to self-regulate adequately could result in someone not sticking to a new exercise regime.
8. Compare and contrast ego depletion and physical fatigue.
9. Provide an analysis of a situation when you have had to use self-regulation in sport in your own life. Which aspects did you do well and which aspects do you feel you could have improved on?

11.5 Contemporary forms of exercise

> ▶ **Syllabus:** Investigate how communities of exercise motivate individuals and groups to participate in and improve performance
>
> **Including:**
> - what are contemporary forms of exercise?
>
> ***Source:*** *Health and Movement Science Stage 6 Syllabus* © 2023 NSW Education Standards Authority (NESA).

The word *contemporary* refers to something that is current or modern, and relevant to us and the kind of lifestyles that we have in the present day. When we think about contemporary exercise, we are referring to exercise that is more personal and reflects the different interests and lives of individuals. This includes a broader range of activities that focus on fun, challenge and social aspects such as **bouldering** or parkrun.

Contemporary forms of exercise are growing quickly in popularity and have a lot of people taking part in them in Australia and around the world. The challenge for the individual is to find a type of exercise that meets their fitness needs and that they enjoy; however, it is not always an easy choice to make. Having knowledge of the range and variety of fitness activities available helps individuals make a more informed choice. The following questions can help a person to make better choices about what to participate in.

1. What type of exercise will help me achieve my fitness/health goals?
2. Do I prefer exercising alone, or in a group?
3. How much time do I have to exercise?
4. How much money do I have available to put towards exercising?
5. Do I want to exercise at home or in another environment?
6. What exercise facilities are available in my area?

> **bouldering** a form of rock climbing that is often performed on artificial rock walls without the use of a rope or harness

In the past, jogging, swimming, cycling, aerobics and weightlifting were common activities for people to do to improve their fitness. Today, many more exercise options are available for individuals and groups that can suit everyone's needs. An increased awareness of health has led to the revival of some fitness and recreational activities and the emergence of other new forms of exercise. There are many different types of contemporary forms of exercise and these will continue to evolve and change as new activities are developed and become popular. Some examples of contemporary forms of exercise that are currently popular include:

FIGURE 11.19 Bouldering is a contemporary form of exercise that is fun and challenging.

- incorporating wearable fitness technology
- HIIT and SIT training
- CrossFit
- outdoor fitness groups
- stand-up paddle boarding.

11.5.1 Wearable fitness technology and training apps

Wearable fitness technology such as smart watches, step counters, GPS trackers, heart rate monitors and phone apps is becoming increasingly popular. These technologies can be included in many contemporary forms of exercises such as HIIT and SIT workouts, providing a sophisticated exercise tracker with the ability to instantly process data and have it available for analysis by the wearer or coach/trainer. As a result of this technology, individuals do not need to stop and manually check their pulse to determine what heart rate zone they are working in, or run a pre-measured course in order to know how far and fast they are running.

FIGURE 11.20 Wearable fitness technology has the ability to instantly process the data of a workout and have it available for the wearer.

Apps such as Strava have put a contemporary spin on a traditional form of exercise like running. Runners can now track their exact routes and performance, connect with other runners and share their workouts with friends and family with a simple upload, as well as compete with themselves or other athletes around the world without actually having to be physically together. These devices help people to program step goals or workouts and set both **short**-and **long-term goals**. The technology provides prompts in relation to progress and also targets behaviour modification; for example, alerting the wearer when they have been sedentary for too long.

short-term goal goals that can be achieved over a short-term period

long-term goal goals that can be achieved over a long-term period

11.5.2 HIIT and SIT

Two highly popular fitness activities trending during the 2020s are **high-intensity interval training (HIIT)**, and **sprint interval training (SIT)**, which are contemporary training types that are physically demanding, yet time-efficient and highly adaptable to many environments. These were also discussed in topic 9 when learning about contemporary methods of aerobic and anaerobic training. HIIT is a form of training in which repeated periods of intense anaerobic work are alternated with brief periods of recovery. These sessions often involve a person completing an exercise at high intensity (usually approximately 80–90 per cent MHR) then having a short rest break for approximately 10–15 seconds before repeating or moving on to the next exercise. An example might involve doing 30 seconds of burpees, resting for 15 seconds then doing 30 seconds of mountain climbers, resting for 15 seconds and continuing on with multiple other stations. With the inclusion of well-thought-out activities, it makes exercise fun and provides the variety that people often crave.

high-intensity interval training (HITT) a form of training that involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

sprint interval training (SIT) a form of high-intensity training characterised by repeated, brief, intermittent bursts of supramaximal-intensity exercise, interspersed with periods of active or passive recovery

SIT training is similar to HIIT, but there are differences in the work-to-rest timings as well as the intensity of work. In SIT training, the person is working at their maximum intensity for a short period of time; for example, sprinting as fast as they can (100 per cent MHR) for 20 seconds. The recovery breaks are longer for SIT than they are for HITT; for example, walking for 2 minutes following the 20-second max effort sprint. This would then be repeated approximately 10 times before the session concludes.

There are multiple reasons why HIIT and SIT styles of training have become so popular, including:

- HIIT and SIT can be adapted for different sports and fitness levels
- this type of training can be followed as an online 'at home' workout session, requiring minimal equipment and space
- the health benefits of HITT and SIT, such as improved cardiovascular health, stabilised blood glucose and sugar levels, and reduction of visceral fat, are well-documented
- HIIT and SIT are time-efficient methods of exercise as they are high intensity (30 minutes of HIIT can be equivalent to 60 minutes of jogging).

FIGURE 11.21 HIIT and SIT are fitness sessions in which participants work intensely for short bursts interspersed with recovery periods.

11.5 PRACTICAL ACTIVITY

As a class, research and design your own 20–30-minute HIIT-style workout to take part in as a practical activity. Think about the different exercises you can include based on the facilities you have available, and ensure that it caters to all participants. Complete the workout and discuss the following questions.

1. Was the workout enjoyable? Why or why not?
2. Rate the difficulty of the workout as a whole—was it easy, moderate or hard?
3. What was the hardest exercise?
4. Would you do a workout like this in the future? Why or why not?
5. What would you do to make the workout better in the future?

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on Resources

 Weblink Benefits of high-intensity interval training

11.5.3 CrossFit

CrossFit is another form of contemporary exercise that has many people taking part both in Australia and worldwide. It involves varied **functional movements** completed at high intensity. These movements are drawn from sports such as gymnastics, Olympic weightlifting, running and rowing, and they are put together to form what is known as a WOD (workout of the day). Many of the exercises selected for the WODs combine multiple skills such as agility, strength, endurance, power, speed and flexibility. The workouts are modified for each individual in order to help them to achieve their goals, as the exercises are adaptable to suit a person's level of fitness. For example, someone who has trained for years might be able to do a clean and jerk weightlifting movement efficiently or repeated box jumps, whereas someone who has just started out would use much lighter weights when doing a clean and jerk and, rather than doing the movement in one motion, they might break it down and do a clean, pause, and then an overhead push press. Rather than box jumps at the full height, they may step up instead of jumping and use a smaller box.

FIGURE 11.22 CrossFit is a popular style of training both in Australia and worldwide.

on Resources

🔗 **Weblink** CrossFit

11.5.4 Outdoor fitness training

Many people are choosing to move away from exercising in gyms and indoor facilities and instead be outdoors in the fresh air and among nature. Many councils have installed permanent outdoor exercise equipment in areas surrounding ovals, parks and beaches so that members of the community can exercise outdoors using this equipment for free.

Outdoor bootcamp training is another popular type of outdoor fitness training. It involves group fitness training conducted by a personal trainer, often with a military-inspired approach, that is designed to develop both strength and cardiorespiratory endurance in its participants. Classes usually run for one hour and involve the group taking part in exercises incorporating **calisthenic movements** such as push-ups, squats and crunches as well as using equipment such as sandbags for weights, mixed with intervals of running, crawling or sprinting. They are appealing forms of exercise for many individuals because they offer challenging workouts that provide a lot of variety in an outdoor setting.

FIGURE 11.23 Outdoor bootcamp is inspired by military-style workouts and is popular among people that like to train in the outdoors.

functional movement exercise that trains and prepares muscles to be able to carry out daily tasks that may be required at home, at work or in sport

calisthenic movement movement that exercises large muscle groups, often using your own bodyweight

11.5.5 Stand-up paddle boarding

Stand-up paddle boarding (SUP) originated in Hawaii and is the fastest-growing board sport in the world; in some places it is the most popular water sport. Given Australia is surrounded by beautiful beaches and waterways, it is not surprising that it is also very popular throughout Australia. SUPing involves a person standing on a large board and using a paddle to move through the water. More experienced riders will also catch waves. The reason for its popularity is that it is a lot easier to learn than more traditional water sports such as surfing and wind-surfing. It can also be done at beaches, lagoons, lakes and rivers because you do not need waves or wind to be able to enjoy this sport. Participants need to maintain their balance on the board while paddling, so they must engage their core muscles and therefore they get a great core workout while completing the activity. Using the paddle to move also strengthens the arms and back. Although some people choose to SUP competitively and race others, the majority of participants take part for recreational and exercise purposes. Another benefit is that it is a **low-impact activity** so people who have had injuries, such as knee or hip issues, can still take part in this activity without further injuring themselves.

FIGURE 11.24 Stand-up paddle boarding is the fastest growing board sport in the world.
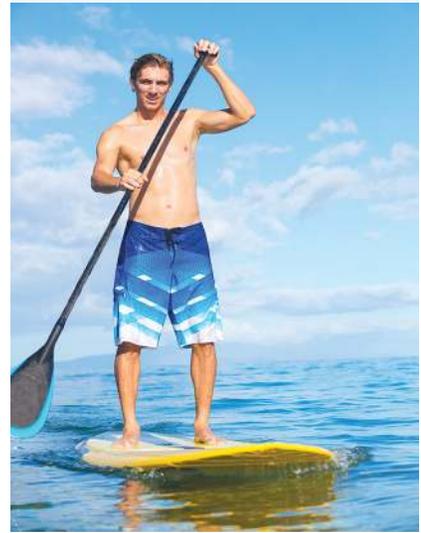
low-impact activity movements or exercises that do not involve a significant amount of force being exerted on the joints

CASE STUDY

parkrun

parkrun is a free, community-established event that is run all around the world with more than five million participants. Every Saturday morning, participants come together to run, jog or walk 5 kilometres along a marked-out course. Volunteers and spectators encourage and motivate the individuals who are taking part. parkrun began in Australia in 2011, and in 2024 there were 484 different venues throughout the country. Registration is free — participants sign up online and receive a personal barcode for the event. They take that to their local event each week and at the end of the 5 kilometres volunteers scan the barcode, which allows them to track their individual time and results or compare their results to other participants arround the world. There are no prizes or time limits set, so all people, regardless of age, gender or fitness level, can take part and try to improve their health and fitness either as a group or individually. This often results in both elite and recreational athletes competing together at the same event but with different goals. The main goal is to try your best, and some set out to beat their personal best time each week. Another reason parkrun has become so popular is that people can go to any event they like and they don't need to pre-register, they can just turn up and participate. Many people enjoy trying different venues each week to experience variety in courses. Others also enjoy that they can still attend parkrun events even when on holiday around Australia or in other countries around the world.

FIGURE 11.25 parkrun is a community event that involves a 5-km run, jog or walk every Saturday morning in various communities throughout Australia.

Case study questions

1. Using the internet, research where your nearest parkrun venue is.
2. In what locations do the majority of parkrun events take place: metropolitan or rural and remote areas? Why do you think this is the case?
3. Discuss why you think parkrun has become so popular in Australia.

DEPTH STUDY IDEA

Take part in practical activities and document your experiences to investigate contemporary forms of exercise.

11.5 Exercises

learn**on**

| **11.5 Quick quiz** **on** | **11.5 Exercise** |

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
1, 2, 3, 4	7, 8	5, 6

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Revise your knowledge

1. Answer the following questions in relation to your own exercise needs.
   a. What type of exercise are you most interested in?
   b. Do you prefer exercising alone, or in a group?
   c. How much time do you have to exercise?
   d. How much money do you have available to put towards exercising?
   e. Do you like exercising at home or in another environment?
2. Why do you think wearable fitness technology has become so popular?
3. Describe what CrossFit training involves.
4. How does stand-up paddle boarding improve fitness?

Apply your knowledge

5. Research contemporary forms of exercise in your local area and complete a table similar to the one below.

Name	Description of the type of training	Types of exercises performed in the session	Positive and negative aspects of this type of training

6. Research a sport that now has a newer, contemporary version of the traditional game, such as Rugby 7s as a variant of Rugby Union, or Twenty20 cricket as opposed to traditional test cricket matches. How is the contemporary form of the game different to the traditional game and what elements of the contemporary game make it more appealing to players and spectators in today's society?
7. Explain how the types of exercise that people engage in have changed over time.
8. Discuss the benefits of exercising in a group as opposed to on your own.

11.6 Contemporary forms of exercise and group dynamics, group cohesion, social interaction and a sense of belonging

This lesson will explore how contemporary forms of exercise encourage a sense of belonging for the participants due to the group elements promoted throughout the workouts.

A common theme of contemporary forms of exercise is the sense of community they establish. Regardless of the participant's age, gender, culture or socioeconomic status, people are uniting for a common goal — to improve their fitness and wellbeing. Statistics show that those who choose to exercise in a group will continue to do so for longer than individuals who exercise alone.

FIGURE 11.26 Contemporary forms of fitness bring people together and establish a sense of community amongst the participants.

Many contemporary forms of exercise have been designed to make sure:

- they meet the needs of various group dynamics
- **group cohesion** is fostered and enhanced during the sessions
- individuals are able to form relationships with other participants and improve their social health
- participants feel a sense of belonging.

This is achieved through:

- modified exercises in workouts
- increased commitment and **accountability**
- increased competitiveness
- increased motivation
- further opportunities for social interactions.

11.6.1 Modified exercises in workouts

One reason contemporary forms of exercise have become so popular is that each exercise in a workout can be modified to ensure various **group dynamics** are catered for. It doesn't matter if a person is just starting out or is a conditioned athlete, these workouts are designed in such a way that all participants can get the most out of the session. For example, during HIIT sessions, exercises are often scaled with three different levels of difficulty. Beginners doing push-ups will be given the option of trying them on their knees and not having to complete the full depth of the movement; intermediate participants will do the push-ups on their knees but with the full range of movement; and the advanced level will do them on their toes with the full depth of movement. By incorporating these modified exercises, people of all levels are encouraged to participate because they feel it is within their capabilities and feel a sense of belonging.

FIGURE 11.27 Modifications are provided in group fitness classes to ensure all members of the group can work at a level that suits their needs.

11.6.2 Increased commitment and accountability

The group mentality of getting fitter and healthier together is encouraged through contemporary forms of exercise and, as a result, participants are more committed because they are held accountable not only by the trainer or coach but by their peers in the class or activity. For example, during CrossFit participants might be paired or grouped with others of a similar fitness level. They often establish a rapport with each other and train together regularly, which increases group cohesion. As a result, their commitment to fitness, the class and each other increases, making them more accountable in achieving their fitness and health goals.

The sense of community that is established in these groups helps people feel like they belong. The improved cohesiveness of the group keeps people coming back because they do not want to let their workout buddies down. Workouts done alone, without the group environment, often mean the individual will not have someone holding them accountable. This can result in people skipping their workout and ultimately lacking the commitment needed to achieve their fitness goals.

11.6.3 Increased competitiveness

Exercise done in group settings results in **positive competitiveness**. For example, wanting to keep up with the people around you can make you push harder than you normally would on your own. This is another example of group dynamics being beneficial in contemporary forms of exercise. Having people in the class who are fitter or stronger can inspire individuals to achieve more, and perhaps break down mental barriers that might be preventing them from reaching their full potential. Studies have shown that, when paired with someone you perceive as being fitter than yourself, you give more effort than you would if you were doing the activity alone. Other studies reveal that, even when paired with someone who is below your ability, you still work harder than you would alone because you are trying to lead by example.

positive competitiveness when individuals compete to improve their own and others' performance in a group setting

Often contemporary forms of exercise have ways for the participant to track their performance and goals throughout each exercise or class. For example, training apps such as Strava allow runners to track and monitor their progress in each run and compare their performance to previous runs, as well as to that of other runners who have completed the same course. Participants might strive to outperform their own previous scores or fellow classmates through the amount of repetitions they are doing, the speed in which they are completing the distance or workout, the weight they are lifting, the heart rate they are achieving or the number of sessions they are attending. Friendly rivalry can enhance group cohesion as participants in the class often encourage each other to work harder and to improve. This often leads to better individual and team results, increased adherence to the program and a more enjoyable experience.

FIGURE 11.28 Contemporary forms of exercise encourage positive competitiveness.

11.6.4 Increased motivation

Being part of these contemporary exercise communities can provide benefits to participants' lives beyond the physical benefits of the workout. These environments are filled with encouragement, positive feelings and support from the coaches and trainers, as well as the other individuals taking part in the session. Positive reinforcement from external sources, such as cheers, high fives, pats on the back and recognition for putting in the effort, create a positive attitude and environment for the whole class. For example, people who attend CrossFit commonly refer to the group cohesiveness and positive community as the best thing about the sessions. The camaraderie, support and encouragement given throughout the workouts allow people to achieve a sense of belonging, and they are motivated to return because of it.

FIGURE 11.29 Positive vibes and encouragement during group workouts help boost motivation.

These environments also improve social interaction between the participants so they feel connected and supported. This is a motivating factor for many, as they may be attending these sessions to try to meet new people and make new friends. Going for a run on your own does not allow many opportunities to meet new people and form social connections. However, going to your local parkrun every Saturday morning gives you a chance to form relationships with the other people who are attending and provides motivation to attend because you are looking forward to the social connection and sense of belonging that accompanies the physical workout.

11.6.5 Further opportunities for social interaction

Contemporary forms of exercise are popular because not only do they provide a space for individuals to interact, connect and feel like they belong during the workout, but most provide opportunities for group members to socialise and connect outside the workout environment. This might be achieved in person, or through social media groups where coaches and members post training schedules, questions, healthy recipes, advice or support for others. By doing this, participants feel supported and connected and a sense of community is established outside the workout space.

Participants in many of these contemporary forms of exercise also hold social outings following the workout. For example, all parkrun venues hold coffee catch-ups immediately after the event at a nominated café, where participants can meet and connect with fellow participants who share a common interest.

Outdoor fitness groups often sign up to group challenges such as obstacle races so that they have a goal to work towards and an opportunity to test their fitness. Many individuals would not normally participate, but because they are doing it in a group, and they know they will have the support of their teammates, they feel able to commit to the challenge. Others might want to experience the social opportunity the event will provide, which further motivates them to take part as the environment enhances the feeling of belonging for all participants.

FIGURE 11.30 People engaging in contemporary forms of exercise often catch up after their workouts, which provides them with more opportunities to be social and feel a sense of belonging.

DEPTH STUDY IDEA

Design and conduct an experiment to test whether exercising with a virtual group achieves similar performance outcomes and feelings of belonging as exercising with an in-person group.

11.6 Exercises

learnon

11.6 Quick quiz on	**11.6 Exercise**

Select your pathway

■ LEVEL 1	■ LEVEL 2	■ LEVEL 3
3, 4, 5	1, 2, 7, 8	6, 9

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Revise your knowledge

1. How do contemporary forms of exercise meet the needs of participants who are at various fitness levels?
2. Explain how group fitness enhances commitment and accountability.
3. What things motivate you most to participate in exercise?
4. Outline what positive competitiveness is and give an example of how it can improve performance.
5. Define group cohesion.

Apply your knowledge

6. 'Community builds the self-esteem that fuels fitness dedication.'
   Analyse what the above quote means, in your own words.
7. Select a contemporary form of exercise and explain how it enhances group cohesion.
8. Discuss the benefits of fitness groups socialising outside of their workout environments.
9. Explain how group cohesion improves performance.

11.7 Sample exam question response

Question

Analyse how motivation increases an individual's participation in sports. **(6 marks)**

Criteria	Marks
• Draws out and relates the implications of motivation and participation in sport • Makes evident the link between motivation and increased participation in sport • Provides relevant and specific examples	6
• Provides the characteristics and features of motivation and participation in sport • Provides characteristics and features of the link between motivation and increased participation in sport • Provides relevant examples	4–5
• Makes clear that motivation increases participation in sport • Provides examples	2–3
• Provides relevant information about motivation or increased participation in sport	1

Sample response

eles-5022

Breaking down the question

Analyse how motivation increases an individual's participation in sport.

Identify the action word/s: Analyse — identify components and the relationship between them; draw out and relate implications

Syllabus terminology: motivation (positive and negative, intrinsic and extrinsic)

Mark allocation: 6 marks — according to HSC past papers, questions worth 6 marks require answers that include multiple body paragraphs, each addressing the action word and providing clear examples.

Answering question using PEEL structure

P Identify the **Point** being raised/state topic sentence/what this paragraph is going to be about[1]

E **Expand**/**Elaborate** on the point and provide a strong link to what the question is asking[2]

E Apply **Examples**/that are relevant and specific[3]

L **Linking** sentence that relates back to the question[4]

Sample annotated response

There are four types of motivation: positive, negative, intrinsic and extrinsic. These can all increase an individual's participation in sport. Both positive and negative motivation can be intrinsically or extrinsically driven.[1]

Positive motivation is when an individual's performance is driven by positive outcomes that could result from success,[2] such as the drive to achieve a personal best.[3] It increases an individual's participation in sport because they want to receive the positive reinforcement that the activity can bring;[4] for example, training regularly in basketball to be selected in the representative team.[3]

Negative motivation is when a person is compelled to do something in order to avoid a negative outcome.[2] It can also increase an individual's participation in sport because they fear the negative outcome;[4] for example, needing to play well in a basketball game to avoid being dropped to a lower division team.[3]

Intrinsic motivation comes from within the individual[2] and can increase participation in sport because it is a self-propelling force;[4] for example, an individual runs every morning to achieve their personal goal of wanting to be able to run 5 km without stopping.[3]

Extrinsic motivation comes from an external source outside of the individual[2] such as a coach.[3] This is an effective type of motivation that can increase an individual's participation in sport;[4] for example, a coach praises an athlete at half-time for their performance, which motivates them to continue to play well in the second half.[3]

It is evident that there is a clear link between all four types of motivation and increased participation in sport.[4]

11.8 Review

11.8.1 Topic summary

11.2 The impact of psychology and personal identity on participation and performance in sport

- Psychological influences such as a person's identity, their sources of motivation and their ability to self-regulate can significantly enhance or inhibit performance in sport.
- Knowledge, values and attitudes, the influence of family and peers and personal characteristics are all factors of a person's identity that have a direct impact on their participation and performance in sport.
- Self-efficacy and self-confidence are two personal characteristics that have a strong influence on an individual's behaviours, particularly in relation to their engagement in sports.

11.3 Motivation to support participation

- Motivation is a state that activates, directs and sustains behaviour towards achieving a particular goal.
- Motivation can be positive or negative. Positive motivation is good because it reinforces actions and behaviours that are correct, or that the player will benefit from if repeated. In contrast, negative motivation inspires the athlete out of fear of the consequences of not performing well, and subsequently is not sustainable.
- Motivation comes from inside (intrinsic), and is also influenced by outside (external or extrinsic) sources. Both forms are valuable, but intrinsic motivation is more sustainable.

11.4 Self-regulation for sports performance and exercise behaviour change

- Self-regulation is the act of managing thoughts and feelings to enable goal-directed actions, and is essential for sports performance and exercise behaviour change.
- Individuals who can effectively self-regulate can sustain efforts in exercise, training and competition for long periods of time.
- Failing to self-regulate often results in emotional outbreaks, poor decisions or a reduction in performance.

11.5 Contemporary forms of exercise

- There are many contemporary forms of exercise that allow people variety and choice when it comes to finding fitness activities that suit their needs.
- Wearable fitness technology, HIIT, SIT, CrossFit, outdoor fitness groups and stand-up paddle boarding are some examples of contemporary forms of exercise that many people engage in.
- Contemporary forms of exercise establish a sense of community among participants, which makes the experience more enjoyable.

11.6 Contemporary forms of exercise and group dynamics, group cohesion, social interaction and a sense of belonging

- Contemporary forms of fitness enhance group dynamics by modifying workouts to appeal to all fitness levels and abilities.
- Group cohesion and a sense of belonging are established throughout contemporary forms of exercise through enhanced commitment, accountability and motivation of participants in a group setting.

on Resources

📄 **Digital document** Topic 11 summary (doc-35913)

11.8.2 Key terms

accountability an obligation or willingness to accept responsibility for one's actions

anxiety predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening

bouldering a form of rock climbing that is often performed on artificial rock walls without the use of a rope or harness

calisthenic movement movement that exercises large muscle groups, often using your own bodyweight

ego orientation focusing on comparing oneself to others and striving to do better than opponents. The emphasis is on winning rather than skill development.

extrinsic motivation occurs when an individual's internal state is modified by sources originating from outside the person

functional movement exercise that trains and prepares muscles to be able to carry out daily tasks that may be required at home, at work or in sport

group cohesion strength of bonds between group members

group dynamics behaviours and processes occurring within groups

high-intensity interval training (HITT) a form of training that involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

intrinsic motivation motivation that comes from within the individual

long-term goal goals that can be achieved over a long-term period

low-impact activity movements or exercises that do not involve a significant amount of force being exerted on the joints

motivation an internal state that activates, directs and sustains behaviour towards achieving a particular goal

negative motivation characterised by an improvement in performance out of fear of the consequences of not performing to expectations

positive competitiveness when individuals compete to improve their own and others' performance in a group setting

positive motivation occurs when an individual's performance is driven by previous reinforcing behaviours

positive self-talk saying positive things about yourself in your mind and having an optimistic voice in your head

psychology the study of the human mind and its functions, especially those affecting behaviour in a given context

sedentary lifestyle characterised by spending a lot of time sitting and not completing much physical activity

self-confidence a feeling of trust in one's own ability, qualities and judgement

self-efficacy a person's degree of confidence in being able to carry out a particular task

self-regulation the act of managing thoughts and feelings to enable goal-directed actions

short-term goal goals that can be achieved over a short-term period

sprint interval training (SIT) a form of high-intensity training characterised by repeated, brief, intermittent bursts of supramaximal-intensity exercise, interspersed with periods of active or passive recovery

task orientation focusing on the completion of particular tasks as a measure of success, such as mastering a skill

on Resources

Digital documents Key terms glossary (doc-36179)
Revision quiz (doc-34740)

Interactivity Missing word interactive quiz (int-8048)

11.8 Exercises

11.8 Exam questions

▶ Question 1 (1 mark)

An athlete has been told by their coach that they need to train more, because if they do not get faster they will not qualify for the Regional Cross-Country Championships. What form of motivation is this? (HM-11-04)

A. Intrinsic and positive

B. Intrinsic and negative

C. Extrinsic and positive

D. Extrinsic and negative

▶ Question 2 (1 mark)

Which of the following best describes self-regulation? (HM-11-04)

A. The act of managing thoughts and feelings to enable goal-directed actions

B. Our opinions and beliefs about ourselves

C. External factors that impact our performance

D. Our ability to succeed at something we set out to achieve

▶ Question 3 (1 mark)

Which of the following psychological factors have the biggest influence on an athlete's performance in sport? (HM-11-04)

A. Positive, negative, intrinsic and extrinsic motivation

B. Personal identity, motivation and self-regulation

C. Task-orientated, intrinsic, augmented, concurrent, delayed, knowledge of results and knowledge of performance feedback

D. The stage of skill acquisition they are at

▶ Question 4 (1 mark)

Which of the following is NOT encouraged during contemporary forms of exercise? (HM-11-04)

A. Group dynamics

B. Group cohesion

C. Social exclusion

D. A sense of belonging

Question 5 (3 marks)

Outline factors that affect an individual's level of motivation. (HM-11-04)

Question 6 (4 marks)

Describe how a person who is new to exercise could use self-regulation to help them achieve their fitness goals. (HM-11-06)

Question 7 (4 marks)

Outline consequences of poor self-regulation in relation to a sport of your choice. (HM-11-06)

Question 8 (4 marks)

Explain how a person's identity could affect their participation in sport in a positive way. (HM-11-04)

Question 9 (4 marks)

Explain the difference between positive and negative motivation. (HM-11-06)

Question 10 (5 marks)

Discuss the reasons why contemporary forms of exercise increase the likelihood of individuals engaging in exercise. (HM-11-09)

Question 11 (8 marks)

Using the following stimulus, **discuss** the characteristics of Nathan Cleary's identity that assist him in being so successful in Rugby League. (HM-11-04)

> At 25, Nathan Cleary played his fourth grand final, leading with finesse to win a third consecutive premiership with the Panthers. He follows in the footsteps of his father Ivan Cleary, who is an ex-NRL player and also the coach of his team.
>
> Mindset played a leading role. He has learnt to grow from his failures, and block out the outside commentary whether positive or negative and instead just focusing on his own game.
>
> 'Confidence has played a big part for me over the past three years where I've been willing to try things and trust what I'm seeing.
>
> 'That's been the biggest development of my game since I debuted, but that confidence comes from working hard and my preparation.'
>
> Cleary emphasises constant growth and his confidence comes from rigorous preparation and relentless effort. This is evident in his meticulous training and commitment to excellence. Setbacks, like the 2020 Grand Final interception, fuel his resolve and drive for improvement. Criticism fuels Cleary's evolution, prompting him to refine his style. While accolades beckon, Cleary remains grounded, prioritising team success over personal glory.
>
> When thinking about rugby league legends, Cleary's name shows the value of perseverance, resilience, and unwavering dedication. Although still young, he is poised to etch his name in the annals of NRL history.
>
> ***Source:*** Adapted from https://www.foxsports.com.au/nrl/nrl-premiership/the-secret-behind-clearys-epic-evolution-and-hard-work-people-dont-see-when-the-lights-go-off/news-story/137548cc3334ecdc6eca51bf780375eb

Question 12 (5 marks)

To what degree is self-regulation required in order to achieve success in sport? (HM-11-09)

▶ Question 13 (6 marks)

Analyse why self-confidence is essential in a high-pressure sport such as tennis. (HM-11-09)

▶ Question 14 (7 marks)

Assess the importance of young athletes being exposed to various types of motivation. (HM-11-04)

▶ Question 15 (7 marks)

Investigate why people who engage in group training continue to do so for longer periods of time than people who exercise alone. (HM-11-09)

▶ Question 16 (12 marks)

Analyse how contemporary forms of exercise encourage group dynamics, group cohesion, social interaction and a sense of belonging. (HM-11-06)

Online Resources

Below is a full list of **rich resources** available online for this topic. These resources are designed to bring ideas to life, to promote deep and lasting learning and to support the different learning needs of each individual.

▶ Topic PDF

11.1 What is the relationship between psychology, movement and performance? (tpdf-2185) ☐

🗎 Digital documents

11.8 Topic 11 summary (doc-35913) ☐
Key terms glossary (doc-36179) ☐
Revision quiz (doc-34740) ☐

▶ Video eLessons

11.7 Sample exam question response (eles-5022) ☐

✦ Interactivities

11.8 Missing word interactive quiz (int-8048) ☐

Weblinks

11.5 Benefits of high-intensity interval training ☐
CrossFit ☐

Teacher resources

There are many resources available exclusively for teachers online.

To access these online resources, log on to **www.jacplus.com.au**.

Glossary

ability the ease with which an individual is able to perform a movement or routine

Aboriginal and Torres Strait Islander approaches to health an approach to health that is holistic and includes interconnections between physical, social, emotional, mental, cultural and spiritual aspects of health and wellbeing. The approach includes the importance of Country/Place and the role of cultural knowledge.

acceleration the rate at which velocity changes in a given amount of time

acclimatisation the process of becoming accustomed to a new environment

accountability an obligation or willingness to accept responsibility for one's actions

accuracy refers to how close a measurement or calculation is to the standard or correct value, which is set by previous reliable studies

acquisition gaining possession of something

acuity sharpness; a sense of being able to hear, see and think clearly and, sometimes, quickly

adenosine triphosphate (ATP) a high-energy compound that stores and transfers energy to body cells, allowing them to perform their specialised functions, such as muscle contraction

adolescence the transition period from childhood to adulthood

advocacy the process of supporting a cause or position, or acting on behalf of yourself or another individual to make sure your or their best interests are taken into account.

aerobic metabolism the breakdown of fuel in the presence of oxygen to produce energy (ATP)

aerobic threshold a level of exercise intensity that is sufficient to cause a training effect. This is approximately 70 per cent of a person's maximal heart rate (MHR).

agility the ability to move the body from one position and direction to another with speed and precision

anaemia a medical term to describe a low red blood cell count

anaerobic describes a process that takes place in the absence of oxygen

anaerobic glycolysis process in which glucose is broken down in the absence of oxygen to produce energy

anaerobic interval training sprint training over short distances using maximal effort

angina chest pain that occurs when the heart has an insufficient supply of oxygenated blood

angular momentum the quantity of angular motion in a body or part of a body

angular motion also commonly referred to as rotation, occurs when a body moves along a circular path at the same angle, in the same direction, at the same time

anorexia nervosa an eating disorder accompanied by a progressive loss of appetite and consequent weight reduction beyond acceptable health levels (15 per cent less than normal for age and height). It is accompanied by an intense fear of gaining weight.

anxiety uneasy emotional state that may be brought on by an actual or perceived threat to the safety and wellbeing of the individual; predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening

applied forces forces generated by muscles working on joints

arteries blood vessels that carry blood away from the heart

associative stage connecting or linking ideas

atherosclerosis the build-up of fatty and/or fibrous material on the interior walls of arteries

augmented feedback all feedback other than that which occurs as a normal consequence of performing a skill; includes various forms of external information, such as suggestions from the coach, video replays, judges' scores and race results

autonomous stage being in full control of actions so they become automatic

average total body density percentage of body fat. The higher the percentage of body fat, the more buoyant a person will be.

axis a point around which an object rotates

balance the ability to maintain equilibrium while either stationary or moving

base of support refers to an imaginary area that surrounds the outside edge of the body when it is in contact with a surface

biomechanics a science concerned with forces and the effect of these forces on and within the human body

biomedical factors factors present in the body that have an impact on health, such as genetics, blood pressure, blood glucose levels, cholesterol levels and physical impairment

biomedical model of health focuses on the physical or biological aspects of disease and illness. It is a medical model of care practised by doctors and health professionals and is associated with the diagnosis, treatment and curing of disease.

blocked practice a type of practice in which each skill component is practised repetitively as an independent block

blood glucose also referred to as blood sugar; a form of stored energy within the blood cells generated from the breakdown of carbohydrates

body composition the percentage of fat as opposed to lean body mass in a human being

body image the attitude or feelings we have about our body and the way we think we look or we think others see us. A person's body image can be positive or negative.

bouldering a form of rock climbing that is often performed on artificial rock walls without the use of a rope or harness

broad features of society determinants of health that include culture, affluence, social cohesion, social inclusion, political structures, the media and language

bulimia nervosa an eating disorder in which large quantities of food are ingested at one time (bingeing) and then purged from the body by self-induced vomiting

calisthenic movement movement that exercises large muscle groups, often using your own bodyweight

cancer a group of diseases characterised by abnormal cell growth which has the potential to spread throughout the body

capillaries the smallest of all blood vessels; they function to exchange oxygen and nutrients for waste

carbohydrate loading the manipulation of training and nutrition prior to endurance events to maximise muscle glycogen (carbohydrate) stores

cardiac muscle involuntary muscle responsible for keeping the heart beating

cardiac output (CO) the amount of blood pumped by the heart per minute

cardiorespiratory endurance the ability of the working muscles to take up and use the oxygen that has been breathed in during exercise and transferred to muscle cells

cardiovascular disease refers to disease that affects the heart or blood vessels

centre of gravity the point at which all the weight of an object is evenly distributed and about which the object is balanced

cholesterol a type of fat required for optimal functioning of the body that in excess can lead to a range of health concerns including blocking of the arteries

circulatory or **cardiovascular system** a network that distributes blood containing oxygen and nutrients and collects wastes; it comprises the heart, arteries, blood and veins

climate action refers to increased efforts to reduce greenhouse gas emissions and strengthen resilience and adaptive capacity to climate-induced impacts

closed skills skills that occur in an environment that is stable and predictable

cognitive stage the mental processing of information, thinking and understanding

concurrent feedback feedback received during the performance of a skill

connectedness a sense of belonging and feeling valued and supported

continuous skills skills that have no distinct beginning or end

continuous training continuous activity that lasts a minimum of 20 minutes at the required intensity using the aerobic energy system. It is submaximal and requires an intensity of 70–85 per cent of maximum heart rate (also known as long, slow distance training).

coordination the ability to use different parts of the body together smoothly and efficiently

cyberbullying deliberate harassment of a person using communications technology, such as instant messaging by email, on social media pages, in chat rooms or on other electronic media

data point a single piece of information or data

decision-making skills the ability to choose between two or more options to reach the best outcome in the shortest time

dehydration an excessive loss of water

delayed feedback received after the skill has been executed

dependent variable the variable being tested in an experiment; as change is made to the independent variable, the effect on the dependent variable is observed and measured

determinants of health the range of factors, as identified by the AIHW — biomedical factors, socioeconomic factors, environmental factors, broad features of society and health behaviours — that determine the health status of individuals and populations

digestive tract the organs that food and liquids travel through when they are swallowed, digested and absorbed, until they leave the body as faeces

discrete skills skills that have a distinctive beginning and end that can be identified

disengaging a process of letting go of one's personal or emotional involvement with a situation or belief

distributed practice involves a broken practice session, with intervals of rest or alternative activities being longer than practice intervals

distribution the extent within a population

diversity the differences that exist within a group, which can include age, sex, gender, gender expression, sexuality, ethnicity, ability/disability, body shape and composition, culture, religion and spirituality, learning differences, socioeconomic background, values and experiences

domestic and family violence violent, abusive behaviour or actions toward partners or family members in order to scare or control them; it is a criminal offence

drag the force that opposes the forward motion of a body or object, reducing its speed or velocity

dynamic health refers to the constant changes that occur in our level of health

dyslipidaemia a condition characterised by an abnormal amount of blood lipids

ecological model of health based on evidence that no one factor can explain why some people or groups are at higher risk than others. It looks at both individual and social determinants of health.

ego orientation focusing on comparing oneself to others and striving to do better than opponents. The emphasis is on winning rather than skill development.

elite athletes individuals who have achieved excellence and competed at a high level (usually nationally or internationally) in their event or sport

emotional health the ability to recognise and express feelings in a positive way

empathy the ability to identify, appreciate and understand another's situation or feelings

empower to give an individual the ability to make decisions about, or have personal control over, their life

environmental factors factors in the built and natural environments that affect health; for example, geographic location, quality of air and water, safe workplaces, community safety and access to physical resources within a community

epidemiology the study of the patterns, causes and effects of health-related states or events (including disease) in a population, through the collection and analysis of data; the goal is to prevent and control health problems by identifying and understanding the causes

equity the fair distribution of resources based on the needs of individuals and populations, with the aim of achieving equitable outcomes

expiration air movement from the lungs to the atmosphere; breathing out

externally paced skills movements for which an external source controls the timing

extrinsic motivation occurs when an individual's internal state is modified by sources originating from outside the person

family and domestic violence violent or aggressive behaviour towards family members that may occur within the home

fast-twitch muscle fibres muscle fibres that contract quickly and are used during fast, explosive activities; referred to as 'white' as they contain less blood

feedback information provided to the learner about the nature or result of their performance

fine motor skills skills that require the use of only small muscle groups to perform the movement

first aid the initial care of the ill or injured, usually given by someone who is on the scene when a person becomes ill or injured

fitness a measure of the body's ability to function efficiently, effectively and without injury in everyday activities, to pursue recreational activities and to cope with emergency situations

FITT principle a framework for developing fitness programs that emphasise the variables Frequency, Intensity, Time or duration of exercise and Type of exercise

flexibility the range of motion about a joint or the ease of joint movement

fluid mechanics a branch of mechanics that is concerned with properties of gases and liquids

food security when all people, at all times, have access to sufficient safe and nutritious food to meet their dietary needs for an active and healthy lifestyle

forces the push or pull acting on a body

freely movable or **synovial joint** a joint that allows maximum movement. Most joints in the body are synovial joints; for example, the hip joint.

functional movement exercise that trains and prepares muscles to be able to carry out daily tasks that may be required at home, at work or in sport

game-centred approach a focus on the whole game and all components, rather than a sequence of basic skills assembled within a game format. The emphasis is on integrating thinking and learning rather than skill development in isolation.

general motion the combination of both linear and angular motion

genetics refers to characteristics, features or hereditary diseases that are genetically linked and passed on within a family

glucose broken down from stored glycogen and transported in the blood to provide energy for working muscles during training

glycaemic index a ranking system for carbohydrates based on how they affect blood sugar level

glycogen the storage form of glucose and is used for fuel when blood glucose levels decline

glycolysis the process of using glycogen or glucose as fuel

glycolytic (lactic acid) a by-product of the incomplete breakdown of carbohydrate in the absence of oxygen

gross motor skills skills that require the use of large muscle groups for execution

group cohesion strength of bonds between group members

group dynamics behaviours and processes occurring within groups

haemoglobin oxygen-carrying component of the blood

health behaviours actions taken by a person that affects their health; the impact of many health problems could be reduced or prevented by changing behaviours, such as reducing alcohol intake, increasing physical exercise and practicing safe sex

health continuum a scale on which an individual's health can be measured or assessed; usually includes categories such as very poor, poor, fair, good and very good

health lens a way of looking at broader systems, such as public policy, that aims to improve health while promoting inclusivity and social justice

health literacy the ability to understand and interpret health information and use it to promote and maintain good health

health promotion the process of helping people to have more control over and improve their health

heart rate (HR) number of times the heart contracts or beats per minute

heredity the inheritance of genetic characteristics from our parents

high density lipoprotein (HDL) referred to as 'good' cholesterol as it assists in the removal of other forms of cholesterol from your blood

high-intensity interval training (HITT) a form of training that involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

higher-order thinking requires greater cognitive processing than lower-order thinking. Learners use higher-order thinking skills when they engage in learning activities that require them to arrive at new meanings and understandings. Some examples of higher-order thinking include synthesising, analysing, application, evaluation and making a judgement.

homeostasis the tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes

hormone chemical substance produced in the body that controls and regulates the activity of certain cells or organs

hypokinetic diseases a term given to modern lifestyle diseases associated with inactivity

hypothesis (plural: hypotheses) an idea or explanation for something that is yet to be proven. A hypothesis can be a basis for further investigation.

immovable or **fibrous joint** a joint in which no movement is possible. Examples include the bones of the cranium, which are fused in lines called sutures.

incidence the number of new cases (of e.g. an illness or event) occurring during a given period

independent variable the factor that is changed or controlled in an experiment; it represents the cause or reason for an outcome

inertia the resistance of a body to a change in its state of motion

infant mortality the number of deaths among children aged under 1 year in a given period, per 1000 live births in the same period

infrastructure the technical structures that support a society, such as roads, railways, water supply, sewerage, public transport, schools and power grids

inspiration air movement from the atmosphere into the lungs; breathing in

intensity the amount of effort required by an individual to accrue a fitness benefit

interplay of energy systems energy systems working together, but at different rates, to supply the ATP required for an activity

intrinsic motivation motivation that comes from within the individual

iron deficiency a lack of iron in the body reducing haemoglobin production in the blood

isometric contraction occurs when muscle fibres are activated and develop force but muscle length does not change; that is, movement does not occur

isotonic concentric contraction the most common type of muscular contraction; the muscle shortens, causing movement at the joint

isotonic eccentric contraction occurs when the muscle lengthens while under tension; often happens with the assistance of gravity

kinaesthetic sense (or **kinaesthesis)** the system of sensitivity that exists in the muscles and their attachments

knowledge of performance information about the pattern of the movement during execution

knowledge of results information about the outcome of a movement

lactate inflection point (LIP) the point beyond which a given exercise intensity or power output cannot be maintained by an individual

lactate a salt formed from lactic acid that accumulates during intense anaerobic activity

LGBTQIA+ acronym that stands for lesbian, gay, bisexual, transgender, queer/questioning, intersex, asexual and others

lift the component of a force that acts at right angles to the drag

line of gravity an imaginary vertical line passing through the centre of gravity and extending to the ground

linear momentum a property of a body that is moving. It is equal to (or a product of) its mass × velocity.

linear motion takes place when a body and all parts connected to it travel the same distance in the same direction and at the same speed

long-term goal goals that can be achieved over a long-term period

low density lipoprotein (LDL) referred to as 'bad' cholesterol as it transports excess cholesterol to the blood vessel walls

low-impact activity movements or exercises that do not involve a significant amount of force being exerted on the joints

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body; these include carbohydrates, fats and proteins

mass the amount of matter in a body

massed practice a continuous practice session, with rest intervals being shorter than practice intervals

Medicare Australia's government-funded health scheme that subsidises the cost of medical services for all Australians

mental health a state of wellbeing in which an individual realises their own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to their community

mentor wise or trusted adviser

micronutrients one of the major groups of nutrients needed by the body for energy production, immune function, blood clotting, growth, bone health and fluid balance among other functions; also known as vitamins

momentum the quantity of motion that a body possesses

morbidity the ill health of an individual and levels of ill health in a population or group

mortality number or rate of deaths in a population during a given time period

motion the movement of a body from one position to another

motivation an internal state that activates, directs and sustains behaviour towards achieving a particular goal

muscular endurance the ability of the muscles to endure physical work for extended periods of time without undue fatigue

muscular power the ability to combine strength and speed in an explosive action

muscular strength the ability to exert force against a resistance in a single maximal effort

negative motivation characterised by an improvement in performance out of fear of the consequences of not performing to expectations

non-government organisations organisations that are independent of the government

open skills skills that occur in an environment that is unpredictable and frequently changing

overtraining a chronic psychological and physiological condition caused by training loads that are too demanding

part practice method applied when a skill is broken into smaller components and each discrete subskill (subroutine) is practised separately

peer group a social group of people who have similar interests, ages or backgrounds

personality an individual's characteristic way of behaving

phosphocreatine (PCr) a chemical compound found in muscle cells that is capable of storing and releasing energy that can be used to resynthesise ATP from ADP and Pi

physical activity body movement that is produced by a contraction of skeletal muscle and that increases energy expenditure. Physical activity is a broad term that includes playing sport; exercise and fitness activities such as dance, yoga and tai chi; everyday activities such as walking to work, doing household chores and gardening; and many other forms of active recreation.

physical fitness a set of attributes (health and skill components) which enable an individual to be physically active

physical health refers to the efficient functioning of the body and its systems, allowing people to carry out everyday activities and to be free from illness

plasma a straw-coloured liquid component of blood, consisting mainly of water (about 90 per cent)

platelets fragments of cells found in blood and responsible for clotting

positive competitiveness when individuals compete to improve their own and others' performance in a group setting

positive motivation occurs when an individual's performance is driven by previous reinforcing behaviours

positive self-talk saying positive things about yourself in your mind and having an optimistic voice in your head

prevalence the number or proportion (of e.g. cases or instances) in a population at a given time

primary data information that is collected by the researcher, rather than getting it from a secondary source

primary investigation a research methodology in which the researcher directly collects data, rather than relying on data collected from previous studies

psychology the study of the human mind and its functions, especially those affecting behaviour in a given context

puberty a stage in the life cycle when rapid physical changes occur that signify that a person has reached sexual maturity

pulmonary circulation the flow of blood from the heart to the lungs and back to the heart

qualitative data information that is expressed in words and narratives

quantitative data information that can be expressed in numbers

random practice a form of practice that involves rehearsing a number of different skills in an unpredictable sequence

reaction forces equal and opposite forces exerted in response to applied forces

reaction time the time taken to respond to a stimulus

recreational athletes athletes doing sport for fun rather than competitively

reliability the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same

research methodology refers to how you will do your research and what techniques you will use. Research methodology includes any theories or theoretical models on which you are basing your research, the different parts of the research, and quantitative and qualitative techniques.

research perspectives (or theoretical perspectives) a set of assumptions about reality that inform the questions we ask and the kinds of answers we arrive at. It can be thought of as a frame that focuses what we look at; one researcher's frame for their research may be different to the next. A review of the literature will help identify other research or theoretical perspectives on a topic that can guide your own research.

resilience the ability to 'bounce back' after difficult times or bad experiences

resistance something opposing a force

respiration the process by which the body takes in oxygen and removes carbon dioxide

resynthesis the process of restoring ATP to its former state

salutogenic model of health focuses on the factors that promote and maintain physical and mental wellbeing, rather than focusing on disease and injury. It pays special attention to how people deal with stressful situations and still manage to stay healthy.

sedentary lifestyle characterised by spending a lot of time sitting and not completing much physical activity

self-confidence a feeling of trust in one's own ability, qualities and judgement

self-efficacy a person's degree of confidence in being able to carry out a particular task and manage emotions, behaviour and motivations

self-esteem the feeling or opinion (negative or positive) one has about oneself

self-paced skills movements for which the performer determines the timing and speed of execution

self-regulation the act of managing thoughts and feelings to enable goal-directed actions

serial skills a sequence of smaller movements that are assembled to make a total skill

short-term goal goals that can be achieved over a short-term period

skeletal muscle voluntary muscles that produce movement

slightly movable or **cartilaginous joint** a joint that permits limited movement. Examples exist in the vertebral column, where fibrous cartilage between discs allows a limited range of movement.

slow-twitch muscle fibres muscle fibres that contract slowly and are used during endurance activities; referred to as 'red' as they contain more blood

smooth muscle involuntary muscles found in the walls of internal organs

social health refers to our interactions with other people as well as the social and communication skills and abilities we display

social justice principles principles that aim to reduce or eliminate inequality, foster inclusivity and diversity, and create supportive environments for all individuals

sociocultural model of health aims to target the wider influences on health (social, cultural, environmental and economic factors) rather than disease and injury. The focus is on health promotion, policies and education.

socioeconomic factors factors that include socioeconomic status, educational attainment, employment status, cultural background, disability, social networks, social expectations and attitudes, cultural traditions and the media

somatotype a person's body type or shape (ectomorphic, mesomorphic or endomorphic)

speed the ability to perform body movements quickly; equal to the distance covered divided by the time taken to cover the distance

spiritual health feeling a sense of purpose and meaning in one's life

sprint interval training (SIT) a form of high-intensity training characterised by repeated, brief intermittent bursts of supramaximal intensity-exercise, interspersed with periods of active or passive recovery

steady state a period of time during which oxygen uptake remains at a sustained level, such as swimming at a constant speed

strategic development plans of action that an individual or team can use to gain advantage in a single game or a number of games

stress a physiological or psychological influence that produces a state of tension in a person

stroke volume the amount of blood ejected by the left ventricle of the heart during a contraction; it is measured in mL/beat

subject-specific vocabulary refers to the specialised words and terms associated with a particular academic discipline or subject area

support structures the people, places and programs that increase an individual's ability to make health-promoting choices

Sustainable Development Goals (SDGs) a set of 17 global goals developed by the UN to be achieved by 2030. The goals are universally applied to all to end poverty, fight inequalities and tackle climate change. They influence strategies that build economic growth and address a range of social needs including education, health, social protection and job opportunities, while tackling climate change and environmental protection.

systemic circulation the flow of blood from the heart to body tissue and back to the heart

tactical development enacting decisions and actions that help gain an advantage in a sport or event; built on problem-solving

tapering a reduction in training that allows the athlete time for extra recovery and for their energy stores to be fully restored

target heart rate (THR) zone area surrounding the target heart rate and is calculated using percentages of maximal heart rate

task orientation focusing on the completion of particular tasks as a measure of success, such as mastering a skill

task-intrinsic feedback feedback that occurs as a normal consequence of performing a skill. It embodies feelings, together with sensory information such as vision and hearing.

telehealth doctor–patient consultations that use any form of technology, including video conferencing, internet or telephone, as an alternative to face-to-face consultations

theoretical model a written or visual representation used to understand the way in which a process or system works

thermoregulation the maintenance of a stable internal temperature independent of the temperature of the environment

traits characteristics or observable features of a person

triangulation using several data collection techniques in order to validate findings

triglycerides a type of fat found in the blood

type 2 diabetes a condition in which the body develops a resistance to insulin or does not produce enough insulin

United Nations Education, Scientific and Cultural Organization (UNESCO) agency of the United Nations that promotes international collaboration in education, sciences and culture to protect human rights

upstander someone who takes action against bullying behaviour

validity refers to how accurately a test or an experiment measures what it says it will measure. Results need to be valid to be able to draw conclusions from the research.

variable includes any factor that can be controlled, changed or measured in an experiment

veins vessels that carry deoxygenated blood from body tissues back to the right atrium. Pulmonary veins from the lungs differ in that they carry oxygenated blood to the left atrium.

velocity the rate of positional change of an object, calculated using displacement divided by time

ventilation refers to our depth and rate of breathing and is expressed in breaths per minute

vitamins inorganic compounds that are essential to maintaining bodily functions

whole practice method applied when a skill is practised in its entirety

World Health Organization (WHO) a specialised agency of the United Nations that acts as the coordinating authority on international public health issues

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