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JACARANDA OUTCOMES 2

HEALTH AND MOVEMENT SCIENCE YEAR 12 | SEVENTH EDITION

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HAYLEY DEAN

JADE HUNT

ERINN McMAHON

WADE RICHARDSON

CLARE WARREN

MICHAEL KENNEDY

RON RUSKIN

KIM PROCTOR

DAVID NEEVES

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Seventh edition published 2025 by
John Wiley & Sons Australia, Ltd
287 Lonsdale Street, Melbourne, VIC 3000

First edition published 1996 © L. Fitzgibbon, R. Ruskin
Second edition published 2001 © R. Ruskin, K. Proctor, D. Neeves
Third edition published 2007 © R. Ruskin, K. Proctor, D. Neeves
Fourth edition published 2009 © R. Ruskin, K. Proctor, D. Neeves
Fifth edition published 2013 © R. Ruskin, K. Proctor, D. Neeves
Sixth edition published 2018 © John Wiley & Sons Australia, Ltd 2018

Typeset in 10.5/13 pt Times LT Std

ISBN: 978-1-3943-1791-2

Front cover images: Getty Images/PhotoAlto/Milena Boniek

Illustrated by various artists, diacriTech and Wiley Composition Services

Typeset in India by diacriTech

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The publisher of this series acknowledges and pays their respects to Aboriginal Peoples and Torres Strait Islander Peoples as the traditional custodians of the land on which this resource was produced.

This suite of resources may include references to (including names, images, footage or voices of) people of Aboriginal and/or Torres Strait Islander heritage who are deceased. These images and references have been included to help Australian students from all cultural backgrounds develop a better understanding of Aboriginal and Torres Strait Islander Peoples' history, culture and lived experience.

It is strongly recommended that teachers examine resources on topics related to Aboriginal and/or Torres Strait Islander Cultures and Peoples to assess their suitability for their own specific class and school context. It is also recommended that teachers know and follow the guidelines laid down by the relevant educational authorities and local Elders or community advisors regarding content about all First Nations Peoples.

All activities in this resource have been written with the safety of both teacher and student in mind. Some, however, involve physical activity or the use of equipment or tools. **All due care should be taken when performing such activities.** To the maximum extent permitted by law, the author and publisher disclaim all responsibility and liability for any injury or loss that may be sustained when completing activities described in this 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 vii
Teaching with learnON xiii
Meet our author team xiv
Syllabus key words xv
Acknowledgements xvi

1 Depth studies 2

1.1 Overview 3
1.2 Depth studies 4
1.3 Planning for your depth studies 8
1.4 Data reliability, validity and accuracy 16
1.5 Analysing and interpreting your data 18
1.6 Communicating your understanding 21
1.7 Review 28

FOCUS AREA 1 HEALTH IN AN AUSTRALIAN AND GLOBAL CONTEXT 32

2 How healthy are Australians? 34

2.1 Overview 35
2.2 Current health status of Australians 37
2.3 Groups experiencing inequities in health 46
2.4 Health status of Australia and other OECD countries 76
2.5 Chronic conditions, diseases and injury in Australia 83
2.6 Impact of an ageing population on Australia's health 98
2.7 Sample exam question response 108
2.8 Review 109

3 Australia's healthcare system 116

3.1 Overview 117
3.2 Healthcare system in Australia 119
3.3 Shared responsibility for the health system 129
3.4 Collaboration between government and non-government organisations 133
3.5 Health expenditure and its impact 138
3.6 Complementary healthcare approaches 150
3.7 Being a critical health consumer 157
3.8 Emerging changes and challenges 161
3.9 Sample exam question response 165
3.10 Review 167

4 Technology and data in Australia's healthcare system 172

4.1 Overview 173
4.2 The relationship between technology and health 174
4.3 New technologies and treatments 181
4.4 The impact of digital health on the healthcare system 191
4.5 How big data is shaping the health of Australians 201
4.6 Sample exam question response 208
4.7 Review 210

5 Sustainable Development Goals 214

5.1 Overview 215
5.2 Key features of the Sustainable Development Goals 216
5.3 Applying SDG 3, 4, 10 and 11 to improve health status 221
5.4 Sample exam question response 236
5.5 Review 238

Practice examination Focus area 1 ..... online only

FOCUS AREA 2 TRAINING FOR IMPROVED PERFORMANCE 242

6 How exercise assessment and prescription can be personalised 244

6.1 Overview 245
6.2 Health screening 246
6.3 Performance/fitness testing for recreational participants and elite athletes 250
6.4 The role of exercise assessments in developing training programs 260
6.5 Sample exam question response 267
6.6 Review 269

7 How training influences movement and performance 274

7.1 Overview 275
7.2 Types of training and training methods 277
7.3 Principles of training 298
7.4 Training principles, physiological adaptations and improved performance 307

7.5 Sample exam question response 318
7.6 Review 320

8 Training for individual and group sports 326

8.1 Overview 327
8.2 Designing a training session 328
8.3 Yearly training programs 334
8.4 Psychological strategies 344
8.5 How strategies and tactics are applied 353
8.6 Sample exam question response 358
8.7 Review 360

9 The impact of sleep, nutrition and supplements on movement and performance 364

9.1 Overview 365
9.2 Dietary requirements and fluid intake 366
9.3 Sleep, nutrition and hydration 378
9.4 Supplements, micronutrients, protein, caffeine and creatine products 391
9.5 Sample exam question response 401
9.6 Review 403

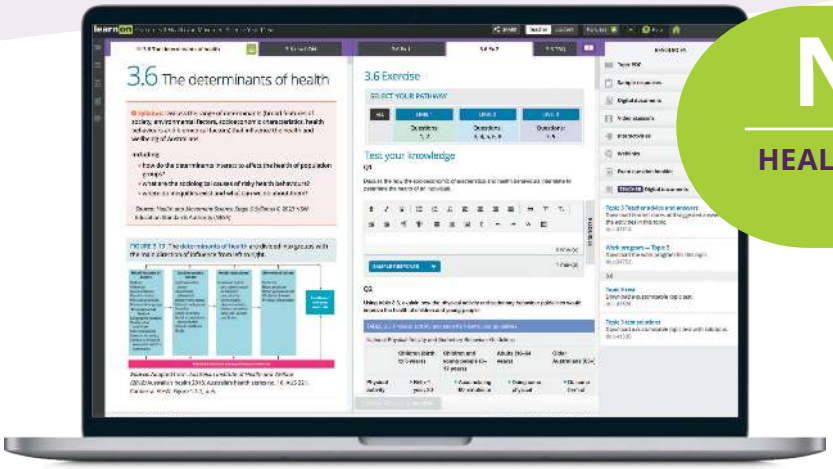
10 How individuals train for sustained movement and performance 408

10.1 Overview 409
10.2 How biomechanics can develop efficient movements 411
10.3 Recovery strategies for sustained movement and performance 419
10.4 The role technology can play to improve performance 425
10.5 The management and prevention of sporting injuries 433
10.6 The impact of drug use 448
10.7 Sample exam question response 456
10.8 Review 458

Practice examination Focus area 2 ..... online only

Glossary 463
Index 470

Learning with learnON



NEW FOR

HEALTH AND MOVEMENT SCIENCE 11–12 SYLLABUS

JACARANDA

OUTCOMES 2 HEALTH AND MOVEMENT SCIENCE YEAR 12 | SEVENTH EDITION

Developed by teachers for students

Tried, tested and trusted. The completely revised and updated sixth edition of *Jacaranda Outcomes 2 Health and Movement Science Year 12* continues to focus on helping teachers achieve learning success for every student — ensuring no student is left behind and no student held back.

Because both *what* and *how* students learn matter

Learning is personal

Whether students need a challenge or a helping hand, you'll find what you need to create engaging lessons.

Whether in class or at home, students can access syllabus-aligned lessons with in-depth skills development, engaging practical activities and engaging multimodal content. Automatically marked quick quizzes and differentiated question sets are all supported by detailed sample responses — so students can get unstuck and progress.

Learning is effortful

Learning happens when students push themselves. With learnON, Australia's most powerful online learning platform, students can challenge themselves, build confidence and ultimately achieve success.

Learning is rewarding

Through real-time results data, students can track and monitor their own progress and easily identify areas of strength and weakness.

And for teachers, Learning Analytics provide valuable insights to support student growth and drive informed intervention strategies.

Learn online with Australia's most

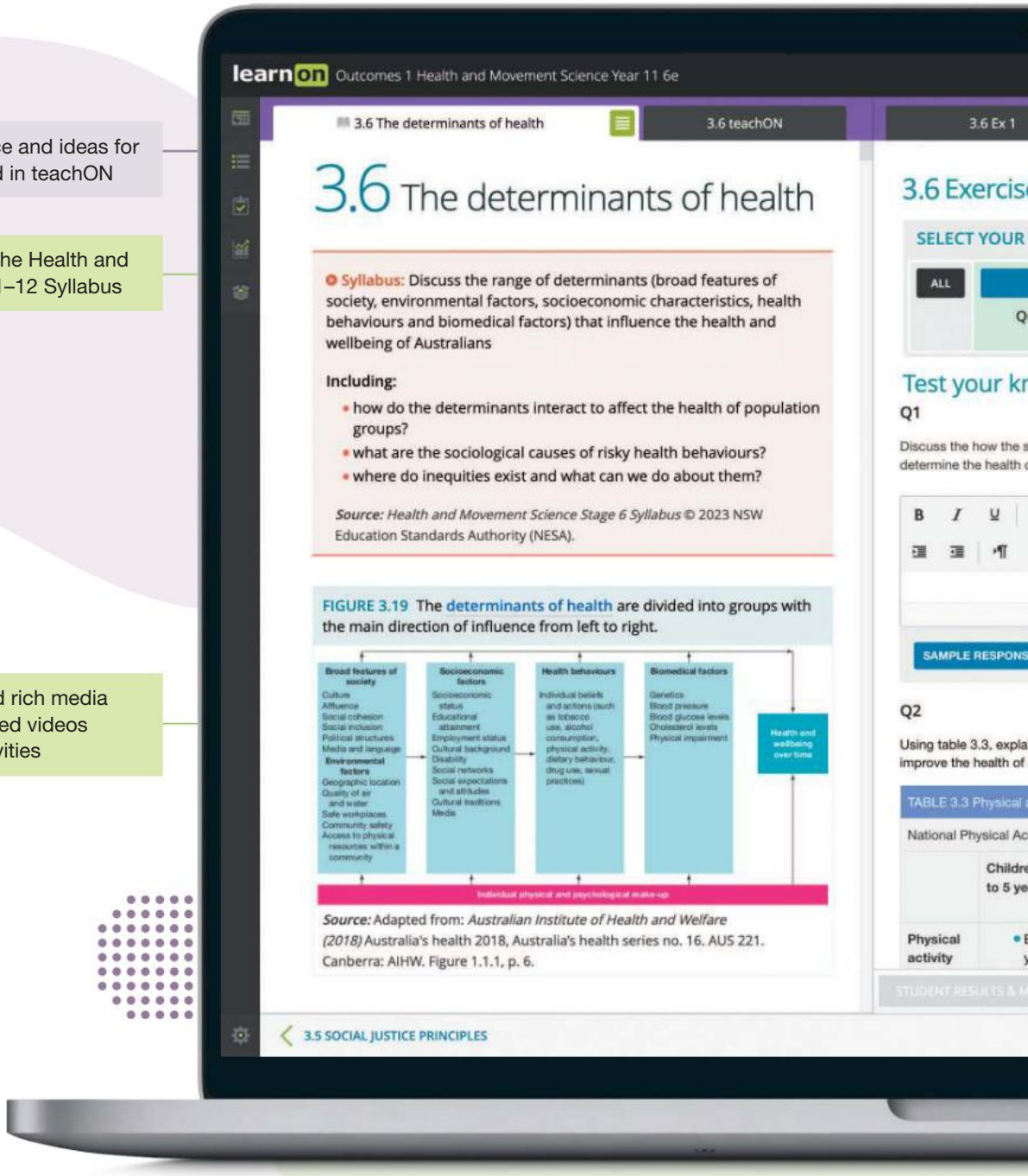
Everything you need for each of your lessons in one simple view

- **Trusted, syllabus-aligned theory**
- **Engaging, rich multimedia**
- **All the teaching-support resources you need**
- **Deep insights into progress**
- **Immediate feedback for students**
- **Create custom assignments in just a few clicks.**

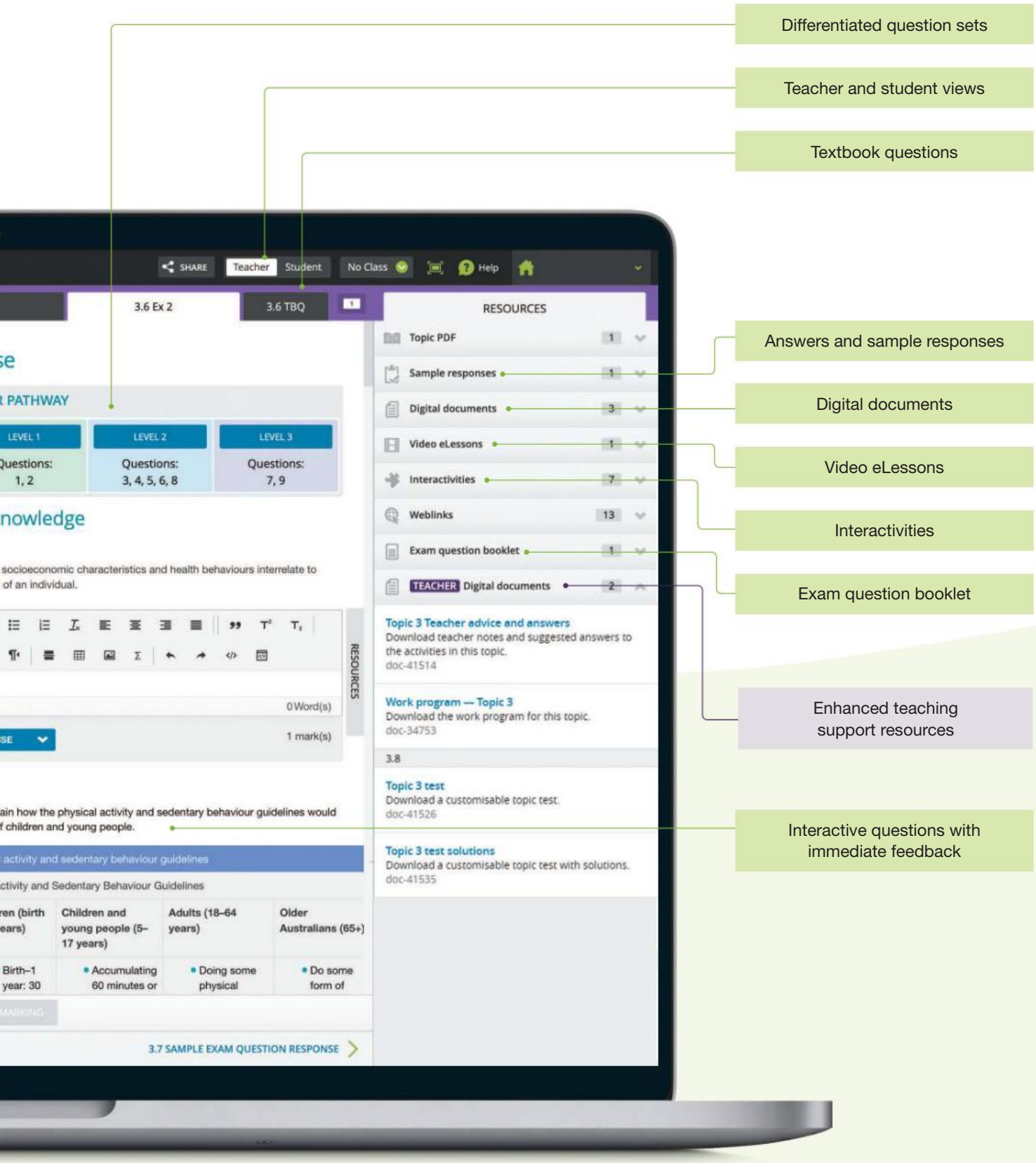
Practical teaching advice and ideas for each lesson provided in teachON

Each lesson linked to the Health and Movement Science 11–12 Syllabus

Reading content and rich media including embedded videos and interactivities



powerful learning tool, learnON

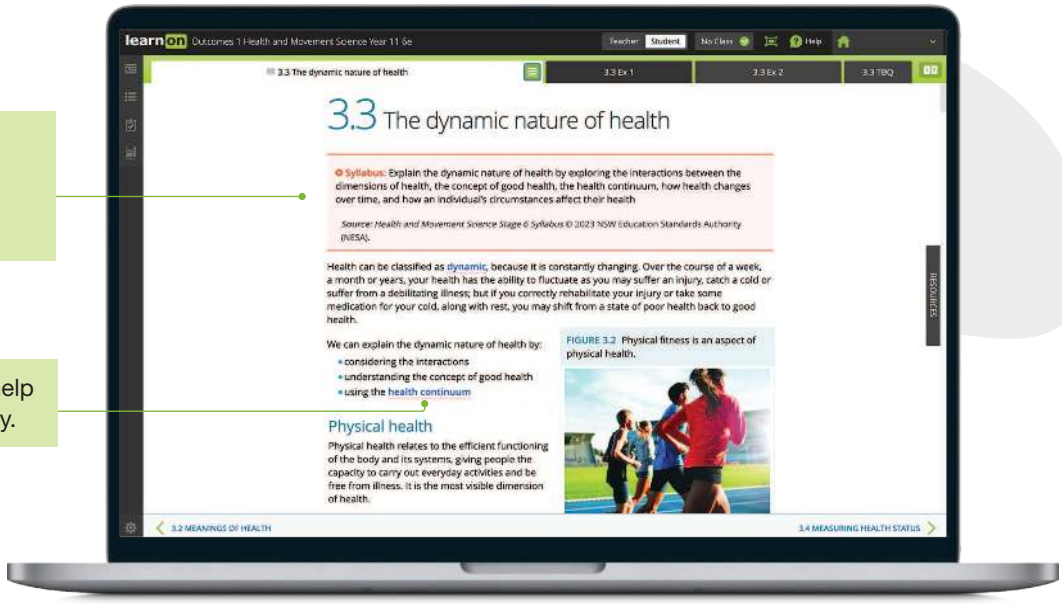


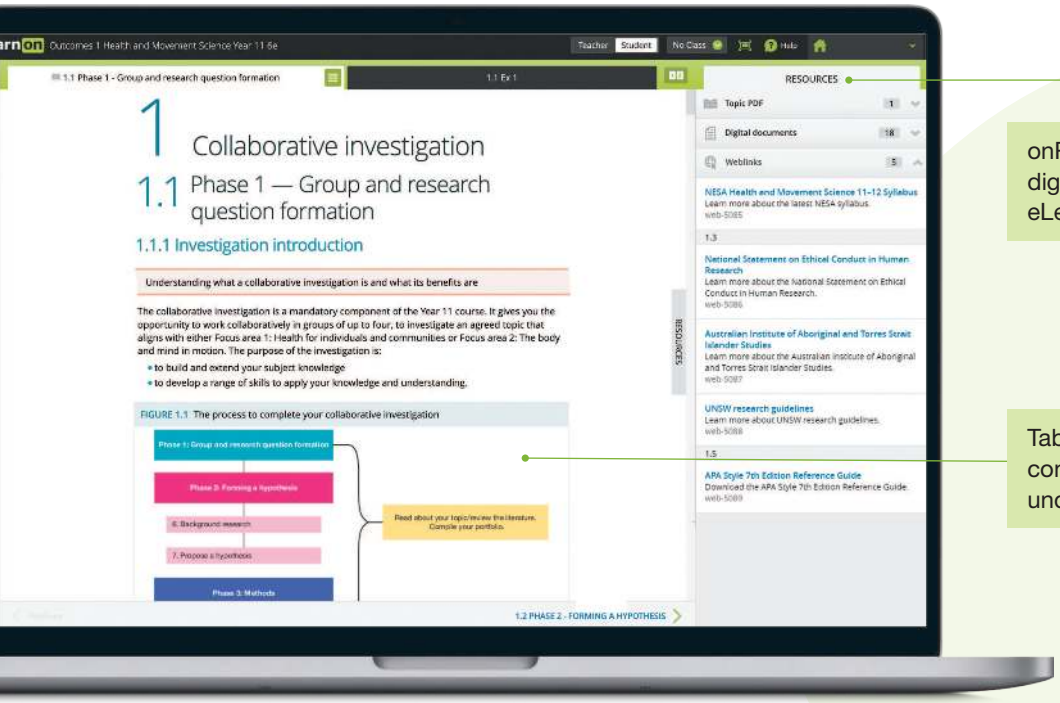
Online, these new editions are the complete package

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.

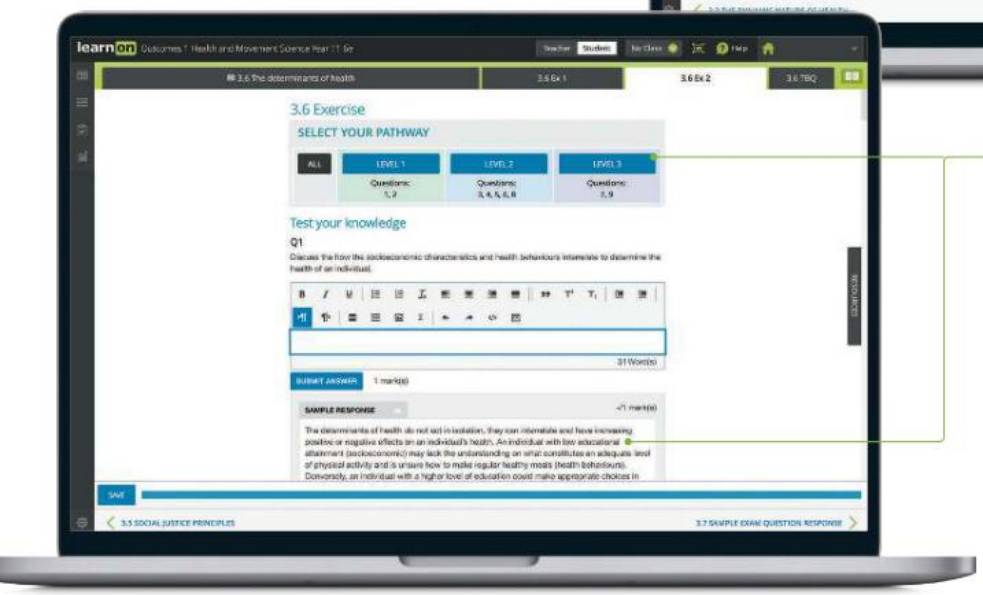




onResources link to targeted digital resources including video eLessons and weblinks.

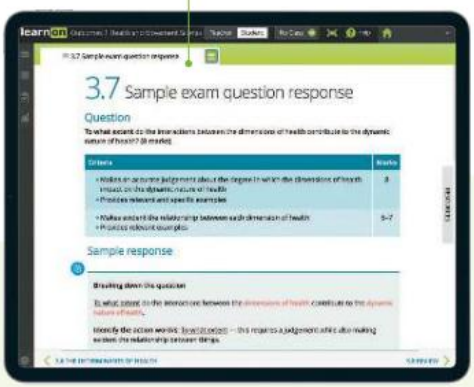
Tables and images break down content, allowing students to understand complex concepts.

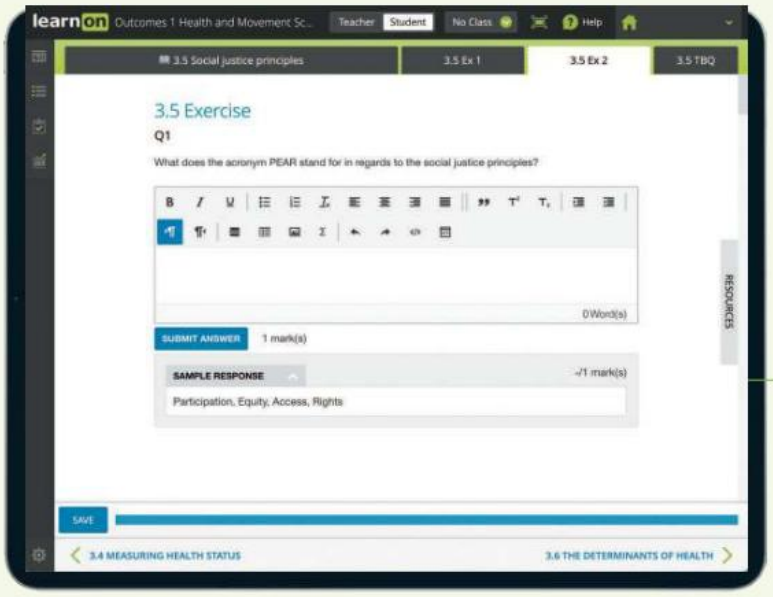
Depth study boxes link depth study ideas to the topic.



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.

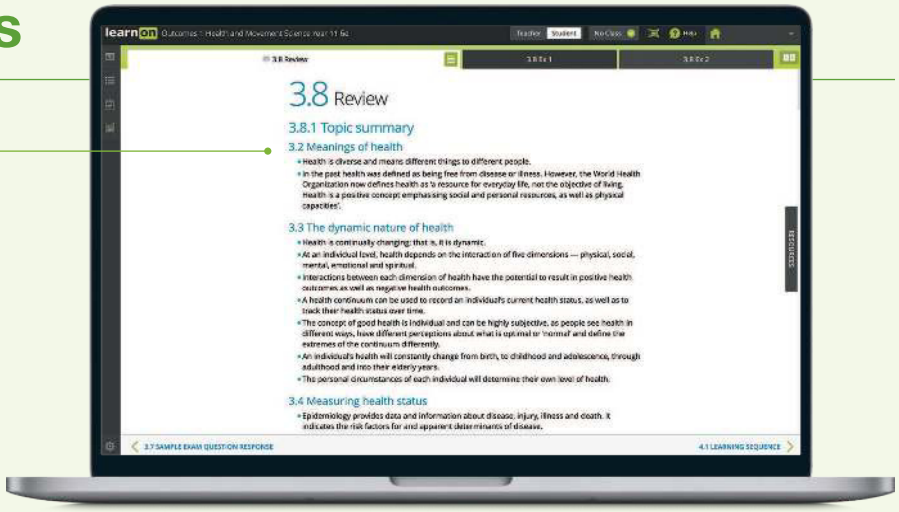




- Online and offline question sets contain practice questions, with exemplary responses.
- Every question has immediate feedback to help students to overcome misconceptions as they occur and to study independently — in class and at home.

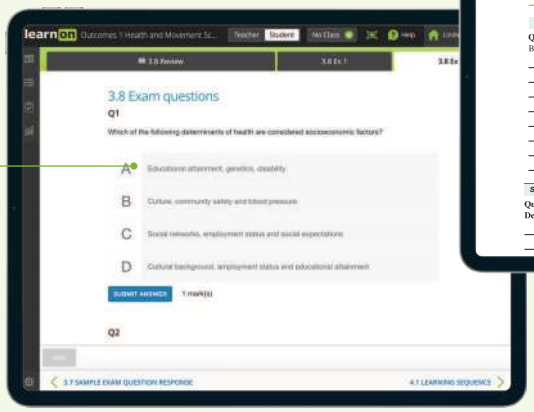
Topic reviews

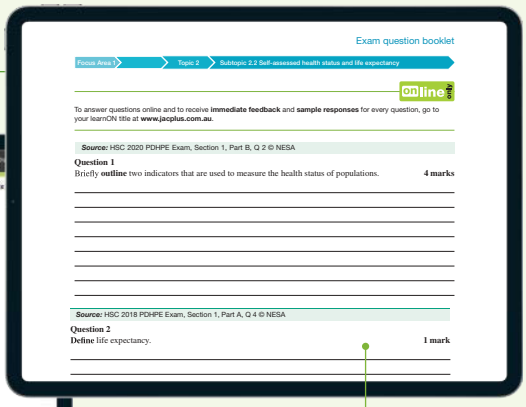
Topic reviews include summaries and topic-level review exercises that cover multiple concepts.



Get exam-ready!

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





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

Expert advice for depth studies

Topic 1 steps students through completing depth studies, providing templates, checklists and practical advice.

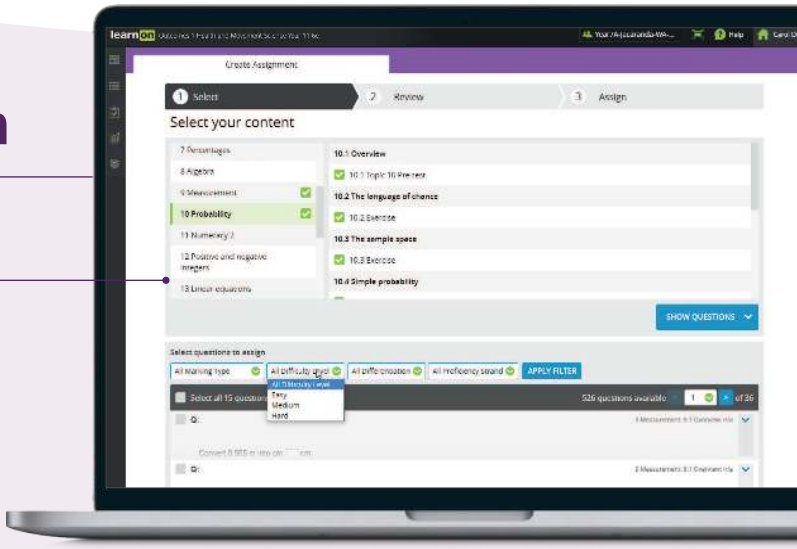
Teaching with learnON

A wealth of enhanced teaching-support resources for every lesson, including:

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

Customise and assign

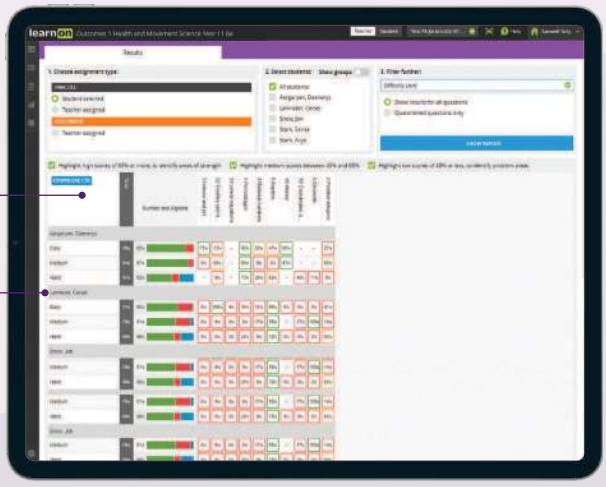
A testmaker enables you to create custom tests from the complete bank of thousands of questions.



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. She has volunteered as both Vice President and Board member of ACHPER NSW.

Jade Hunt has fifteen years' experience as a Personal Development, Health and Physical Education teacher. For over a 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 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.

Michael Kennedy has over fifteen years' experience as a PDHPE educator. He has taught PDHPE and PASS at both Barker College and Roseville College and has been an assistant head of department and an acting HOD, in addition to other pastoral and sport leadership roles. Michael completed a Bachelor of Education (Human Movement and Health Education) at the University of Sydney. He has also completed the Harvard Teaching for understanding online course: Focus on student understanding. Michael has been an HSC marker and has personally taught three state-ranked students (Top 10 in NSW) during his time teaching the PDHPE HSC course. Michael is a passionate educator who has a strong understanding of health and movement science.

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.

Kim Proctor was a Director, School Services with the NSW Department of Education and is now retired. Kim has vast experience in working in and with schools to develop and implement quality teaching programs in PDHPE and school-wide policies that support student health and wellbeing. She has specific experience in sexual health education, anti-discrimination education, strengths-based teaching practices and community health issues. She is the co-author of a number of PDHPE textbooks.

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 responses required.

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
Assess	Make a judgement of value, quality, outcomes, results or size
Clarify	Make clear or plain
Compare	Show how things are similar or different
Contrast	Show how things are different or opposite
Critically evaluate	Add a degree or level of accuracy, depth, knowledge and understanding, logic, questioning, reflection and quality
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
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

Source: A Glossary of Key Words © NSW Education Standards Authority for and on behalf of the Crown in right of the State of New South Wales, 2024. Find the complete version at https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/hsc/hsc-student-guide/glossary-keywords

Acknowledgements

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The full list of acknowledgements can be found here:
www.jacaranda.com.au/acknowledgements/#2025

NESA Acknowledgement

1 Depth studies

LEARNING SEQUENCE

1.1 Overview 3
1.2 Depth studies 4
1.3 Planning for your depth studies 8
1.4 Data reliability, validity and accuracy 16
1.5 Analysing and interpreting your data 18
1.6 Communicating your understanding 21
1.7 Review 28

1.1 Overview

Hey students! Bring these pages to life online

Watch videos

Engage with interactivities

Answer questions and check results

Find all this and MORE in jacPLUS

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).

Outcomes

- analyses the health status of Australians at a national and international level HM-12-01
- examines how technology and data can achieve better health for all Australians HM-12-02
- evaluates how the Sustainable Development Goals can be used to improve the health of a community HM-12-03
- investigates factors that impact movement and performance HM-12-04
- analyses individual and group training programs to improve performance HM-12-05
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

Source: *Health and Movement Science Stage 6* © NSW Education Standards Authority for and on behalf of the Crown in right of the State of New South Wales, 2025.

Resources

Digital documents Topic 1 summary (doc-43044)
Key terms glossary (doc-43045)

1.2 Depth studies

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

1.2.1 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. You might review content or concepts, or conduct a primary or secondary investigation. A **primary investigation** will need more time to allow for the collection and analysis of primary data. Depth studies can be done 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

You will study a minimum of two depth studies in Year 12, with one formally assessable. Your teacher will provide guidance on the nature of your depth studies.

An investigation is not complete until it has been communicated. In subtopic 1.6 you can learn about various ways to communicate the findings of your depth study, with activities to build the knowledge, understanding and skills you need. Choose the best method to share your work based on your purpose and audience. Complete the activities that match your chosen method, which will prepare you for your presentation.

1.2.2 Types of depth studies

Depth studies can be divided into three broad categories:

1. Consolidating knowledge

In this type of depth study, you spend more time learning or understanding a concept and then communicating your understanding.

2. Applying knowledge and skills — secondary investigation

In this type of depth study, you apply your knowledge and skills through practical application of concepts. It involves looking at research by other people.

3. Deepening knowledge — primary investigation

In this type of depth study, you develop a deeper understanding, connect concepts and/or apply to real-world concepts. It involves doing your own research.

These will now be discussed in more detail.

Figure 1.1 and Figure 1.2 give you some guidelines on which type of depth study to choose, and the types of research focus that your depth study may have.

FIGURE 1.1 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:
1.3.1 Depth study plan: Consolidating knowledge
1.6 Communicating your understanding

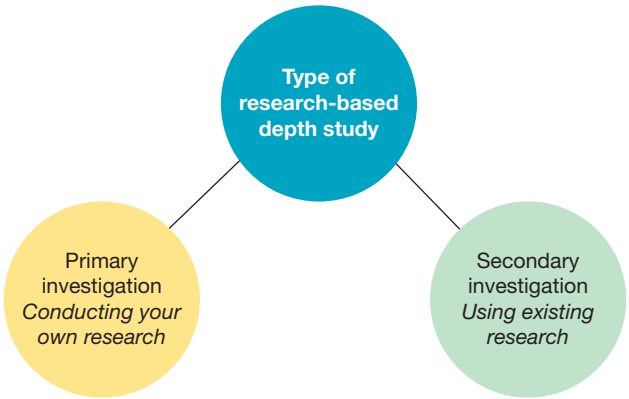
Apply my knowledge and skills
- Apply knowledge and skills through practical application of concepts

Go to:
1.2.3 Secondary investigations
1.3.2 Depth study plan: Applying knowledge and skills — secondary investigation
1.6 Communicating your understanding

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

Go to:
1.2.4 Primary investigations
1.3.3 Depth study plan: Deepening knowledge — primary investigation
1.4 Data reliability, validity and accuracy
1.5 Analysing and interpreting your data
1.6 Communicating your understanding

FIGURE 1.2 Type of research-based depth study



1.2.3 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. Secondary investigations can include:

- writing a blog, op-ed (an op-ed is an opinion article), 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 1.3 Investigating emerging health technology such as 24-hour access to health experts is a type of secondary investigation.

FIGURE 1.4 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.

1.2.4 Deepening knowledge — primary investigation

Conducting first-hand research requires you to have a good knowledge and understanding of the content and concepts. This enables critical and creative thinking and problem-solving. Conducting primary research will allow you to research an area where you have questions or there are gaps. You will generate your own new data to answer these questions and fill the gaps.

Primary investigations to collect first-hand information can include:

- *experiments* — for example:
  - physiological adaptations and improved performance
  - psychological strategies to improve participation and performance, pre-, during and post-performance
  - nutrition and hydration or recovery strategies
- *fieldwork observations* — these are practical investigations that can take place in the relevant environment — either at school, home, in a community or with athletes or 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 1.5 An experiment assessing nutrition strategies is an example of primary investigation.

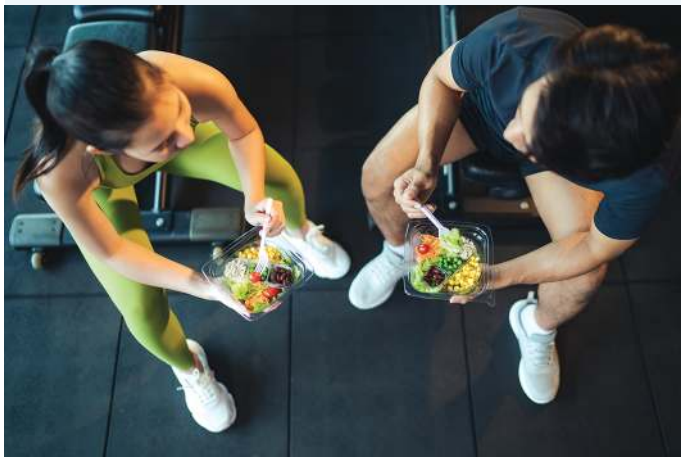
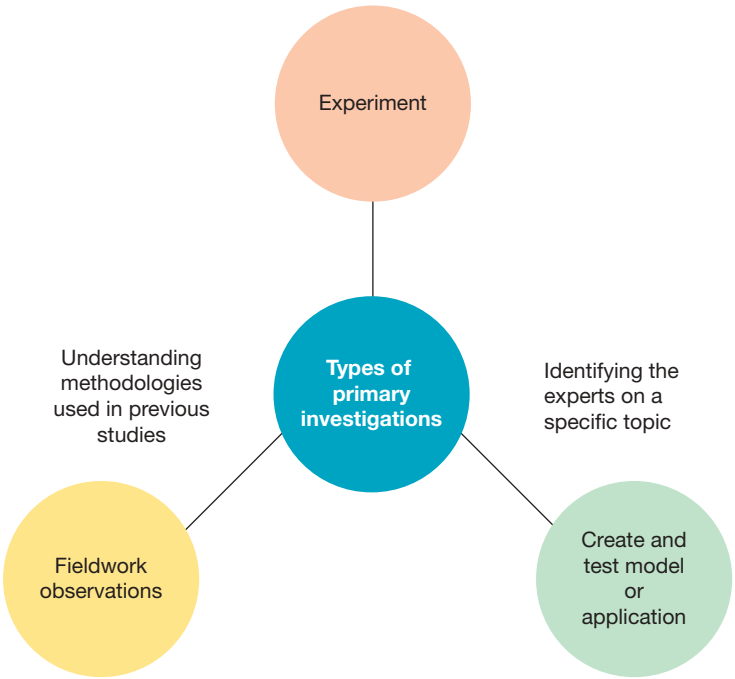


FIGURE 1.6 Types of primary investigations



1.2 ACTIVITIES

I see, I think, I wonder

As you are learning, keep a copy of the syllabus or textbook with you, and carry out 'pulse checks' by highlighting your understanding and using the 'I see, I think, I wonder' process listed below. Pulse checks are an opportunity to stop and reflect on your learning and where you are with your knowledge and level of understanding in relation to the content. Pulse checks can be conducted with your teacher, in pairs or individually. However, a conversation is always useful, providing opportunity for questions and feedback.

1. *Highlight your understanding* — when you have covered the content in a key inquiry question, reflect on your understanding. Use traffic light colours to highlight your level of understanding, with red signalling consolidation of knowledge required, orange signalling application required for understanding, and green signalling deep understanding and that you are able to confidently apply this content or concept to create new knowledge and understanding. Take the opportunity to discuss your level of understanding with another student.
2. *I see, I think, I wonder* — use your syllabus or textbook to comment on what you see, think and wonder as you are learning the content. These notes and your highlighting should inform the depth studies you carry out in terms of content/concepts and the purpose of each depth study, to consolidate your knowledge or to apply or develop your depth of understanding. Share these observations and thinking processes with others in your class.
3. *Planning* — choose content from step 2 for which you wish to consolidate your knowledge of, apply your knowledge or deepen your understanding. Review the rest of this topic to plan one of your depth studies. Use the following information in a table to create your plan:
   - *Focus area* — are you focusing on Focus area 1 or Focus area 2 content?
   - *Content* — what syllabus points will your depth study relate to?
   - *Outcome(s)* — what outcomes will your depth study relate to?
   - *Purpose* — will you focus on consolidating, applying or deepening your understanding of content/concepts?
   - *Type of depth study* — see section 1.2.2.
   - *Time* — how much time will you allocate to completing the depth study? (Refer to your teacher.)

1.3 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 need. This will help work out the type of depth study you do. Conducting a primary investigation will require more time 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, 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.

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.

FIGURE 1.7 When working in a group, brainstorming is a great way to start planning your depth study.

1.3.1 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 1.2 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 in red:

- Compare the health status of Australia with that of other OECD countries.

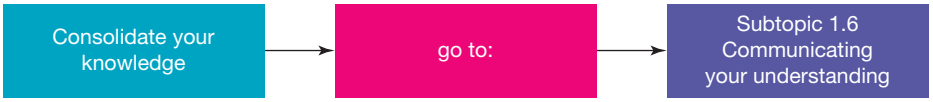
This suggests that you recognise the need to consolidate (or improve) your understanding. Following discussion with your teacher, individually or in a small group, you may choose to review your notes and classwork on this content. Then do further research on one or more of the content points listed below, through websites of organisations such as OECD, World Health Organization or Healthy Cities Illawarra.

- Where does Australia rank in relation to other OECD countries?
- Why might this be the case?
- Why do some countries rank higher or lower than Australia?
- What can we learn from other countries that may be applied to the Australian context?

Consolidation of your knowledge happens through reading (reviewing your notes and doing further reading on the topic) and writing (presenting the information in your own words). Once you have consolidated your knowledge, you can then plan to communicate your understanding. Subtopic 1.6 provides suggestions as to how to present your understanding. You might choose to present it verbally, or share with peers because when you explain it to others and respond to questions it helps build your own understanding.

Figure 1.8 can be used as a first step to help you plan your depth study: consolidating knowledge.

FIGURE 1.8 Pathways for your depth study: consolidate your knowledge



Planning an investigation

Table 1.1 can be used as a first step to plan a research-based depth study.

TABLE 1.1 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?

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

Table 1.2 shows a depth study plan for secondary research. This includes identifying the rationale or reasons for your research and the methods of data collection that you might use. Table 1.3 and table 1.4 show example plans for your reference.

TABLE 1.2 Depth study plan for secondary research

Depth study elements	Description
Researcher(s)	List the individual or members of the group conducting the study.
Guiding question	You or your teacher may choose a guiding question/s for your depth study.
Rationale	Explain why you chose 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: • investigate the impact of a growing population on Australia's health • investigate the current and emerging changes and challenges to the healthcare system • research new health apps and the use of artificial intelligence in healthcare • assess types of training and training methods in a particular or variety of sports or • compare year training programs for an individual and a group sport.
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 1.3 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 1 content

Depth study elements	Description
Researcher	Name of student
Guiding question	How is artificial intelligence being used in the healthcare system to support equity of access for individuals?
Rationale	Artificial intelligence (AI) is revolutionising the healthcare system by addressing long-standing challenges related to equity of access for individuals. By using data-driven insights, AI has the potential to minimise disparities and improve healthcare delivery for all. This guiding question explores how AI applications, such as predictive analytics, telemedicine and natural language processing, are breaking barriers to healthcare equity. This question is vital for examining how the integration of AI technologies can create a more equitable healthcare system. It involves a critical analysis of the opportunities and challenges in using AI to ensure that all individuals, regardless of socioeconomic status, geographic location or cultural background, can access high-quality healthcare.

Type of depth study	Secondary investigation on Focus area 1 content, investigating new technologies and treatments in the healthcare system.
Communicating your understanding	A blog will be written to highlight how the integration of AI technologies can create a more equitable healthcare system. It will include a critical analysis of the opportunities and challenges in using AI to ensure that all individuals, regardless of socioeconomic status, geographic location or cultural background, can access high-quality healthcare.
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 how the integration of AI technologies can create a more equitable healthcare system, including opportunities and challenges. Choose a database to explore journal articles, review news articles, NSW Health and Australian Government websites, AIHW. • Review how to write a blog and complete the activities in this text.
3 hours	**Communicate/present data** • Plan blog structure and argument. • Draft blog using a word-processing application (such as Word). • Share for peer feedback • Edit blog based on any feedback. • Submit blog.

TABLE 1.4 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 2 content

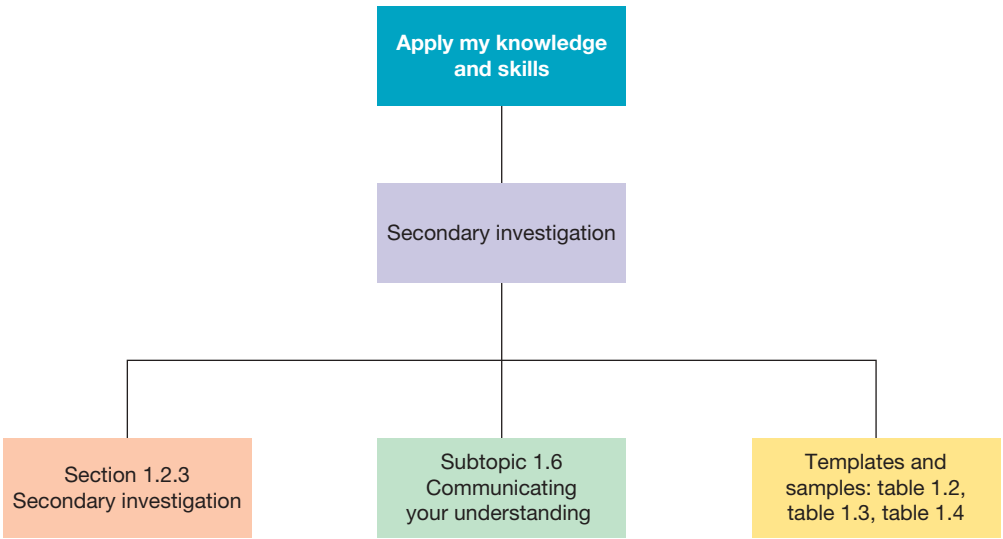
Depth study elements	Description
Researcher	Name of student
Guiding question	How are the principles of training applied to a training program for players of different positions within the same team to support movement and performance? • Choose a sport and at least two positions to assess, e.g. attacking player and defending player or attacking player and goalkeeper. • Investigate each player's position, their training program and consider the similarities and differences in aspects of the principles of training underpinning each program.
Rationale	This depth study explores the principles of training through a comparative analysis of different player positions within a chosen sport. By focusing on at least two distinct positions, such as an attacking player and a defending player, insights are gained into how the physiological, biomechanical and tactical demands of each role shape their specific training programs. This investigation will apply theoretical knowledge, including concepts like specificity, overload and progression, to real-world scenarios in sport. Through this process, I will identify similarities and differences in the training programs for each position, such as fitness components, skill development and recovery protocols. This analysis fosters critical thinking and a deeper understanding of how training is tailored to optimise performance while meeting the unique requirements of each role.

(continued)

TABLE 1.4 Example plan — Individual 10-hour depth study conducting secondary research on Focus area 2 content *(continued)*

Depth study elements	Description
Type of depth study	Secondary investigation
Communicating your understanding	Annotated programs for each athlete and a written evaluation will provide evidence of a detailed analysis.
Timeline (10 hours)	**Phase**
Week 1 (1 hour)	**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 2–6 (5 hours)	**Conduct investigation** • Choose a sport and specific positions to research. • Review the literature to gain insights into how the physiological, biomechanical and tactical demands of each role shape their specific training programs. • Assess and compare programs for individual athletes in the same team — annotate based on the demands of each role and the principles of training.
Weeks 6–10 (4 hours)	**Communicate/present data** • Seek feedback on program annotations — discuss with the teacher and/or a peer. • Synthesise the annotations around how training is tailored to optimise performance while meeting the unique requirements of each role. • Evaluate the effectiveness of the training programs for each player based on the demands of each role and use of the principles of training.

FIGURE 1.9 Pathways for your depth study: apply your knowledge and skills



on Resources

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

1.3.3 Depth study plan: Deepening knowledge — primary investigation

If you are planning to deepen your knowledge through primary investigation, Figure 1.10 outlines the pathways that your study might take.

Table 1.5 shows a depth study plan for primary research. This includes identifying the rationale or reasons for your research and the methods of data collection that you might use. Table 1.6 shows an example plan for your reference.

FIGURE 1.10 Pathways for your depth study: deepen your knowledge

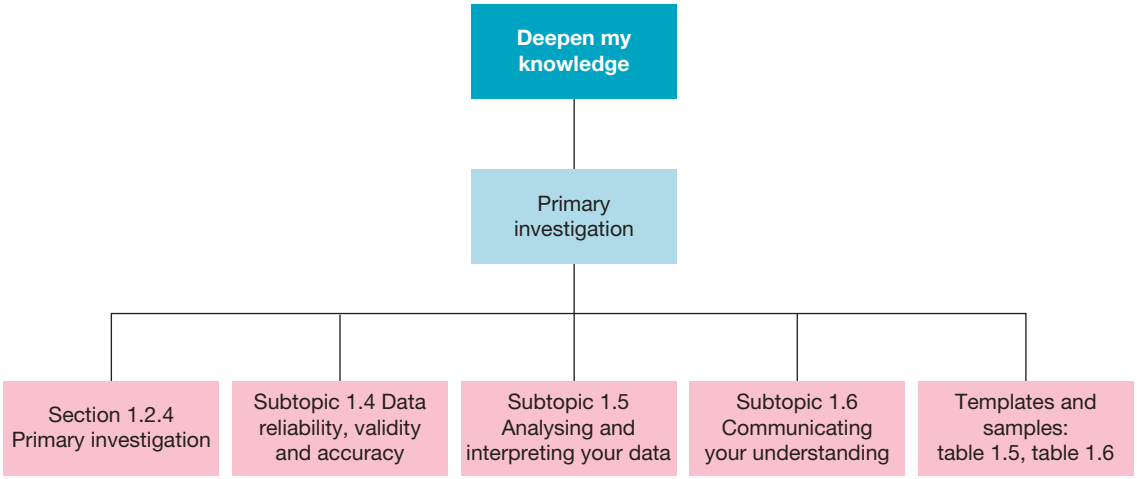


TABLE 1.5 Depth study plan for primary research

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.

(continued)

TABLE 1.5 Depth study plan for primary research *(continued)*

Depth study elements	Description
	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 1.6 Example plan — 15–20-hour depth study conducting primary research

Depth study elements	Description
Research question or hypothesis	What is the role of explicit instruction when coaching a team during a training session? *Sub questions:* • How does the instruction provided effect player understanding and participation in training? • How does the instruction provided effect player motivation and engagement? • How does the coach modify the instruction based on the expertise of the player? What effect does this have?
Key search terms	explicit instruction, motivation, engagement, learning, participation
Rationale	This depth study investigates the role of explicit instruction in coaching and its impact on player development and team dynamics during training sessions. By exploring the main question and sub-questions, I will analyse how the clarity and delivery of instruction influences player understanding, participation, motivation and engagement. This study also examines how coaches adapt their instruction methods based on players' different levels of expertise and how these modifications affect performance and learning outcomes. This investigation will support a deeper understanding of the relationship between communication, teaching strategies and player psychology in a team setting. It applies theoretical concepts, such as pedagogical approaches, motivation theories and skill acquisition models, to real-world coaching scenarios.
Type of depth study	Primary investigation, fieldwork observation
Leading researchers	Sweller, J., Archer, A., Rosenshine, B., Hammond, L., Mathews, H., and Cohen, J., Martin, A., Evans, P., Ginns, P., Ayers, P., Kalyuga, S.
Communicate your understanding	Viva voce presentation in Week 10

Timeline	Phase
3–4 hours	**Planning phase** • Participate in class discussions to understand the research topic and discuss key terms. • Do some preliminary reading to deepen understanding to inform your research questions and design. • Plan the research question and sub-questions. • Plan how the research will be conducted. • 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 and maintaining anonymity and confidentiality for participants in the research. • Plan how the research will be communicated.
5–6 hours	**Conduct investigation and record data** • Conduct individual or group research based on the sub-questions and key concepts like explicit instruction during sports coaching/training, effects on player participation, learning, motivation, engagement, and differentiation of instruction. • Conduct a fieldwork observation by watching a coaching session (preferably live but could also be recorded) and take notes aligned to your sub-questions. You may also have the chance to interview a coach and players, record their responses, and analyse them.
5 hours	**Analyse and interpret data** • Analyse and interpret your findings in relation to your research sub-questions. What were your key findings? How did the findings relate to previous research on the topic? Were there any limitations? • Join class discussions to link your observations to research findings and deepen your understanding.
3–4 hours	**Communicate your understanding** • Plan the structure and argument. • Draft your response to communicate your understanding • Share for peers and/or teacher feedback. • Edit based on any feedback • Submit. • Share and discuss key findings with the class to deepen your understanding.

on Resources

Digital documents Depth study plan template: primary research (doc-34894)
Ethics checklist (doc-34896)
Participant information (doc-36159)
Consent form (doc-36160)

1.4 Data reliability, validity and accuracy

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

Primary Investigation

1.4.1 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

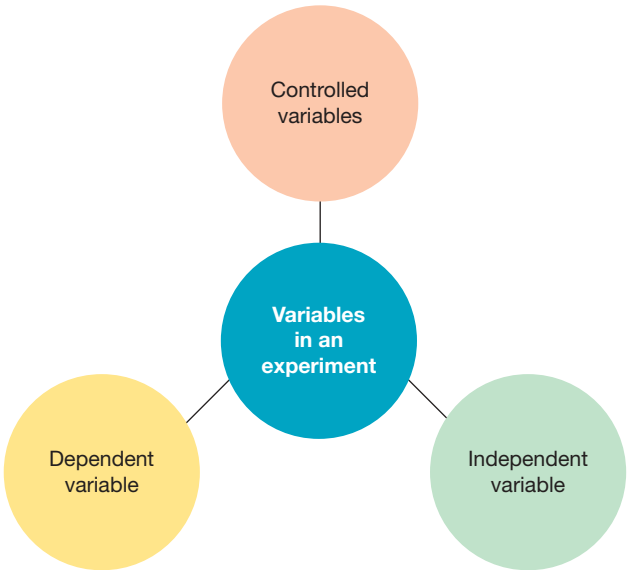
accuracy refers to how close a measurement or calculation is to the standard or correct value, which is set by previous reliable studies

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

FIGURE 1.11 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 the relationship between the principles of training, physiological responses and improved performance, the variables would be as follows:

- *independent variable* — training threshold or intensity
- *dependent variable* — heart rate
- *controlled variables* — athlete/s, activity, time of day, environment in which the activity is conducted.

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.

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

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 1.7.

TABLE 1.7 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.

1.5 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.

1.5.1 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 1.8.

TABLE 1.8 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 help 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.

1.5.2 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 1.9 Example of analysing qualitative data using codes

Research title	Element to be coded	Codes
Equitable actions to improve the health of Australians	Sustainable Development Goals (SDGs)	Good health and wellbeing (SDG 3)
		Quality education (SDG 4)
		Reduced inequalities (SDG 10)

Step 2 — Identifying themes, patterns and relationships

Unlike quantitative data analysis, there is no universally comparable technique for generating findings. 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 show 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

Question: What planning has been put in place to promote and improve the health of young Australians?

Coding for Sustainable Development Goals indicators: SDG3[1], SDG4[2], SDG10[3]

NSW Youth Summit — Ministerial Releases extract (2024, November 18)

'With more than a dozen key Ministers in attendance, the Youth Summit is an unprecedented opportunity for young people to speak truth to power, addressing the policies that impact their lives and shaping NSW's future. A Youth Summit Working Group made up entirely of young people led the design of the event[3], identifying the critical issues for discussion with Ministers and Commissioners including cost-of-living pressures[3], mental health[1], housing availability[3], climate change, education[2] and employment.'

NSW Youth Summit Working Group member, 18-year-old Molly Croft from Dubbo said:

'I'm particularly passionate about addressing the challenges faced by young people with disabilities, including those living with chronic illness[1].

As someone who has lived with the effects of cancer and a disability, I understand firsthand the barriers to inclusion and access that exist[3]. Whether it's education[2], employment or simply feeling a sense of belonging, these barriers can be significant[3].

I hope to see tangible outcomes that address key issues raised during the Summit, including policy recommendations that promote inclusion, mental health support[1] and better access to services for rural and regional youth[3].'

Source: NSW Government (2024, Nov 18). NSW Youth Summit: Young people shaping the future of NSW. https://www.nsw.gov.au/media-releases/nsw-youth-summit-young-people-shaping-future-of-nsw.

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. This 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.

[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.

1.6 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

1.6.1 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 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.

For example, it may be used as evidence for these outcomes:

- Knowledge outcome: analyses the health status of Australians at a national and international level **(HM-12-01)**
- Skill outcome: Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts **(HM-12-07)**.

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 show your learning and achievement.

As portfolios are created over a period of time, it is important you consider the ICT application you will use. 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. These may change over time so make sure to use the latest versions available.

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 or EduChat [Department of Education schools]). 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.

1.6 ACTIVITIES 1

Planning your portfolio

1. Choose one or more syllabus dot points.
2. Select the knowledge and skill outcomes that align with the syllabus dot point(s) you have chosen.
3. Choose one of the ICT applications listed and set up a structure that allows you to include work samples with a combination of self, peer and teacher reflections/feedback to showcase your learning against the outcomes selected.
4. Share your resource with a peer and seek feedback on the layout.

1.6.2 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 1.12 Suggested steps for writing an essay.

1.6 ACTIVITIES 2

Planning your essay

Planning your essay involves considering what you already know about the topic. You then need to research to find answers to the essay question.

1. *Statement*. Start by developing a statement that provides a clear answer to the essay question. This should be one or two sentences, which then become part of the introduction.
2. *Main points*. Follow with a paragraph or set of points that indicate your reasons for your answer. Each point should be developed into a paragraph. These paragraphs are the building blocks of your argument. Aim for about 3 points in a 1000-word essay. You may want to write your main points, then number them. Decide on a logical order and present your ideas as a unified discussion.
3. *Structure*. Draft your introduction, body and conclusion. Include possible references in your plan, and state the evidence you might draw on to support your main points.

1.6.3 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.

1.6 ACTIVITIES 3

Planning for your viva voce

- In pairs, each student should develop a list of questions relating to the topic or content point/concept from the syllabus.
- Take turns asking your partner a question and providing feedback (linked to knowledge and skill outcomes) on the response.
- Try to incorporate the feedback given for the next question.
- Reflect on how you performed. What did you do well? What could you improve?

1.6.4 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. Think about 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. Part of this is identifying how the research could be improved.
- *References* — 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 EndNote, Zotero or Mendeley can help to automatically generate a reference list that can be included at the end of the paper.

1.6 ACTIVITIES 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.

1.6.5 How to create a multimodal presentation

A multimodal presentation is one that uses two or more modes of communication to present content and 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 show 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.

1.6 ACTIVITIES 5

Creating a multimodal presentation

1. Use PowerPoint to create a short multimodal presentation on a syllabus dot point that you have studied. Insert your text first, then use the 'insert media' function to create voice-overs and insert video. Finally, 'screen record' your presentation and share with your class as a source of revision.
2. Research software applications that will enable you to create a presentation for your purpose and audience. This may involve talking to others, reading software review articles or watching tutorial videos.
3. Choose an application and get to know the features. Create a short multimodal presentation that includes text, images or video, and sound.

1.6.6 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.

1.6 ACTIVITIES 6

Planning for your unseen timed response: stimulus — video

Use the video weblinks in the Resources panel to watch one of the videos:

1. A recovery video that includes an underwater treadmill. (Weblink: **Redskins hydrotherapy complex**)
2. A full recovery routine for a footballl player, including injury recovery methods. (Weblink: **How Pro Athletes Recover**, note: watch until 12.10)
3. Cool-down for after dance activities. (Weblink: **Cool-down for after dance activities**)

Then answer the following question. In pairs, as a group or a class:

- Discuss how recovery strategies are used for sustained movement and performance (consider types of recovery activities; including physiological, psychological, nutrition and hydration, timing in relation to games/performance, sequence, specificity to sport).

Resources

Weblink Redskins hydrotherapy complex
How Pro Athletes Recover
Cool-down for after dance activities

1.6.7 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.

To do a literature review, start by identifying a research topic.

Refine your research question to define the study's scope, which will likely evolve as you review literature. Create a list of synonyms for your research terms to use in searches.

Find relevant information using library catalogues, online databases, Google Scholar, and the websites of reputable organisations such as NSW Health, AIHW, OECD, WHO, and UNESCO. These sources offer evidence-based reports and literature reviews.

Be strategic in sorting your readings. Read introductions or abstracts to see if they fit your research. Sometimes, reading the conclusion is also helpful.

Analyse, evaluate, and summarise your readings. Consider making an annotated bibliography, summarising each source in 100–200 words. Organise your readings by theme for easy reference. Discuss your research ideas with your teacher for guidance.

When writing your literature review:
Introduction: Define your topic, purpose, key themes, and structure.
Body: Organise content into themes with headings, and discuss various perspectives.
Conclusion: Summarise key findings, note study limitations, identify gaps, and link to your research.

1.6 ACTIVITIES 7

Steps in a literature review

Start by researching your topic to inform your hypothesis and methods.

Split tasks among group members: search for information, sort readings, and summarise findings.

Tools to help:
- OneNote: Organise and share notes.
- R Discovery: AI-based app to find relevant papers.
- Microsoft Word or Mendeley: Organise references and format citations.

1.6.8 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.

FIGURE 1.13 Writing a blog is a different way to share your research findings and your perspectives on a topic.

Most blogs include a basic structure and features. These may include:
- a header with a menu or navigation bar
- a main content area with 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.

The benefits of blogging include the following:
- *Being clear 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 bullet points.
- *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.
- *Finding your voice*. 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.
- *Developing deep understanding*. The process of planning and writing a blog really help to consolidate knowledge and develop deep understanding.

1.6 ACTIVITIES 8

Planning your blog

If you are considering choosing a blog to communicate your understanding, complete the following questions. These can 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.

1.6.9 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 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.
- *keep to 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.

on Resources

Weblink What the Olympics Can Teach Us About Excellence (2024, August 9)

1.6 ACTIVITIES 9

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 '*The New York Times*' Op Ed: **What the Olympics Can Teach Us About Excellence** 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.

1.7 Review

1.7.1 Topic summary

1.2 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 12 and a total of 30 hours in-class time allocated to Focus area 1 and/or Focus area 2.
- One depth study must be formally assessed as a school-based assessment task.

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.

1.3 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. One of your depth studies must be formally assessed. Your teacher will provide guidance on how this task is to be conducted and assessed.
- Thorough planning at the beginning will support time-management and effective decision-making throughout your depth study.

1.4 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.

1.5 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.

1.6 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-informed 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.

Resources

Digital documents Topic 1 summary (doc-43044)
Key terms glossary (doc-43045)

FOCUS AREA

1 Health in an Australian and global context

TOPIC

2 How healthy are Australians? 34

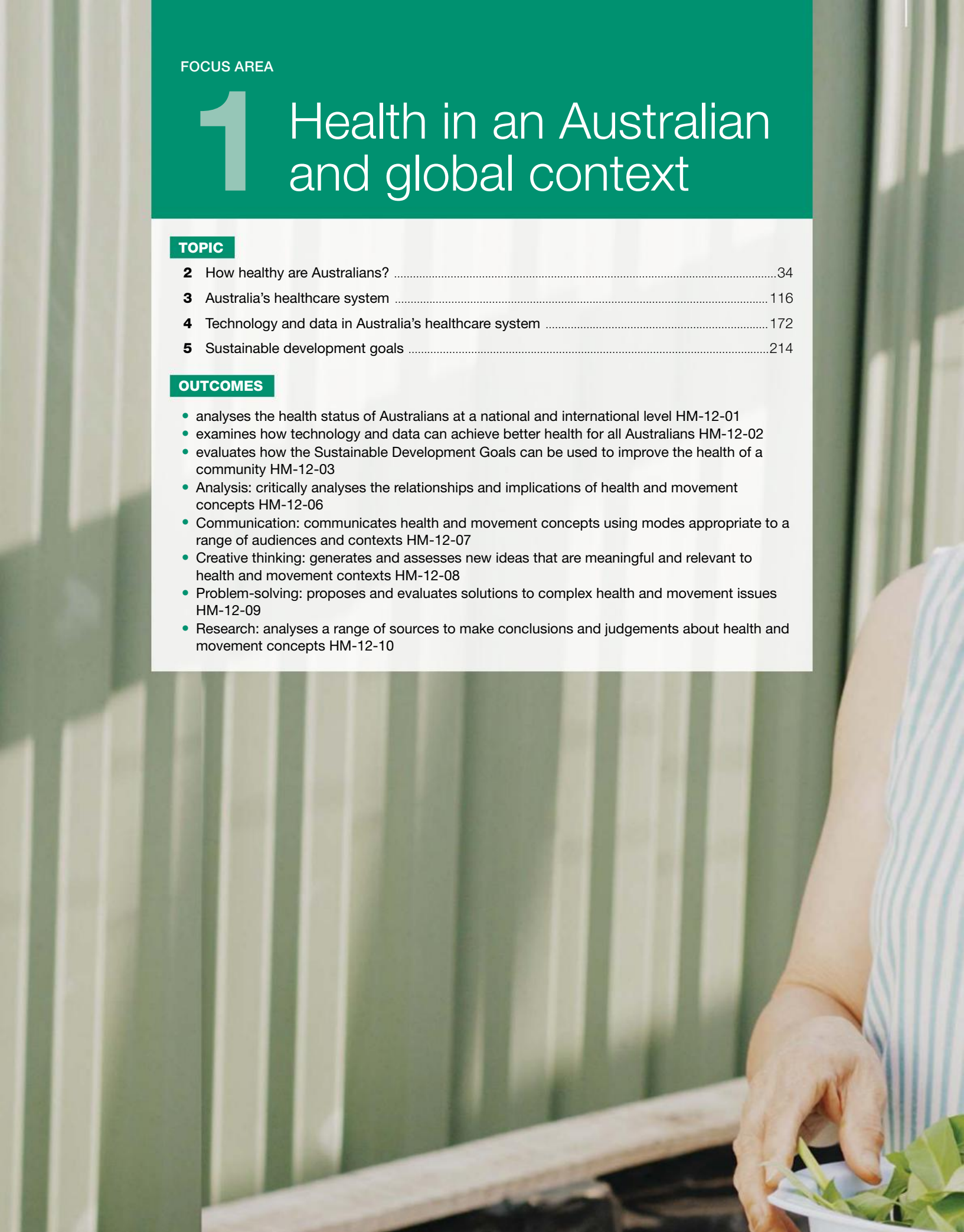
3 Australia's healthcare system 116

4 Technology and data in Australia's healthcare system 172

5 Sustainable development goals 214

OUTCOMES

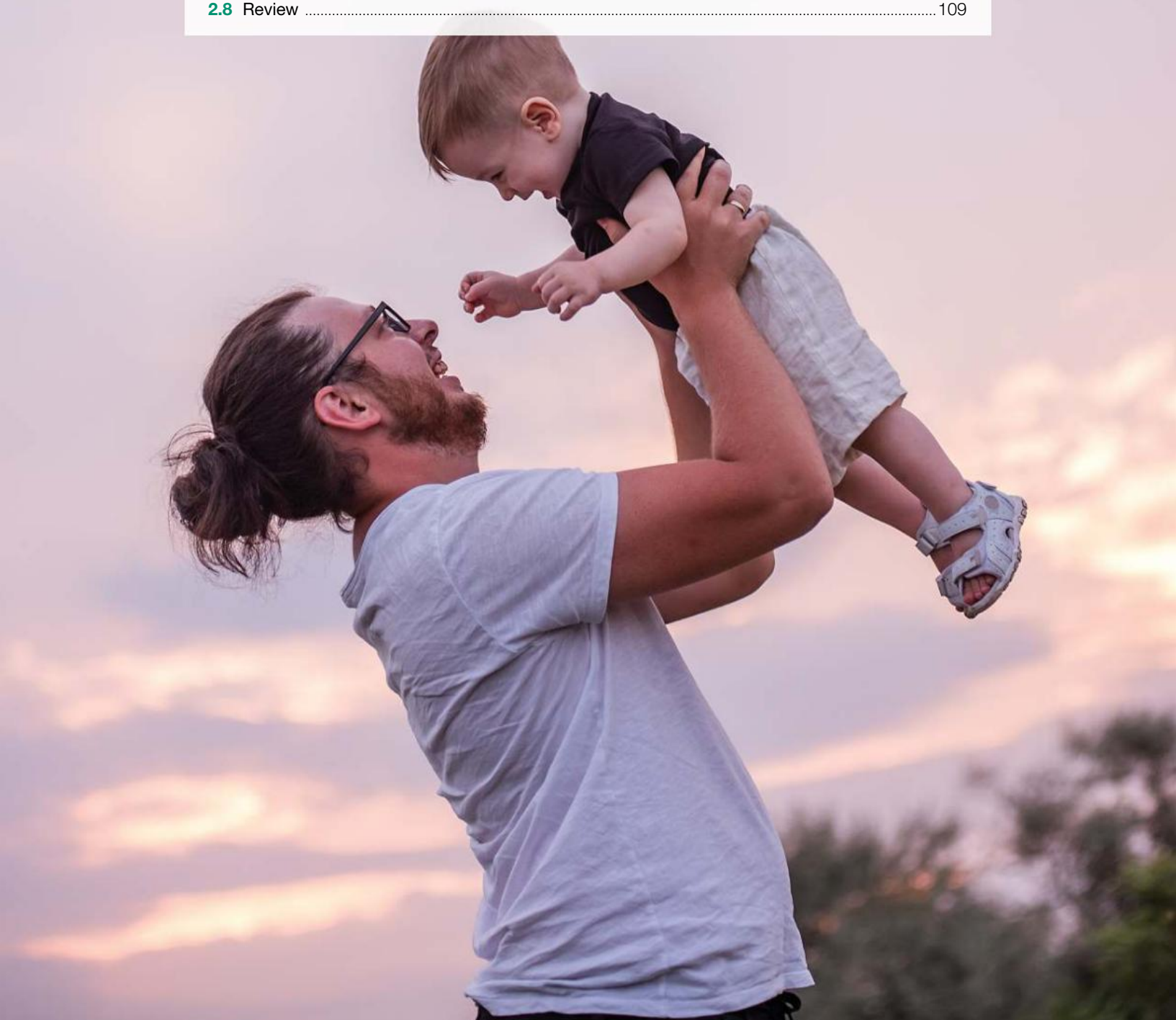
- analyses the health status of Australians at a national and international level HM-12-01
- examines how technology and data can achieve better health for all Australians HM-12-02
- evaluates how the Sustainable Development Goals can be used to improve the health of a community HM-12-03
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10



2 How healthy are Australians?

LEARNING SEQUENCE

2.1 Overview 35
2.2 Current health status of Australians 37
2.3 Groups experiencing inequities in health 46
2.4 Health status of Australia and other OECD countries 76
2.5 Chronic conditions, diseases and injury in Australia 83
2.6 Impact of an ageing population on Australia's health 98
2.7 Sample exam question response 108
2.8 Review 109



2.1 Overview

Hey students! Bring these pages to life online

Watch videos

Engage with interactivities

Answer questions and check results

Find all this and MORE in jacPLUS

Key inquiry question

How healthy are Australians?

Syllabus

Note: Students do not need to know the latest statistics on the rates of illness and death. It is only important that they develop an understanding of the trends.

	Syllabus content	Subtopic
○	■ Analyse the current health status of Australians from *Australia's Health* and other health reports, tables and graphs **Including:** • what does the data tell us? • what are the major causes of morbidity and mortality, and the life expectancy for males, females and the general population? • what are the sociological causes of risky health behaviours? • where do inequities exist and what can we do about them?	**2.2**
○	■ Analyse groups experiencing inequities in health, including Aboriginal and Torres Strait Islander Peoples and one other group (socioeconomically disadvantaged people, rural and remote, culturally and linguistically diverse populations, people with disability or older people) **Including:** • what does the data tell us? • how do the determinants interact to affect the health of population groups? • what are some of the causes that underpin the inequities in health? • what actions can be implemented to improve the health status of these groups? **Example(s):** **Causes that underpin the inequities in health:** Impacts of colonisation on Aboriginal and Torres Strait Islander Peoples.	**2.3**
○	■ Compare the health status of Australia with that of other OECD countries **Including:** • where does Australia rank in relation to other OECD countries? • why might this be the case? • why do some countries rank higher or lower than Australia? • what can we learn from other countries that may be applied to the Australian context?	**2.4**
○	■ Examine chronic conditions, diseases and injury in Australia, including cardiovascular disease, cancer and ONE other condition, disease and injury using *Australia's Health* and other health reports **Including:** • what does the data tell us about the mortality and morbidity, prevalence and incidence rates of these conditions? • what are the risk and protective factors for these conditions? • where and for whom are these conditions changing?	**2.5**

◯	■ Investigate the impact of an ageing population on Australia's health **Including:** • what does the data tell us? • what is healthy ageing? • what are the opportunities and challenges for an ageing population? • what are current and future strategies to support healthy ageing? • what do government and non-government agencies need to consider to address the future needs of a growing and ageing population?	**2.6**

Source: *Health and Movement Science Stage 6* © NSW Education Standards Authority for and on behalf of the Crown in right of the State of New South Wales, 2025.

Outcomes

- analyses the health status of Australians at a national and international level HM-12-01
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

on Resources

Digital documents Topic 2 summary (doc-43047)
Key terms glossary (doc-43048)
Revision quiz (doc-43049)

2.2 Current health status of Australians

Syllabus: Analyse the current health status of Australians from *Australia's Health* and other health reports, tables and graphs

Including:

- what does the data tell us?
- what are the major causes of morbidity and mortality, and the life expectancy for males, females and the general population?
- what are the sociological causes of risky health behaviours?
- where do inequities exist and what can we do about them?

2.2.1 What does the data tell us?

Epidemiology is 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. Epidemiological data on the health status of Australians is published by the Australian Institute of Health and Welfare (AIHW) in their report titled *Australia's Health*. This is published every two years. It serves as a report card on the nation's health by presenting the most recent data on the major causes of **morbidity**, **mortality** and **life expectancy** as well as exploring the **sociological causes** of **risky health behaviours** and the **inequities** faced by different population groups.

FIGURE 2.1 Epidemiological data looks at the health of the Australian population.

The most recent publications of *Australia's Health* show that over the last 100 years, life expectancy in Australia has increased significantly and deaths from infectious diseases have declined. However, because of the COVID-19 pandemic, for the first time in over 50 years, an infectious disease is in the top five causes of death.

Key trends

- Since the 1960s, mortality rates for coronary heart disease have fallen by more than 80 per cent and mortality rates for cancer decreased by 32 per cent over the last 30 years.
- Chronic conditions such as dementia and mental illness continue to increase in prevalence, resulting in substantial rates of ill health, disability and premature death.
- There have been improvements in some risk factors including the decline in daily tobacco smoking and risky alcohol consumption; however, the proportion of people using e-cigarettes and those living with overweight and obesity is increasing.
- Although there have been improvements in the health of Aboriginal and Torres Strait Islander Peoples, such as a decline in mortality rates for cardiovascular disease, there remains a significant health gap compared with other Australians.

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

life expectancy measures how long, on average, a person is expected to live, based on current age and sex-specific death rates. It is often expressed as the number of years a person born today is expected to live.

sociological causes societal influences or reasons. These include social relationships, social interaction and culture of everyday life.

risky health behaviours a health behaviour is considered risky when it increases the likelihood of negative health outcomes, such as injury, illness or premature death

inequities unfair differences in levels of health status between groups in a society

2.2.2 What are the major causes of morbidity and mortality, and the life expectancy for males, females and the general population?

Morbidity

Morbidity refers to the ill health of an individual and levels of ill health in a population or group. Morbidity data is often measured in terms of the burden of disease. Burden of disease, measured in Disability-Adjusted Life Years (DALYs), combines the years of healthy life lost due to living with ill-health (non-fatal burden) with the years of life lost due to dying prematurely (fatal burden). The leading causes of disease burden differ for males and females:

- males experience a higher total burden than females overall and across most age groups.

Disease burden differs throughout various stages of life:

- in the first half of life (ages 5–44) mental health conditions and substance use disorders are the greatest cause of burden.
- musculoskeletal conditions, cardiovascular diseases and cancer are the leading causes in the latter part of life (ages 45–84)
- neurological conditions, including dementia, are the leading cause in those aged 65 and over.

TABLE 2.1 Leading causes of disease burden for males and females, 2023

Males	Females
1. Coronary heart disease	1. Dementia
2. Back pain and problems	2. Anxiety disorders
3. Suicide and self-inflicted injuries	3. Back pain and problems

Source: Australian Institute of Health and Welfare (2024) *Australia's health 2024: in brief*, catalogue number AUS 249, AIHW, Australian Government.

TABLE 2.2 In 2023, the five leading disease groups that caused the most burden overall were mostly chronic, or long-lasting, conditions

	Cancer	Mental health & substance use	Musculoskeletal	Cardiovascular	Neurological
% of total DALY	17	15	13	12	8
% of total DALY that was fatal	91	2	3	74	49
Change in age-standardised rates between 2003 and 2023	↓ Decreased	↑ Increased	↓ Decreased	↓ Decreased	↑ Increased

Note: DALY = Disability adjusted life year

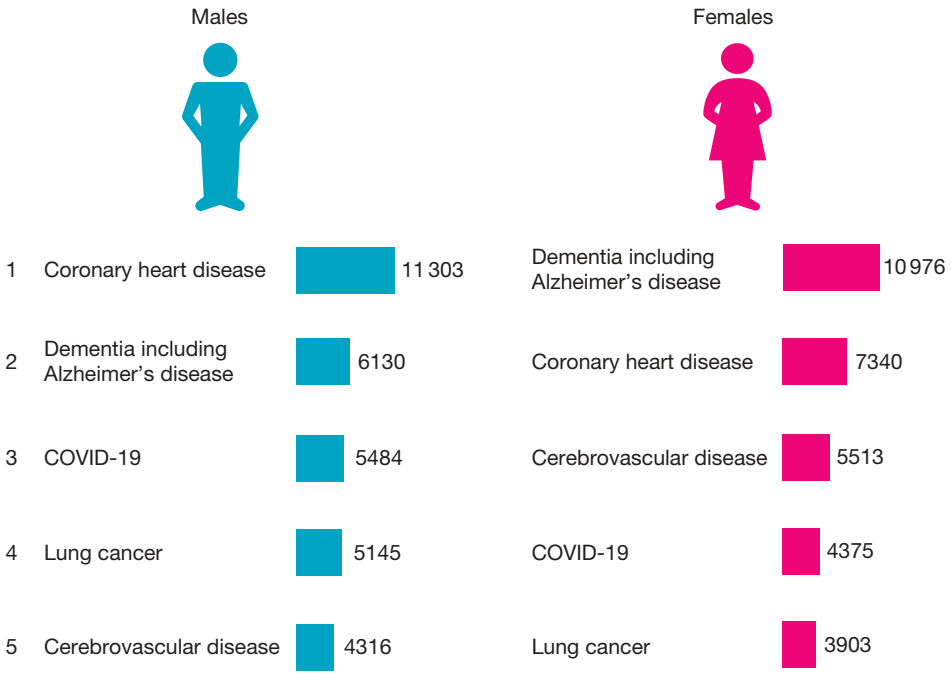
Source: Australian Institute of Health and Welfare (2024) *Australia's health 2024: in brief*, catalogue number AUS 249, AIHW, Australian Government.

Mortality

Mortality is defined by the number or rate of deaths in a population during a given time period. The collection of mortality data assists in working out the health status of Australians as a whole, as well as specific population subgroups.

Figure 2.2 shows the leading causes of death for males and females in 2022. The five leading causes of death are the same for both males and females; however, there are differences in their order. For males, coronary heart disease is the leading cause of death, whereas dementia, including Alzheimer's disease, is the leading cause for females.

FIGURE 2.2 The leading causes of death, by sex, 2022



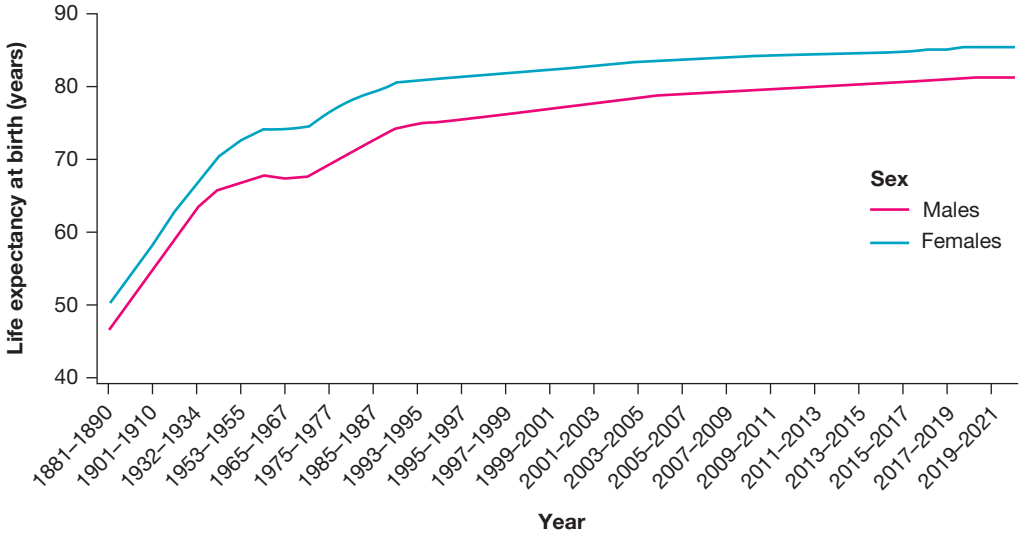
Source: AIHW National Mortality Database; Table S3.1. http://www.aihw.gov.au.

Life expectancy

Life expectancy measures how long, on average, a person is expected to live, based on current age and sex-specific death rates. It is often expressed as the number of years a person born today is expected to live. For Australians born between 2020–22, they can expect to live on average 81.2 years for males and 85.3 years for females.

As shown in figure 2.3, life expectancy increased dramatically between 1881 and 1995 and has continued to steadily increase until 2019. Between 2020–22, for the first time since the mid-1900s, life expectancy decreased. This is primarily due to the large increase in deaths in 2022, which can be attributed to COVID-19 and increases in other causes of mortality.

FIGURE 2.3 Life expectancy (years) at birth in Australia, by sex, 1891–1900 to 2020–22



Source: Australian Institute of Health and Welfare. http://www.aihw.gov.au.

2.2.3 What are the sociological causes of risky health behaviours?

Health behaviours refer to a person's beliefs and actions regarding their health and wellbeing. Examples include tobacco use, alcohol consumption, physical activity and dietary behaviour. It is important to recognise that there are many factors that influence an individual's health behaviours including their environment, community, culture and social values. A health behaviour is considered risky when it increases the likelihood of negative health outcomes, such as injury, illness or premature death. As a result, risky health behaviours can lead to:

- Increased risk of disease or illness including chronic diseases (such as coronary heart disease, cancer or diabetes), and infectious diseases (such as sexually transmitted diseases).
- Potential for immediate harm or injury; for example, driving under the influence of alcohol or drugs can result in car accidents, causing injury or death.
- Long-term health consequences due to cumulative damage to the body from diets high in ultra-processed foods, tobacco smoking or alcohol abuse.
- Negative impacts on mental health, increasing stress, anxiety or depression. For example, substance abuse can worsen mental health conditions, leading to addiction, social isolation and a decline in overall wellbeing.

It is important to recognise that an individual's health behaviours are influenced greatly by sociological causes. Sociological causes are defined as the societal influences or reasons influencing human behaviour. These include social relationships, social interaction and the culture of everyday life.

Social relationships

Social relationships refer to the connections and bonds people have with family, friends, peers and their communities, all of which can influence risky health behaviours. Through the influence of social networks and peer pressure, young people are more likely to start smoking, drinking or using illicit drugs if their friends engage in these behaviours. Furthermore, social reinforcement of these behaviours can delay quitting despite an individual's awareness of health risks.

FIGURE 2.4 Social relationships, including family life, can influence our health behaviours.

The family environment, including factors such as parental behaviour, can influence the likelihood of engaging in risky behaviours. For example, children growing up in households where smoking or alcohol consumption is common may be more likely to adopt these behaviours, as they observe and internalise these actions as part of normal family life.

Social interaction

Social interaction focuses on how daily interactions with others in society influences behaviours, often through what is accepted as normal (peer norms) and social settings. Work-related stress due to long hours, high pressure or low job satisfaction often leads to the development of unhealthy coping mechanisms. For example, employees in high-stress environments, combined with long working hours, may drink alcohol excessively as a way to manage stress, and may not find opportunities within their week to include appropriate levels of physical activity.

The normalisation of risky behaviours within specific social settings or communities may also lead to negative health outcomes. Drinking alcohol at sporting events and social gatherings has become culturally embedded in some communities. When binge drinking becomes the social norm, such as within sporting clubs or parties, it can contribute to alcohol-related health issues such as injury, land transport accidents and chronic diseases such as cardiovascular disease.

health behaviours a person's beliefs and actions regarding their health and wellbeing. For example, tobacco use, alcohol consumption, physical activity or dietary behaviour.

Culture of everyday life

The culture of everyday life involves norms, practices and shared understandings that shape health behaviours. These are often affected by systems, the environment and the media. For example, government policies can shape everyday life systemically by regulating access to harmful substances like tobacco and e-cigarettes. Successful regulations involving tobacco have reduced the numbers of daily smokers in Australia in recent decades. Strict measures, such as high taxes on tobacco products, plain packaging laws and public health campaigns helped to discourage smoking. However, weak regulations and the rise in popularity of e-cigarettes have led to increased rates of use and associated health concerns, particularly among teenagers.

An individual's attitudes to smoking and e-cigarettes can be shaped by their environment. For example, if a child is raised in a smoke-free household they will be more likely to avoid this risky health behaviour themselves. If smoking and e-cigarettes are common in an individual's environment, they are more likely to copy the behaviour and start using them.

Media and marketing can normalise risky health behaviours through advertising. Since the early 1990s, tobacco advertising and sponsorship have been banned in Australia, with further restrictions introduced in 2012 through plain packaging laws. However, the rise of social media influencers has allowed e-cigarettes to bypass these public health measures. When young people see influential social media personalities using e-cigarettes, it can encourage them to do the same. The heavy promotion of alcohol, fast food and gambling, particularly during sporting events, can also lead to cumulative harm to an individual's physical, social and mental health.

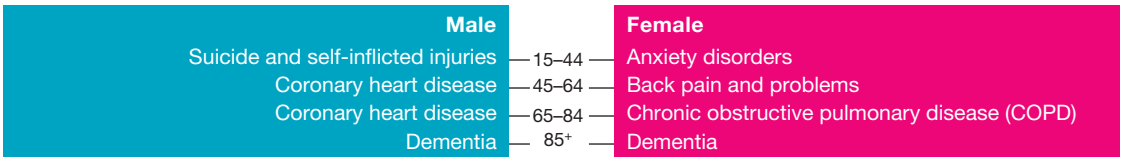
2.2.4 Where do inequities exist and what can we do about them?

The World Health Organization (WHO) defines health inequities as 'the differences in health status or in the distribution of health resources between different population groups'. Across the general population of Australia, a number of health inequities exist in terms of morbidity, mortality and life expectancy for males and females.

Males

Males are more likely to die prematurely whereas females are more likely to live with disease for longer. The leading causes of ill health and premature death for males and females are shown in figure 2.5.

FIGURE 2.5 Leading causes of ill health and premature death, by age group, 2022



Source: Australian Institute of Health and Welfare. http://www.aihw.gov.au.

The fact that males are more likely to die prematurely is consistent over the past 100 years, as seen in the life expectancy data in figure 2.3. In 2022, the difference in life expectancy at birth for males and females was 4.1 years.

What can we do about health inequities for males?

Importantly, although these inequities may be unfair, they have the potential to be reduced through the right mix of individual, social and government intervention. According to the Australian Institute of Health and Welfare (AIHW), around 40 per cent of ill health and premature death in Australian males is potentially preventable.

In order to prevent ill health or premature death, it is important to reduce exposure to, or avoid, specific risk factors. These include factors such as tobacco use, being overweight (including obesity), all dietary risks, alcohol and illicit drug use. As men age, certain health risks become more noticeable (see figure 2.6).

It is important to improve awareness and health literacy for men through health promotion campaigns that emphasise regular check-ups and early intervention. This health literacy can also encourage men to choose protective health factors such as being more active, eating balanced diets, and avoiding smoking and alcohol. Additionally, men can take preventive measures like regular check-ups and screenings to lower their chances of getting chronic diseases like cardiovascular disease and diabetes.

FIGURE 2.6 Leading risk factor contribution to ill health and premature death, males aged 15 and over, 2018

Males	Age group (years) 15–24	25–44	45–64	65–84	85+
1st	Alcohol (23.3; 14.4%)	Alcohol (55.4; 11.7%)	Overweight/ obesity (88.5; 11.9%)	Tobacco (122.6; 13.8%)	Blood pressure (24.5; 11.5%)
2nd	Illicit drug use (14.4; 8.9%)	Illicit drug use (53.5; 11.2%)	Tobacco (87.0; 11.7%)	Overweight/ obesity (104.1; 11.7%)	Diet (20.8; 9.7%)
3rd	Child abuse/neglect (8.9; 5.5%)	Child abuse/neglect (22.0; 4.6%)	Diet (63.0; 8.5%)	Diet (77.6; 8.7%)	Tobacco (20.5; 9.6%)
4th	Occupational (4.8; 3.0%)	Overweight/ obesity (20.6; 4.3%)	Blood pressure (47.3; 6.4%)	Blood pressure (76.8; 8.7%)	Overweight/ obesity (19.0; 8.9%)
5th	Overweight/ obesity (2.7; 1.6%)	Occupational (19.5; 4.1%)	Alcohol (47.0; 6.3%)	Blood glucose (64.7; 7.3%)	Physical inactivity (12.0; 5.6%)

Notes:

1. For age groups under 25, many risk factors were not measured due to data limitations of linked diseases among these age groups.
2. DALY = Disability Adjusted Life-Year.
3. Partner violence = Intimate partner violence; Blood glucose = High blood glucose; Blood pressure = High blood pressure; Occupational = occupational exposures and hazards.

Source: Australian Institute of Health and Welfare. http://www.aihw.gov.au.

Another way to reduce the health inequities faced by Australian males is to improve their ability to seek healthcare services. A significant proportion of males aged 15 and over, who needed to see a GP, often waited longer than they felt acceptable to make an appointment. By avoiding or delaying seeking healthcare, individuals:

- Increase their likelihood of receiving a late diagnosis and treatment. For males, this can be particularly problematic for conditions such as coronary heart disease, mental health disorders and cancers, which may progress silently without detection.
- Elevate psychological distress if they are experiencing anxiety or depression. This delay may prevent men from accessing timely interventions, which are critical for the management of mental health disorders.

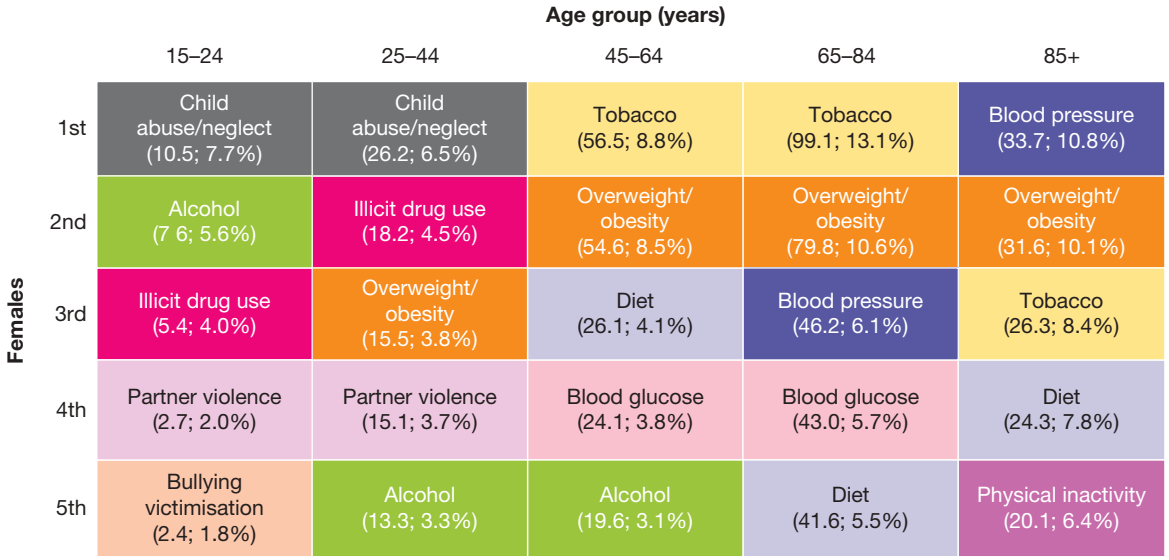
In order to improve male access to health services, one strategy is to implement targeted programs that encourage men to seek care earlier and more frequently. Male-friendly clinics with flexible hours and drop-in services could help to address some of the cultural barriers to healthcare and encourage more men to seek healthcare without delay.

Females

Although females have a higher life expectancy than men, they experience higher rates of poor mental health. According to recent AIHW data, the leading causes of disease burden for females include anxiety disorders, back pain and problems, chronic obstructive pulmonary disease (COPD) and heart disease (see figure 2.5). Females also have specific sexual and reproductive health needs which change over their lives and are more likely to experience sexual violence and intimate partner violence.

Although females are more likely than males to seek timely medical care which improves their health outcomes, there are still a number of risk factors, that if removed, could potentially prevent ill health. These include tobacco use, overweight and obesity, all dietary risks and high blood pressure (see figure 2.7).

FIGURE 2.7 Leading risk factor contribution to ill health and premature death, females aged 15 and over, 2018



Notes:

1. DALY = Disability Adjusted Life-Year. This is a measure of healthy life lost, either through premature death or living with disability due to ill health. It is the basic unit used to measure the burden of a disease.
2. Note: For age groups under 25, many risk factors were not measured due to data limitations of linked diseases among these age groups.
3. Partner violence = Intimate partner violence; Blood glucose = High blood glucose; Blood pressure = High blood pressure.

Source: Australian Institute of Health and Welfare. http://www.aihw.gov.au.

What can we do about health inequities for females?

There is increasing evidence that systemic issues in healthcare delivery and medical research leads to poorer health outcomes for women. Women are more likely to face delays in diagnosis, be overprescribed medications, and have their symptoms inadequately investigated. For instance, heart attack symptoms in women are often less recognised compared to those in men.

In order to improve these inequities, strategies include:

- Increase the availability of women-centered healthcare services. These include specialised women's health clinics that focus on gender-specific issues and offer integrated care for conditions affecting women's physical and mental health.
- Increased funding for women's health research, which will include the different ways diseases, such as heart disease, show and progress in women. This also includes conditions that primarily affect women; for example, endometriosis and breast cancer.
- Training healthcare practitioners to recognise **unconscious bias** which may influence diagnosis and treatment decisions for women. This can help reduce the tendency to dismiss or downplay women's symptoms as psychosomatic (in their minds) or less severe.
- Foster a collaborative approach between healthcare providers and female patients, where women are encouraged to participate actively in their care decisions. This could include longer consultations and open discussions about alternative treatments to reduce overprescribing and ensure medications are tailored to the individual, thus minimising harmful side effects.

unconscious bias the attitudes or social stereotypes about certain groups of people that individuals form outside their own conscious awareness. They can affect our understanding, actions and decisions.

DEPTH STUDY IDEA

Complete a data analysis project using *Australia's Health 2024* and other AIHW resources to compare health status indicators between men and women. Students should:

- Present findings in graphs and tables.
- Identify major health issues impacting each gender.
- Draw conclusions about how gender impacts health outcomes and what interventions may be necessary.

2.2 ACTIVITIES

Gender and pain

Use the weblink **Tackling the Gender Pain Gap** in the Resources panel to answer the following questions.

1. How does the gender pain gap affect women's access to care for chronic pain conditions?
2. How can longer Medicare-subsidised appointments improve women's health?
3. The article discusses how deeply embedded gender norms influence healthcare. What are some gender norms for males and females that may contribute to the health inequities they experience?

Inequities and health

Visit the weblink **Australia's Health 2024 — in brief**. Create a brief report on other inequities that exist within the Australian population. Share your findings with the rest of your class.

Case study 1: Causes of death data

Use the weblink in the Resources panel to read the case study **COVID-19 the third-leading cause of death in Australia in 2022, data shows** and answer the following questions.

1. What was the rank of COVID-19 as a cause of death in Australia in 2022?
2. Describe the significance of COVID-19 becoming one of the leading causes of death in Australia.
3. Suggest reasons which may be contributing to the 56 per cent increase in dementia deaths over the last decade.
4. Discuss the relationship between an increase in life expectancy and dementia.
5. Design an intervention program aimed at reducing the incidence of diabetes and alcohol-related deaths in Australia. What key components would you include?

on Resources

Weblinks Tackling the Gender Pain Gap
Australia's Health 2024 – in brief
COVID-19 the third-leading cause of death in Australia in 2022, data shows

2.2 Exercises

learnon

2.2 Quick quiz on | **2.2 Exercise**

Learning pathways

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

These questions are even better in jacPLUS!

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Revise your knowledge

1. Distinguish between mortality and morbidity.
2. What are the leading causes of mortality for males and females?

3. Define ‘risky health behaviours’. Provide examples.
4. Outline TWO sociological causes of e-cigarette use.
5. Describe the health inequities faced by males in Australia.

Apply your knowledge

Use figure 2.6 and figure 2.5 to answer questions 6 and 7.

6. What is the leading cause of ill health and premature death for 15–24-year-olds?
7. Propose reasons for why this is the leading cause of ill health and premature death for this age group.
8. Discuss reasons for the trends in coronary heart disease and cancer in Australia over the past few decades.
9. How has life expectancy in Australia changed between 2020–22, and what factors contributed to this change?
10. To what extent does age and gender influence the health inequities faced by different population groups in Australia?

2.2 Exam questions

Question 1 (1 mark)

Source: *HSC 2021, PDHPE Exam, Section I, Part A, Q.1*

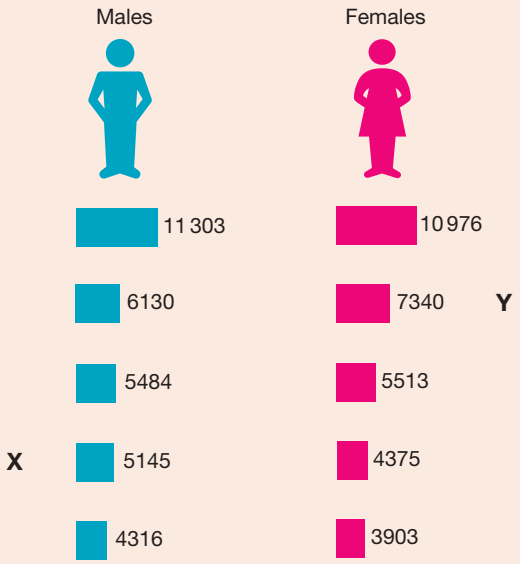
Which of the following describes the trend in life expectancy at birth in Australia over the last 10 years?

A. Stable
B. Increasing
C. Decreasing
D. No clear trend

Question 2 (1 mark)

Source: Adapted from *HSC 2018, PDHPE Exam, Section I, Part A, Q.15*

The table shows the data related to leading causes of death, by sex, in Australia in 2022.



What are the causes labelled by X and Y?

	X	Y
A.	Coronary heart disease	Cerebrovascular disease
B.	Cerebrovascular disease	Lung cancer
C.	Lung cancer	Coronary heart disease
D.	COVID-19	Dementia/Alzheimer’s disease

Question 3 (4 marks)

Source: Adapted from *HSC 2020, PDHPE Exam, Section I, Part B, Q.22*

Complete the table for THREE current leading causes of mortality for males and females in Australia.

Current leading cause of mortality	Trend in mortality rate for males over the last 10 years	Trend in mortality rate for females over the last 10 years

Question 4 (5 marks)

Explain what can be done to address the health inequities faced by males in Australia.

Question 5 (8 marks)

Analyse the sociological causes contributing to risky health behaviours in Australia.

2.3 Groups experiencing inequities in health

Syllabus: Analyse groups experiencing inequities in health, including Aboriginal and Torres Strait Islander Peoples and one other group (socioeconomically disadvantaged people, rural and remote, culturally and linguistically diverse populations, people with disability or older people)

Including:

- what does the data tell us?
- how do the determinants interact to affect the health of population groups?
- what are some of the causes that underpin the inequities in health?
- what actions can be implemented to improve the health status of these groups?

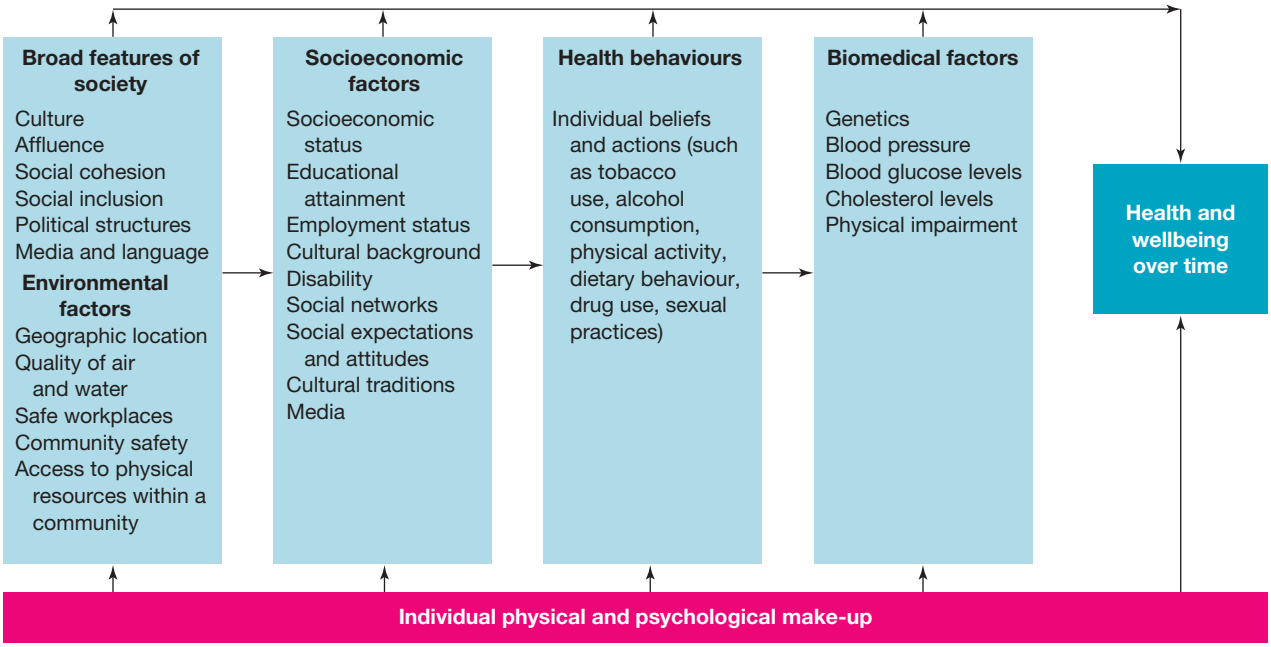
With all the improvements that have occurred in education, technology and research in the past 100 years, the life expectancy of the Australian population has increased from approximately 57 years in 1901 to approximately 84 years in 2023. There have also been drastic improvements in reducing mortality rates from cardiovascular disease and cancers. Unfortunately, these improvements in health status have not been shared by the entire population. There are some groups who face a range of health inequities such as the unequal distribution of illnesses or conditions, higher mortality rates and lower life expectancy. Major indicators — such as the **incidence** and **prevalence** of disease and different rates of sickness, hospitalisation and death — point to areas in which inequities exist.

Health is, to a large extent, the result of people's decisions about health behaviours (such as regular participation in physical activity) and their everyday experiences as they interact and respond to the social, physical and cultural environments in which they live. However, an individual's level of health is determined by a broader range of factors and not just their health-related decisions. The broad features of society, environmental factors, socioeconomic characteristics and biomedical factors play a significant role in the achievement of good health. Some factors have the potential for change, such as individuals choosing not to smoke, or governments making roads safer. Other factors, such as an individual's genetic makeup, are generally not modifiable.

incidence the number of new cases (of an illness or event, and so on) occurring during a given period

prevalence the number or proportion (of cases, instances, and so forth) in a population at a given time. For example, in relation to cancer, it refers to the number of people alive who had been diagnosed with cancer in a prescribed period (usually 1, 5, 10 or 26 years).

FIGURE 2.8 The determinants of health



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.

Health is therefore not only the responsibility of the individual. Governments and health authorities recognise that people cannot always choose a particular lifestyle. Health promotion and illness prevention campaigns attempt to address the **determinants** that have an impact on health or affect people's ability to make good decisions about their health. A determinant is a factor that can have an impact on a person's or group's health status, either positively (protective factors) or negatively (risk factors) (see figure 2.8).

determinants factors that can have an impact on a person's or group's health status, either positively (protective factors) or negatively (risk factors)

The following sections will investigate the main groups that experience health inequities in Australia; that is:

- Aboriginal and Torres Strait Islander Peoples
- socioeconomically disadvantaged people
- rural and remote populations
- culturally and linguistically diverse populations
- people living with disability
- older people.

Each section will analyse the health inequities of each group in terms of:

- What does the data tell us?
- How do the determinants interact to affect the health of the population group?
- What are some of the causes that underpin the inequities of health?
- What actions can be implemented to improve the health status of this group?

2.3.1 Aboriginal and Torres Strait Islander Peoples

What does the data tell us?

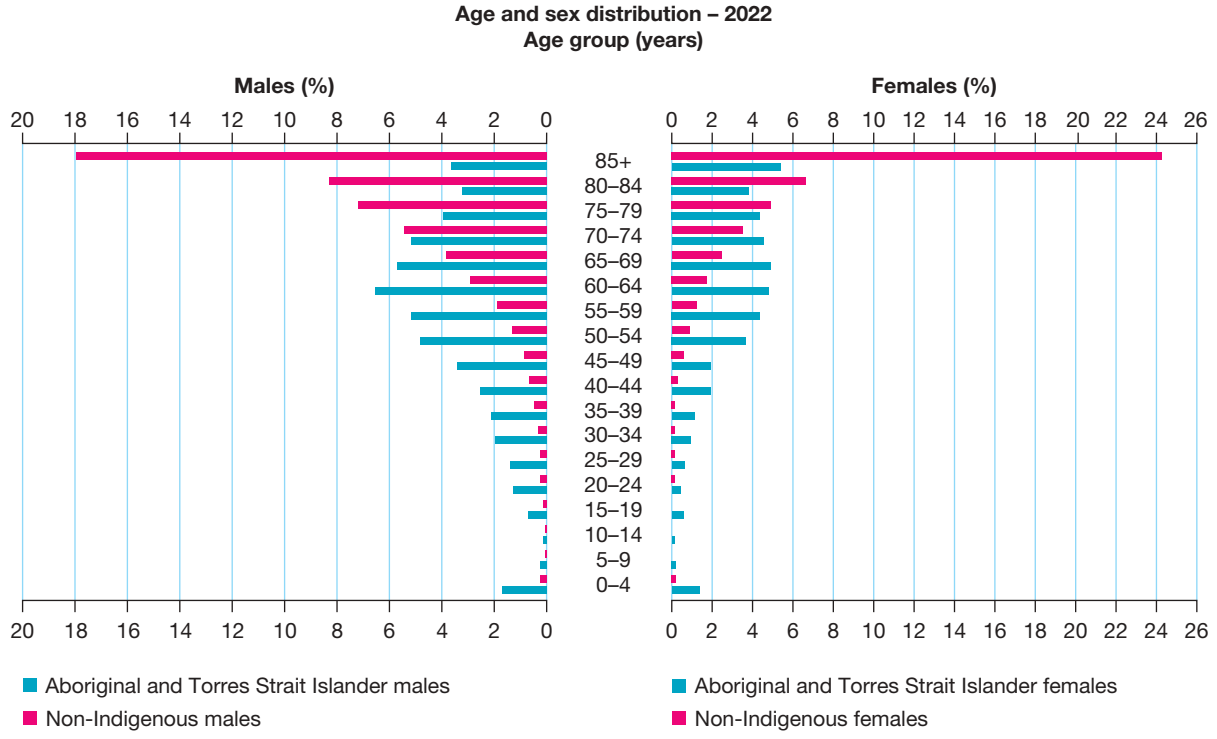
Aboriginal and Torres Strait Islander Peoples make up 3.3 per cent of the Australian population and experience poorer health status than the rest of the population in relation to nearly all health indicators. For example, the life expectancy for Aboriginal and Torres Strait Islander Peoples born in 2022 is 71.9 years for males and 75.6 years for females, accounting for more than eight years difference in life expectancy compared to non-Indigenous Australians (see table 2.3).

TABLE 2.3 Difference in life expectancy between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians, 2022

	Life expectancy from birth (years)
Aboriginal and Torres Strait Islander males	71.9
Aboriginal and Torres Strait Islander females	75.6
Non-Indigenous males	80.6
Non-Indigenous females	83.8
Difference between Aboriginal and Torres Strait Islander males and non-Indigenous males	8.8
Difference between Aboriginal and Torres Strait Islander females and non-Indigenous females	8.1

Even though there have been some significant improvements in recent years in Aboriginal and Torres Strait Islander Peoples' mortality rates, they are more likely to die at a younger age than non-Indigenous Australians. In fact, 61 per cent of Aboriginal and Torres Strait Islander Peoples die before the age of 65 compared to just 17 per cent of the non-Indigenous Australians population (see figure 2.9).

FIGURE 2.9 Age distribution of deaths among Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians



Source: Australian Bureau of Statistics, Deaths, Australia, 2022.

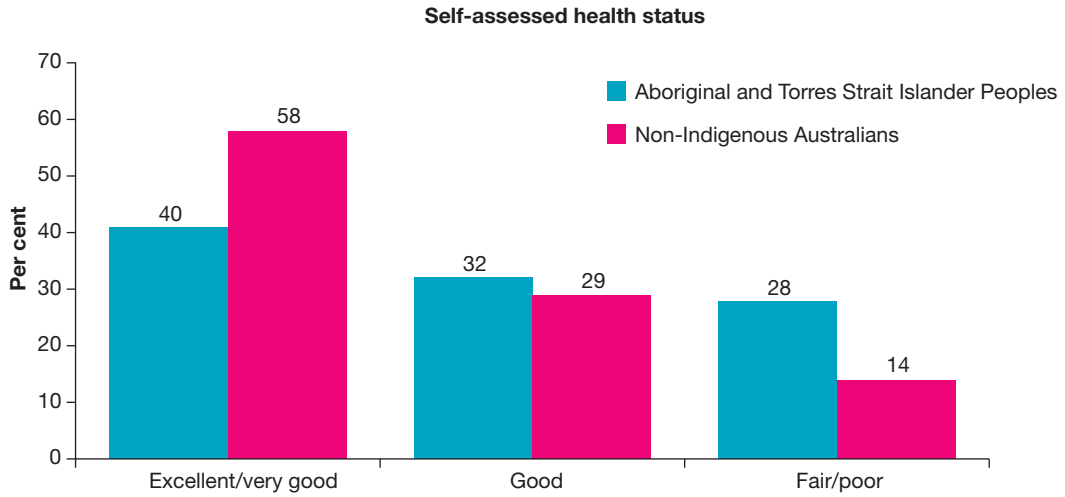
Other variations in health status relating to the inequities faced by Aboriginal and Torres Strait Islander Peoples include:

- a higher overall mortality rate (1.5 times) compared to non-Indigenous Australians
- higher mortality rates from chronic diseases such as cardiovascular disease, cancer and diabetes
- infant mortality rates (1.5 times) higher than the rest of the population
- high or very high levels of psychological distress experienced at nearly three times the rate of the non-Indigenous population, with rates of suicide that are four times higher than non-Indigenous Australians
- a higher burden of disease (2.3 times) the rate of non-Indigenous Australians
- being less likely to report their health as excellent/very good compared with non-Indigenous Australians and twice as likely to report their health status as fair or poor (see figure 2.10).

- being nearly twice as likely to have a disability or a restrictive long-term health condition
- higher rates of diabetes, chronic kidney disease, asthma, dental decay and gum disease.

It's important to recognise that there are inequities within Aboriginal and Torres Strait Islander Peoples' communities themselves. For example, those living in rural and remote areas often experience poorer health outcomes and higher rates of risky health behaviours compared to those in major cities. These disparities may result from several factors, including limited access to services, lower socioeconomic status in rural areas, and the higher proportion of Aboriginal and Torres Strait Islander Peoples living in these regions — or a combination of all three.

FIGURE 2.10 Age-specific self-assessed health status among people aged 15 and over, by Indigenous status, 2018–19



Sources: Table D1.17.5 AIHW and ABS analysis of National Aboriginal and Torres Strait Islander Health Survey 2018–19; National Health Survey 2017–18.

How do the determinants interact to affect the health of the population group?

The determinants of health influence how likely we are to stay healthy or to become ill or injured. It is important to understand that each determinant does not work in isolation — they are interconnected, meaning that multiple factors interact to shape health outcomes. These interactions between the determinants create a complex web contributing to the overall health of Aboriginal and Torres Strait Islander Peoples as individuals and as a community.

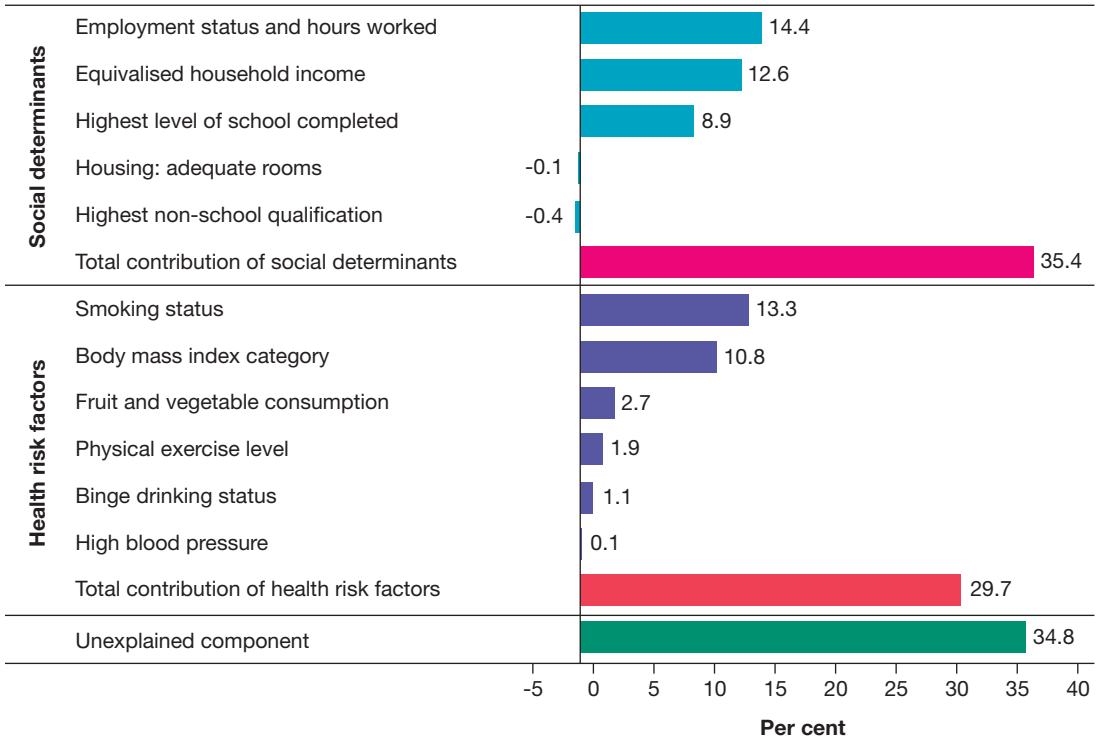
The substantial disparities that exist in health between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians is known as the 'health gap'. Analysis of health data has shown that approximately 35 per cent of the health gap was explained by social determinants, and another 30 per cent by selected health behaviours (see figure 2.11). The unexplained component of the gap includes possible effects which were not available in the data analysed. This may include access to affordable and culturally appropriate healthcare, connection to Country and language, and the effects of structural disadvantage and racism.

For example, educational attainment can affect an individual's health status. Higher education levels improve health literacy, enhancing understanding of risk factors and promoting the use of protective measures. Additionally, greater education increases job opportunities and income, enabling access to better housing, nutritious food and healthcare services.

Conversely, low levels of education can negatively impact an individual's health. Limited education often results in lower health literacy, making it harder to understand and address health risks, which can lead to poor decision-making around health behaviours. For Aboriginal and Torres Strait Islander Peoples, lower educational attainment is closely linked with higher rates of unemployment and lower income, which restricts access to quality housing, nutritious food and healthcare services. This, in turn, can be a contributing factor to higher rates of chronic diseases, mental health issues and shorter life expectancy within these communities.

Therefore, improving educational attainment is crucial, as it helps break a cycle of disadvantage, leading to better overall health outcomes and long-term wellbeing.

FIGURE 2.11 Contribution of determinants of health to the health gap between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians, aged 18–64, 2017–19



Source: AIHW analysis of ABS NATSIHS 2018–19 and ABS NHS 2017–18. https://www.aihw.gov.au.

What are some of the causes that underpin the inequities of health?

It is important to recognise that there are other causes that underpin the health inequities faced by Aboriginal and Torres Strait Islander Peoples. The ongoing impact of colonisation has led to the disruption of communities, displacement from traditional lands and the breakdown of cultural practices, which are deeply tied to health and wellbeing. The **intergenerational trauma** stemming from the forced removal of children (the Stolen Generations) and cultural suppression continues to affect Aboriginal and Torres Strait Islander Peoples, contributing to higher rates of mental health issues, substance abuse and chronic diseases.

Health services in Australia have historically been structured around the biomedical model of care, which often fails to address the specific needs and cultural values of Aboriginal and Torres Strait Islander Peoples. The lack of culturally appropriate care creates distrust in the healthcare system, deterring many Aboriginal and Torres Strait Islander Peoples from seeking treatment. Additionally, regional, rural and remote areas, where many Aboriginal and Torres Strait Islander Peoples live, often lack sufficient healthcare infrastructure, leading to limited access to quality care. This unequal access results in higher rates of preventable diseases, untreated chronic conditions and shorter life expectancy among this population group.

What actions can be implemented to improve the health status of this group?

After exploring the determinants of health and the underlying causes of health inequities, it becomes clear that effective health interventions must address multiple, interconnected determinants to improve outcomes. Examples of interventions include:

- Expanding Aboriginal Community-Controlled Health Organisations (ACCHOs) and training healthcare providers in cultural competency will likely increase trust in the healthcare system among Aboriginal and Torres Strait Islander Peoples,

intergenerational trauma the emotional and psychological effects of trauma experienced by one generation that are passed down to subsequent generations, affecting their wellbeing even without direct experience of the trauma

leading to higher rates of healthcare use, earlier diagnosis and better treatment outcomes. Having Aboriginal and Torres Strait Islander Peoples as health workers embedded in mainstream services will ensure more consistent, culturally respectful care. This will lead to better access, reduced fear and a recognition of the importance of healthcare, ultimately reducing health disparities and improving long-term outcomes.

- Improved access to quality education will enhance health literacy, which empowers individuals to make informed health choices. Improved education can also lead to better employment opportunities, lifting people out of poverty and reducing the socioeconomic inequities that are strongly linked to poor health outcomes. For example, the Clontarf Foundation uses sport as a vehicle to improve educational outcomes for young Aboriginal and Torres Strait Islander men. The foundation operates within schools to encourage attendance, engagement and academic achievement. Over time, this can improve health literacy, employment opportunities and long-term health outcomes, reducing rates of chronic disease and improving mental health.

FIGURE 2.12 Having Aboriginal and Torres Strait Islander health workers in mainstream services helps ensure culturally respectful healthcare.

- Involving Aboriginal and Torres Strait Islander Peoples in decision-making processes related to health policies makes sure that solutions are culturally appropriate and tailored to community needs. For example, the *National Aboriginal and Torres Strait Islander Health Plan 2021–2031* was developed in full partnership with Aboriginal and Torres Strait Islander Peoples. By respecting their priorities and perspectives, this increases the likelihood of successful implementation and fosters a sense of ownership and pride, leading to more sustainable health outcomes.
- Danila Dilba Health Service is a comprehensive, community-controlled health organisation in the Northern Territory, dedicated to improving the health and wellbeing of the Biluru community of the Yilli Rreung Region. DDHS provides a range of services, including primary healthcare, mental health support, chronic disease management, and preventative care. Another example is the Purple House, based in Central Australia, which offers dialysis treatment and support services to those in remote communities suffering from kidney disease, a prevalent issue. Both programs address critical healthcare needs in culturally sensitive ways, which reduces barriers to care and builds trust within communities. By providing accessible and tailored services, Danila Dilba and Purple House contribute to lowering preventable health risks, improving chronic disease outcomes, and promoting overall wellness among Aboriginal and Torres Strait Islander Peoples.

CASE STUDY 1

Aboriginal-run doctors clinics are succeeding where many other GP services are failing

*By **Erin Cooper-Douglas***

23 July 2023

'How's the bowls going, Smokey?'

As he's offered a cuppa, Michael 'Smokey' Beeton tells his greeter he 'just got beat' on the green on the weekend.

You might think he's at a community house or a friendly barbecue, but you'd be wrong — he's at the doctors clinic.

He's been walking through these doors for 20 years, and while the staff have changed over that time, they all know Smokey.

The 73-year-old has been treated for a range of issues from diabetes, to chronic back pain and even breast cancer. He thinks many of these things would have gone untreated if it weren't for the service.

'I lived about half an hour out of town and I very rarely went to the doctor — very rarely,' he says.

'But they'd come out to do my sugar checks and see if I needed anything, so it became a bit of a habit.'

Smokey says it's because he got to know everyone so well that he keeps coming back.

'I used to go to the doctor and you'd be in there for 10 or 15 minutes, they'd give you a prescription, and you'd never hear from them again,' he says.

'Here, it's very special. You're treated like family.'

This is the Aboriginal Health Service in Launceston, and while the service is norm for patients like Smokey, it's worlds away from what many Australians experience when going to see a doctor.

According to a recent review, however, Aboriginal and Torres Strait Islander-run services are achieving better health outcomes for their patients than private general practice.

Amid ever-present headlines about the GP crisis, what can we learn from Aboriginal health services?

Healthcare 'one-stop shop'

One of the people calling Smokey to remind him to attend his appointments and get his prescriptions filled is Di Spotswood.

The chronic care coordinator is buzzing around the office, wrangling a multitude of tasks, but finds time to say hello to everyone.

'This morning, I've been working with a patient who's illiterate and vulnerable who has to go in for day surgery,' she says.

'I went through the instructions with him about what to do before he gets to hospital, then I'll contact his family to make sure there's someone with him when he gets home.'

Before that, she was on the phone to another patient to arrange a diabetic eye check.

Her role is unique in the primary health system — she coordinates the allied and specialist health appointments of hundreds of patients.

'That's the beauty of the Aboriginal Health Service, we look holistically at a person,' Di says.

'We don't just treat a broken arm, we say, "why do you have a broken arm?"'

'Maybe you're falling at home, so we'd come over and check it out and do something like provide non-slip mats.'

Di manages close relationships with in-house staff, such as a diabetic educator, physiotherapist, podiatrist and dietician, and contacts in the hospital system, such as cardiologists.

'It's pretty much a one-stop shop here, and if they do need to go somewhere else, we can take them if they can't get there,' she says.

A bright spot in a dark landscape

The review, published this year in the *Medical Journal of Australia*, has analysed the challenges facing Medicare funding from 2000 to 2021.

Among the findings is that Aboriginal-controlled community health organisations (ACCHOs) are one of the few parts of the system working well.

Co-author and health economist at the Menzies Research Institute, Martin Hensher, says while the health gap between Aboriginal and Torres Strait Islander Peoples and the rest of the population is far from closed, ACCHOs are shrinking it.

'What we've found in our review is, once you adjusted for the fact the communities they serve tend to be sicker to start with, it looks like a lot of them achieve better health outcomes than traditional general practice,' he says.

Source: Cooper-Douglas, E. (2023), 'Aboriginal-run doctors clinics are succeeding where many other GP services are failing'. *ABC News*, 23 July, https://www.abc.net.au/news/2023-07-23/aboriginal-gp-services-lessons-for-traditional-doctor-clinics/102571316.

Case study questions

1. What are the key differences between the services offered by Aboriginal Health Services and traditional general practices, as highlighted in the article?
2. How do Aboriginal-controlled community health organisations (ACCHOs) address healthcare holistically, and what impact does this have on patient outcomes? Use examples.
3. Identify the role of the chronic care coordinator in the Aboriginal Health Service and describe how this role contributes to better health outcomes for patients.
4. Based on the success of ACCHOs, propose strategies that could be implemented in traditional general practices to address complex healthcare needs, particularly for patients with chronic illnesses.

2.3.2 Socioeconomically disadvantaged people

What does the data tell us?

Socioeconomic status (SES) can be broadly measured by income, housing, education level and employment, and how these influence where a person fits into a society over a period of time. People or groups who are characterised by poor levels of education, low income, poor housing and unskilled work or long periods of unemployment are said to be **socioeconomically disadvantaged**.

There is a consistent relationship between an individual's socioeconomic status and their health. Socioeconomic disadvantage tends to be a risk factor for ill health. In all age groups, men and women from lower socioeconomic backgrounds have higher mortality and higher levels of illness than those of the more affluent groups in the population. People in the highest SES groups tend to have more choices and resources available to them and they enjoy better health outcomes.

Studies have revealed that, in Australia:

- higher SES groups have a lower infant mortality rate
- higher SES groups are better educated about their health — that is, lower education is associated with higher levels of blood pressure in both sexes, higher LDL (low-density lipoproteins) cholesterol levels in women and a higher body mass index in both sexes
- the decline in heart disease death rates is greater in higher SES groups
- the higher the level of socioeconomic disadvantage, the more likely people are to smoke tobacco and e-cigarettes (see figures 2.13 and 2.14).
- people of low SES are more likely to have lower levels of health literacy
- lower SES groups make less use of preventative health services such as immunisation, family planning, dental checkups and **pap smears**
- people from low SES groups tend to be sick more often and die younger. People from lower socioeconomic areas have higher rates of mortality overall and for most causes of death.

socioeconomic status a measure of an individual's or group's social and economic position, often determined by income, education and occupation

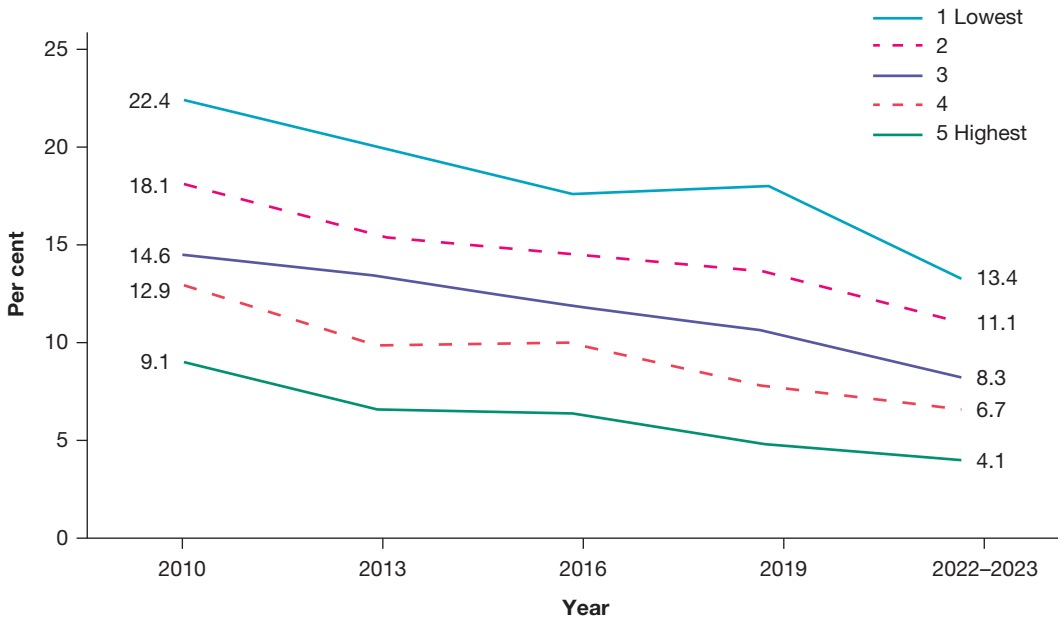
socioeconomically disadvantaged individuals or groups with limited access to financial resources, education and healthcare, resulting in poorer quality of life and health outcomes

pap smears a medical test that screens for cervical cancer by collecting cells from the cervix to detect any abnormalities

How do the determinants interact to affect the health of the population group?

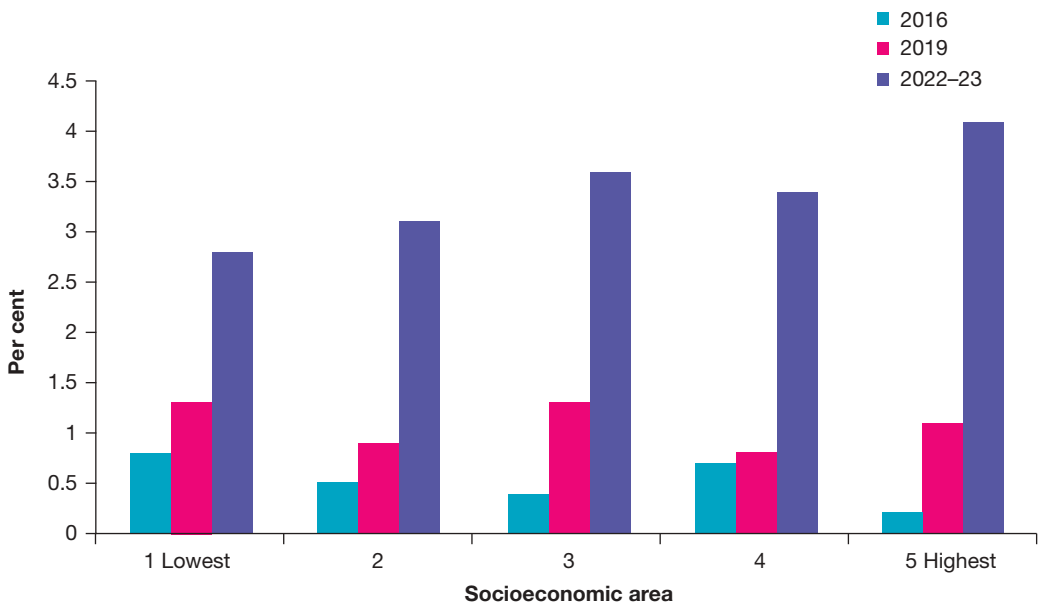
Socioeconomically disadvantaged people face many barriers to achieving a positive health status. For instance, their geographic location is often in areas which have limited access to healthcare facilities and nutritious food. Additionally, they are more likely to have lower levels of educational attainment, employment and income.

FIGURE 2.13 Daily smoking by socioeconomic area, 2010 to 2022–23



Source: Australian Institute of Health and Welfare (2024) *National Drug Strategy Household Survey 2022–2023*, Table 9a.14.

FIGURE 2.14 Daily use of e-cigarettes by socioeconomic area, 2016 to 2022–23



Source: Australian Institute of Health and Welfare (2024) *National Drug Strategy Household Survey 2022–2023*, Table 3.11.

In areas like Walgett, Bourke and Coonamble, residents face significant socioeconomic disadvantages that impact their access to healthcare services. The necessity to travel long distances, often exceeding 100 kilometres to reach a hospital or specialist, adds considerable financial burdens, including fuel costs and medical expenses. For those with chronic conditions, this situation can lead to missed appointments, delays in necessary treatment, and increased time off work, making financial strain worse. Consequently, these barriers to accessing healthcare contribute to worse health outcomes for this group.

The challenges faced by socioeconomically disadvantaged individuals extend beyond geographical remoteness, as seen in certain suburbs in western Sydney that are classified as food deserts. In these areas, there is a high concentration of fast-food outlets and convenience stores, while access to fresh food markets and supermarkets is severely limited. Residents without their own vehicles often encounter difficulties reaching available fresh food options due to inadequate public transport. This lack of access contributes to food insecurity, forcing individuals to rely on processed foods that are high in sugars and unhealthy fats, which increases the risk of obesity and related health issues.

FIGURE 2.15 Socioeconomically disadvantaged areas are more likely to have a high concentration of fast-food outlets.

What are some of the causes that underpin the inequities of health?

Socioeconomic disadvantage is closely linked to educational attainment, employment opportunities and income levels, all of which significantly impact health status. Individuals with lower levels of education often experience reduced health literacy, making it challenging to understand health information and navigate the healthcare system effectively. Furthermore, unstable employment or unemployment can lead to financial stress and reduced access to healthcare services. Individuals may work in low-paying, insecure jobs that do not provide adequate health benefits. This financial strain can limit their ability to afford medical care or maintain a healthy lifestyle, ultimately resulting in poorer health outcomes.

FIGURE 2.16 Substandard living conditions including a lack of clean water negatively impacts health outcomes.

Poor living conditions, unhealthy lifestyle choices and **psychosocial stressors** all interact to worsen health outcomes for socioeconomically disadvantaged populations. Many individuals live in substandard housing or environments with limited access to clean water and adequate sanitation, which can expose them to environmental hazards and increase the risk of illness. Additionally, the lack of access to healthy food options and safe recreational spaces often leads to unhealthy dietary habits and a sedentary lifestyle, contributing to obesity and other chronic conditions. These challenges are made worse by chronic stress related to financial insecurity, job instability and social exclusion, which not only affects mental health but can also contribute to physical health issues such as hypertension and heart disease. The constant strain of living in disadvantaged circumstances creates a cycle that worsens poor health outcomes, with little opportunity for improvement without targeted interventions.

psychosocial stressors life situations that create an unusual or intense level of stress

What actions can be implemented to improve the health status of this group?

To improve the health outcomes of socioeconomically disadvantaged populations, a range of targeted actions can be implemented across various sectors. Some interventions include:

- Expanding access to affordable or free healthcare through government programs, community clinics and telehealth services. This can reduce financial and geographic barriers, allowing socioeconomically disadvantaged individuals to receive medical care without the need for long-distance travel. For example,

the Isolated Patients Travel and Accommodation Assistance Scheme (IPTAAS), created by the NSW Government, provides financial assistance to patients who need to travel long distances for specialist medical treatment.

- The St Vincent's Homeless Health Service in inner Sydney is a vital healthcare provider for homeless and socioeconomically disadvantaged individuals, offering a range of services that many would otherwise be unable to access. The service focuses on delivering holistic care through initiatives such as Homeless Outreach, which provides on-the-ground assessment, treatment and care coordination to rough sleepers via clinics and drop-in services. This approach helps to prevent chronic health conditions from escalating, thereby reducing hospital admissions.
- The Good for Kids, Good for Life program, operating in the Hunter New England region, is an initiative aimed at promoting healthy eating and physical activity to combat childhood obesity. It primarily focuses on early childhood education and schools, supporting the implementation of state-wide programs such as Munch & Move and Live Life Well @ School. Over time, this initiative has shown positive impacts on the health behaviours of children, making it a key strategy for addressing health inequities in socioeconomically disadvantaged populations.

The NSW 'Fee-Free' training program supports disadvantaged groups, including young people, job seekers and carers, by offering free access to courses in essential industries. By improving access to vocational education, it helps these individuals gain qualifications to boost their employability and potential earnings. This can lead to better socioeconomic outcomes, which are associated with improved health status due to factors like greater job stability and access to healthcare resources.

The 'My QuitBuddy' app, developed by the Australian government, supports people in quitting smoking by addressing both health and financial disparities associated with tobacco use. As smoking disproportionately affects those of lower socioeconomic status, the app offers tailored tools to help users reduce cravings and track progress, such as a savings calculator that shows the financial benefits of quitting, which can significantly alleviate financial stress.

CASE STUDY 2

Inequity in mental healthcare is widening, with treatment 'out of reach' for many Australians

*By **the Specialist Reporting Team's Evan Young and Penny Timms***

14 March 2023

Links between disadvantage and higher rates of mental health issues are well-established.

Disadvantaged households reported having anxiety disorders and affective disorders (such as depression and bipolar) at a much higher rate than wealthier households, government data from 2020 and 2021 shows.

A review of the Better Access program last year found lower-income earners were more likely to be prescribed medication, rather than be referred to a psychologist.

Ms Gardiner said mental healthcare was increasingly becoming something only affluent people could afford and that needed to change.

Inequality increasing

Tegan Carrison, executive director of the Australian Association of Psychologists, said the gap between who could and could not afford to access mental healthcare was widening.

She said disadvantaged Australians faced 'barrier after barrier after barrier' when trying to access mental healthcare.

'The first barrier … is that [patients] need to see a GP,' she said.

'Often there is quite a long waiting list [and] often there'll be an out-of-pocket expense just to get that referral. Then we have barriers with regards to wait times to see a psychologist.

‘When patients do have that psychologist appointment, then they have this huge barrier of what the Medicare rebate is.’

Ms Carrison said the rebate of around $89 for most psychology sessions still left people ‘out-of-pocket well over $100 in most instances’.

‘That means accessing a psychologist is out of reach for people on the lowest incomes.’

Recent data also points to difficulties lower-income Australians are having accessing treatment.

Last month, a Productivity Commission report showed the number of Australians who delayed or avoided seeking healthcare because of cost had grown by 50 per cent last year.

Almost a quarter of people delayed seeing a mental health professional because of cost — and 22 per cent of people postponed appointments with a mental health professional other than a GP.

Research by The University of Sydney’s Brain and Mind Centre found out-of-pocket payments rose year-on-year between 2013 and 2021.

In fact, out-of-pocket costs for patients increased by 164 per cent over that time period.

A high demand for general practitioners is leading to longer wait times and putting pressure on doctors. A new report says it’s time we overhauled the way GPs work and how they’re paid.

Sebastian Rosenberg, a senior lecturer at the Brain and Mind Centre, said out-of-pocket fees had been increasing ‘very swiftly’ and it had entrenched disadvantage.

...

Dr Rosenberg said the current system was creating ‘repeat customers’, where patients get ‘stuck in a cycle’ of receiving a few sessions of care ‘but not actually get any better’.

‘We need to fundamentally alter the way we design our service system,’ he said.

‘We also need to design a better way of taking into account the impact of the care we provide to see whether what we’ve done has actually helped [the patient].’

‘We are in dire straits’

Ms Carrison said there were a number of levers the government could pull to start reducing inequality within the system.

‘We need to increase Medicare rebates to psychologists and allied health professionals, as well as to GPs,’ she said.

‘We need to offer incentives for mental healthcare providers to provide services in regional, rural and remote regions … and expand who can provide services. We would love for the government to allow provisional psychologists in the last phase of supervised practice to be able to provide services on Medicare.
‘And we need to look at improving career pathways and increasing Commonwealth support in places so that we can have more psychologists on the ground.’

Ms Carrison said Australia also had ‘about 30 per cent fewer psychologists than we need’ to service the population.

Source: Young, E. & Timms, P. (2023), ‘Inequity in mental healthcare is widening, with treatment “out of reach” for many Australians’. *ABC News*, 14 March, https://www.abc.net.au/news/2023-03-14/mental-health-inequities-widening-lower-income-earners/102009884.

Case study questions

1. Identify the key barriers that disadvantaged Australians face when trying to access mental healthcare.
2. What does the research from The University of Sydney’s Brain and Mind Centre reveal about out-of-pocket costs for mental healthcare from 2013 to 2021?
3. Based on the article, how do you think rising out-of-pocket costs for mental health services contribute to the mental health disparities in Australia?

2.3.3 People in rural and remote areas

What does the data tell us?

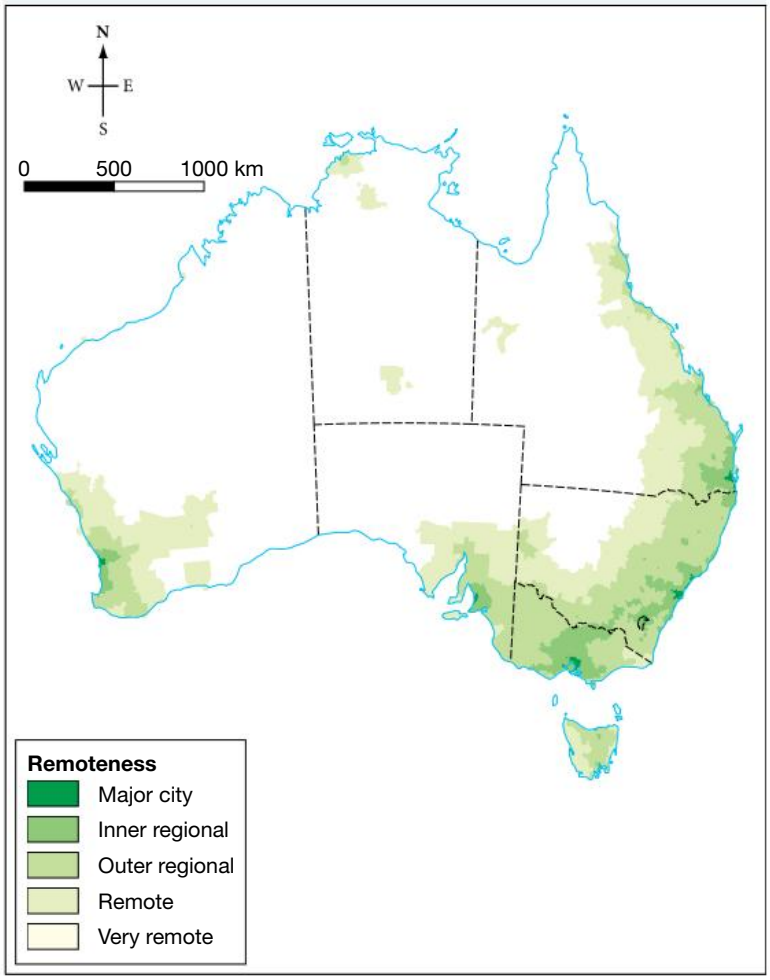
About 7 million people — approximately 28 per cent of the Australian population — live in rural or remote areas. Because the AIHW classifies anyone living outside a major city as rural and remote, the locations and communities within this group are very diverse. On average, increasing levels of remoteness results in worse health outcomes and decreased access to health services.

Although Aboriginal and Torres Strait Islander Peoples are more likely to live in major cities, the proportion of the total population who are Aboriginal and Torres Strait Islander Peoples is larger in remote and very remote areas (see table 2.5). Consequently, geographic location acts as a compounding factor on already existing health inequities faced by Aboriginal and Torres Strait Islander Peoples.

TABLE 2.4 Proportion of Australians by area of remoteness, 2022

Area of remoteness	Proportion of Australian population
Major cities	72%
Inner regional areas	18%
Outer regional areas	8.1%
Remote areas	1.2%
Very remote areas	0.8%

FIGURE 2.17 Map of remoteness areas for Australia



Source: © Australian Bureau of Statistics.

TABLE 2.5 Aboriginal and Torres Strait Islander Peoples population by remoteness area, 2021

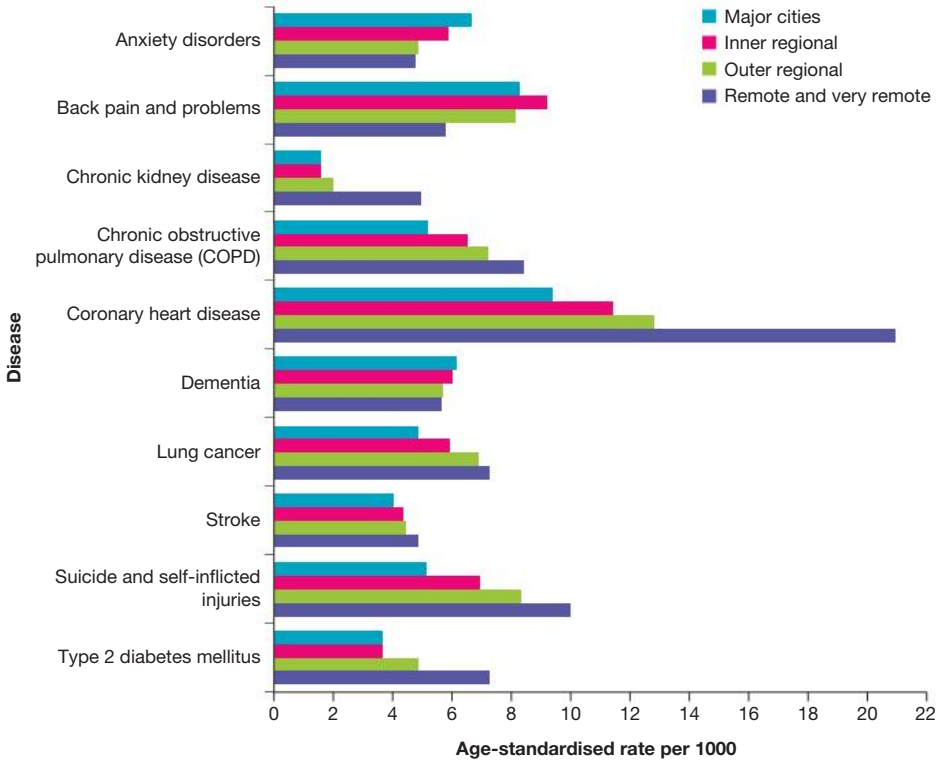
Remoteness area	Number	Proportion (%) of total Aboriginal and Torres Strait Islander population	Proportion (%) of total population of each area
Major cities	401 674	40.8	2.2
Inner regional	244 012	24.8	5.3
Outer regional	187 150	19.0	9.0
Remote	58 727	6.0	19.6
Very remote	92 146	9.4	47.1

Source: HPF Table D2 – AIHW analysis of ABS population estimates based on 2021 Census.

Those living in rural and remote areas experience the following differences in health status when compared to their major city counterparts:

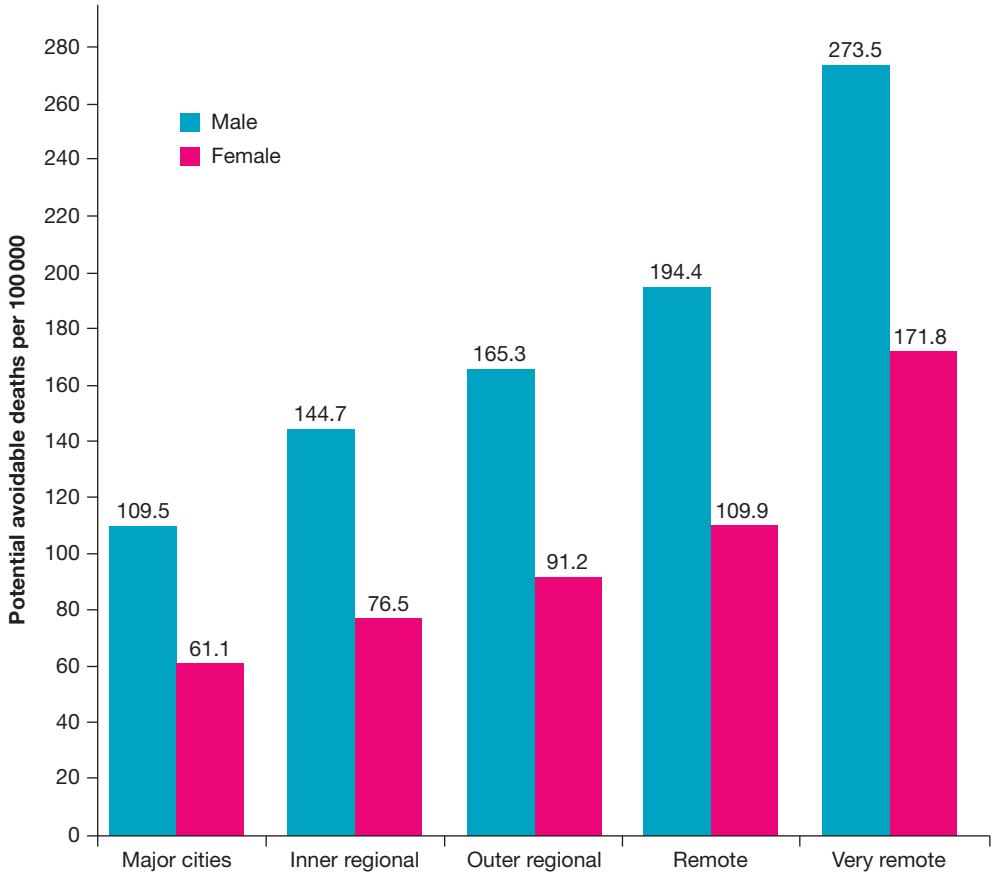
- lower life expectancy (life expectancy decreases as the level of remoteness increases: one to two years less for rural areas and up to seven years less for remote areas)
- higher burden of disease from both fatal and non-fatal causes
- mortality rates 1.4 times higher than those in major cities
- higher rates of preventable cancers (lung, melanoma and detectable cancers, such as cervical cancer)
- higher death rates from cardiovascular disease, including coronary heart disease
- higher rates of avoidable deaths (see figure 2.19)
- higher rates of injury, including a mortality rate 2–4 times higher than those in major cities for land transport accidents
- higher rates of diabetes
- higher rates of suicide
- higher rates of asthma and chronic obstructive pulmonary disease.

FIGURE 2.18 Health burden for major diseases and injuries, by remoteness area, 2018



Source: Australian Institute of Health and Welfare (2024) *Rural and remote health*.

FIGURE 2.19 Potential avoidable deaths by sex and remoteness, 2021



Source: Australian Institute of Health and Welfare (2024) *Rural and remote health*.

How do the determinants interact to affect the health of the population group?

Broad features of society such as culture and social cohesion in rural communities can result in strong social networks that provide support and promote health. However, cultural norms may also discourage help-seeking behaviours (particularly in males) and encourage risky health behaviours, such as smoking and increased alcohol consumption, which lead to a higher incidence of chronic disease and injuries.

Geographic location also limits access to healthcare services, including specialists and emergency care. This can result in delays in treatment and higher rates of mortality. Additionally, rural and remote areas often lack facilities for physical activity and safe workplaces, contributing to sedentary lifestyles and higher rates of injury.

Employment opportunities are also limited in rural and remote areas, which can result in lower paying or more hazardous jobs creating financial stress and higher rates of injuries. Skilled workers and professionals may also lack opportunities for employment causing them to move to larger cities in order increase their employment prospects. This can impact not only the population of the area, but decrease social cohesion when families relocate.

What are some of the causes that underpin the inequities of health?

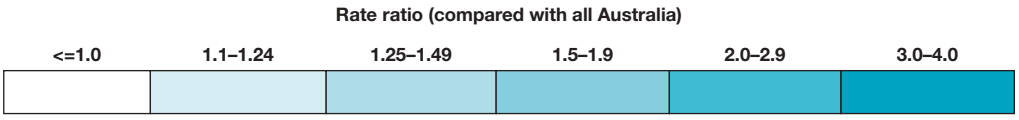
Underpinning causes of health inequities for rural and remote people include limited healthcare infrastructure and socioeconomic disadvantage.

Healthcare facilities in rural areas are often under-resourced and may lack essential services, such as specialists or advanced medical technology. For example, residents with chronic illnesses, such as diabetes or heart disease, in rural New South Wales can lack access to endocrinologists or cardiologists. This can cause them to rely on general practitioners who may not have the resources or training to manage complex cases adequately.

Rural and remote communities also have reduced access to diagnostic services that leads to a reduction in preventative practice. These limitations can result in poorer health outcomes, including higher rates of complications, hospitalisations and premature death.

FIGURE 2.20 Leading cause of death by remoteness area, with comparison of mortality rates to 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



Notes:

1. Rates are age-standardised to the 2001 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: Australian Institute of Health and Welfare. http://www.aihw.gov.au.

Many rural populations experience socioeconomic disadvantages, including lower income levels, higher unemployment rates and limited educational opportunities. For example, in remote areas of New South Wales, many residents struggle with below average wages and fewer job opportunities compared to major cities. The inability to access healthcare and employment can result in a higher burden of disease and an overall decrease in wellbeing.

CASE STUDY 3

Rural patients deserve better healthcare. We just need to be brave and implement change

*By **Jack Archer***

23 March 2023

If you live in rural and remote Australia, your access to healthcare remains well below the standard that citizens of one of the richest nations on Earth should expect.

Rural and remote areas experience serious health workforce shortages, despite having a greater need for medical services.

Lower rates of cancer screening and higher rates of potentially preventable hospital stays are just some of the issues people in the regions face.

The outcome is lower life expectancy and higher rates of illness and disease.

It is a key issue that drives people to move away from rural and remote areas, undermining progress for these economies and communities.

For those of us who don't live the reality, this stream of facts and stories can be tiring. It can seem like just another unfortunate thing in the world that can't be changed.

But if you look a little harder, you can see this isn't really true. In fact, many of the answers are right in front of us.

How tech creates opportunities

New technologies are opening up exciting opportunities for better access to quality care each day.

Artificial intelligence is assisting isolated healthcare workers to collect information for a rapid diagnosis without specialist training.

There are also new initiatives identifying ways to resolve chronic workforce shortages across the sector.

The small town of Glen Innes in rural New South Wales, which suffers from serious health workforce shortages, recently secured two new local general practitioners, a pharmacist, an exercise physiologist, a diabetes educator, a nurse practitioner and a speech pathologist in just six months.

They did this by embracing the emerging Attract Connect Stay initiative that helps communities lead the way in finding, welcoming and retaining new health workers.

Despite the workforce shortages, there is already the same or a stronger presence of nurses per person in rural and remote areas.

The opportunities to enable these nurses to do more and to make their practice more rewarding and impactful are significant.

For example, overseas evidence shows that nurse practitioners are able to provide 67–93 per cent of all primary care services if given the scope of practice and access to funding similar to Medicare.

At present, these skilled specialist nurses who can diagnose and prescribe for many illnesses, and work closely with specialist doctors to provide complex care, are thin on the ground.

By investing in more nurse practitioner positions in rural and remote areas and expanding their scope of care we could make a big, big impact on rural health problems.

Telehealth improves access to care

Last, but certainly not least, is the role that telehealth now plays in rural and remote healthcare.

The pandemic finally gave government the push to make telehealth more widely available, with enduring benefits for people in rural and remote areas in terms of access to care.

These are all great examples of the change that is possible.

There are many others and they should all give us real hope for the future.

But the reality is that, aside from the telehealth rollout, these are fragile green shoots, good options or just one-off pilots that prove change is possible, but don't make it so.

Real change needs a long-term investment combined with a system-wide commitment to innovation and change.

The foundation for making this happen is moving to equitable Medicare spending for rural and remote communities.

A rapid analysis of the latest data on national health spending reveals that the Medicare Benefits Scheme (MBS) spent about $290 less per person in small rural towns and remote areas than in major cities over the previous financial year.

In total, this equates to more than $600 million each year that is not being spent on Medicare benefits for rural and remote Australians, mostly because they can't access the services they need.

Source: Archer, J. (2023), 'Rural patients deserve better healthcare. We just need to be brave and implement change'. *ABC News*, 23 March.

Case study questions

1. What are some of the health challenges faced by rural and remote areas in Australia?
2. What role can nurse practitioners play in addressing workforce shortages in rural healthcare?
3. How has telehealth impacted healthcare access in rural and remote communities?
4. Compare and contrast the disparities in Medicare spending between rural or remote areas and major cities.
5. View the **Attract, Connect, Stay** weblinks in the Resources panel and summarise how this initiative aims to improve the health status of people in rural and remote areas.

What actions can be implemented to improve the health status of this group?

There are many actions which can be implemented to improve the health status of rural and remote people. These may include:

- Establishing mobile clinics that travel to remote communities can provide essential healthcare services, including cancer screenings, vaccinations and preventative care. For example, the NSW Health Mobile Dental Program provides free dental care using fully equipped dental vans on school grounds. Treatments include examinations, x-rays and teeth cleaning for primary school-aged children. By bringing the van to the school, the barrier of travel has been removed allowing initial care and follow up treatment without the need to travel long distances to the nearest dentist.

FIGURE 2.21 The Royal Flying Doctor Service aims to provide emergency medical and primary healthcare services for rural and remote areas.

- The Stronger Rural Health Strategy (SRHS) is a comprehensive ten-year plan that began in 2018–19 and is aimed at increasing the number of healthcare workers in Australia, particularly in rural and remote areas. The strategy offers various initiatives, including financial incentives designed to encourage junior doctors to train and work in these underserved regions. Additionally, it features the Visas for GPs program, which directs international medical graduates to practice in areas that need more healthcare professionals. This approach seeks to address the shortage of medical staff in rural locations and enhance access to quality healthcare for local populations.

CASE STUDY 4
Australia's Stronger Rural Health Strategy fails to address the doctor drought

*By **Emma Wylie***

Australia's rural and remote communities face significant healthcare disadvantage when compared to major cities. Critical workforce shortages, inaccessibility to healthcare services, and increased rates of risk-taking behaviours are all major contributors to this health inequity. In an attempt to address this issue, the Department of Health introduced the Stronger Rural Health Strategy with the aim of redistributing 3000 doctors and 3000 nurses to underserved areas by 2028.

How is the strategy performing?

Despite receiving funding of over 250 million dollars annually, the Stronger Rural Health Strategy has failed to adequately address the rural health crisis. The strategy encompasses various programs and initiatives including: International Medical Graduate (IMG) restrictions; The Visas for GPs Program; Bonded Medical Program; HELP debt reduction scheme; and the Workforce Incentive Program. Although these programs have shown some efficacy in recruiting doctors through obligatory rural service, they fail to ensure long term retention. This is evident in the consistent departure of IMGs from rural areas following the completion of their obligatory rural period; the high buy-out rate of participants in the Bonded Medical Program, with only 4.4% of participants having completed their rural service; and the limited effectiveness of financial incentives in retaining doctors long-term.

The long-term effectiveness of the Stronger Rural Health Strategy is called into question by these findings, as it appears to offer temporary solutions to a long-term problem. The strategy fails to address the fundamental factors that discourage practitioners from working in rural areas, such as inadequate opportunities for career progression; professional and personal isolation; and reduced employment and education opportunities for partners and children. Therefore, it is crucial that future recruitment and retention strategies address these determinants and provide sustainable, long-term solutions.

So, what works?

Rural entry schemes, immersion opportunities, and training pathways have all consistently demonstrated efficacy in promoting rural retention. Students who attend Rural Clinical School (RCS) programs for instance, are 2.6 times more likely to pursue rural practice. It is important to note that the Stronger Rural Health Strategy includes only two initiatives that align with these evidence-based approaches: the Murray-Darling Medical Schools Network and the Junior Doctor Training Program. Both programs embrace the concept of voluntary rural training, an approach that has shown to be effective throughout the literature.

To address the maldistribution and inequitable delivery of healthcare across the country, governments and education providers should prioritise and expand initiatives of this nature. For example, enhancing the availability of Rural Clinical Schools, expanding post-graduate rural training opportunities, mandating medical school Rural Entry Schemes, and replacing obligatory service strategies with voluntary rural immersion programs are all promising measures to enhance workforce retention.

What can we as students do?

The onus of this issue doesn't just lie with policy makers and education providers, future doctors need to be a part of the solution. With this in mind, I encourage prospective and current medical students to venture beyond their comfort zones and embrace purpose built rural training programs such as Deakin's Rural Training Stream. By actively seeking firsthand experience in rural healthcare, we can challenge and dispel the misconceptions that often surround rural practice. It is through these concerted actions that we can effectively confront the nations critical rural workforce shortage.

Source: https://blogs.deakin.edu.au/publichealthmedicine/2023/05/18/australias-stronger-rural-health-strategy-fails-to-address-the-doctor-drought.

Case study questions

1. What was the main goal of the Stronger Rural Health Strategy introduced by the Department of Health?
2. Why has the author of this article considered the strategy ineffective in ensuring long-term retention of healthcare workers in rural areas?
3. Summarise the key factors that discourage doctors from remaining in rural practice, according to the article.
4. Considering the challenges outlined in the article, what long-term strategies would you recommend to improve rural doctor retention beyond financial incentives?

2.3.4 Culturally and linguistically diverse populations

What does the data tell us?

Australia's population includes many people who were born overseas, have a parent born overseas or who speak a variety of languages. Together, these groups of people are known as **culturally and linguistically diverse (CALD)** populations.

As of 2021, approximately 7 million (28 per cent) of people living in Australia were born overseas. This population group is considered a priority due to the numerous health and social disadvantages they experience, along with the significant challenges they face in navigating the healthcare system and accessing services.

FIGURE 2.22 Overseas-born people tend to have better levels of health than the Australian-born population.

For first generation migrants, they often enjoy a higher level of health than that of the Australian-born population. This is known as the 'healthy migrant effect'. The main reasons for this appear to be that:

- people who migrate to Australia are generally willing and financially secure; sick or disabled people are less likely to apply
- the government selects migrants based on their health as well as education, language and job skills
- health screening checks and eligibility requirements aim to ensure the health of migrants does not pose a significant cost to the health system.

Statistics reveal lower death rates, lower hospitalisation rates and a reduced incidence of lifestyle-related risk factors; for example, the mortality rate for skin cancer is very low among overseas-born Australians.

Studies reveal new migrants mostly maintain their traditional diet and eat as a family. However, the longer they live in Australia, the more likely overseas-born Australians are to adopt the Australian lifestyle. This change may explain why the health advantage of new migrants, known as the healthy migrant effect, can disappear over time, making their health status similar to those born in Australia.

When observed as a whole group, the CALD population generally enjoys good health outcomes. They have lower rates of hospitalisation and mortality compared with people born in Australia. Because this group is very diverse, it brings challenges when collecting health data as it does not always show the full picture of their health. However, disparities arise when data is collected based on the region or country of birth. These disparities include:

- greater risk of poorer health outcomes due to potentially preventable hospitalisations. People born in Somalia (Sub-Saharan Africa) had the highest rates of vaccine preventable conditions, while those born in Serbia (Southern and Eastern Europe) had the highest rates of chronic obstructive pulmonary disease (COPD) and hypertension
- during 2021, the mortality rate from COVID-19 for those born in Tonga was 80 times higher than those born in Australia
- people with low English proficiency have a higher prevalence of chronic diseases such as heart disease, and lung and mental health conditions.
- daily or occasional smoking (all NSW residents 15 per cent; Iraq 27 per cent; Lebanon 25 per cent)
- overweight or obesity (all NSW residents 53 per cent; Lebanon 75 per cent; Italy 72 per cent; Iraq 66 per cent)
- inadequate physical activity (all NSW residents 42 per cent; Lebanon 60 per cent; Italy 58 per cent; Vietnam 55 per cent; Iraq 55 per cent)
- diabetes or high blood glucose (all NSW residents 9 per cent; Italy 23 per cent; Lebanon 17 per cent; Vietnam 14 per cent; United Kingdom 12 per cent).

culturally and linguistically diverse (CALD) Australia's population includes many people who were born overseas, have a parent born overseas or speak a variety of languages. Together, these groups of people are known as culturally and linguistically diverse populations.

How do the determinants interact to affect the health of the population group?

Cultural factors, such as beliefs and practices, can significantly influence health behaviours within CALD communities. Maintaining cultural practices and beliefs through gatherings, traditions and religions can foster a sense of identity and belonging, which are crucial for mental wellbeing. For example, the Muslim festival of Eid al-Fitr is a period of great celebration. It takes place at the end of Ramadan and involves friends and families coming together, sharing large meals and giving to charity. Conversely, in environments where CALD individuals feel marginalised or face discrimination, social cohesion can diminish, leading to increased feelings of isolation and mental health challenges.

FIGURE 2.23 The Muslim festival of Eid al-Fitr is a period of great celebration and involves friends and families coming together and sharing meals.

Health behaviours, such as tobacco and alcohol use, can vary across cultural groups. Some CALD populations may have higher rates of smoking or alcohol consumption due to cultural acceptance or stress-related factors from acculturation challenges. Additionally, dietary behaviours influenced by cultural practices can either promote health (e.g. traditional diets rich in fruits and vegetables) or contribute to health problems (e.g. reliance on fast food due to convenience).

What are some of the causes that underpin the inequities of health?

Health inequities among CALD populations can stem from various connected causes. Here are some key factors:

- Language differences can make effective communication between healthcare providers and CALD individuals harder, leading to misunderstandings, misdiagnoses and inadequate treatment. For instance, patients with a poor understanding of English may struggle to understand medical advice or follow prescriptions if they are not provided in their preferred language.
- Experiences of racism and discrimination can lead to social exclusion. These experiences can result in avoiding sporting activities and group activities due to not feeling welcome or not seeking medical help due to previous negative instances of cultural bias. This can lead to increased mental and physical health problems from a reluctance to engage with the healthcare system.

What actions can be implemented to improve the health status of this group?

To effectively improve the health status of CALD populations, a range of targeted actions can be implemented. These include:

- The delivery of health information to CALD communities in their own languages, through a range of mediums including print, radio, digital and social media.
- Effective communication is essential to providing high quality healthcare, so access to bilingual staff in clinical services and the community is very important. For example, the Sydney HealthCare Interpreter Service provides interpreting and translation services to healthcare patients. This service allows patients, carers and families to access information in their preferred language.
- Research indicates that forming strong partnerships with health consumers can enhance their experiences and improve the quality of healthcare. Involving health consumers, along with their carers and families from various backgrounds, in the design, research and evaluation of services can encourage more equitable access to care and better service delivery.
- Provide culturally sensitive services, particularly for CALD populations. For example, when Muslim women access healthcare, their specific needs, such as privacy during medical examinations and gender preferences for healthcare providers, should be recognised and respected. These preferences stem from cultural and religious values and are essential for making patients feel comfortable and safe.

These approaches foster a more accessible healthcare environment, encouraging trust and participation from CALD communities.

2.3.5 People with disability

What does the data tell us?

According to the World Health Organization (WHO), **disability** is an umbrella term for any or all of the following components:

- impairments: challenges in body function or structure
- activity limitations: difficulties in executing activities
- participation restrictions: challenges an individual may experience in involvement in life situations.

The disability prevalence rate in Australia has remained relatively stable over time. In 2022, there were an estimated 5.5 million people (21 per cent) with disability. The total number of people with disability has increased since 2003. People with disability are diverse in terms of the nature of their impairment, cultural background, socioeconomic status and need for assistance. The prevalence of disability also tends to increase with age (see table 2.6).

TABLE 2.6 Disability prevalence by age, 2022

Age	Percentage of those with disability (%)
0–14	7.6
15–24	9.3
15–64	13
65+	50

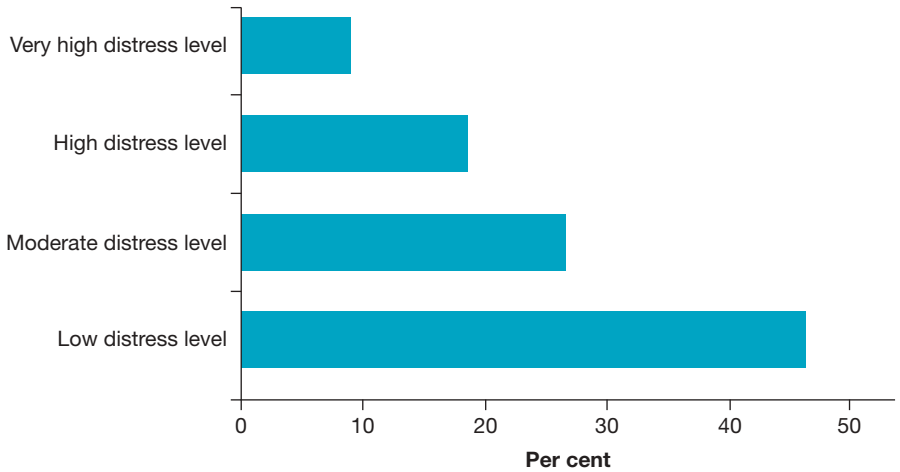
Source: Australian Institute of Health and Welfare (2024) *People with disability in Australia*.

According to the Australian Bureau of Statistics (ABS) and the Australian Institute of Health and Welfare (AIHW), when compared with people without disability, people with disability:

- rate their own health lower. Data collected by the AIHW shows that 31 per cent of adults living with disability reported as excellent or very good, compared with 68 per cent for those without disability
- report higher levels of psychological distress (see figure 2.24) and bodily pain
- experience higher rates of social isolation (19 per cent of people with disability compared with 9.5 per cent without a disability)
- have lower levels of satisfaction within their local community (44 per cent of people aged 15–24 years with disability compared with 27 per cent without disability)
- are less likely to complete year 12 (34 per cent of people with disability compared to 66 per cent without disability)
- are less likely to participate in tertiary education (proportion of students with disability in VET is 4.1 per cent; undergraduate is 10 per cent)
- are twice as likely to be unemployed (10 per cent compared to 4.6 per cent)
- have a lower level of personal income (see figure 2.25).

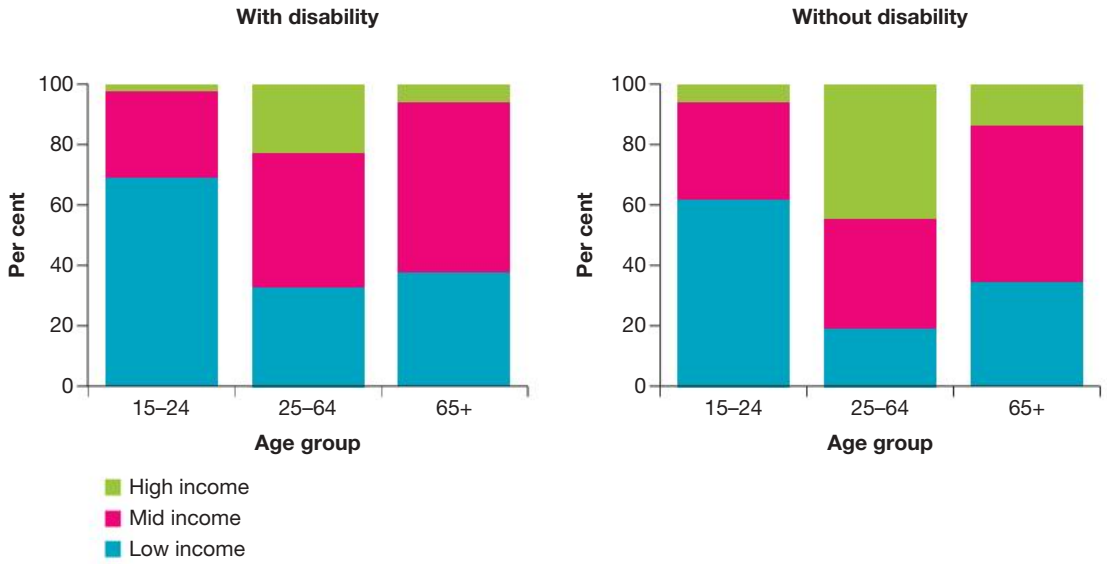
disability is defined in terms of the lack of ability to perform everyday functions or activities. It refers to limitations in functional abilities.

FIGURE 2.24 Ratings of psychological distress among adults with disability



Source: Australian Institute of Health and Welfare (2024) *Australia's health 2024: in brief*, catalogue number AUS 249, AIHW, Australian Government.

FIGURE 2.25 Weekly personal income, by disability status, age group and sex, 2018



Source: Australian Bureau of Statistics.

How do the determinants interact to affect the health of the population group?

People with disability in Australia have lower incomes and are more likely to live in poverty than people without disability. This is partly due to lower education and employment levels compared to the general population. Lack of job opportunities or not having a job then limits opportunities for social connections. The health of people with disability can be affected if they are socially excluded or marginalised. They may also face violence and discrimination related to their disability.

The majority of people with disability live in households rather than accommodation establishments. They can be disadvantaged by living in poor quality housing or be affected by living in accommodation that is inappropriate for their disability.

People with disability are generally more likely to smoke and have insufficient physical activity than people without disability, but have a lower incidence of alcohol misuse. People living with severe or profound disability are more likely to be overweight or obese.

What are some of the causes that underpin the inequities of health?

Health inequities for people with disability in Australia are underpinned by a range of systemic and structural factors. Here are some key causes:

- *Access barriers* — many community facilities in Australia lack essential accessibility measures (e.g. ramps, adjustable equipment), making it difficult for people with physical disability to receive care. Communication barriers also arise for those with sensory or intellectual disabilities due to limited tailored aids or accessible formats. Additionally, people in rural or remote areas face greater challenges accessing specialised healthcare, including shortages in facilities, transportation and trained personnel.
- *Discrimination and stigma* — negative attitudes, unconscious biases and a lack of disability-specific training among healthcare providers can result in substandard care, including misattributing health issues to disability. Social isolation and marginalisation further contribute to mental health problems and reluctance to seek care due to fear of judgement or mistreatment.
- *Intersectionality* — people with disability who belong to other marginalised groups, such as Aboriginal and Torres Strait Islander Peoples, socioeconomically disadvantaged and rural and remote people, experience compounded disadvantages which exacerbates their healthcare inequities.

What actions can be implemented to improve the health status of this group?

Improving the health status of people with disability in Australia requires a combination of systemic reforms, targeted policies and community-based actions. Key actions include:

- *Improving the accessibility of healthcare facilities* — ensure healthcare facilities meet accessibility standards (e.g. ramps, adjustable equipment) and provide communication aids such as sign language interpreters and braille materials for those with sensory or intellectual disabilities. Expanded telehealth services or home visits by healthcare workers can improve access, especially for those in rural areas or with mobility issues.
- *Inclusive health education programs* — develop community-based health programs that are specifically designed for people with disability, such as adapted physical activity programs or nutrition workshops. For example, inclusive fitness programs with specialised trainers can help people with disability engage in regular exercise.
- *Foster social connections* — create inclusive community programs, such as sports clubs or hobby groups, that bring together people with and without disability, promoting both social inclusion and physical activity.

FIGURE 2.26 Accessibility is important in improving health status of people with disability.

- *Improve access to public services and spaces* — ensure public spaces like parks and recreational facilities are fully accessible. Expanding transportation options to include features like ramps, lifts, and visual or auditory signals across various modes of public transport is crucias.
- *Subsidised access to programs* — provide financial support or subsidised fees for people with disability to participate in health-promoting activities, such as gym memberships or community health classes.
- *Promote inclusive employment* — promote disability-inclusive employment, as having meaningful work can lead to greater social participation and better access to health-promoting environments (e.g. through workplace wellbeing programs).
- *Ongoing support of the NDIS* — ensure that the National Disability Insurance Scheme (NDIS) continues to provide ongoing support for individuals with disability, helping them access necessary health services, community participation opportunities, and social services.

2.3.6 Older people

What does the data tell us?

Older Australians make up a growing proportion of the Australian population. The population in Australia aged 65 or over increased from 1.1 million in 1971 (8 per cent of the population) to approximately 4.2 million in 2020 (16 per cent). Older Australians refers to those aged 65 years and above; however, due to the difference in life expectancy for Aboriginal and Torres Strait Islander Peoples, data is inclusive of those aged 50 and above.

Older Australians represent a diverse population, varying in age, socioeconomic status, life experiences and lifestyles. These factors shape the ageing process and have a significant impact on their health and wellbeing.
A combination of recent epidemiological data shows:

FIGURE 2.27 The elderly often have mobility problems and require additional support if they have dementia.

- approximately three in four (74 per cent) of people aged 65 and over rated their health as good, very good or excellent. Those aged 75 and over are more likely to rate their health as fair or poor
- half (50 per cent) of people aged 65 and over were living with disability — this has remained stable over the past decade
- dementia, including Alzheimer's disease, is the overall leading cause of death among older people, closely followed by coronary heart disease
- the risk of serious illness or death from COVID-19 is higher in older people, particularly in those with underlying health conditions
- cancer, cardiovascular disease and neurological conditions were the leading cause of disease burden among older people
- older people are at higher risk of hospitalisation and deaths from certain injuries, including falls.

FIGURE 2.28 Approximately 3 in 4 (74 per cent) of people aged 65 and over rated their health as good, very good or excellent.

How do the determinants interact to affect the health of the population group?

Media plays a role in shaping public attitudes toward ageing and can either contribute to ageism or promote positive images of ageing, which in turn influences older adults' self-esteem and mental health. Some media campaigns highlight positive aspects of ageing, such as healthy ageing, lifelong learning or seniors participating in active lifestyles. This can enhance the mental health of older Australians by fostering a sense of purpose, inclusion and societal value.

Older adults living in rural or remote areas often have limited access to healthcare services, thereby impacting their ability to manage chronic conditions. The availability of community resources such as parks, healthcare facilities and senior centres impacts physical activity levels, social engagement and access to necessary services for older adults.

Increasing housing options for the elderly, particularly through the expansion of retirement village communities and home care services, is essential for supporting ageing populations. Retirement villages can offer safe, community-oriented environments where seniors can enjoy a range of social activities, which contributes to better mental and physical health outcomes. Additionally, expanding home care services ensures that elderly individuals can access essential healthcare, get assistance with daily living, and remain in familiar surroundings for longer periods. This approach fosters independence, reduces social isolation, and provides opportunities for continued participation in community life.

FIGURE 2.29 Socioeconomic status affects the ability to pay for activities that help older people stay healthy.

Socioeconomic indicators such as higher education and income levels and supportive social environments all contribute to a higher likelihood of elderly people maintaining good health. In contrast, older Australians with lower socioeconomic status are more likely to have poorer health due to limited access to care and the ability to

afford daily essentials. A senior living in public housing with limited income may struggle to afford necessary medications or doctor visits.

As older Australians are more prone to physical impairments, this affects their ability to engage in physical activity, manage daily tasks and live independently. For example, an elderly person with mobility issues may find it challenging to maintain an active lifestyle, leading to further physical decline and isolation, which can negatively impact their mental health. Without adequate support, such as accessible housing or home care, their ability to live independently is compromised, contributing to anxiety, depression and reduced quality of life.

What are some of the causes that underpin the inequities of health?

Ageism and discrimination are causes that underpin the health inequities faced by older people. Ageist attitudes in broader society can contribute to social isolation, which negatively affects both mental and physical health. Older adults may be excluded from social, employment, or educational opportunities, leading to feelings of uselessness or depression.

Some older adults have lower health literacy and technology skills compared with younger people. They can lack the knowledge or skills to navigate modern healthcare systems, understand medical advice, or engage with digital health technologies (e.g. telehealth, online appointment systems). With healthcare increasingly moving online, older adults who are not familiar with technology may struggle to access services, manage appointments or stay informed about their health. This can contribute to reduced access to care leading to poorer health outcomes.

A lack of available or affordable caregiving options can also make health inequities worse for older adults who require assistance with daily activities or healthcare, leading to increased physical and mental health challenges.

What actions can be implemented to improve the health status of this group?

Some actions that can improve the health status of older people in Australia include:

- *Community-based health programs* — support community-based programs that encourage physical activity, healthy eating and social engagement. For example, local councils can organise regular fitness classes tailored to older people and offer nutrition workshops.
- *Social participation programs* — create opportunities for older adults to engage socially through activities such as senior clubs, volunteering and intergenerational programs that foster connections with younger people. Programs such as Men's Sheds offer spaces for older men to socialise, thereby reducing isolation.

FIGURE 2.30 Community activities such as community gardens and Men's Sheds can help older people with social participation.

- *In-home and community support services* — expand access to affordable in-home services (e.g. housekeeping, personal care) and day programs that support older people in maintaining independence while staying socially connected.
- *Financial support* — increased subsidies or financial support for older people to access healthcare, medications and essential services such as more bulk billing options and making more medications available through the Pharmaceutical Benefits Scheme (PBS). Additionally, in New South Wales, seniors are entitled to a Gold Opal Card which allows for unlimited travel on public transport for $2.50 a day and a Seniors Card which provides discounts at thousands of businesses including shops, restaurants and professional services.

DEPTH STUDY IDEA

Conduct a secondary source investigation focusing on one group other than Aboriginal and Torres Strait Islander Peoples. Analyse literature from a range of sources including the AIHW and ABS to compile your findings into a comprehensive report, including visual data representations (graphs and tables) and a presentation summarising your analysis. The structure of the report should include:

- Introduction
- Data analysis
- Determinants of health
- Causes of health inequities
- Recommendations for improvement
- Conclusion.

EXAM TIP

Aboriginal and Torres Strait Islander Peoples' communities

As Aboriginal and Torres Strait Islander Peoples have among the poorest health outcomes in Australia, it is important to consider areas of inequity when addressing exam questions featuring this population group. This means recognising the social factors that contribute to areas of disadvantage such as lower levels of retention in completing year 12, higher levels of unemployment, (for those living in rural settings) geographical isolation, feelings of disconnect with healthcare that is not culturally aligned, higher levels of alcohol and tobacco use and how these factors combine to contribute to chronic conditions such as heart disease, liver/kidney conditions, cancer, diabetes and poor mental health. This provides an overview of the interaction between the determinants to support syllabus content.

In exam questions that address actions that could be implemented, consider how governments and communities need to show support and cultural appreciation. Include in your response the need for Aboriginal and Torres Strait Islander Peoples to have increased ownership and voice to empower better health outcomes. An appreciation of Country, spirit and place is integral to these communities and needs to be considered when responding to questions regarding healthcare services and lifestyle practices. For example, *by introducing health practices that are spiritual and culturally appropriate, Aboriginal and Torres Strait Islander Peoples are more likely to engage in help-seeking behaviours and are more likely to adopt preventative practice*. This reveals an understanding of an action that could be implemented by governments to improve the health status of these communities.

(When dealing with an exam question regarding Aboriginal and Torres Strait Islander Peoples, health it is important to be sensitive in naming this community. Please do not abbreviate this community to ATSI or Aboriginals as this is offensive and does not consider the diverse nature of language, tradition and culture specific to these traditional communities. Aboriginal and Torres Strait Islander Peoples or First Nations Australian communities allows for diversity to be acknowledged.)

2.3 ACTIVITIES

Aboriginal and Torres Strait Islander Peoples' health and wellbeing

1. **a.** Use the internet to research the following terms:
   - Dispossession
   - Dislocation
   - Discrimination

   b. Discuss how these three factors have impacted Aboriginal and Torres Strait Islander Peoples' cultures, identity and wellbeing since colonisation.

2. Research the **Closing the Gap** campaign using the weblink in the Resources panel and other sources to answer the following questions.
   a. What is the aim of Closing the Gap?
   b. What are the targets of Closing the Gap?
   c. How many of these targets have been achieved or are on track to being achieved?
   d. Suggest reasons why the majority of the Closing the Gap targets have not been met.
3. a. In groups, consider Aboriginal and Torres Strait Islander Peoples and one other group experiencing health inequities. For these two groups, research:
   - What does the data tell us?
   - How do the determinants interact to affect the health of population groups?
   - What are some of the causes that underpin the inequities in health?
   - What actions can be implemented to improve the health status of these groups?

   b. Share your findings with the class in a short oral presentation.
4. Organise the class into two groups based on de Bono's red and yellow thinking hats.
   Consider the following question: What are the benefits of governments providing more funding to increase the number of Aboriginal and Torres Strait Islander health workers?
   Red hat group: consider your gut instincts, honest emotions and intuition
   Yellow hat group: consider the positive possibilities and advantages of this strategy

Culturally informed counselling

5. Visit the weblink in the Resources panel to read the case study **What is culturally informed counselling and why is it important for people seeking help for mental health issues?** and answer the following questions.
   a. What does 'maintaining face' mean, and how does it act as a barrier to mental healthcare in Asian communities?
   b. How do rising costs of living impact international students' ability to seek mental health support?

Intellectual disability and inequality

6. Visit the **Intellectual disability and inequality** weblink in the Resources panel to read the case study and answer the following questions.
   a. What are the main health disparities faced by people with intellectual disability in the Australian healthcare system?
   b. Why do people with intellectual disability have higher rates of potentially avoidable deaths?
   c. Define the term 'advocacy'. How did advocacy play a critical role in ensuring better healthcare outcomes for people with intellectual disability?
   d. Visit the weblink **Back the National Roadmap to End Disability Discrimination in the Resources panel**. Explain the barriers people with disability have when accessing healthcare services.

on Resources

Weblinks Closing the Gap
What is culturally informed counselling and why is it important for people seeking help for mental health issues?
Back the National Roadmap to End Disability Discrimination
Intellectual disability and inequality

2.3 Exercises

learnon

2.3 Quick quiz on | 2.3 Exercise

Learning pathways

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

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Revise your knowledge

1. Identify the difference in life expectancy between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians.
2. Describe the interaction between **two** determinants of health impacting the health of one group other than Aboriginal and Torres Strait Islander Peoples.
3. List two chronic diseases that have higher mortality rates among Aboriginal and Torres Strait Islander Peoples compared to non-Indigenous Australians.
4. For one group other than Aboriginal and Torres Strait Islander Peoples, outline the barriers faced when seeking healthcare.
5. What is one action that can be implemented to improve the health status of Aboriginal and Torres Strait Islander Peoples?

Apply your knowledge

6. Discuss how the health status of one group, other than Aboriginal and Torres Strait Islander Peoples, differs in terms of chronic diseases.
7. Define 'intergenerational trauma' and explain its effects on the health of Aboriginal and Torres Strait Islander Peoples. How does this trauma relate to their current health status?
8. Assess the implications of not having culturally appropriate healthcare for culturally and linguistically diverse (CALD) populations. Discuss how this affects their willingness to seek medical treatment.
9. Discuss the significance of Aboriginal Community-Controlled Health Organisations (ACCHOs) in bridging the health gap. What unique services do they provide that traditional healthcare systems might not?
10. Justify the role of programs like the Clontarf Foundation in improving health literacy and educational outcomes for Aboriginal and Torres Strait Islander youth. What long-term effects might this have on community health?

2.3 Exam questions

Question 1 (1 mark)

Source: Adapted from *HSC 2020, PDHPE Exam, Section I, Part A, Q.16*

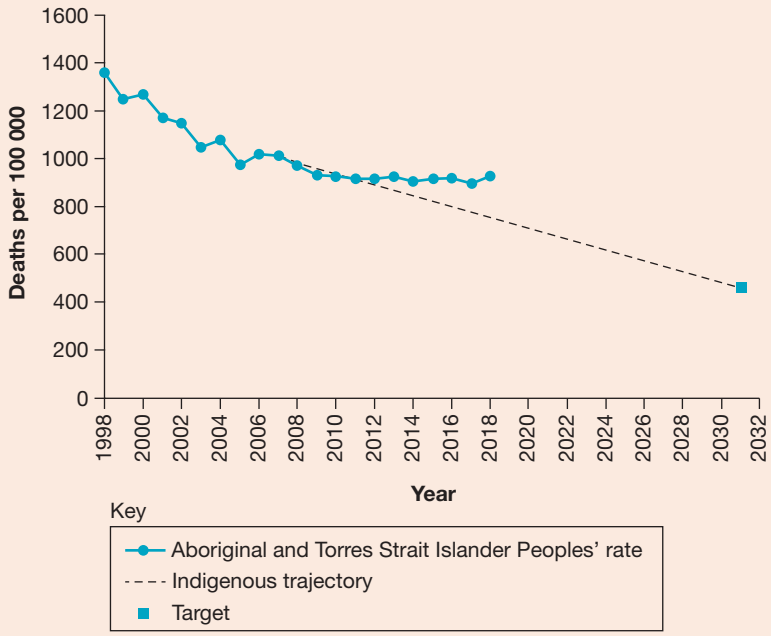
Which of the following identifies the health inequities experienced by Aboriginal and Torres Strait Islander Peoples when compared to non-Indigenous Australians?

A. Lower life expectancy, higher mortality rate from diabetes, higher incidence of lung cancer
B. Lower life expectancy, lower morbidity rate from diabetes, higher incidence of breast cancer
C. Higher infant mortality rate, lower mortality rate from diabetes, higher incidence of lung cancer
D. Higher infant mortality rate, higher morbidity rate from diabetes, lower rate of hospitalisation due to injury

Question 2 (1 mark)

Source: Adapted from *HSC 2022, PDHPE Exam, Section I, Part A, Q.18*

The graph shows the mortality rate and projected trajectory to the year 2031 for Aboriginal and Torres Strait Islander Peoples.



Which of the following was the most significant factor that contributed to the trend in the mortality rate for Aboriginal and Torres Strait Islander Peoples from 1998–2005?

A. More Aboriginal and Torres Strait Islander students completed Year 12
B. The Australian Government's implementation of the Closing the Gap framework
C. Increased childhood immunisation rates among Aboriginal and Torres Strait Islander Peoples in Australia
D. Improvement in the early detection and management of chronic disease for Aboriginal and Torres Strait Islander Peoples

Question 3 (4 marks)

Describe one action that can be implemented to improve the health status of one group other than Aboriginal and Torres Strait Islander Peoples.

Question 4 (5 marks)

Source: Adapted from *HSC 2019, PDHPE Exam, Section I, Part B, Q.23*

Explain how environmental determinants contribute to the health inequities experienced by Aboriginal and Torres Strait Islander Peoples.

Question 5 (8 marks)

Analyse the causes that underpin the inequities in health for Aboriginal and Torres Strait Islander Peoples.

2.4 Health status of Australia and other OECD countries

Syllabus: Compare the health status of Australia with that of other OECD countries

Including:
- where does Australia rank in relation to other OECD countries?
- why might this be the case?
- why do some countries rank higher or lower than Australia?
- what can we learn from other countries that may be applied to the Australian context?

The **OECD** (Organisation for Economic Co-operation and Development) is an international organisation that develops policies for a range of social, economic and environmental challenges. The OECD is widely used to compare health outcomes and systems across the world for several reasons:

- *Comprehensive data* — the OECD collects standardised health data, including life expectancy, infant mortality, healthcare spending and disease prevalence, enabling consistent comparisons across countries.
- *International benchmarking* — it allows countries to compare health outcomes and system performance with similar economies, assessing efficiency in spending, public health outcomes, and care access.
- *High-income focus* — since most OECD members are developed nations, comparisons are relevant for countries with similar economic development and healthcare challenges, such as Australia.
- *Policy guidance* — the OECD offers policy recommendations based on international best practices to help countries improve their healthcare systems.

FIGURE 2.31 The OECD is dedicated to fostering economic growth, stability and improved living standards across member countries.

2.4.1 Where does Australia rank in relation to other OECD countries?

Overall, Australia performs well compared to other OECD countries on various health metrics. It ranks above the OECD average in areas such as self-reported health, mortality rates, and both public and private health insurance coverage. However, Australia falls behind in certain areas, particularly with higher rates of alcohol consumption and obesity.

According to OECD data from 2022, Australia:

- ranks first among OECD countries for equity and healthcare outcomes, and holds third place for overall healthcare performance, behind Norway and the Netherlands.
- has the fourth highest life expectancy, behind Japan, Switzerland, Korea and equal with Spain.
- has the fifth lowest mortality rate for cardiovascular disease
- ranks 21st in infant mortality with 3.3 deaths per 1000 lives births, but is below the OECD average of 4.1 deaths per 1000 live births

OECD Organisation for Economic Co-operation and Development. An international organisation that develops policies for a range of social, economic and environmental challenges.

- was fourth most likely to perceive their health as 'good/very good' in those aged 15 and over
- is above the OECD average for people aged 25–64 with a tertiary qualification (50 per cent of total population, but ranks in the bottom third for providing equitable access to quality education)
- ranks last in the gender gap for feeling safe when walking alone at night (80 per cent of men, compared to 50 per cent of women)
- has the sixth equal lowest level of air pollution.
- has the eighth highest number of people aged 15 and over who are overweight or obese (65 per cent) among OECD countries
- has the fifth lowest proportion of daily smokers but the fifth highest proportion of e-cigarette users.

FIGURE 2.32 OECD member countries work together to share best practices and address common challenges.

Visit the **OECD interactive** weblink in the Resources panel to find out more.

2.4.2 Why might this be the case?

Australia has a well-established healthcare system that combines public and private sectors that provides comprehensive coverage. The Medicare system ensures that essential health services are accessible to all, and other initiatives such as the Pharmaceutical Benefits Scheme (PBS) and the National Disability Insurance Scheme (NDIS) assist in contributing to high equity and healthcare outcomes.

There are effective public health campaigns aimed at promoting healthy lifestyles, including initiatives to reduce smoking and encourage physical activity, which positively impact overall health metrics. Additionally, Australia has a relatively high standard of living, a robust economy, and good educational attainment levels, which correlate with better health outcomes.

FIGURE 2.33 Health promoting laws such as banning smoking in playgrounds helps improve the health of Australians.

The Australian culture generally promotes outdoor activities and a healthy lifestyle due to a favourable climate and access to outdoor facilities. However, there are also cultural norms surrounding alcohol consumption and dietary habits that negatively contribute to issues such as cardiovascular disease and obesity.

2.4.3 Why do some countries rank higher or lower than Australia?

Countries that invest more in preventive healthcare, social services and prioritise education generally achieve better health outcomes. This can lead to more informed populations who engage in healthier behaviours, thereby contributing to better health outcomes.

Cultural attitudes towards health, diet and physical activity vary significantly among countries. For example, Mediterranean countries such as Spain have diets rich in fruits and vegetables, which may contribute to their lower obesity rates.

Australia has effective government policies that promote health, such as strict regulations on tobacco use which lead to better outcomes. Due to these stringent public health policies, Australia has lower rates of smoking compared to the OECD average.

Although Australia has some of the highest rates of cancer among the OECD countries, this may be due to the completeness and high quality of data available.

2.4.4 What can we learn from other countries that may be applied to the Australian context?

Analysing the strengths and weaknesses of other countries can provide Australia with effective strategies to enhance health outcomes, address existing challenges, and build on its successes for a healthier population. Some examples of approaches to health used by other OECD countries are outlined below.

Soft drink industry levy (United Kingdom)

The aim of this levy is to encourage manufacturers to reduce the sugar content in soft drinks containing added sugar, thus reducing levels of childhood obesity.

Emerging evidence indicates that since the start of the sugar levy in 2018, there has been a decrease in obesity rates among girls aged 10–11, particularly benefiting those from deprived backgrounds. It is estimated that the tax has helped prevent over 5000 obesity cases among year 6 girls in England. This suggests that the levy is successfully meeting its intended goals and should be celebrated.

As a result of the levy, almost $650 million dollars in revenue was raised in 2021–22, with the government aiming to reinvest the revenue back into young people's nutrition initiatives.

The Australian Medical Association (AMA) is continuing to call on the Australian government to introduce a tax on sugary drinks as current trajectories indicate 64 per cent of Australians will be overweight or obese by 2030. Analysis by the AIHW reveals that this will result in 13 400 preventable deaths. A sugar tax could help form healthier dietary habits from a young age and make unhealthier options less affordable.

FIGURE 2.34 The AMA has proposed a soft drink levy in Australia, due to its success in the United Kingdom.

National Mental Health Strategy (Sweden)

Beginning in 2015, this initiative is designed to prevent the onset of mental disorders and aims to provide comprehensive mental health support throughout society.

The initiative emphasises early intervention and prevention of mental health disorders, aiming to reduce the incidence of these conditions before they develop. The Swedish government has significantly increased funding for mental health services, making it one of the highest spenders on mental healthcare in the world. This funding supports various programs, facilities and services aimed at improving mental healthcare access.

The initiative seeks to ensure that mental health services are available to all populations, including marginalised and underserved communities, such as the LGBTIQA+ community, individuals in rural areas and socioeconomically disadvantaged groups.

Mental health services in Sweden are also integrated into primary healthcare. This means that patients can receive a comprehensive range of health services, including mental health support, without needing to visit multiple facilities. For example, a patient seeing a general practitioner (GP) for a physical ailment can also receive advice or referrals for mental health issues, such as anxiety or depression, during the same appointment. This allows a holistic approach where physical and mental health needs are addressed together.

FIGURE 2.35 A holistic approach to mental health, such as a GP giving advice or referrals, has many benefits.

To apply this strategy to an Australian context, governments could:

- increase funding for mental health services providing more comprehensive mental health programs, an increased access to care and reduced wait times for services
- integrate mental health services into primary care to allow for a more holistic understanding of patient health. This would address both physical and mental health concerns in a single visit and reduce stigma associated with seeking mental healthcare
- target support by developing specific programs and services tailored to the needs of marginalised and underserved populations, including Aboriginal and Torres Strait Islander Peoples, those in rural areas, and the LGBTIQA+ community.

CASE STUDY 5

Australians are living longer than most people in English-speaking OECD countries, new research says

*By **Ahmed Yussuf***

29 August 2024

People living in Australia have better health outcomes and face less inequality compared to other high-income countries in the Anglosphere [English speaking countries].

That is according to research published in the open access medical journal *BMJ Open*.

International researchers analysed several English-speaking countries such as New Zealand, Canada, the United States and the United Kingdom to review life expectancy between 1990 and 2018.

They found Australia was the best performer in life expectancy at birth since the 1990s.

‘Australia performs well, but still has room for improvement, particularly in the area of reducing inequalities among its indigenous populations,’ researchers said.

‘Overall, Australia offers a potential model for lower-performing Anglophone countries, such as the USA and UK, to follow to reduce both premature mortality and inequalities in life expectancy.’

Why Australia is leading in life expectancy

The study in BMJ Open has suggested that Australia’s high number of people born overseas was a possible explanation for its performance compared to other English-speaking OECD nations.

Health economist Martin Hensher said that it was an established phenomenon that countries with high levels of immigration tend to have better levels of life expectancy.

‘So basically, young immigrants arrive and they tend to be healthier than the locals, so they drive up life expectancy,’ he said.

The study also highlighted lower smoking rates, public health campaigns regarding gun ownership and mental health, as well as the country’s healthcare system as reasons for Australia doing better than other countries.

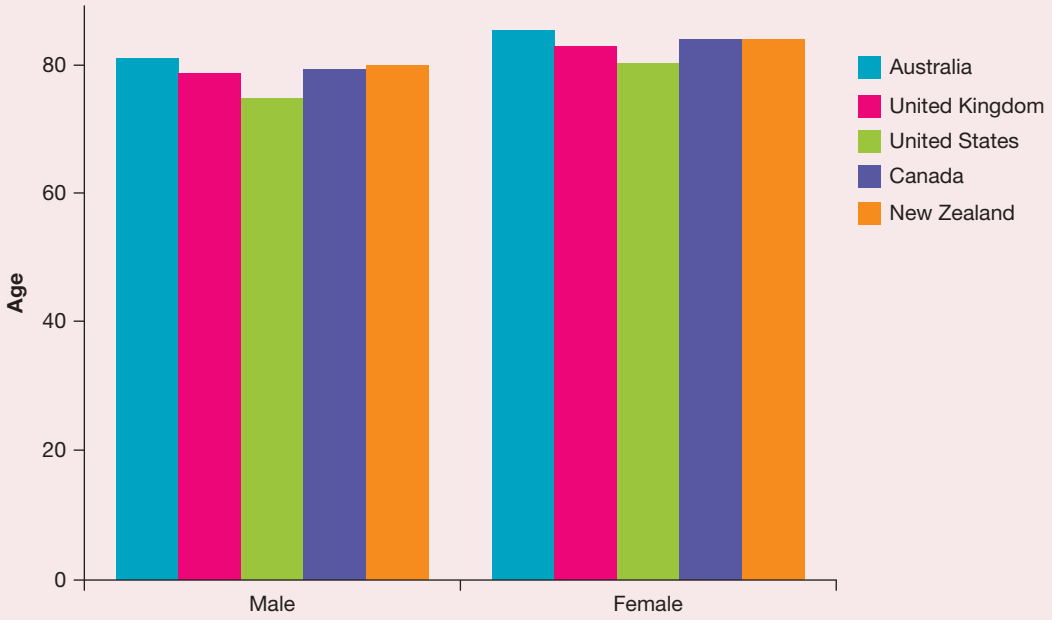
Australia had about a four- to five-year life expectancy advantage over the US and a one- to 2.5-year advantage over Canada, New Zealand and the UK.

The worst performer in life expectancy every year since 2001 has been the US, despite its healthcare spending, both per person and as a share of GDP, being higher than any other OECD nation.

Dr Hensher highlighted that despite the study looking into the years between 1990 and 2018, Australia still has better life expectancy rates than the other countries included in the research.

‘Our COVID response was massively superior to most of these other countries. So we didn’t have the big dip in life expectancy that particularly America and the United Kingdom had,’ he said.

Life expectancy comparison



Sources: ABS, StatsCan, Stats NZ, CDC, UK ONS.

Australia also had the lowest within-country inequality for both men and women, particularly for ages over 40.

New Zealand and the US had the highest inequality among women, while the UK, New Zealand and the US had the highest among men.

Experts warn Australia should not be complacent

Dr Hensher said Australia's growing economic inequalities could see life expectancy fall if governments do not act to effectively combat it.

'We also need to keep pushing on these public health measures that improve health. So the very obvious example is the watering down of the restrictions on gambling advertising that's a step in the wrong direction,' he said.

He said for Australia to continue to see better health outcomes, and prevent further inequalities, there needed to be more action on critical determinants of health such as housing and air quality.

'If we do let increasing numbers of people become homeless, that absolutely will lead to reduced life expectancy and poorer health down the track.

'We need to get on top of making sure that every Australian has access to decent housing, we need to be working hard on air pollution, which particularly in urban areas is quite a driver of preventable diseases.'

One of the key areas of improvement for Australia highlighted in the study was the disparity in health outcomes between Indigenous and non-Indigenous communities.

'We need to not rest on our laurels here because what you can see in this [journal] article is that they show that the outlier in Australia is the Northern Territory,' he said.

'That reflects the terrible inequalities in poor health status that the Indigenous population, particularly in the Northern Territory, suffer.'

Source: Yussuf, A. (2024), 'Australians are living longer than most people in English-speaking OECD countries, new research says'. *ABC News*, 29 August, https://www.abc.net.au/news/2024-08-29/australia-life-expectancy-better-than-most-oecd-nations/104284440.

Case study questions

1. What are the main findings of the research published in *BMJ Open* regarding Australia's health outcomes compared to other high-income countries?
2. How does Australia's life expectancy compare to that of the United States, Canada, New Zealand and the United Kingdom?
3. Assess how the public health measures mentioned could help maintain or enhance Australia's health.

DEPTH STUDY IDEA

Conduct a role play acting as stakeholders in health policy.

Students take on the roles of health ministers from OECD countries (e.g. Australia, Sweden and the United States). Each representative will present their country's health data via a presentation and then discuss their challenges and successes in a roundtable discussion.

Students reflect on the insights gained from other countries and how these can inform Australia's health policies.

2.4 ACTIVITIES

Comparing OECD countries

1. Organise a debate on the statement: 'Australia's health system is the best in the OECD'. Students will be divided into pro and con teams, requiring them to research and argue based on health data and outcomes from other OECD countries.
2. Select an OECD country and investigate its unique health challenges and successes. Prepare a one-page case study summarising your findings, focusing on what Australia can learn from these examples.

Sugar tax

3. Visit the weblinks **AMA calls for Sugar Tax** and **Mounting Evidence for Sugar Tax Success** in your Resources panel. Write a letter to the Australian government, advocating for the introduction of a sugar tax in Australia to assist in lowering rates of childhood obesity.

Resources

Weblinks AMA calls for Sugar Tax
Mounting Evidence for Sugar Tax Success

2.4 Exercises

learnon

2.4 Quick quiz on | **2.4 Exercise**

Learning pathways

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

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Revise your knowledge

1. What does OECD stand for?
2. Identify TWO reasons the OECD is used to compare health outcomes between countries.
3. What was Australia's ranking for life expectancy in 2022 among OECD countries, and which countries ranked higher?
4. What is Australia's infant mortality rate, and how does it compare to the OECD average? Provide reasons for why Australia's infant mortality rate is different to other OECD countries.
5. What are two initiatives that contribute to the high equity and healthcare outcomes in Australia?

Apply your knowledge

6. Outline specific community-based programs Australia could implement to address its high rates of obesity and alcohol consumption.
7. Considering the gender gap in safety perceptions, what strategies might Australia adopt from countries with strong gender equality policies to improve safety for women in public spaces? Provide examples.
8. Research and identify a specific aspect of Sweden's mental health services that Australia could integrate into its healthcare system to improve overall health outcomes.
9. What urban planning strategies might Australia adopt from countries with low air pollution levels to reduce pollution sources in its cities?

2.4 Exam questions

Question 1 (1 mark)
Which of the following is a reason for why Australia ranks highly in healthcare outcomes among OECD countries?

A. Lower rates of obesity
B. High rates of tobacco use
C. A well-established public and private healthcare system
D. High infant mortality rates

Question 2 (4 marks)
Outline Australia's health ranking in relation to other OECD countries.

Question 3 (5 marks)
Why do some OECD countries rank higher or lower than Australia in terms of health status?

Question 4 (5 marks)
Australia's life expectancy at birth is ranked equal fourth among OECD countries. **Explain** reasons for why Australia's health ranking is high among OECD countries.

Question 5 (5 marks)
Discuss what Australia can learn from other OECD countries to improve health outcomes.

2.5 Chronic conditions, diseases and injury in Australia

Syllabus: Examine chronic conditions, diseases and injury in Australia, including cardiovascular disease, cancer and ONE other condition, disease and injury using *Australia's Health* and other health reports

Including:

- what does the data tell us about the mortality and morbidity, prevalence and incidence rates of these conditions?
- what are the risk and protective factors for these conditions?
- where and for whom are these conditions changing?

2.5.1 Cardiovascular disease

Cardiovascular disease (CVD) refers to damage to, or disease of, the heart, arteries, veins and/or smaller blood vessels. It is a general term covering all diseases of the heart and circulatory system. The three major forms of this disease are:

- *coronary heart disease* — the poor supply of blood to the muscular walls of the heart by its own blood supply vessels, the coronary arteries (includes angina and heart attack)
- *cerebrovascular disease* — conditions that interruption of the supply of blood to the brain (e.g. stroke and brain aneurysm)
- *peripheral vascular disease* — diseases of the arteries, arterioles and capillaries that affect the limbs, usually reducing blood supply to the legs.

cardiovascular disease (CVD) damage to, or disease of, the heart, arteries, veins and/or smaller blood vessels

TABLE 2.7 Summary of cardiovascular disease terms

Term	Description
Angina	The medical term used to describe the symptoms of chest pain that occurs when the heart has an insufficient supply of oxygenated blood.
Atherosclerosis	The narrowing of the artery (due to fat deposits on the inside of the walls) makes it more difficult for blood to pass through the artery (increased blood pressure). A clot may form or lodge at that point.
Arteriosclerosis	A degenerative disease that affects most people to some extent as part of the process of ageing, the arteries become harder and less elastic.
Brain aneurysm	A weakness in a blood vessel in the brain that balloons and fills with blood. This can rupture, causing life-threatening bleeding.
Heart attack	Also known as myocardial infarction. Generally caused by the complete closure of a coronary artery by atherosclerosis, it may also occur when a blood clot forms and blocks a narrowed artery (thrombosis).
Heart failure	When the heart is unable to pump blood effectively, causing fatigue, shortness of breath and fluid buildup.
Hypertension	The medical term for high blood pressure.
Peripheral vascular disease	The result of reduced blood flow to the legs and feet, usually due to atherosclerosis and/or arteriosclerosis. It usually affects the arteries, arterioles and capillaries of the legs and feet.
Stroke	Results from a blockage of the blood flow to the brain. Occurs either when the blood supply to the brain is interrupted by a clot or atherosclerosis, or when a burst blood vessel haemorrhages into the brain.

FIGURE 2.36 Atherosclerosis. The narrowing of the artery (due to fat deposits on the inside of the walls) makes it more difficult for blood to pass through the artery.

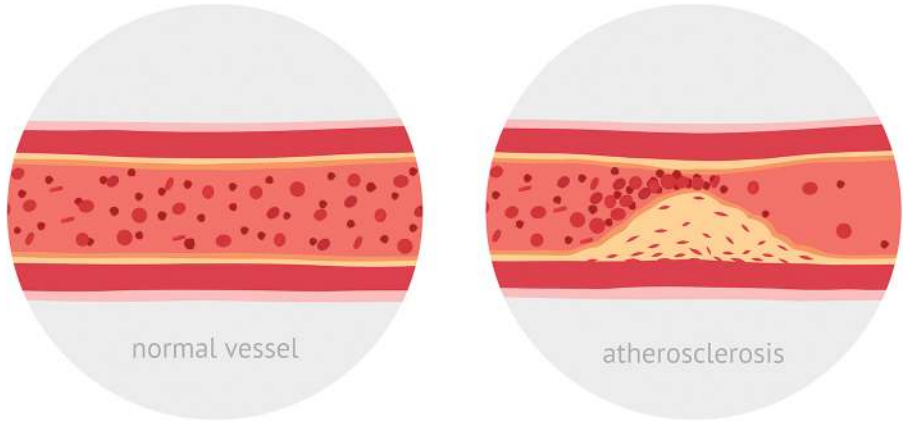


FIGURE 2.37 The effects of heart failure

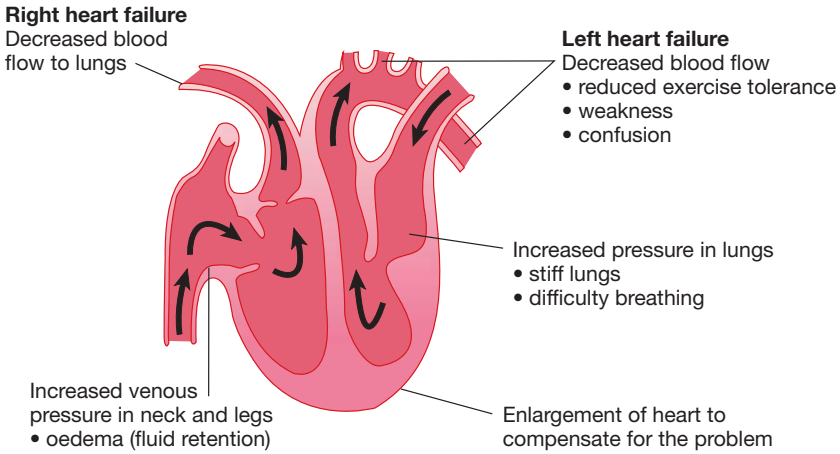
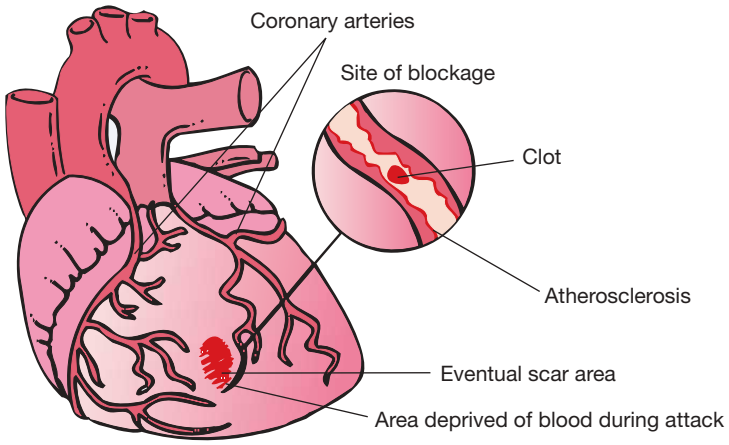


FIGURE 2.38 Blockage or closure of an artery leads to a heart attack.



What does the data tell us about mortality and morbidity, prevalence and incidence rates of these conditions?

Mortality

Cardiovascular disease has long been a major health issue in Australia. In 2022, all forms of cardiovascular disease were the underlying cause of 45 000 deaths (24 per cent of all deaths), behind all forms of cancers (27 per cent of all deaths).

Coronary heart disease (CHD) is the single leading cause of death in Australia. Figure 2.39 shows that death rates from CHD have fallen more than 80 per cent for both men and women between 1980 and 2022. Mortality rates from strokes have also seen similar sharp declines over the same period (see figure 2.40). The increase in life expectancy throughout the latter stages of the twentieth century is largely attributed to these steep declines in cardiovascular disease deaths.

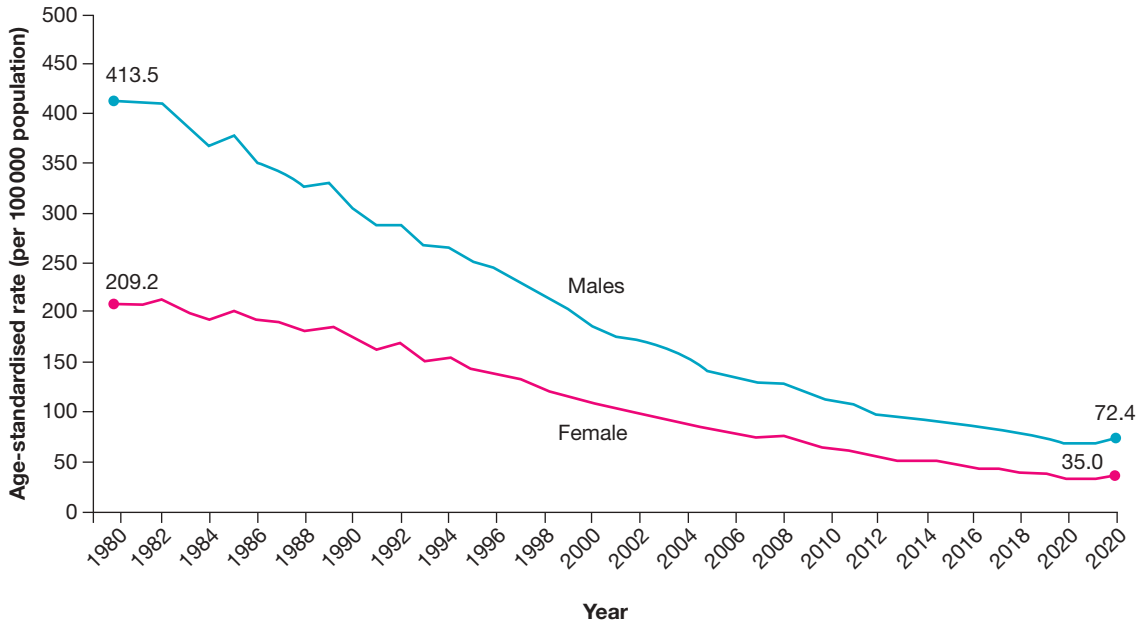
The decline in cardiovascular disease mortality in Australia is largely due to advancements in prevention and treatment.

These include:

- a reduction in the levels of risk factors; for example, the implementation of prevention strategies has led to a reduction in smoking levels, increased monitoring of hypertension levels and diet modifications
- improved medical care and treatment; for example, better medications include those that control hypertension (ACE inhibitors) and cholesterol (statins), while improved surgical interventions such as keyhole surgery results in less invasive procedures with faster recovery times. Collectively, these improvements have reduced mortality and improved quality of life.

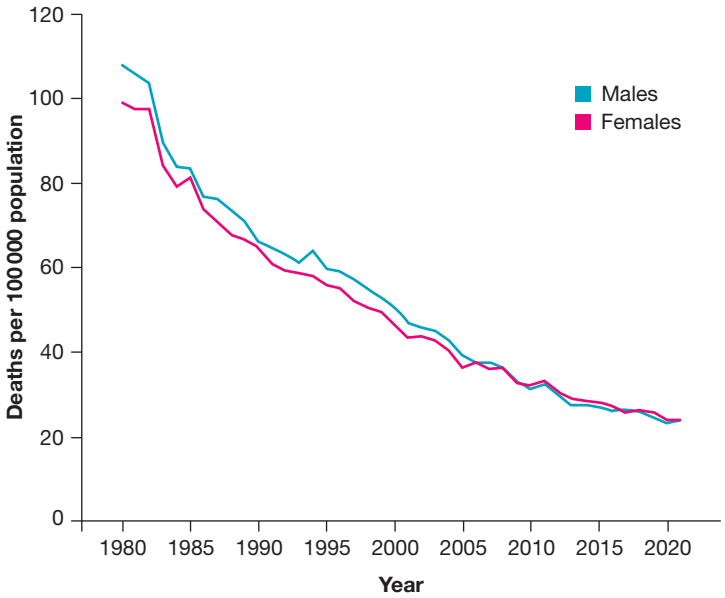
Despite these improvements in the mortality rates for cardiovascular disease, they did increase during 2021 and 2022. These increases were associated with COVID-19, as people with pre-existing conditions such as coronary heart disease were at higher risk of severe outcomes from the virus.

FIGURE 2.39 CHD deaths have fallen significantly; however, it is still the leading single cause of death in Australia.



Source: Australian Institute of Health and Welfare (2024) *Australia's health 2024: in brief*, catalogue number AUS 249, AIHW, Australian Government.

FIGURE 2.40 Stroke mortality rates, by sex, 1980–2021



Source: AIHW National Mortality Database. https://www.aihw.gov.au.

Morbidity

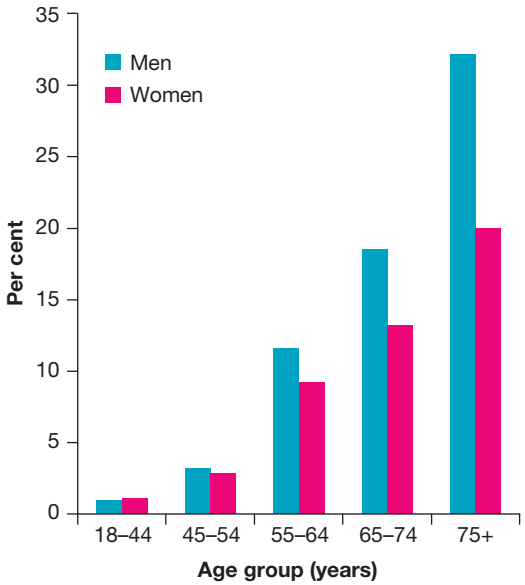
The prevalence of cardiovascular disease is very high with an estimated 1.2 million Australians aged 18 (6.2 per cent of the adult population) and over living with one or more conditions related to heart, stroke or vascular disease. As seen in figure 2.41, the prevalence of cardiovascular disease increases with age, and is higher in males compared to females.

In 2020–21, cardiovascular disease accounted for 5.1 per cent of all hospitalisations in Australia, totaling 600 000 cases. While this represents an increase in total hospitalisations compared to 2001, the age-standardised rates have declined during this period (see figure 2.42). Hospitalisation rates for males were higher than those for females, although both sexes experienced similar declines.

The phenomenon of increasing total hospitalisations for cardiovascular disease while experiencing a decline in the age-standardised hospitalisation rate can be attributed to several interrelated factors:

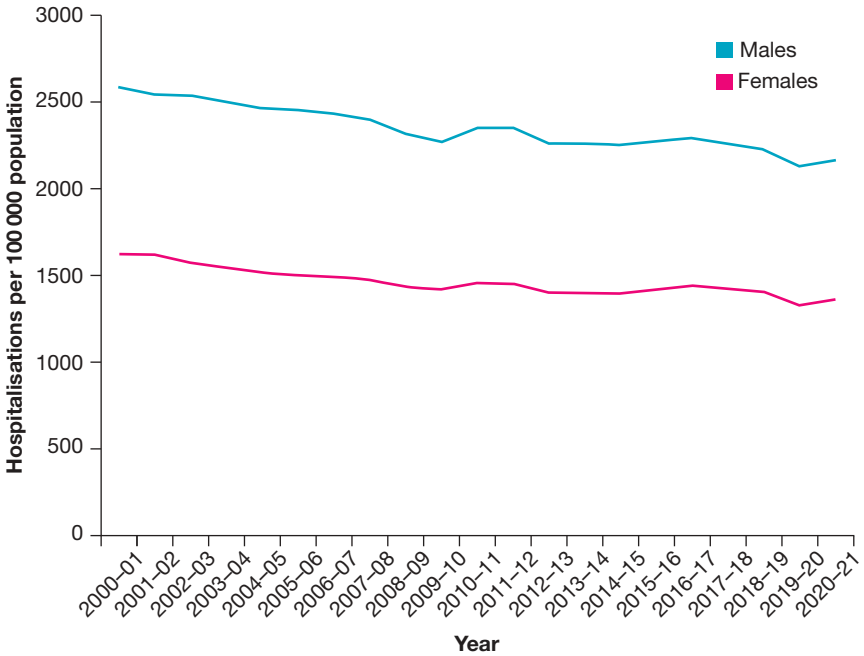
- Australia has an ageing population, which means there are more individuals at risk of developing cardiovascular disease
- improved early medical interventions such as improved screening methods lead to early detection and management of the condition
- increased education and awareness of the risk and protective factors of heart disease improving health literacy
- improved survival rates, meaning patients who would have previously died are surviving longer and require more hospitalisations.

FIGURE 2.41 Prevalence of self-reported cardiovascular disease among persons aged 18 and over, by age and sex, 2017–18



Source: ABS 2019. Microdata: National Health Survey, 2017–18. ABS cat. no. 4324.0.55.001. Canberra: ABS, Findings based on Detailed Microdata analysis. https://www.aihw.gov.au.

FIGURE 2.42 Cardiovascular disease hospitalisations rates, by sex, 2000–01 to 2020–21



Source: AIHW National Hospital Morbidity Database.

What are the risk and protective factors for these conditions?

The major risk factors for developing cardiovascular disease include some that are non-modifiable, or cannot be changed. These include:

- *a family history of heart disease.* People with a family history of heart disease tend to be more likely to develop cardiovascular disease
- *sex*. The cardiovascular disease mortality rate for men is higher than women. However, the risk for women is often under-recognised due to under-diagnosis and under-treatment. This can be due to women presenting with additional symptoms, such as dizziness and nausea, which distract from the chest pain symptom
- *advancing age*. The risk of cardiovascular disease increases with age.

Other major risk factors that can be modified or eliminated include those shown in table 2.8.

TABLE 2.8 Modifiable risk factors for cardiovascular disease and their associated protective factors

Risk factor	Description	Protective factors
Smoking	This is the most significant modifiable risk factor. The risk of heart attack and stroke is doubled by heavy smoking. The risk of sudden cardiac death is also higher. These risks decrease when smoking stops and as the non-smoking period lengthens.	• Not smoking or quitting • Avoiding second-hand smoke
High cholesterol	Generally, the higher the blood cholesterol and triglyceride levels, the higher the risk of heart disease. A diet high in saturated fat can raise blood cholesterol levels.	• Balanced diet including fruit and vegetables • Limiting saturated fats • Regular screenings and check-ups to monitor cholesterol levels

(continued)

TABLE 2.8 Modifiable risk factors for cardiovascular disease and their associated protective factors *(continued)*

Risk factor	Description	Protective factors
High blood pressure	The risks of heart disease, stroke and heart failure all increase with hypertension. High blood pressure can overload the heart and blood vessels and speed up atherosclerosis.	• Regular physical activity • Balanced diet including fruit and vegetables • Managing stress • Regular screenings and check-ups to monitor cholesterol levels
Overweight and obesity	These are thought to increase directly the risk of heart disease. They also contribute to other risk factors such as high blood pressure, high blood cholesterol and diabetes.	• Regular physical activity • Balanced diet including fruit and vegetables • Support from healthcare professionals
Physical inactivity	The association of inactivity with obesity, high blood pressure and high fat levels makes it a significant contributor to the development of heart disease.	• Regular aerobic and strength exercises • Incorporating physical activity into daily routine (e.g. walking, cycling, using stairs)

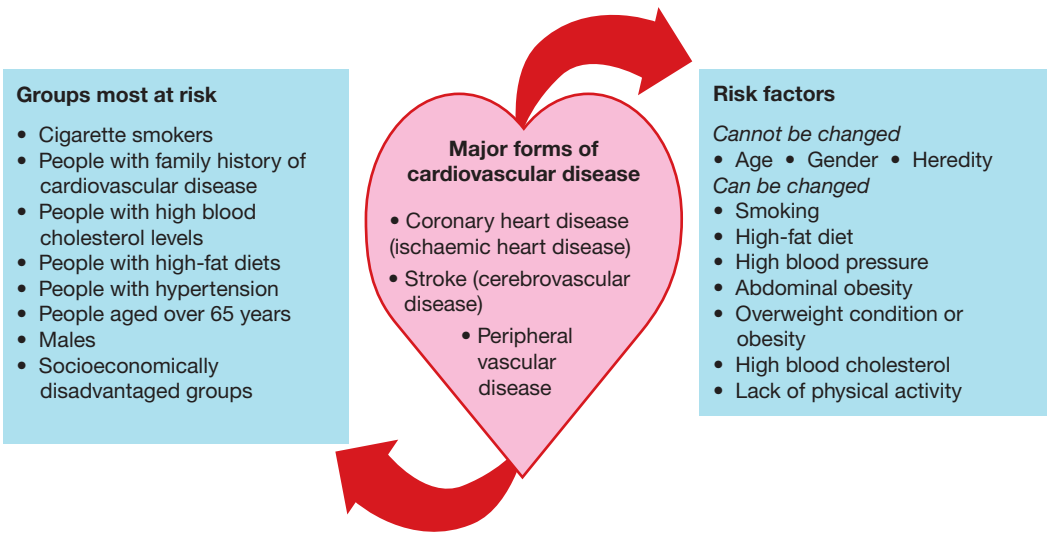
Where and for whom are these conditions changing?

Cardiovascular disease is a major health issue in Australia. Its prevalence and impact varies among different groups and geographical regions. To plan and allocate resources effectively, it is important to understand how these conditions are changing over time. By looking at the data, we can see how cardiovascular health is evolving and identify which populations are at higher risk. The following data will show where and for whom these changes are happening.

Aboriginal and Torres Strait Islander Peoples

Cardiovascular disease remains a major health issue for Aboriginal and Torres Strait Islander Peoples, with higher rates of both incidence and mortality compared to other Australians (see figure 2.44). Socioeconomic disadvantages are the primary cause for this health gap, while higher rates of risk factors such as smoking, obesity and high blood pressure also play a role.

FIGURE 2.43 Cardiovascular disease — a summary of the risk factors and groups at risk



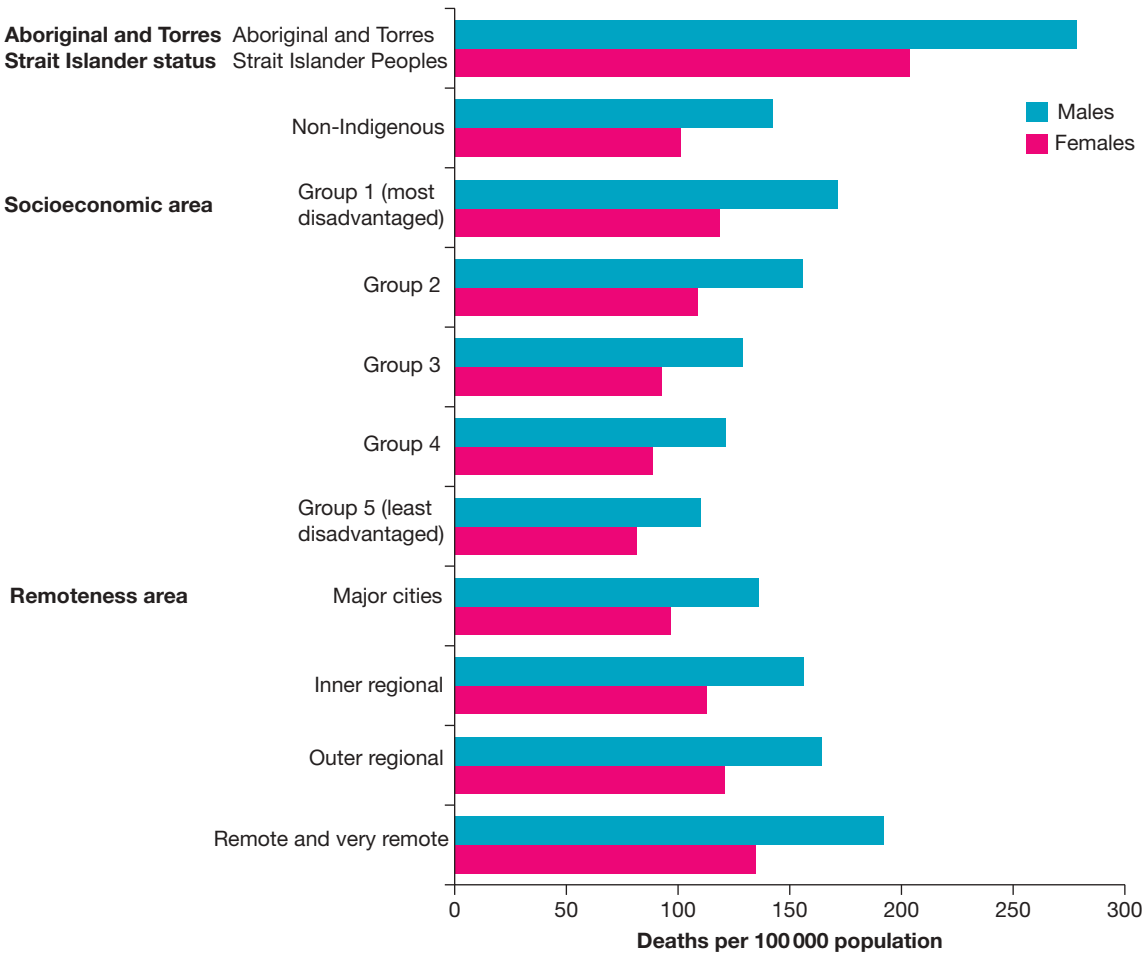
Level of remoteness

Recent studies show that the prevalence of cardiovascular disease does not vary significantly by remoteness area; however, mortality rates increase as the level of remoteness increases (see figure 2.44). This is due to reduced access to healthcare (including specialists and medical technology) and fewer resources for prevention, and lifestyle differences in rural and remote areas.

Socioeconomic disadvantage

Both sexes living with socioeconomic disadvantage are at greater risk of mortality from cardiovascular disease, compared to those of high socioeconomic status (see figure 2.44). Furthermore, although mortality rates are declining overall, in some instances the socioeconomic inequalities are widening. Socioeconomic disadvantage negatively affects mortality rates through the impact on multiple health behaviours, including smoking, overweight and obesity, and poor diet. Management of chronic conditions is also expensive, with people of low socioeconomic status having greater difficulty affording the direct (e.g. payments for doctors and specialists) and indirect costs (e.g. transportation costs, income lost due to time off work) associated with medical treatment.

FIGURE 2.44 Cardiovascular disease mortality rates, by population group and sex, 2019–21



Source: AIHW National Mortality Database.

2.5.2 Cancer

Cancer refers to a diverse group of several hundred diseases with a common feature — the uncontrolled growth and spread of abnormal body cells. It involves a mutation and is believed to originate from a single cell whose genetic material has been influenced or damaged by some foreign agent. The changed cell divides and multiplies uncontrollably, transferring its damaged genetic material to its offspring cells. Eventually, a **tumour** develops and cells that would normally work together for the benefit of the tissue continue to multiply independently, starving other nearby cells of nourishment. This group of cells is now referred to as a **neoplasm**.

cancer a large group of diseases that are characterised by the uncontrolled growth and spread of abnormal cells.

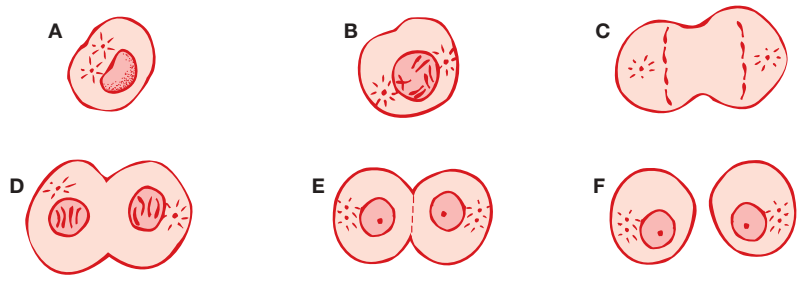
tumour a swelling or enlargement caused by a clump of abnormal cells

neoplasm an abnormal mass of cells that forces its way among healthy cells and interferes with their normal functioning

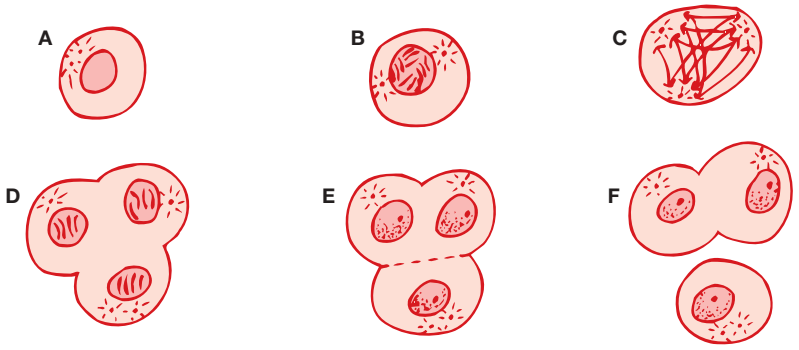
There are two quite different types of tumour.

1. *Benign tumours* are not cancerous. They generally grow slowly, surrounded by a capsule that tends to control their spread. Usually, the cure is surgical removal. Benign tumours may cause some damage by robbing surrounding tissue of necessary nutrients, or interfering with the function of vital organs.
2. *Malignant tumours* are cancerous. These tumours can spread to other parts of the body, starve surrounding tissue of necessary nutrients and invade healthy tissues. These tumours cause sickness and death.

FIGURE 2.45 Differences between the formation of normal and cancerous cells

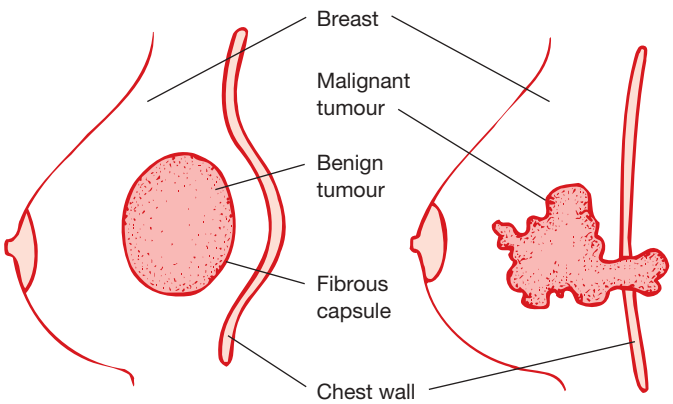


(a) An example of normal cell division



(b) An example of abnormal cell division

FIGURE 2.46 Malignant and benign tumours in the breast



Metastases are secondary or new tumours. A malignant tumour has the ability to invade surrounding tissues, blood vessels and lymphatic channels, spreading into either the bloodstream or lymph fluid and travelling to other parts of the body. Both metastases and malignant tumours are then capable of spreading to many sites throughout the body, thus affecting the whole body with the disease.

metastases secondary or new tumours, which may develop some distance from the original malignant tumour

Cancer is generally classified according to the type of cell in which it originates (see table 2.9). Medical experts suggest that around 90 per cent of cancers are products of an individual's environment and lifestyle and exposure to **carcinogens**. But the precise causes of cancer remain a mystery. Different countries experience different degrees of incidence of cancer in different body sites. Varying environmental factors from one country to another may play a major role in this variation in incidence.

carcinogens cancer-causing agents such as chemicals, pollutants, radiation, cigarette smoke and alcohol

TABLE 2.9 Cancer classifications and sites

Classification	Site
Carcinoma	Skin; membranes lining the respiratory, gastrointestinal and urinary tracts; the breasts
Sarcoma	Bones; cartilage; muscles
Leukaemia	Blood-forming organs such as bones; the liver; the spleen
Lymphoma	Infection-fighting organs (glands and the spleen)

What does the data tell us about mortality and morbidity, prevalence and incidence rates of these conditions?

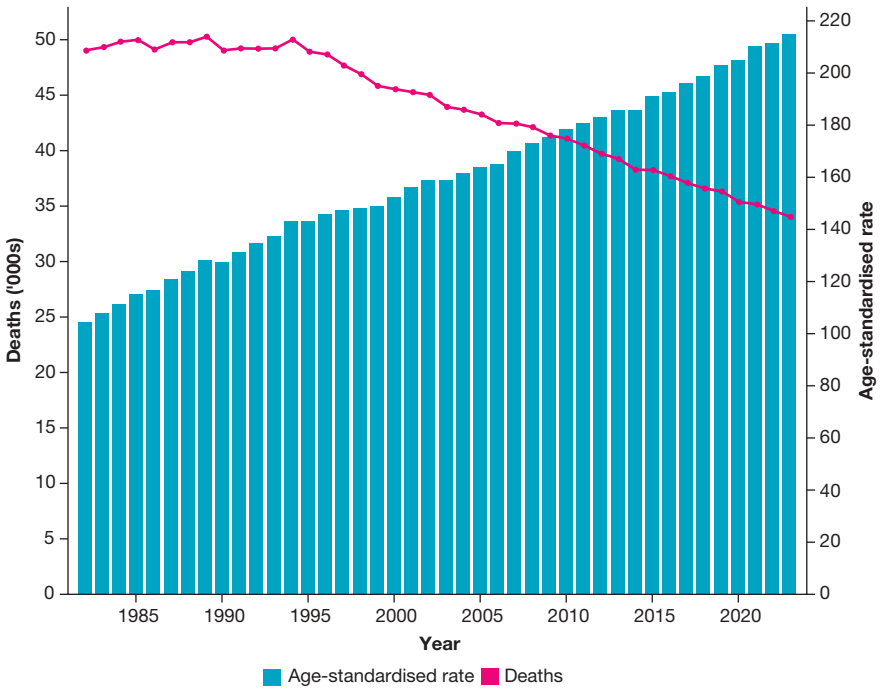
Mortality

Even though cancer survival rates have increased and cancer mortality rates have decreased, cancer (including all forms) is still the leading underlying cause of death in Australia. In 2022, cancer was responsible for 27 per cent of all deaths, with males dying at higher rates than females. Lung cancer is the leading cause of death for all cancers for both males and females.

Figure 2.47 shows that the total number of cancer deaths is increasing year upon year, while the age-standardised mortality rate showing a consistent downward trend. This can be attributed to the following reasons:

- Australia has an ageing population. As the population ages, the total number of deaths from cancer increases because it is more prevalent among older adults.
- Advances in cancer treatment and early detection techniques have significantly improved survival rates for many types of cancer and patients are now living longer after diagnosis.

FIGURE 2.47 Cancer-related deaths and age-standardised mortality rates, 1982–2023



Source: AIHW National Mortality Database.

Morbidity

Cancer is the only major cause of death in Australia that is increasing in incidence in both sexes. The most significant increases in the past two decades have been for prostate cancer, breast cancer and melanoma. Table 2.10 summarises the trends in incidence, mortality rates and improvements in five-year survival rates for the top five leading causes of cancer. The main reasons for the increases in incidence are:

- an ageing population — as life expectancy increases, a larger proportion of the population reaches older age groups where cancer risk is higher
- the better detection of cancer — advances in medical practices, such as the implementation of routine screenings (e.g. mammograms for breast cancer), lead to earlier and more frequent cancer diagnoses
- new diagnostic technology and screening programs — innovations such as liquid biopsies and enhanced imaging techniques (e.g. MRI and CT scans) allow for earlier identification of various cancers, thereby improving detection rates
- the better reporting of cancer — mandatory reporting of cancer cases by healthcare professionals ensures more accurate recording and tracking of incidence rates. For instance, Australian cancer registries, like the Australian Institute of Health and Welfare (AIHW) Cancer Database, integrate data from hospitals, pathology labs and treatment centres, using big data analytics to monitor trends in cancer incidence and treatment outcomes more effectively.

The five-year survival rates indicate improvements over time, reflecting advances in detection, treatment and management of each cancer type.

TABLE 2.10 Summary of incidence and mortality trends for the leading causes of cancer

Rank	Cancer type	Incidence trend	Mortality trend	Five-year survival rate improvement
1	Prostate cancer	Increasing	Decreasing	Increased from 89% (1991–95) to 96% (2016–20)
2	Breast cancer	Increasing	Decreasing	Increased from 79% (1991–95) to 92% (2016–20)
3	Melanoma of the skin	Increasing	Decreasing	Increased from 90% (1996–2000) to 94% (2016–20)
4	Colorectal cancer	Decreasing	Decreasing	Increased from 56% (1991–95) to 71% (2016–20)
5	Lung cancer	Stable (across total population); decreasing for males; increasing for females	Decreasing for males; increasing for females	Increased from 9.7% (1991–95) to 26% (2016–20)

Source: Australian Institute of Health and Welfare (2024) *Cancer data in Australia*.

What are the risk and protective factors for these conditions?

Risk factors for cancer can be classified into modifiable factors, that individuals can change or influence, such as diet, physical activity and sun protection practices, and non-modifiable factors, that include age, gender and family history. Understanding these factors is crucial for developing effective prevention strategies and improving overall cancer outcomes.

TABLE 2.11 Risk and protective factors for different types of cancer

Cancer type	Risk factors	Protective factors
Prostate cancer	• Male • Age (increased risk after 50) • Family history • Overweight or obesity	• Regular exercise • Balanced diet, including fruit and vegetables • Maintaining a healthy weight • Screening (blood test or rectal examination)
Breast cancer	• Female • Age (increases with age) • Family history • Overweight or obesity • Alcohol consumption	• Regular screening and mammograms • Self-examination • Balanced diet, including fruit and vegetables • Regular physical activity • Maintaining a healthy weight
Melanoma cancer	• Excessive sun exposure • Fair skin, hair and eye colour • Family history • Number and types of moles on skin • Use of tanning beds (solariums)	• Reduce exposure to the sun (hat, sunscreen, protective clothing, sunglasses) • Regular skin checks • Self-monitoring moles on skin
Colorectal cancer	• Age (increased risk after 50) • Family history • Overweight or obesity • Diet high in red and processed meats • Sedentary lifestyle	• Balanced diet, including fruit and vegetables • Regular physical activity • Screening (bowel sample or colonoscopy)
Lung cancer	• Smoking (primary risk factor) • Exposure to secondhand smoke • Occupational exposure • Family history • Air pollution	• Avoiding smoking or secondhand smoke • Balanced diet, including fruit and vegetables • Regular physical activity

Where and for whom are these conditions changing?

Aboriginal and Torres Strait Islander Peoples

Data suggests that Aboriginal and Torres Strait Islander Peoples have a higher prevalence of risk factors attributed to some cancers including tobacco smoking, risky alcohol consumption, poor diet, low levels of physical activity and high rates of overweight and obesity.

Aboriginal and Torres Strait Islander Peoples also have lower participation in cancer screening programs compared to non-Indigenous Australians. Invasive cancers that could be prevented or detected earlier by participating in national screening programs include breast, bowel and cervical cancer. Due to higher proportions of Aboriginal and Torres Strait Islander Peoples living in remote or very remote areas, there can be difficulties accessing preventative, diagnostic and curative health services.

These factors combined result in Aboriginal and Torres Strait Islander Peoples experiencing higher incidence and mortality rates for cancers, with the leading cause being lung cancer.

Socioeconomic disadvantage

Socioeconomic disadvantage tends to be associated with poorer health and poorer health outcomes relating to cancer. Incidence rates for some cancers in Australia are higher in areas of most disadvantage compared with the least disadvantage. These include colorectal, kidney, liver, cervical and lung cancer. This can be attributed to increased risky health behaviours such as smoking, excessive alcohol consumption and a poor diet. Five-year survival rates are lower and mortality rates are higher for the most socioeconomically disadvantaged.

Levels of remoteness

The incidence rate for all cancers combined was highest in inner regional and outer regional areas, slightly lower in major cities and remote areas, and lowest in very remote areas. This is likely influenced by the difficulties faced by those in remote and very remote areas in accessing cancer screening which leads to later detection of cancer. People with increasing levels of remoteness also have a lower life expectancy due to death from other causes, which means they may not live long enough for cancer to be the primary cause of death.

Once diagnosed with cancer, people living in major cities had the highest five-year survival rates for cancers, while those in very remote areas had the lowest survival rate. This can be attributed to the proximity of appropriate healthcare to treat and manage various forms of cancer.

CASE STUDY 6

Examining cancer disparities in Australia

The most recent version of the Australian Cancer Atlas exposes the profound impact that postcodes have on the likelihood of receiving a cancer diagnosis and the chances of survival. This Atlas, developed by Cancer Council Queensland in conjunction with the Queensland University of Technology, offers insights into cancer prevalence and geographic trends.

The findings reveal that regions such as Mackay report diagnosis rates that are 100 per cent higher than the national average, while survival rates in regional and remote areas consistently lag behind those in cities. Professor Peter Baade of Cancer Council Queensland highlights that the differences in non-urban regions have persisted over time, emphasising that location plays a crucial role in cancer outcomes.

Dr. Nicole Higgins, a Mackay GP and RACGP President, was disheartened but not entirely surprised to see her town leading the diagnosis statistics. She noted, “My community has high levels of smoking and alcohol use…. People in rural and regional areas often present later with more complex illnesses. This map allows us to start a conversation about improving this situation.”

The data from the Atlas can be segmented by cancer types, diagnoses, suburbs, sex, risk factors, screening rates, and hospital stays.

It starkly illustrates the country’s disparity between diagnosis levels and survival rates.

Although cancer rates in regional and remote areas are lower, survival rates are significantly poorer. For examples, in Yuendumu, a remote NT town, survival rates are 56 per cent worse than the national average.

Associate Professor Joel Rhee, Chair of RACGP Specific Interests Cancer and Palliative Care, highlights the Atlas raises questions about equity and the chronic underfunding of rural health services. He underscored that while several factors contribute to the differences in cancer outcomes, not all are related to personal choices.

He remarked, “People in rural areas are more likely to engage in unhealthy behaviors such as smoking, alcohol consumption, poor diet, and less physical activity. These behaviours are deeply linked to social factors affecting rural communities.”

Beyond lifestyle factors, Associate Professor Rhee pointed out issues related to access and rural stoicism- that is people not prioritising healthcare for symptoms the see as minor.

Addressing these rates requires a community effort, according to Dr. Higgins. She mentioned previous successful initiatives such as targeting obesity. Mackay was fairly recently the most overweight community in Australia- changes focused on this issue now means they are just below the national average for obesity.

Associate Professor Rhee called for substantial work to address this, suggesting that a significant investment in rural communities to address social determinants of health is crucial.

Case study questions

1. What does the Australian Cancer Atlas reveal about cancer diagnosis and survival rates in regional and remote areas compared to urban areas?
2. Describe potential reasons for the lower cancer diagnosis rates in rural areas despite worse survival rates.
3. Propose strategies that could be implemented to improve cancer survival rates in regional and remote areas of Australia.

DEPTH STUDY IDEA

Students will conduct a secondary source investigation on one condition, disease or injury other than cardiovascular disease or cancer. This could include, but is not limited to, diabetes, mental health and chronic obstructive pulmonary disease. They should research information including:

- data on morbidity, mortality, prevalence and incidence
- risk and protective factors
- where and for whom are these conditions changing?

2.5 ACTIVITIES

Regional differences in cancer

1. Visit the weblink **The Cancer Atlas** in the Resources panel.
   a. Explore the cancer rates in your local region and compare them to the national average.
   b. Select a different area of Australia with a different level of remoteness and compare its cancer rates to your own region.

Risk and protective factors

2. Create a chart or infographic that lists the risk and protective factors associated with the three conditions studied. Present this chart to the class, discussing how lifestyle choices and environmental factors influence these conditions.

Chronic conditions in Australia

3. Organise a panel discussion where students act as public health officials.
   a. Discuss strategies to address the rising rates of chronic conditions in Australia.
   b. Use data to support your suggestions and consider the impact of various risk factors on different populations.

on Resources

Weblink The Cancer Atlas

2.5 Exercises

learnon

2.5 Quick quiz on | **2.5 Exercise**

Learning pathways

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

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Revise your knowledge

1. What are the primary non-modifiable risk factors for cardiovascular disease?
2. How has the mortality rate for cardiovascular disease changed in Australia since 1980?
3. What are the main types of cancer that contribute to the highest mortality rates in Australia?
4. Create a mind map of the lifestyle factors that influence the risk of cancer. Provide a ranking of which lifestyle behaviours contribute more significantly to cancer risk. Justify your response.
5. Explain how early detection through screening programs can improve cancer survival rates.

Apply your knowledge

6. Outline TWO different types of cardiovascular disease.
7. Why are cancer incidence rates increasing in Australia?
8. How does socioeconomic disadvantage influence the prevalence of cardiovascular disease in Australia?
9. Analyse why people living in rural or remote areas of Australia have higher mortality rates from cardiovascular diseases compared to those living in major cities.
10. Evaluate three barriers that may prevent individuals in remote communities from accessing early cancer detection services, and suggest solutions to improve access.

2.5 Exam questions

Question 1 (1 mark)

Source: *HSC 2019, PDHPE Exam, Section I, Part A, Q.1*

Which of the following is a non-modifiable risk factor for breast cancer?

A. Age
B. Obesity
C. High-fat diet
D. Physical inactivity

Question 2 (1 mark)

Source: *HSC 2019, PDHPE Exam, Section I, Part A, Q.8*

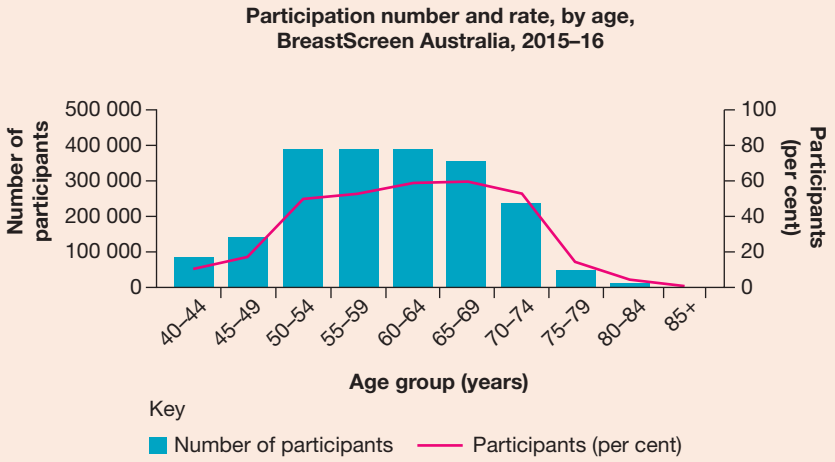
Which of the following identifies the two types of cardiovascular disease with the highest rates of mortality in Australia?

A. Stroke and angina
B. Stroke and coronary heart disease
C. Peripheral vascular disease and angina
D. Peripheral vascular disease and coronary heart disease

Question 3 (1 mark)

Source: *HSC 2020, PDHPE Exam, Section I, Part A, Q.19*

The graph shows the number of women who participated in BreastScreen Australia services, by age, in 2015–2016. The graph also shows the participation rate which is based on the number of women screened as a percentage of the eligible female population.



Source: © Australian Institute of Health and Welfare, 2019.

Which of the following conclusions is best supported by the data provided?

A. The breast cancer mortality rate decreases with age.
B. The incidence of breast cancer will increase for women aged over 75 years.
C. The participation rate of women aged under 50 years may result in increased risk of breast cancer mortality for this age group.
D. The participation rate of women aged 50–69 years may result in lower rates of hospitalisation for breast cancer for this age group.

Question 4 (4 marks)

Source: *HSC 2021, PDHPE Exam, Section I, Part B, Q.21b*

Explain how TWO protective factors can reduce the risk of cardiovascular disease.

Question 5 (3 marks)

Outline how an individual's level of remoteness impacts their survival rate from cancer.

Question 6 (7 marks)

Select ONE condition, disease or injury other than cardiovascular disease or cancer to answer BOTH parts (a) and (b) of this question.

a. **What** does the mortality and morbidity data tell us about this condition. **3 marks**
b. **Explain** the risk and protective factors for this condition. **4 marks**

2.6 Impact of an ageing population on Australia's health

Syllabus: Investigate the impact of an ageing population on Australia's health

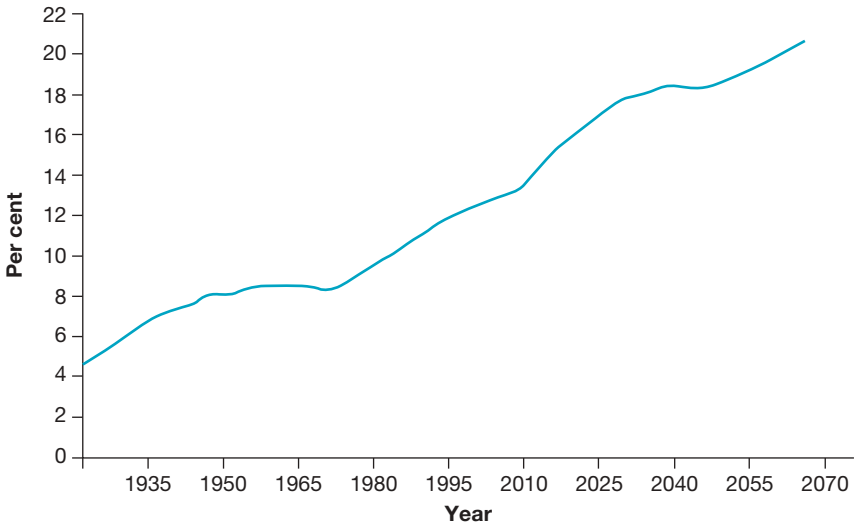
Including:

- what does the data tell us?
- what is healthy ageing?
- what are the opportunities and challenges for an ageing population?
- what are current and future strategies to support healthy ageing?
- what do government and non-government agencies need to consider to address the future needs of a growing and ageing population?

2.6.1 What does the data tell us?

Australia's population aged 65 and over is steadily increasing, both in absolute numbers and as a proportion of the total population. This can be explained by the significant increases in life expectancy in the past 50 years, combined with decreases in fertility rates. Figure 2.48 shows that the percentage of Australians aged 65 and over was approximately 17 per cent in 2024 and is projected to increase to almost 21 per cent by 2066. This demographic shift presents both challenges and opportunities for the health and welfare sectors in Australia.

FIGURE 2.48 Percentage of the Australian population aged 65 and over, over time



Sources: Australian Bureau of Statistics, 2018, 2019. https://www.aihw.gov.au/reports/older-people/older-australians/contents/demographic-profile.

2.6.2 What is healthy ageing?

Every person deserves the opportunity to live a long and healthy life. The environment in which we live has the capacity to promote health or hinder it. The World Health Organization (WHO) defines **healthy ageing** as 'the process of developing and maintaining the functioning ability that enables wellbeing in their older age'. This means that people should be able to:

- meet their basic needs
- learn, grow and make decisions
- be mobile
- build and maintain relationships
- contribute to society.

healthy ageing the process of developing and maintaining the functioning ability that enables wellbeing in their older age (WHO)

FIGURE 2.49 Being physically active is part of healthy ageing.

See the **WHO Healthy ageing** weblink in the Resources panel for more information.

With our population getting older, it has become a priority for the government to encourage healthy ageing to enable people to contribute economically for as long as possible. If people are unhealthy later in life due to sickness or injury, their working years are likely to be shortened, resulting in a reduction in economic growth.

The national research priority 'Supporting healthy and thriving communities' includes a focus on developing the technologies, tools and techniques for more Australians to enjoy healthier lives from birth well into old age. Achieving this goal will improve disease prevention, reduce illness periods, and maintain economic and social participation. Such initiatives ultimately lead to better health outcomes for older Australians, therefore reducing the economic burden on the government.

2.6.3 What are the opportunities and challenges for an ageing population?

As Australia's population ages, both opportunities and challenges arise for society. These will require innovative strategies and policies to respond to and use the changing demographic landscape.

Opportunities

- *Extended work life:* With healthier, older individuals, there are opportunities for continued contributions to the workforce, either through paid employment or volunteer roles. For example, many older people can contribute their expertise and wisdom to guide younger people in their work, allowing older people to experience feelings of satisfaction through remaining actively involved in society.
- *Intergenerational learning:* Older adults can provide mentorship and share wisdom with younger generations, not only in the workplace but within families and communities. With increasing life expectancy, grandparents can play a significant role in childcare, and in sharing traditional values, cultural stories and life experiences. In community settings, elders often serve as custodians of cultural heritage, by leading events, rituals or storytelling sessions the assist in preserving cultural knowledge and fostering understanding across generations.

Challenges

- *Increased healthcare demand:* An ageing population will require more medical care, particularly in the management of chronic illnesses (e.g. arthritis, diabetes, heart disease). Australia's healthcare system will face increasing pressure as hospitals and aged care facilities struggle to meet the needs of patients with conditions requiring formal care. The future levels of chronic diseases could be reduced if younger people control the more significant risk factors for developing chronic disease, such as smoking, obesity, excessive drinking and physical inactivity.
- *Pension and retirement system pressures:* Governments must find ways to continue to fund pensions and superannuation, which may strain public finances as the older population grows. For example, debates over raising the retirement age in Australia have emerged to ensure the system remains sustainable. The government has already taken action in response to this concern by improving Australia's retirement income system in the following ways.

FIGURE 2.50 The ageing population creates additional demands for healthcare and services.

FIGURE 2.51 Grandparents can be a significant educator of grandchildren.

FIGURE 2.52 A shortage of aged care workers will continue to be a challenge to heathy ageing.

- a means-tested age pension is available to provide income for people after retirement
- all Australian employers are required to provide compulsory superannuation cover for all eligible employees. Under the superannuation guarantee, the minimum level of superannuation cover made by employers is 11.5 per cent of an employee's base earnings
- voluntary, private superannuation contributions and other forms of private savings, made by employees, are also encouraged.

- *Social isolation:* Many elderly individuals may experience loneliness due to living alone, the death of peers, or decreased mobility, which can affect mental health. For instance, Australians living in rural areas, who lack access to community services, may experience feelings of isolation due to limited social interaction.
- *Ageing workforce:* A smaller proportion of younger people in the workforce can lead to labour shortages and productivity concerns. Australia's aged care system and healthcare sectors are already experiencing a shortage of younger workers, which threatens the capacity to care for the increasing elderly population. The government has introduced a number of initiatives to meet the needs of a growing number of older Australians, including:
  - increased residential aged care places
  - more funding for dementia care in aged care
  - incentives for people to remain in their homes
  - attracting, retaining and training aged care workers.
- *Availability of carers and volunteers:* Australia's workforce consists not only of paid workers, but also **carers** and **volunteers**, who are ageing with the rest of the population. Many older Australians contribute to society as carers or volunteers, activities which are productive to the economy and society. This enhances the quality of life for all Australians. Older Australians are also cared for by volunteers and carers. It is projected that there will be little growth in the number of available carers, compared to the anticipated rise in demand for home-based support. This is likely to result in a shortage of carers in the future.

carer a person who, through family relationship or friendship, looks after an older person or someone with a disability or chronic illness

volunteer a person who offers to perform a service for the community on a voluntary basis

CASE STUDY 7

The number of Australians living with dementia projected to more than double by 2058

*By **Ahmed Yussuf***

13 September 2024

Australia needs a focus on prevention and better primary care to deal with the increase in people living with dementia, according to the peak body for people living with the condition.

The Australian Institute of Health and Welfare (AIHW) issued a new report saying the number of people living with dementia was projected to more than double over the next 34 years.

About 411 100 Australians are estimated to be living with dementia, with about one in three with the condition living in the community rather than in specialist care.

'With Australia's population expected to continue growing and aging into the future, the number of people with dementia is also expected to rise,' the AIHW said.

Australia's aging population linked to rise in dementia

The government agency said because Australia's population was expected to continue to grow and age, the number of people living with dementia was likely to increase.

That's because the rate of dementia dramatically rises with age.

For example, there is fewer than one person with dementia per 1000 Australians under 60.

But that number sharply increases to 71 people per 1000 for people between 75 and 79, then to 429 per 1000 people for those 90 and over.

‘Interestingly, the rates are similar for men and women in the younger age groups, but quickly diverge with increasing age. For the oldest age group, the rate of dementia among women is 1.4 times the rate of men,’ AIHW said.

Dementia is a brain condition that can affect mood, memory, thinking and behaviour. It can happen to anybody but is most common with people over the age of 65.

There are treatments available to manage symptoms but there is no known cure.

How does Australia compare to the rest of the world?

Dr Sykes, from Dementia Australia, said if nothing significant changed in Australia’s response to dementia there will be increased pressures on the health system.

‘People living with dementia going into the health context when perhaps they could otherwise be supported in their own home or indeed in aged care,’ he said.

‘We know from the research that people living with dementia stay in hospital longer, have more adverse health outcomes as a result of going into hospital.’

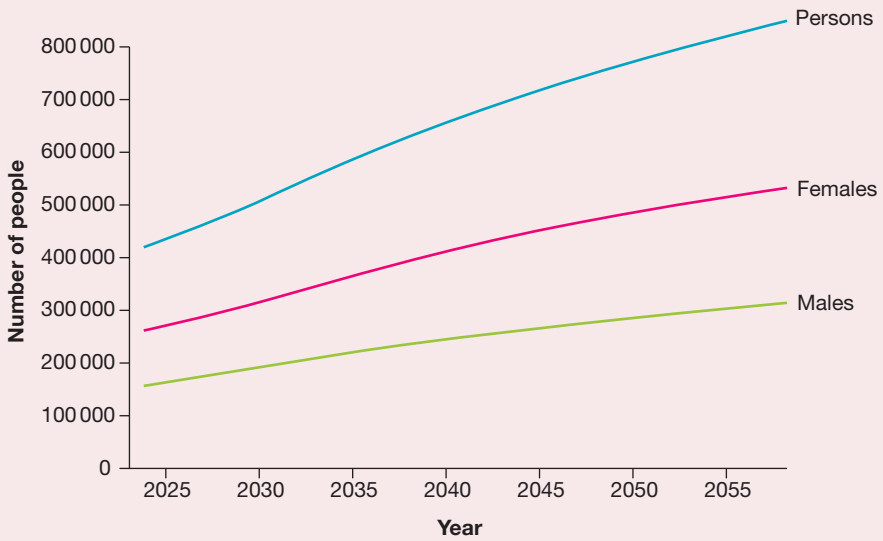
Professor Anstey, the director of the University of New South Wales’ Ageing Futures Institute, said the current health and aged care system could not meet the projected increase in demand.

‘We simply won’t have enough care workers to meet the needs of people living with dementia,’ she said. ‘We need to increase the services.’

Dr Sykes pointed to examples in places such as Scandinavia that have a larger focus on community-based aged care approaches in how they support older people more broadly, as well as people living with dementia.

‘There are other countries, like Scotland, that have been doing some work around brain health clinics that are promoting brain health,’ he said. ‘Instead of having an illness-focused system, to flip to being how do we help people to maintain a healthy lifestyle and get prevention things in place much sooner.’

Projection of Australians living with dementia by 2058



Source: Australian Institute of Health and Welfare (2024) *Dementia in Australia*.

Source: Yussuf, A. (2024), ‘The number of Australians living with dementia projected to more than double by 2058’. *ABC News*, 13 September, https://www.abc.net.au/news/2024-09-13/number-of-australians-living-with-dementia-more-than-double-2058/104347372.

Case study questions

1. What is the projected increase in the number of people living with dementia in Australia over the next 34 years?
2. Consider some reasons to explain the projected trends on the graph.

3. What impact will these rates of dementia have on the aged care system?
4. How can healthy ageing assist with the increasing rates of dementia in Australia?

2.6.4 What are the current and future strategies to support healthy ageing?

The Ageing Well in NSW: Seniors Strategy 2021–2031 is the NSW government's response to the opportunities and challenges of our ageing population. Some of the current strategies used in this policy include:

- enhancing public spaces, transportation and housing to support independent living
- promoting social participation and respect for older adults
- improving access to employment, learning and volunteering opportunities
- emphasising collaboration between community and health services to support physical and mental wellbeing, prevent elder abuse, and provide accessible, culturally appropriate information and support during unforeseen events
- empowering older adults with tools for informed decision-making is a priority.

Other current strategies to promote healthy ageing include:

- *Preventative healthcare* — regular screenings, vaccinations, and health education programs to prevent illness and manage chronic conditions.
- *Active ageing programs* — community centres and health clubs offer physical activity programs designed for seniors, focusing on strength, balance and mobility.
- *Mental health support* — services for depression and dementia, including counselling and memory clinics.
- *Home care services* — allowing older people to remain in their homes for longer through the provision of home help services (e.g. cleaning, meal delivery).
- *Government intervention* — the *National Plan to Respond to the Abuse of Older Australians* outlines strategies to prevent and respond to elder abuse, including improving access to support services, promoting community awareness and ensuring legal protections.

Looking to the future, new strategies are essential for adapting to our ageing population and ensuring that older adults can thrive in their communities.

Technology integration

Implementing telehealth services can provide older adults with convenient access to healthcare professionals from the comfort of their homes. For example, an older person can have virtual check-ups via video calls, thereby reducing the need for travel. Additionally, wearable health monitors, like smartwatches, can track vital signs such as heart rate and activity levels, alerting users and healthcare providers to any concerning changes. Smart home devices can enhance safety by enabling emergency alerts, allowing older adults to maintain independence while ensuring immediate help is available if needed.

FIGURE 2.53 Wearable technology can help improve health monitoring.

Policy reform

Adjusting retirement ages and pension schemes can help create a more sustainable economic environment for older adults. For instance, finding ways to allow individuals to continue contributing to the workforce, which not only supports their financial stability but also promotes social engagement. Additionally, reforming tax policies to provide benefits for those who continue to work part-time can incentivise older adults to remain active in the workforce longer.

Lifelong learning

Encouraging education and skill development can significantly enhance cognitive health and social engagement. For example, local community centres could offer workshops on digital literacy to help older adults learn how to use technology for social connections and daily tasks, such as online banking or shopping. Furthermore, adult education programs can provide classes on topics such as art, music or history to foster a sense of community and belonging while stimulating the mind, providing purpose and reducing boredom.

2.6.5 What do governments and non-governmental agencies need to consider to address the future needs of a growing and ageing population?

advocating supporting a cause or position or acting on behalf of yourself or someone else to ensure that best interests are considered

As Australia's population continues to age, both governments and non-governmental organisations (NGOs) play a vital role in addressing the evolving needs of older citizens. Governments are responsible for creating policies, infrastructure and systems that make sure older adults have access to necessary healthcare, age-friendly communities and supportive services. NGOs complement these efforts by **advocating** for the rights of older individuals, by providing essential services, and by research and innovation to promote healthy and active ageing. Together, these efforts are essential for ensuring that Australia's ageing population can age with dignity and care.

Governments can address the future needs of Australia's ageing population by:

- *Healthcare infrastructure* — governments need to invest in healthcare systems that can handle the increasing demand for aged care, specialised services, and long-term care facilities. For example, expanding existing hospitals and building new aged care facilities equipped with specialised geriatric services can help meet the growing needs of the ageing population.
- *Urban planning* — cities and communities should be designed or retrofitted to be age-friendly, with accessible transportation, healthcare, and housing. For instance, creating pedestrian-friendly pathways and ensuring public transportation systems are equipped with features such as low-floor buses and priority seating can significantly enhance mobility for older residents.
- *Aged care workforce development* — training and expanding the workforce to support aged care services is crucial as demand grows. Governments can introduce programs that provide scholarships or financial incentives for students pursuing careers in aged care, thus ensuring a well-trained workforce that meets the needs of older adults.

NGOs can address the future needs of Australia's ageing population by:

- *Advocacy and awareness* — NGOs can raise awareness about the challenges of ageing and advocate for better policies on behalf of older people. For example, organisations such as National Seniors Australia work to influence government policy and public perception of older Australians. Additionally, the Council on the Ageing has advocated for increases to the age pension and aged care reform.
- *Service provision* — many NGOs provide essential services such as community support, home care, mental health services and social engagement programs. For example, the Red Cross offers home care services, social visits and emergency support to older individuals to help them maintain independence and connection to their communities.
- *Research and innovation* — NGOs can invest in research to explore new models of care, innovative technologies and better ways to promote healthy ageing. Aged Care Research and Industry Innovation Australia is an example of an NGO that aims to equip the aged care sector with the knowledge and skills to use evidence-based practices and new technologies.

DEPTH STUDY IDEA

Students participate in an open-ended problem focusing on addressing the needs of an ageing population.

Problem: How can Australia effectively prepare for the health needs of a growing and ageing population?

Students should:

- Investigate current challenges faced by older Australians, including chronic disease management, healthcare access and financial security.
- Examine successful international models of care for ageing populations and identify lessons that can be applied in Australia.
- Brainstorm innovative strategies for supporting healthy ageing, such as improved healthcare funding, community programs, and technology integration for remote monitoring.

EXAM TIP

Ageing population

As our ageing population is dramatically increasing (with longer life expectancy) we need to consider future implications. Exam questions may ask you to consider the social, economic and residential support needs of our elderly community. Consider key concerns that exist, for instance the impacts of increases in the cost of healthcare and an increase in funding to support the treatment of chronic conditions (such as cancer and heart disease with a big focus on the rise of dementia). This helps you to address syllabus content around the financial challenges this population group represents. Social, housing and care concerns also need to be explored.

The importance of healthy ageing is often a focus in exam style questions and is often a key priority for governments as they try to provide funding to this sector. Consider examples that could be used to show your understanding of what governments can do to address the future needs of this population group; for example, *by encouraging Australians to retire at a later stage of their lives or adopt volunteering opportunities. This can reduce strain on the Australian economy and promote greater autonomy*. Strategies that could be considered in an exam question include the need for cognitive stimulation, the promotion of regular exercise and an expansion of social opportunities to promote healthy ageing; for example, *communities providing free local guided bush walks can support social interaction and promote cognitive and physical health of their elderly residents*. This example shows syllabus knowledge of an opportunity to support a healthy ageing population.

2.6 ACTIVITIES

Ageing population in Australia

1. Conduct a debate on the following topic: 'The ageing population presents more opportunities than challenges for Australia's health and social systems.'
   a. Each group will research their assigned position, to identify key points, statistics and real-world examples to support their arguments.
   b. Each group will present their arguments in turn, followed by a rebuttal session.
2. In groups, design an initiative to promote healthy ageing in Australia. It should outline how it can be implemented effectively at both the government and community levels.

2.6 Exercises

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2.6 Quick quiz on | **2.6 Exercise**

Learning pathways

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

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Revise your knowledge

1. What percentage of Australia's population is projected to be aged 65 and over by 2066?
2. Define 'healthy ageing'. Describe the social and economic benefits of healthy ageing.
3. What are some challenges that Australia's healthcare system will face due to the ageing population?
4. Describe how intergenerational learning can be an opportunity for Australia's ageing population.
5. Assess the role of governments and non-governmental organisations in addressing Australia's ageing population.

Apply your knowledge

6. What is a current strategy to support healthy ageing in Australia and how does it work?
7. Explain how the availability of carers and volunteers is a challenge for Australia's ageing population. Propose some strategies to increase the availability of carers.
8. If you were to design a program to promote healthy ageing in rural areas, how would you address the issue of social isolation?
9. Propose an urban planning initiative to make Australian cities more age-friendly. What specific features would you focus on to improve mobility and accessibility for older adults?
10. Discuss the impact of Australia's retirement system reforms on both individuals and the government's financial sustainability as the ageing population grows.

2.6 Exam questions

Question 1 (1 mark)

Source: *HSC 2020, PDHPE Exam, Section I, Part A, Q.16*

Which strategy is most likely to reduce the current impact of a growing ageing population on Australia's health system and services?

A. Increasing support services that enable older Australians to keep living in their own home
B. Providing education programs in secondary school to reduce the risk factors for preventable chronic disease
C. Introducing an application fee for individuals to register as volunteers with organisations that assist the elderly
D. Sending annual reminder emails to older Australians encouraging them to register for government support programs

Question 2 (1 mark)

Source: *HSC 2022, PDHPE Exam, Section I, Part A, Q.13*

The number of palliative care hospital admissions in Australia increased in the period 2013–2018.

Which of the following was the most significant factor that contributed to this increase?

A. Increased prevalence of dementia and cancer
B. Longer waiting times for elective surgery in public hospitals
C. Increased mortality rates from diabetes and mental health illness
D. A greater number of Australians participating in health screening programs

Question 3 (3 marks)

Source: *HSC 2019, PDHPE Exam, Section I, Part B, Q.21*

Outline how a growing and ageing population can affect volunteer organisations. Provide an example to support your answer.

Question 4 (5 marks)

Explain the role of healthy ageing.

Question 5 (8 marks)

Examine the opportunities and challenges for an ageing population in Australia.

2.7 Sample exam question response

Question

Explain the risk and protective factors for coronary heart disease. **(5 marks)**

Criteria	Marks
• Explains the risk AND protective factors for coronary heart disease • Provides relevant examples	5
• Explains the risk OR protective factors for coronary heart disease OR • Describes the risk AND protective factors for coronary heart disease. • Provides examples	3–4
• Outlines risk and/or protective factors for coronary heart disease OR • Provides some relevant information	1–2

Sample response

Breaking down the question

Explain the risk and protective factors for coronary heart disease.

Identify the action word/s: Explain — the answer must make the relationships between things evident.

Syllabus terminology: risk and protective factors

Examples: must be related to coronary heart disease

Mark allocation: 5 marks — according to HSC past papers, questions worth 5 marks require answers that include 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

Coronary heart disease occurs when the arteries supplying blood to the heart become blocked due to the build-up of plaque.[1]

Risk factors for coronary heart disease include smoking, a sedentary lifestyle, poor diet (high in saturated fats), and excessive alcohol consumption are significant modifiable risk factors.[2] For example, smoking damages the arteries and leads to plaque buildup, directly increasing the risk of atherosclerosis and in turn, coronary heart disease.[3] Additionally, a sedentary lifestyle and a diet high in saturated fats can increase the fatty deposits within arteries, contributing to high blood pressure reducing efficiency of blood flow to and from the heart.[4]

Protective factors help reduce the likelihood of coronary heart disease.[1] Regular physical activity improves cardiovascular health by strengthening the heart and allowing for more forceful contractions thereby controlling body weight, lowering blood pressure and reducing the risk of coronary heart disease.[2] A balanced diet rich in fruits, vegetables, and whole grains can lower cholesterol and blood pressure.[4] For example, a diet rich in fruits, vegetables, and whole grains can help lower cholesterol levels and reduce the risk of plaque buildup in the arteries, protecting against coronary heart disease.[3]

2.8 Review

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Review your results

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2.8.1 Topic summary

2.2 Current health status of Australians

- Australia's life expectancy has significantly increased over the past century, but COVID-19 caused a rise in infectious disease deaths for the first time in decades.
- Mortality rates for coronary heart disease have decreased by over 80 per cent since the 1960s, and cancer mortality has dropped by 32 per cent in the last 30 years.
- Chronic conditions such as dementia and mental illness are increasing, contributing to disability and premature death, particularly in older populations.
- Some risk factors have improved, with reductions in smoking and risky alcohol consumption, but e-cigarette use and obesity are rising.
- The health of Aboriginal and Torres Strait Islander Peoples has improved, including declines in cardiovascular disease mortality, but significant health inequities remain.
- Males experience more overall disease burden than females, with coronary heart disease as the leading cause, while dementia is the leading cause for females.
- Sociological factors such as social relationships, peer pressure and cultural norms strongly influence risky health behaviours, such as smoking, alcohol consumption and poor diet choices.

2.3 Groups experiencing inequities in health

- Despite improvements in education, technology and research, health inequities persist in Australia, with certain groups facing higher mortality rates and lower life expectancy.
- The main groups experiencing health inequities in Australia include Aboriginal and Torres Strait Islander Peoples, socioeconomically disadvantaged people, rural and remote populations, culturally and linguistically diverse populations, people with disabilities, and older people.
- Aboriginal and Torres Strait Islander Peoples experience poorer health status across nearly all indicators.
- The 'health gap' between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians is due to social determinants and health behaviours.
- People experiencing socioeconomic disadvantage tend to experience lower levels of health.
- People in rural and remote areas experience higher mortality rates from cardiovascular disease and cancer.
- Culturally and linguistically diverse populations face difficulties such as communication, racism and discrimination when accessing health services.
- People living with disability tend to rate their health lower than those without a disability.
- The media plays a role in shaping public attitudes towards older people.

2.4 Health status of Australia and other OECD countries

- The OECD collects standardised health data for comparing health outcomes and systems among developed nations, including Australia.
- Australia ranks highly in self-reported health, mortality rates and healthcare coverage but struggles with high alcohol consumption and obesity.
- Key contributors to Australia's health metrics include Medicare, effective public health campaigns, and a high standard of living, though cultural norms around alcohol and diet are problematic.

- Countries with better health outcomes typically invest more in preventive care and education, and cultural dietary habits, like those in Mediterranean nations, impact obesity rates.
- Learning from the strengths of other countries can help Australia improve health outcomes and tackle existing challenges.

2.5 Chronic conditions, diseases and injury in Australia

- Cardiovascular disease (CVD) includes diseases of the heart and circulatory system, including coronary heart disease, cerebrovascular disease and peripheral vascular disease.
- Death rates from CVD have dropped significantly since 1980, attributed to improved prevention and treatment.
- Aboriginal and Torres Strait Islander Peoples experience higher rates of CVD incidence and mortality due to socioeconomic disadvantages and increased risk factors.
- Cancer encompasses a diverse range of diseases characterised by the uncontrolled growth and spread of abnormal cells, leading to tumour formation.
- Cancer remains the leading cause of death in Australia, accounting for 27 per cent of all deaths in 2022, with lung cancer being the most common cause of cancer-related deaths.
- Cancer incidence rates are highest in inner and outer regional areas, with remote populations facing challenges in accessing screenings and treatments that leads to poorer outcomes.

2.6 Impact of an ageing population on Australia's health

- The proportion of Australians aged 65 and over is projected to rise from 17 per cent in 2024 to nearly 21 per cent by 2066, driven by increased life expectancy and declining fertility rates.
- Healthy ageing, defined by the WHO, involves maintaining functional ability, allowing individuals to meet their needs, engage in learning, and contribute to society.
- Opportunities for an ageing population include extended work life for older individuals and intergenerational learning, allowing them to share their expertise and cultural knowledge.
- Challenges include increased demand for healthcare services to manage chronic illnesses and the strain on aged care facilities.
- Strategies to support healthy ageing include improving public infrastructure, promoting preventative healthcare, integrating technology for remote services, and developing an adequate aged care workforce.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Case study — Actions to improve the health status of Aboriginal and Torres Strait Islander children and families

Time: 6 hours

Task description: Extended response with stimulus

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents Topic 2 summary (doc-43047)
Key terms glossary (doc-43048)
Revision quiz (doc-43049)

Interactivity Missing word interactive quiz (int-9359)

2.8 Exercises

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2.8 Revision quiz on | 2.8 Exam questions

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2.8 Exam questions

Section I

Question 1 (1 mark)

Source: *HSC 2020, PDHPE Exam, Section I, Part A, Q.7*

Which of the following refers to poor blood supply from the heart to the limbs?

A. Angina
B. Coronary heart disease
C. Cerebrovascular disease
D. Peripheral vascular disease

Question 2 (1 mark)

Source: *HSC 2023, PDHPE Exam, Section I, Part A, Q.12*

In 2022, the Australian Institute of Health and Welfare reported that the average life expectancy for Aboriginal and Torres Strait Islander Peoples was eight years less than that of non-Indigenous people in Australia.

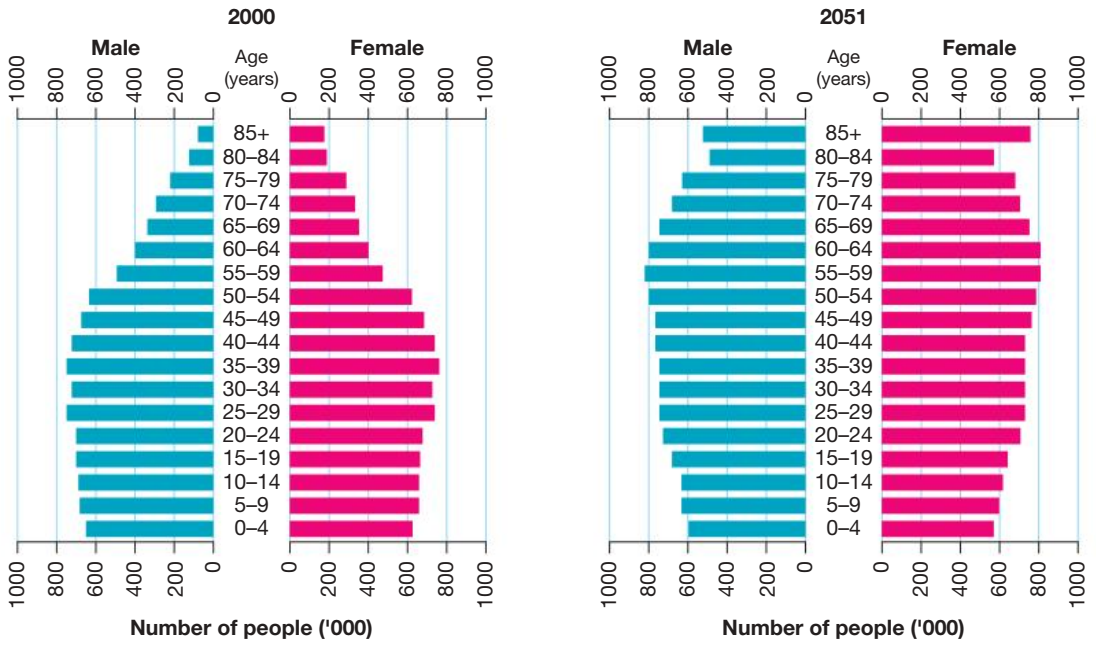
Which of the following determinants is likely to have the most significant influence on narrowing this gap in the next five years?

A. Improved access to housing
B. Better access to culturally responsive health services
C. Increased participation in outdoor recreational activities
D. The further development of cultural maintenance programs

Question 3 (1 mark)

Source: *HSC 2023, PDHPE Exam, Section I, Part A, Q.13*

The following graphs represent the age and biological sex of Australia's population in 2000 (observed) and 2051 (projected).



Which action would the Australian Government need to implement in 2023 to best support the health of Australians in 2051?

A. Increase the number of staff in aged care facilities
B. Develop legislation to regulate the use of e-cigarettes
C. Target strategic planning to improve the health of infants
D. Increase funding and research into Alzheimer's disease and dementia

Section II

Question 4 (3 marks)

Source: *HSC 2021, PDHPE Exam, Section I, Part B, Q.21a*

Outline TWO types of cardiovascular disease in Australia.

Question 5 (3 marks)

Outline one major cause of mortality for females in Australia.

Question 6 (3 marks)

Outline one of the causes that underpin the health inequities faced by ONE group other than Aboriginal and Torres Strait Islander Peoples.

Question 7 (3 marks)

Why is healthy ageing important for the health of Australians?

Question 8 (4 marks)

How can sociological causes lead to risky alcohol consumption?

Question 9 (4 marks)

Describe causes of health inequities for males and females in Australia.

Question 10 (4 marks)

Explain how ONE approach to health used in other OECD countries could be used in Australia to improve health.

Question 11 (4 marks)

The incidence of dementia is increasing in Australia. **Describe** the challenges this presents for an ageing population.

Question 12 (5 marks)

Explain the long-term trends in life expectancy in Australia.

Question 13 (5 marks)

How can determinants interact to affect the health of Aboriginal and Torres Strait Islander Peoples?

Question 14 (5 marks)

Compare the health status of Australia with that of other OECD countries.

Question 15 (8 marks)

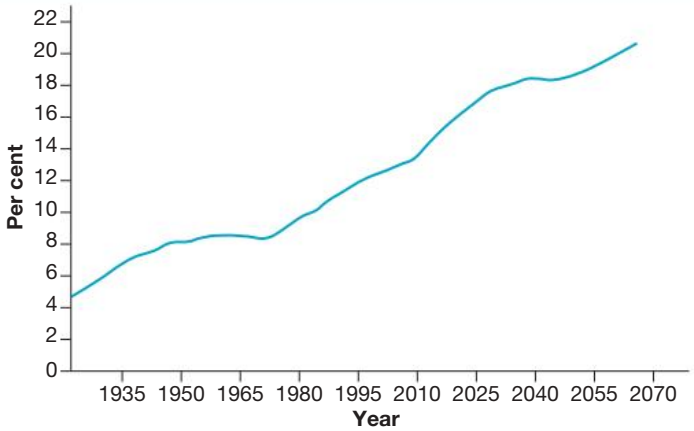
Analyse TWO actions that can be implemented to improve the health status of Aboriginal and Torres Strait Islander Peoples.

Section III

Question 16 (12 marks)

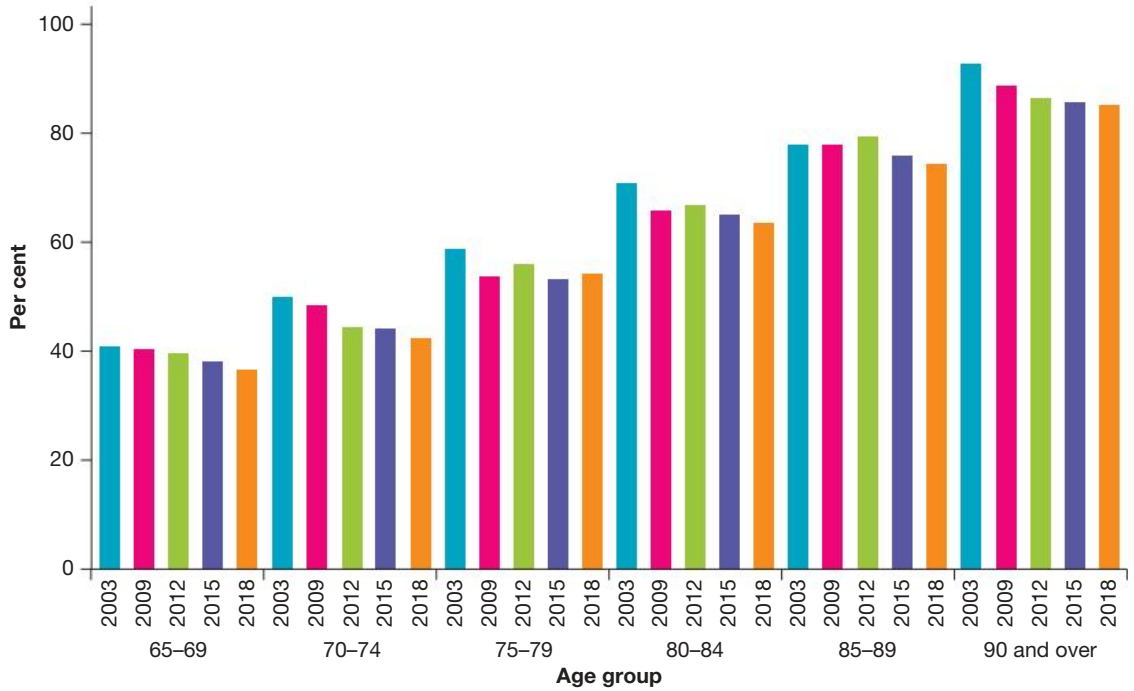
Refer to the information below as well as your own knowledge to answer the question.

FIGURE 1 Percentage of the Australian population aged 65 and over, at 30 June, over time



Sources: ABS 2018, 2019.

FIGURE 2 Proportion of people aged 65 and over with disability by age group, 2003–2018



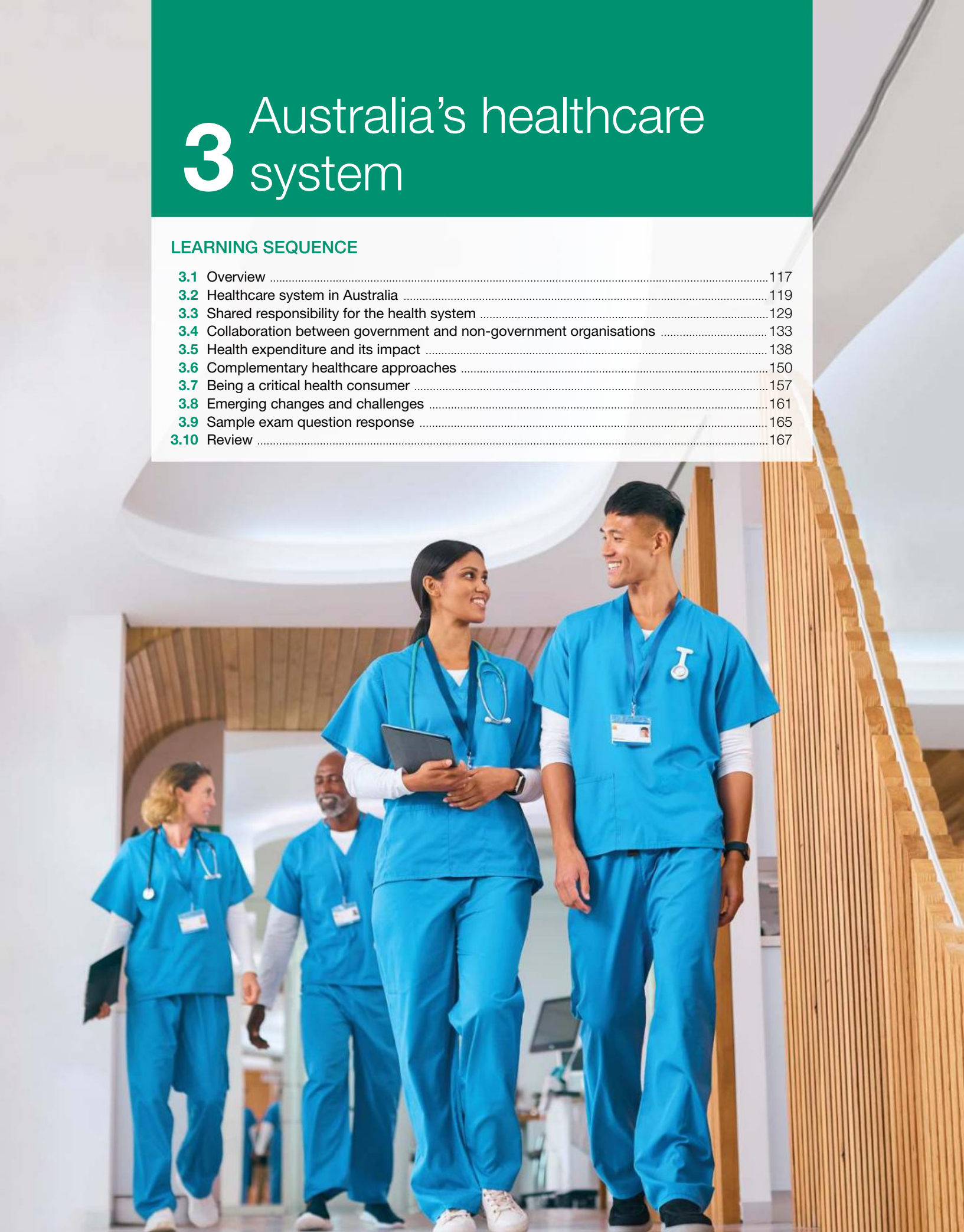
Source: Australian Bureau of Statistics 2019.

To what extent is healthy ageing important to address the challenges of an ageing population?

3 Australia's healthcare system

LEARNING SEQUENCE

3.1 Overview 117
3.2 Healthcare system in Australia 119
3.3 Shared responsibility for the health system 129
3.4 Collaboration between government and non-government organisations 133
3.5 Health expenditure and its impact 138
3.6 Complementary healthcare approaches 150
3.7 Being a critical health consumer 157
3.8 Emerging changes and challenges 161
3.9 Sample exam question response 165
3.10 Review 167



3.1 Overview

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Key inquiry question

How does Australia's healthcare system work towards achieving better health for all Australians?

Syllabus

	Syllabus content	Subtopic
○	■ Assess the effectiveness of the healthcare system in Australia **Including:** • the role of the healthcare system • equity of access to the healthcare system • future opportunities for the healthcare system **Example(s):** **Future opportunities for the healthcare system:** In rural and remote locations. For Aboriginal and Torres Strait Islander Peoples. For individuals with disability.	**3.2**
○	■ Explain how government and non-government organisations share responsibility for the health system **Including:** • federal, state and territory and local government • non-government sector – private and not-for-profit	**3.3**
○	■ Outline how government and non-government organisations collaborate to provide person-centred healthcare	**3.4**
○	■ Discuss health expenditure and its impact on current and future populations **Including:** • healthcare versus prevention • sustainability, access and equity • Medicare, private health insurance and related Commonwealth-funded programs **Example(s):** **Medicare, private health insurance and related Commonwealth-funded programs:** National Disability Insurance Scheme (NDIS). My Aged Care.	**3.5**
○	■ Explain complementary healthcare approaches **Including:** • products and services available • as a preventative measure • treating the health issue • as a supplement to other medical treatments **Example(s):** **Products and services available:** Health apps and websites. Naturopathy.	**3.6**

(continued)

(continued)

	Syllabus content	Subtopic
◯	■ Explain the importance of being a critical health consumer **Including:** • how do you know whom to believe? • what do you need to know to make informed decisions? • how do you assess the accuracy and credibility of health information, products and services?	**3.7**
◯	■ Investigate the current and emerging changes and challenges to the healthcare system **Example(s):** Privatisation. Function of hospitals.	**3.8**

Outcomes

- analyses the health status of Australians at a national and international level HM-12-01
- examines how technology and data can achieve better health for all Australians HM-12-02
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

on Resources

Digital documents Topic 3 summary (doc-43050)
Key terms glossary (doc-43051)
Revision quiz (doc-43052)

3.2 Healthcare system in Australia

Syllabus: Assess the effectiveness of the healthcare system in Australia

Including:

- the role of the healthcare system
- equity of access to the healthcare system
- future opportunities for the healthcare system

3.2.1 Role of the healthcare system

Healthcare facilities and services play a vital role in achieving better health for all Australians. They diagnose, treat and rehabilitate the sick and injured, while also working to prevent illness and promote health. Traditional health facilities, such as hospitals and doctors' surgeries, provide accurate health information to the public. In addition, the state and territory governments provide services aimed at preventing disease and promoting health — for example, immunisation programs, anti-smoking campaigns, and school medical and dental health services.

However, the health of Australians depends not only on quality healthcare services and facilities, but also on factors such as housing, employment, education, hygiene, income and environmental safety. For healthcare services and facilities to effectively cure and prevent disease, the healthcare sector must partner with other community sectors to promote health-related activities.

The healthcare system involves complex relationships between:

- federal, state and local governments
- health insurance funds
- public and private providers of services; for example, doctors
- institutions; for example, hospitals
- other organisations, such as community health services.

The system is both extensive and diverse in nature. Traditionally, it has provided:

- diagnosis
- treatment
- rehabilitation
- care for people with long-term illness or disability.

FIGURE 3.1 Healthcare facilities and services provide a vital role in achieving better health outcomes for all.

However, since the mid 1990s, the Australian government has strengthened its commitment to improving health outcomes and health gains (illness prevention and health promotion), rather than simply providing healthcare services. The current role of the healthcare system in Australia is to provide quality health facilities and services to meet the health needs of all Australians. Health services are organised, financed and delivered by both public (government) and private (fee-for-service) sources.

3.2.2 Range and types of healthcare facilities and services

The major types of healthcare in Australia are primary healthcare, secondary healthcare and hospitals. These provide a broad range of types of healthcare facilities and services available to Australians. Examples of primary and secondary healthcare are illustrated in figure 3.2.

FIGURE 3.2 Primary and secondary healthcare in Australia

Primary healthcare	Secondary healthcare
• GPs • nurses • allied health professionals • midwives • pharmacists • dentists • Aboriginal and Torres Strait Islander health workers • focus includes illness prevention, health promotion and clinical care • setting for this care includes a patient's home, GP clinic, community health centre, Aboriginal Community Controlled Health Services • can be delivered via communication technologies such as telehealth and video consultations	• care provided by those who don't have first point of contact with patients, such as a breast cancer care nurse • this type of care usually occurs after referral by a primary healthcare provider • can include specialists and other health professionals, services and sectors; for example a dermatologist or a cardiologist • a hospital or clinic is often the setting for this care • can include ongoing services such as occupational therapists, psychiatrists and physiotherapists
	

Hospitals — public and private

In Australia, hospitals provide most secondary healthcare. Hospitals are classified as either public or private.

Patients in all hospitals are classified as being either private or public, according to their choice of service. If they choose to be in a public ward in a public hospital, then they are allocated a doctor by the hospital and provided with a bed — all free of charge. If they choose private treatment, either in a public or private hospital, then they may choose their own doctor but must pay for the service and accommodation provided by the hospital and the doctor. Medicare and any private health insurance of the patient will refund much of this expense.

TABLE 3.1 Hospitals in Australia: a snapshot

Hospitals	Public hospitals	Private hospitals
How many in NSW	About 220	About 210
Financial support	Federal and state government	Individuals and community groups
Service	• Greater proportion of elderly and very young patients • More highly complex and specialised services; e.g. heart and lung transplants • Same day surgery • Take most of the non-admitted patients (out- patients)	• Same day surgery • Perform more short stay surgery • **Elective procedures** (non-emergencies such as knee replacements) • Less complex procedures requiring less expensive equipment; e.g. nose, throat, eye, breast and musculoskeletal system

Nursing homes

Nursing homes provide care and long-term nursing attention for those who are unable to look after themselves — the aged, the chronically ill, and people with dementia or with disability. Some nursing homes cater specifically for young people with disability. There are three types of nursing home — private charitable, private for profit, and state government — but the Australian government assumes responsibility for most of the financial cost of running nursing homes in Australia.

Aged-care assessment teams make sure only highly dependent people are placed in residential care. They also recommend the placement of clients in accommodation outside of institutions, such as hostels. Hostels provide long-term accommodation and a basic level of healthcare for young people with disability, and the aged and frail.

FIGURE 3.3 Nursing homes are an important healthcare facility for the aged, the chronically ill and people with disability.

Mental health services

Treatment of people with severe mental illness has changed over recent years, moving away from institutional care to a system of care that integrates both hospital services and continuing care within community settings. Given the resulting reduction in extended hospitalisation of people with mental illness, the number of public **psychiatric hospitals** has fallen. At the same time, there has been a corresponding increase in the number of beds in community-based residential services. The range of service providers for mental healthcare today includes general practitioners (GPs), private psychiatrists, community-based public mental health services and specialised residential mental healthcare facilities.

elective procedures those operations that are not classified as emergencies

psychiatric hospitals care for patients diagnosed with mental illness

Medical services

Doctors, specialists and other health professionals provide a number of services. The most extensively used service is that of GPs who diagnose and treat minor illnesses. According to the *General Practice: Health of the Nation* report in 2023, more than 22 million Australians visited their GP. Each year, almost nine in ten Australians visit a GP.

FIGURE 3.4 Doctors, specialists and health professionals provide important services including diagnosis and treatment of illnesses.

GPs work in medical centres, hospitals and many private surgeries throughout Australia. Under Medicare, all Australians are eligible to claim refunds for their payments for medical services outside hospitals (and for services as private patients in hospitals). The whole or part of the cost of a GP consultation is reimbursed by Medicare.

The number of consultations with GPs has increased over the last two decades. General practitioners sometimes refer their patients to specialists, who have particular skills in a field of medicine as well as the usual medical training. Examples of specialists are allergists (treat allergies), cardiologists (treat heart conditions) and gynaecologists (treat disorders of the female reproductive system).

Health-related services

Health-related services include ambulance work, **chiropody**, dentistry, health inspection, nursing, occupational and speech therapy, pharmacy, physiotherapy, **optometry**, radiography, counselling, social work, and dietary planning and advice. The number of dental services has risen in recent years as a result of the trend towards preventative dental care.

chiropody involves diagnosis and treatment of disorders of the foot, ankle and lower leg

optometry a healthcare profession that addresses problems with eyes and vision

Pharmaceutical Benefits Scheme (PBS) a Commonwealth Government program that provides subsidised prescription drugs to Australian residents, ensuring affordable access to a range of essential medicines

Pharmaceuticals

In Australia, pharmaceutical drugs are supplied through hospitals and doctors by private prescription and over the counter in shops. Over-the-counter medicines account for about one-third of all sales. Instant scripts online are now available which improves the access of patients to prescriptions for everyday medications.

FIGURE 3.5 Pharmacists dispense drugs prescribed by general practitioners. Most drugs are subsidised under the PBS.

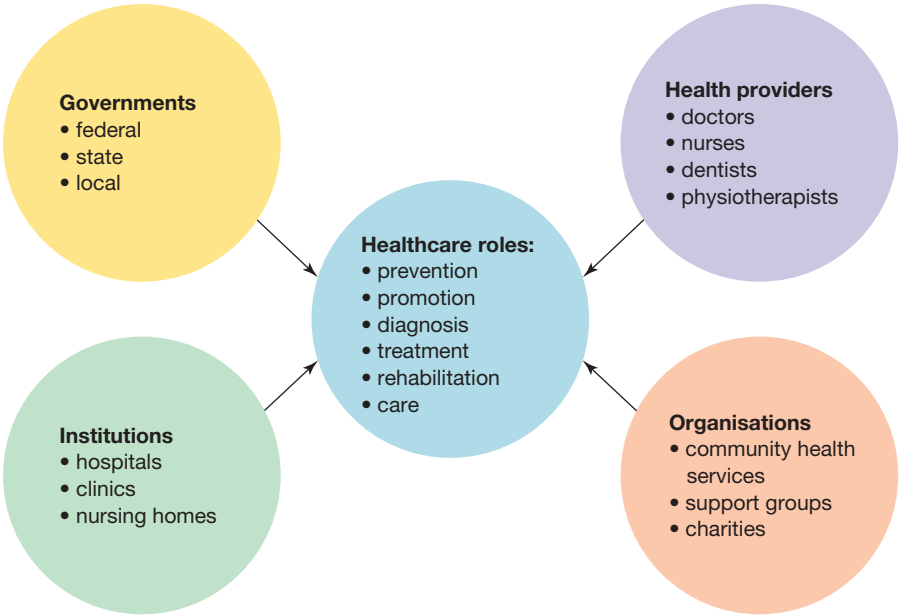
Most prescription drugs sold in Australia are subsidised through the federal Government's **Pharmaceutical Benefits Scheme (PBS)**. Through this scheme, the government subsidises the cost of a wide range of prescription medicines. The amount of subsidy depends on a patient's level of eligibility. From 1 January 2024, the patient contribution under the general rate is a maximum of $31.60 for each medicine. The patient contribution for concession card holders, such as low-income earners, war veterans and invalids, is $7.70. The amount of subsidy is updated every year.

Some people who are chronically ill or require regular long-term medications are protected from excessive cost by the **PBS Safety Net**. The PBS Safety Net caps the amount a family will pay for PBS subsidised medications in a calendar year. The aim of the Safety Net scheme is to ensure no-one is excluded from access to necessary medicines for financial reasons. People who do not have a government concession card become eligible for the Safety Net Concession Card when $1647.90 (in 2024) has been spent on PBS medicines. Pharmaceutical Benefits Scheme medicines can then be purchased at a lower price, usually $7.70 per prescription for the rest of the year. If the person holds a government concession card they are eligible for a Safety Net card when they have spent $277.20 (in 2024) on prescriptions. All PBS medicines for the rest of the year are then free.

Community supports

Community supports are a significant factor in the provision of an environment that is conducive to positive health outcomes. These supports promote health but are not a recognised part of the healthcare system. The food industry, for example, implements policies to ensure the production and delivery of food that meets health regulations and food safety standards, and displays nutrition information on food packaging to inform the public about nutrition. Another example are town planners and engineers who have a role in providing infrastructure that is safe and promotes positive health; for example, safe roads, adequate sanitation and sewerage facilities, areas for physical activity such as playgrounds and sports fields, and the clear signage of environmental hazards.

FIGURE 3.6 Features and roles of the healthcare system



3.2.3 Equity of access to health facilities and services

Equity is the allocation of resources according to the needs of individuals and populations.

Access to health facilities and services is about the health system's ability to provide affordable and appropriate healthcare to people when they require it. Access also refers to equitable distribution of healthcare facilities and services to all sections of the Australian population. An individual's ability to access healthcare facilities and services can reflect their:

- **socioeconomic status**
- knowledge of available services
- geographic isolation
- cultural and religious beliefs.

PBS Safety Net caps the amount a family will pay for PBS subsidised medications in a calendar year

equity the allocation of resources according to the needs of individuals and populations. The goal is to achieve equality of outcomes.

socioeconomic status a measure of an individual's or group's social and economic position, often determined by income, education and occupation

Access might also be affected by issues such as:

- shortages of qualified staff
- lack of funding or equipment
- patient waiting lists for surgery or other treatment in public hospitals
- waiting times in outpatient clinics or emergency departments.

The majority of Australians have access to fundamental medical care through the national health insurance system — Medicare. However, this health insurance system does not cover all health services such as dental and physiotherapy. As a result, some health services are inaccessible to those who cannot afford them.

An individual's ability to access services and facilities can also be influenced by their knowledge and understanding of health information and the services available to help them. A knowledge gap may exist as a result of the individual's lack of education, their poor literacy skills or, in the case of culturally and linguistically diverse population and some Aboriginal and Torres Strait Islander Peoples, a cultural or language barrier.

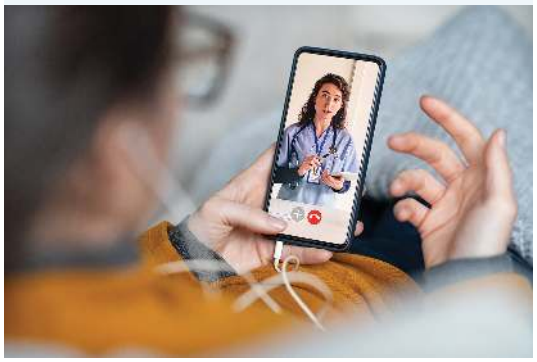
3.2.4 Future opportunities for the healthcare system

According to the Bloomberg Global Health Index in 2024, Australia is one of the top ten healthiest countries in the world with a healthcare system which has many strengths. However, for Australia to retain a strong healthcare system, there are various opportunities to improve.

In rural and remote locations

The National Rural Health Alliance has identified that those living in rural and remote parts of Australia require different and innovative models of care compared to their urban counterparts. Telehealth is one way to improve healthcare access and overcome staff shortages in rural and remote locations. By ensuring good digital infrastructure and consistent low-cost internet connection, barriers to healthcare may be overcome.

FIGURE 3.7 A telehealth consultation between a medical practitioner and someone who lives in a remote location in a Australia.



Another opportunity that exists is the training of the healthcare workforce in rural and remote areas. The Australian government's Stronger Rural Health Strategy aims to deliver 3000 additional physicians and 3000 extra nurses by 2028. This includes a range of medical schools, junior doctors and workforce incentives.

For Aboriginal and Torres Strait Islander Peoples

The Australian government supports Aboriginal and Torres Strait Islander Peoples' health by making it a national priority. The government aims to improve health and wellbeing by working in partnership with Aboriginal and Torres Strait Islander Peoples to develop and implement health strategies, programs and initiatives. Examples include the National Agreement on Closing the Gap and funding for Aboriginal Community Controlled Health Services (ACCHSs).

Further opportunities exist when health services focus on providing culturally appropriate healthcare. Health services should use the Cultural Safety Monitoring Framework which was developed by the Australian government and aims to measure progress in achieving cultural safety. This is in specific reference to the care Aboriginal and Torres Strait Islander Peoples receive, their ability to access services and raise concerns as a part of healthcare.

There are also opportunities for further policy development to improve the lives of Aboriginal and Torres Strait Islander Peoples. This involves enhancing the commitment of all state and territory governments and the Coalition of Peaks (a representative body of more than 80 Aboriginal and Torres Strait Islander community-controlled organisations). This includes enacting the National Aboriginal and Torres Strait Islander Health Plan

2021–2031. Strengthening and prioritising the community-controlled health sector leads to culturally safe and responsive healthcare. For example, the Orange Aboriginal Medical Service (OAMS) has provided medical and primary healthcare services to the local Orange community, and outreach dental services to Bathurst, Cowra, Parkes and Forbes. The OAMS meet the enablers for change, focusing on prevention with a culturally informed evidence base.

FIGURE 3.8 The National Aboriginal and Torres Strait Islander Health Plan 2021–2031 Vision aims to help Aboriginal and Torres Strait Islander Peoples achieve better health outcomes.

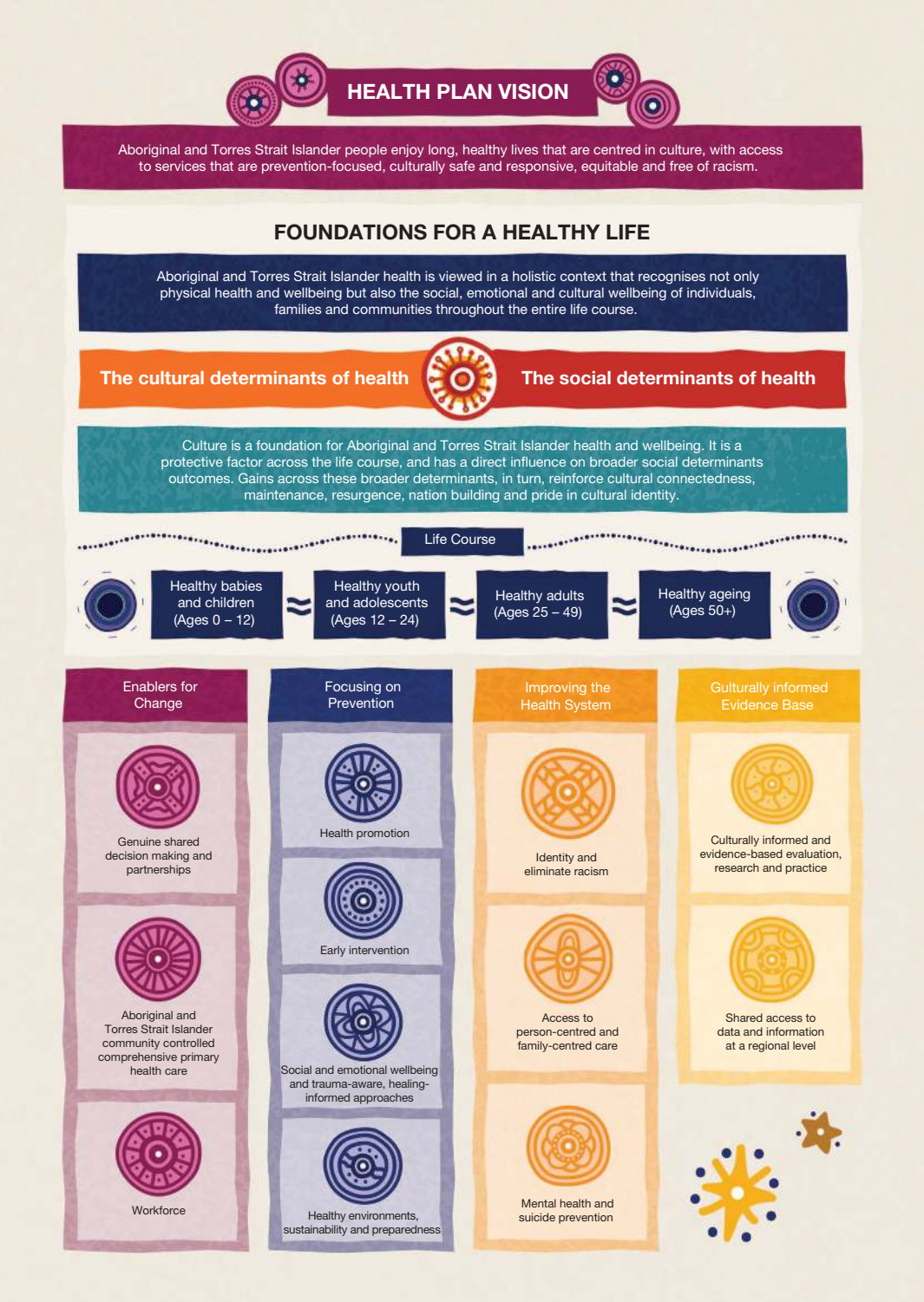


FIGURE 3.9 Increasing the number of Aboriginal and Torres Strait Islander healthcare workers will improve the delivery of culturally appropriate services.

FIGURE 3.10 Culturally appropriate healthcare services improve health outcomes.

For individuals with disability

The NSW government funds and offers mainstream services; however, by also providing more specific and targeted services, people with disability can access support for their individual needs. This is done through a multidisciplinary approach with a team of people who specialise in the specific type of healthcare needed. Examples include two state-wide disability mental health hubs which provide mental healthcare for people with intellectual or developmental disability.

The Australian Institute of Health and Welfare (AIHW) reports there are several key barriers to accessing health services. Future opportunities for individuals with disability include:

- shortening the waiting times for access to a health service, including a GP
- lowering the cost of health services for people with disability
- increasing the accessibility of buildings to enhance more physical access to a medical service
- decreasing the discrimination by health professionals.

FIGURE 3.11 Access to health services

Cost as barrier to healthcare	Waiting times	Coordination of care
In 2018, 7.6% of people with disability aged under 65 delayed or did not see a GP when needed because of cost.	In 2018, 24% of people aged 15–64 with disability waited longer than they felt acceptable to get an appointment with a GP.	In 2018, 47% of people with severe or profound disability aged under 65 saw three or more health professionals for the same condition.

Source: Australian Institute of Health and Welfare (2024) *People with disability in Australia 2024*, catalogue number DIS 72, AIHW, Australian Government.

DEPTH STUDY IDEA

Use secondary sources to investigate the healthcare system in Australia. Use your data to determine its effectiveness. Compare it to another country in the world and present your findings in an essay or multimodal presentation.

3.2 ACTIVITIES

Improving access

1. Use the **Healthdirect** weblink in the Resources panel to identify key health services. Include a primary healthcare such as general practice, a secondary healthcare such as a hospital and one other type of care.
   a. Using the interactive map, reflect on the geographical location for the majority of these services.
   b. How would rural and remote locations benefit from more healthcare options?
2. Use the **Coalition of Peaks** weblink in the Resources panel. Explain how they work with the Australian government to improve the lives of Aboriginal and Torres Strait Islander Peoples using specific examples from the National Agreement on Closing the Gap.

Health inequities

3. For elective surgery, treatment in a private hospital is almost immediate when you have private health insurance. Yet some waiting lists for elective surgery in public hospitals are over a year long. As a class, investigate equity of access to public and private elective surgery.
4. Choose one population group that suffers inequities in health status; for example:
   - Aboriginal and Torres Strait Islander Peoples
   - migrants
   - rural dwellers
   - people who are homeless.

   Brainstorm changes to healthcare that would make it more inclusive for a group experiencing inequity.
   a. Research information and statistics about your selected group's access to healthcare facilities and services.
   b. Create a PowerPoint presentation or an oral report on the impact of the level of access on the health status of your selected population group and present it to your class.

Rural health

5. Research the **Stronger Rural Health Strategy** using the weblink in the Resources panel. Assess how the Stronger Rural Health Strategy will create better health for rural and remote Australians.

on Resources

Weblinks Healthdirect
Coalition of Peaks
Stronger Rural Health Strategy
PBS

3.2 Exercises

learnon

3.2 Quick quiz on | **3.2 Exercise**

Learning pathways

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

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Revise your knowledge

1. What role does the healthcare system in Australia play in achieving better health for all Australians?
2. Australia's healthcare system involves interrelationships between which other sectors of the community?
3. Describe the equity issues that some Australians face when accessing healthcare.
4. Describe the future opportunities for Australians with disability to be able to access appropriate healthcare.
5. Outline the features of an effective community healthcare service.

Apply your knowledge

6. Describe how equity has an impact on the health of Australians.
7. Write a letter to your state/territory government summarising the health system of Australia and suggest changes to make it better.
8. a. Use the information in section 3.2.2 on Pharmaceuticals or access the latest figures on the **PBS** website and determine the maximum price in each of the following scenarios that a person would pay for prescription drugs.

Scenario	Maximum price
i. A teenager is prescribed a weight reduction drug costing $46. The drug is not on the PBS list.	
ii. An adult needs blood pressure tablets that are on the PBS list.	
iii. An adult has already spent $1563 on prescription drugs during the year and now requires an additional script.	
iv. A concession card holder spent $263 on prescription drugs in the previous year.	
v. A single mother needs a special drug for her 5-year-old son. The drug costs $110 each visit to the chemist because it is not on the PBS list.	

   b. Evaluate each of the scenarios in terms of equity of access to healthcare.
9. Analyse the Australian healthcare system's commitment to equity of access.
10. Evaluate the range and types of healthcare services in providing effective healthcare to all Australians.

3.2 Exam questions

Question 1 (1 mark)

Source: Adapted from *HSC 2023, PDHPE Exam, Section I, Part A, Q.8*

What strategy would be most effective in improving equity of access to health services for Aboriginal and Torres Strait Islander Peoples?

A. Increasing awareness of online health resources
B. Increasing the funding for child immunisation programs
C. Providing a telephone or video consultation with a specialist
D. Implementing training for community members to become healthcare providers

Question 2 (1 mark)

Source: *HSC 2022, PDHPE Exam, Section I, Part A, Q.10*

Which strategy could the Australian Government implement to most effectively address the inequity of access to healthcare for socioeconomically disadvantaged individuals?

A. Decreasing the Medicare rebate for health services
B. Supplying free child immunisations to all Australian families
C. Providing additional funding to train more doctors and nurses
D. Increasing the number of medical centres with doctors who bulk bill patients

Question 3 (1 mark)

Source: *HSC 2020, PDHPE Exam, Section I, Part A, Q.17*

Which of the following best demonstrates a strategy to improve equity of access to medical services for people living in a remote location in Australia?

A. Providing an interpreter at a medical consultation
B. Providing medical appointments in the late afternoon
C. Providing culturally appropriate staff at a medical centre
D. Providing a telephone or video consultation with a specialist

Question 4 (5 marks)

Describe the key features of Medicare and its significance in providing accessible healthcare to Australians.

Question 5 (8 marks)

Evaluate the effectiveness of the Australian healthcare system in addressing the healthcare needs of diverse populations, such as Aboriginal and Torres Strait Islander Peoples and one other population group.

3.3 Shared responsibility for the health system

Syllabus: Explain how government and non-government organisations share responsibility for the health system

Including:

- federal, state and territory and local government
- non-government sector – private and not-for-profit

The healthcare system in Australia is provided by:

Government

- Federal government
- State and territory government
- Local government

Non-government sector

- Private
- Not-for-profit community groups

3.3.1 Government sector

Australian government

The Australian government is mainly concerned with the formation of national health policies and the control of health system financing through the collection of taxes. It gives funds to the state and territory governments for healthcare, and influences their health policy making and delivery.

The Australian government also has direct responsibility for special community services, such as health programs and services for war veterans and Aboriginal and Torres Strait Islander communities.

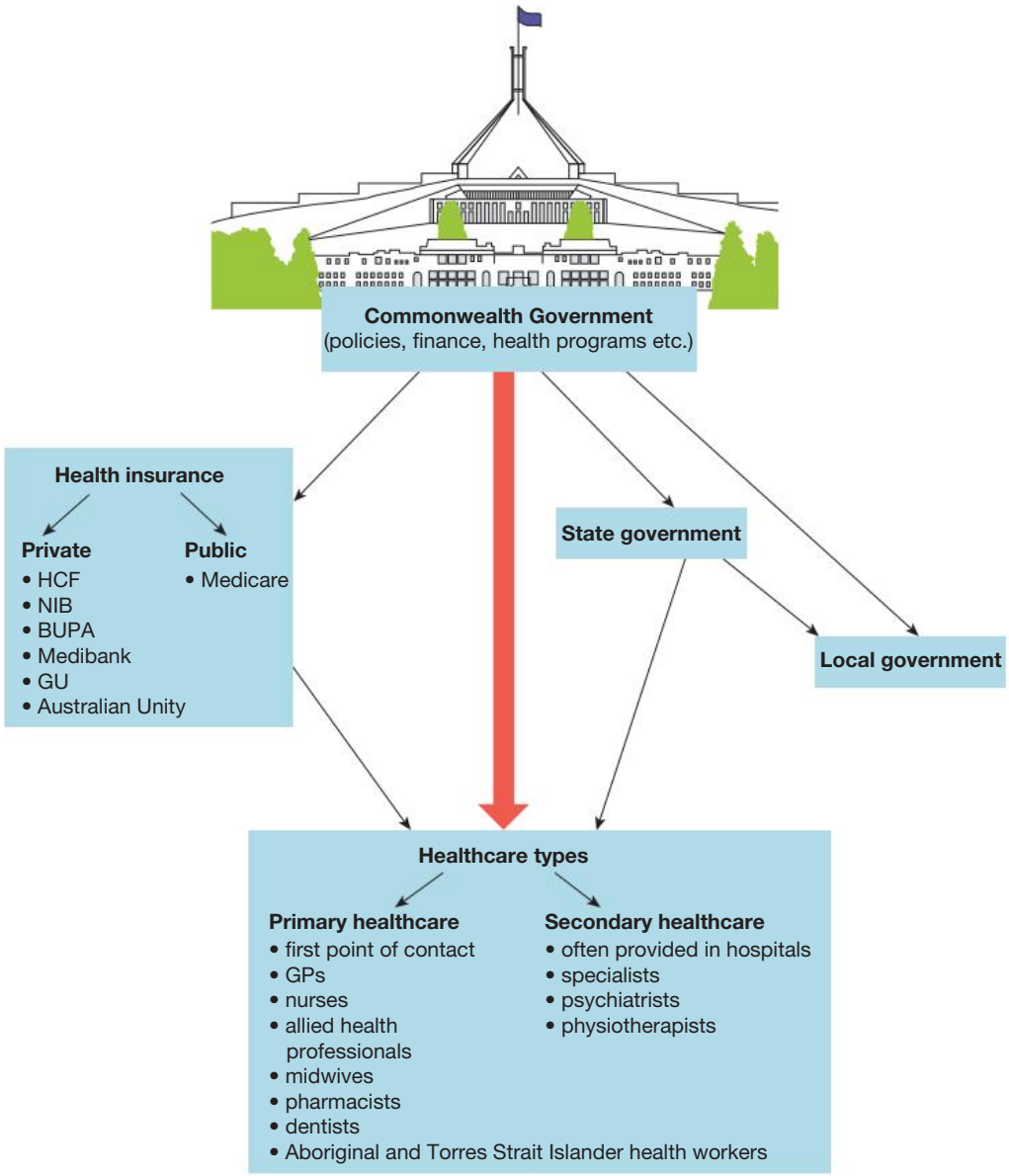
The Australian government contributes major funds to:

- high-level **residential care**
- medical services
- health research
- public hospitals
- public health activities.

Pharmaceuticals are funded by both the Australian government and non-government sources.

residential care care given to a patient away from their home. It takes into account the needs and wishes of the person. An example of high-level residential care is a clinic that provides help and treatment to sufferers of anorexia.

FIGURE 3.12 The healthcare system in Australia involves the interrelationship of many government and non-government bodies.



State and territory governments

The various state and territory governments have the main responsibility for providing health and community services. The principal functions of state and territory health authorities include:

- hospital services
- mental health programs
- dental health services
- home and community care
- child, adolescent and family health services
- women's health programs
- health promotion
- rehabilitation programs; for example, following heart surgery
- regulation, inspection, licensing and monitoring of premises, institutions and personnel.

The state and territory governments also contribute major funds to:

- community health services
- public hospitals
- public health activities.

Local government

The health responsibilities of local governments vary from state to state, but mainly concern environmental control and a range of personal, preventative and home care services. They include the monitoring of sanitation and hygiene standards in food outlets, waste disposal, the monitoring of building standards, immunisation, Meals on Wheels and antenatal clinics. The state health department controls some of these services (e.g. immunisation), while local councils are responsible for implementing them.

3.3.2 Non-government sector

Private sector

The private sector provides a wide range of services, such as private hospitals, dentists and alternative health services (e.g. chiropractors). Privately owned and operated, these services are approved by the federal Department of Health. Many religious organisations, charity groups and private practitioners run such services. Some private organisations, such as the Heart Foundation and Cancer Council Australia, receive funding from both state governments and the Australian government.

FIGURE 3.13 A dentist is one of the services that the private sector provides.

Not-for-profit community groups

Many community groups also promote health. They are formed largely on a local needs basis and established to address problems specific to an area or region. However, where concerns exist nationally, groups are more extensive, usually highly structured and linked in the provision of information, knowledge and support. Examples of prominent community groups are Cancer Council Australia and support groups run by state-based cancer councils, such as Cancer Council NSW; Carers Australia and state-based members of the National Network of Carers Association, such as Carers NSW; Dads in Distress; Family Planning NSW; and Diabetes Australia.

DEPTH STUDY IDEA

Use an open-ended problem to explore how both the government and non-government work together to share responsibility for Australia's health system. Present your findings as a journal article.

3.3 ACTIVITIES

Parts of the health system

1. Create a concept map outlining the levels of responsibility in the Australian health system. Identify the:
   a. Name and level of responsibility
   b. What they are primarily concerned with
   c. What do they fund/where do they get their funding from?
2. Use the following scenario to consider how the levels of government can support healthcare requirements and promote recovery.
   A 45-year-old woman, Sarah, living in regional NSW, is diagnosed with breast cancer. She is a single mother of two young children and works part-time as a teacher.

3. As a class, discuss how each of the parts of the healthcare system is needed in order for the other parts to function properly.

Community health

4. Research a non-government not-for-profit community group in your local area. Use this as an example to show how it can enhance the health of your local community.

3.3 Exercises

learnon

3.3 Quick quiz on | **3.3 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
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Revise your knowledge

1. Identify the five levels of responsibility in the Australian healthcare system.
2. What is the primary role of the Australian government in the healthcare system?
3. Identify the health services and facilities funded by the state or local government available in your local area.
4. What are the main health responsibilities of local governments?
5. Outline the relationship between the different sectors involved in Australia's healthcare system.

Apply your knowledge

6. How does the government's funding of healthcare affect an individual's health status?
7. Explain how the non-government sector can enhance an individual's health.
8. Compare how not-for-profit community groups and the private sector share the responsibility for healthcare in your local area.
9. Analyse the interrelationships between different levels of government and non-government organisations in the provision of healthcare services in Australia.
10. Evaluate the shared responsibility for Australia's health system between government and non-government organisations. Provide specific examples to illustrate how these entities collaborate and address the diverse health needs of Australians.

3.3 Exam questions

Question 1 (1mark)

Source: *HSC 2023, PDHPE Exam, Section I, Part A, Q.4*

The table shows some health-related responsibilities of governments in Australia.

Which row of the table correctly matches a responsibility to the relevant level of government?

	States and Territories	Commonwealth
A.	Subsidising aged care services	Providing ambulance services
B.	Implementing school vaccination programs	Managing public hospitals
C.	Funding community health services	Managing Medicare
D.	Regulating Pharmaceutical Benefits Scheme	Funding the National Disability Insurance Scheme

Question 2 (1 mark)

Source: *HSC 2021, PDHPE Exam, Section I, Part A, Q.18*

What are the likely benefits of health promotion that involves a partnership between the government sector, non-government agencies and local communities?

A. More effective and sustainable health outcomes as this collaboration has a greater focus on treatment and cure.

B. Efficient use of resources and enhanced empowerment of individuals as education programs are replaced by broader government policies.

C. More comprehensive and specifically tailored strategies are established with health issues addressed at a number of levels with effective use of resources.

D. Common goals are established and cost-saving strategies are implemented as individuals should require fewer consultations with a general practitioner (GP).

Question 3 (4 marks)

Explain the concept of 'shared responsibility' in the context of the Australian healthcare system. Using an example, explain how this approach contributes to the overall health and wellbeing of the population.

Question 4 (6 marks)

A patient with a chronic illness requires ongoing medical treatment, including regular visits to a specialist and prescription medications. **Discuss** how the shared responsibility model applies to this scenario, outlining the roles and responsibilities of the individual, the government and the various healthcare providers.

Question 5 (8 marks)

To what extent does the Australian healthcare system effectively balance the principles of individual responsibility and social equity in providing healthcare services? Support your arguments with relevant examples.

3.4 Collaboration between government and non-government organisations

Syllabus: Outline how government and non-government organisations collaborate to provide person-centred healthcare

3.4.1 What is person-centred healthcare?

According to the Australian Commission on Safety and Quality in Health Care, the person-centred care approach is care that respects and responds to the preferences, needs and values of patients and consumers. It is a more **holistic** way of looking at healthcare and treats each person respectfully, placing the human first and not just as a condition to be treated. It focuses on working together to develop a shared understanding about health decisions and care plans. It seeks to understand what is important to the patient, carers and support people including families and builds trust and mutual respect in the decision-making process. Through building health literacy and shared decision making, it fosters trust and mutual respect.

For example, a Year 12 student who is in the care of a psychologist as a part of the Child and Adolescent Mental Health Services. If the psychologist uses a person-centred approach they might:

- begin by asking the student about their goals and what they want to see as a result of their healthcare
- go at the pace of the student
- take into consideration the effect of the environment; for example offering to go for a walk instead of being in a room
- consider the frequency of sessions and check if the student wants their parent/carer in the session or not

holistic an approach that considers the whole person, including physical, mental, emotional and social aspects, in the assessment and treatment of health and wellbeing, recognising the interconnectedness of these elements

- consider the culture of the student and whether an interpreter is required
- think about the cognitive capacity of the student
- choose to show any documents about the student to them first as a sign of respect, before sending to anyone else.

In this example, governments and non-governments work together towards person-centred care. The psychologist operates from Child and Adolescent Mental Health Services (a government service). They may also collaborate with the National Disability Insurance Scheme (NDIS, a government service) and private psychologists (non-government organisations).

The psychologist might refer the student's parents to parenting programs (NGOs) to help them understand their child's needs better. They could also assist with housing (government service) if the student needs it. Additionally, they might connect the student with local NGOs such as Project Youth, which offers family support, The Family Co., which provides programs for young people to strengthen and foster positive relationships, and headspace, which helps young people learn about mental health and how to maintain it.

FIGURE 3.14 A psychologist listening to a young person is showing a person-centred approach.

CASE STUDY 1

New data provides greater insight into culturally and linguistically diverse Australians with chronic health conditions

8 February 2023

Australians from English-speaking backgrounds generally have a higher prevalence of long-term health conditions than other Australians, according to a new report from the Australian Institute of Health and Welfare (AIHW).

However, the data show that some groups of culturally and linguistically diverse (CALD) Australians experience a higher prevalence of specific long-term health conditions and a lower prevalence of other conditions than the Australian-born population.

…

'Australia is a multicultural nation, with Australia's population including people born in nearly every country of the world. Some CALD populations face inter-connected health and social disadvantages, as well as greater challenges when dealing with the healthcare system and services,' said AIHW spokesperson Claire Sparke.

'With such diversity, today's report is fundamental to building a more complete picture of the health status of more than 7 million CALD people living in Australia. It will help build a clearer understanding of the health differences between CALD populations, enabling better design and delivery of services to ensure they can access the health and community services they require.'

'On average, migrants to Australia have a lower prevalence of long-term health conditions, which is sometimes referred to as the "healthy migrant effect". But this is not the case for all migrants.'

Country of birth

People born in Australia and migrants from other English-speaking countries and Europe generally had a higher prevalence of chronic conditions such as arthritis, asthma, cancer, lung conditions and mental health conditions.

Australians born in some overseas countries had a higher prevalence of dementia, heart disease, stroke, diabetes and kidney disease than the Australian-born population, particularly for people born in regions such as Polynesia, South Asia and the Middle East.

'Bangladesh-born Australians had the highest prevalence of both diabetes and heart disease – 12 per cent and 4.6 per cent respectively,' Ms Sparke said.

'Kidney disease was highest in people born in Polynesian countries such as Tonga (1.9 per cent) and Samoa (1.5 per cent).'

Languages

For main languages used at home, the findings were consistent with those for country of birth.

'People who spoke Tongan or Māori (Cook Island) had the highest prevalence of diabetes and kidney disease (12 per cent and 2.1 per cent), respectively,' Ms Sparke said.

Time since arrival in Australia and proficiency in spoken English

The report also presents data for these conditions by combinations of country of birth and time since arrival, language used at home and English proficiency and time since arrival and English proficiency.

'Indicators like the length of time migrants have been in Australia can give a picture of how familiar they are with Australian society and health practices. It is also useful to explore how the social characteristics of migrants change with length of time spent in Australia. Using this indicator in combination with others can better inform on socio-cultural differences between the CALD populations,' Ms Sparke said.

The year of arrival in Australia and level of English proficiency were interacting factors linked to the prevalence of many long-term health conditions such as arthritis, asthma, mental health and lung conditions.

'For early arrivals (people who first arrived to Australia more than 10 years before the 2021 Census), the prevalence of one or more long-term health conditions was higher for people with low English proficiency (33 per cent) than for people with high proficiency (23 per cent),' Ms Sparke said.

'These data are crucial for identifying those who may experience barriers in accessing services due to their lack of ability in spoken English. For people who arrived more recently (within 10 years before the 2021 Census), there was little difference in the prevalence of many long-term health conditions for people with low or high English proficiency, except for asthma which was more common among people with high English proficiency. A higher prevalence of asthma among people with high English proficiency was observed across many languages.'

The prevalence of chronic health conditions generally increased with the number of years since arriving in Australia for most countries of birth, even after controlling for age. However, recent arrivals from Iraq had a higher prevalence for multiple conditions, including dementia, heart disease and kidney disease.

A lower English proficiency among people who spoke Arabic (the most common language spoken in Iraq) was also linked to a higher prevalence of long-term health conditions.

'The findings presented in today's report reflect the diverse cultures, languages, migration trajectories, social and economic circumstances among CALD people in Australia. Further work will be undertaken to help fill knowledge gaps that can be used to target barriers faced by CALD populations in accessing healthcare,' Ms Sparke said.
Source: Australian Institute of Health and Welfare.

Case study questions

1. Select two culturally and linguistically diverse Australian groups and identify two health conditions that are more prevalent in those communities.
2. What were identified as issues of equity of access in this report?
3. What needs to be different in order for Australians with CALD backgrounds to be able to access healthcare better?

DEPTH STUDY IDEA

Choose one health issue discussed in this subtopic and find a case study to illustrate it.

Viva Voce Presentation: In your viva voce, imagine you are delivering a speech to the Health Minister to advocate the need for a coordinated approach for healthcare. You can present this case study by discussing each point in detail, explaining how the collaboration between different sectors enhances the care provided to adolescents. Highlight specific examples and emphasise the importance of a coordinated approach to healthcare.

3.4 ACTIVITIES

Person-centred healthcare

1. Using the following elements as a stimulus, develop a scenario which uses both government and NGO healthcare organisations in your local area:
   - Simon is 17 years old
   - Enjoys school, hanging out with his friends and gaming
   - Has a physical disability
   - Is looking for a part-time job.

   Share your scenario with a partner and explain how government and NGOs could work together to provide person-centered healthcare for Simon.
2. Use the **Australian Commission on Safety and Quality in Health Care** weblink in the Resources panel to learn more about person-centred care and complete the activity below.

   Think: about a time when you have received person-centred care and a time when you haven't.

   Pair: discuss with the person next to you about how it made you feel in both scenarios.

   Share: about your experience with the class and compile a list of all the ways that it made the class feel when there was both person-centred care and non-person-centred care.
3. Watch the **WHO: What is person-centred care?** video at the weblink in the Resources panel.
   a. Develop a role play or video presentation showing how the Australian healthcare system can collaborate between the government and non-government organisations to provide person-centred care.
   b. Outline how the benefits can help:
      - Australians to access healthcare
      - health professionals to provide better healthcare
      - the healthcare system to not waste resources.

on Resources

Weblinks Australian Commission on Safety and Quality in Health Care
WHO: What is person-centred care?

3.4 Exercises

learnon

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Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
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Revise your knowledge

1. Using your own words, define what 'person-centred care' means.
2. Describe how person-centred care is different from conventional models of care.
3. What are the benefits of person-centred care?
4. Explain how person-centred care principles can be applied to promote the health and wellbeing of a young person with a chronic illness.
5. Discuss strategies to promote a person-centred approach within a busy hospital environment in order to improve healthcare of individuals.

Apply your knowledge

6. Imagine you are a healthcare provider working with a patient from a culturally and linguistically diverse (CALD) background. How would you apply the principles of person-centred care to ensure their needs are met and they are actively involved in their treatment decisions?

Use the following scenario to answer questions 7 and 8.

Alex, a 17-year-old student and keen basketball player in Sydney, injures his knee during a game. He experiences significant pain and swelling, and is unable to put weight on his leg. Alex is taken to the nearest public hospital emergency department. He undergoes an X-ray and is diagnosed with a torn anterior cruciate ligament (ACL). The hospital provides immediate pain relief and arranges for a follow-up appointment with an orthopaedic surgeon within the public healthcare system. While waiting for his surgery, Alex's physiotherapist recommends he contact the local branch of Sports Medicine Australia, an NGO. They provide him with information on ACL injury rehabilitation, connect him with support groups, and offer access to specialised exercise programs designed to aid his recovery.

7. To what extent do government and non-government organisations collaborate to help Alex?
8. Assess how Alex's care could be more person-centred and what impact this would have on Alex and his recovery.
9. Justify the importance of ongoing collaboration and communication between government and non-government organisations in achieving optimal health outcomes for all Australians.
10. Evaluate how successful the Australian healthcare system has been at collaborating together to provide person-centred care.

3.4 Exam questions

Question 1 (1 mark)

Which of the following best describes the person-centred care approach?

A. Focusing solely on the medical condition of the patient.
B. Providing care that respects and responds to the preferences, needs, and values of patients and consumers.
C. Ensuring that all healthcare decisions are made by healthcare professionals without patient input.
D. Treating all patients with the same standard procedures regardless of their individual needs.

Question 2 (1 mark)

How do government and non-government organisations collaborate to provide person-centred care for a Year 12 student in the example in subtopic 3.4?

A. The psychologist works alone to address all the student's needs.
B. The psychologist only refers the student to government services.
C. The psychologist collaborates with both government services (such as CAMHS and NDIS) and non-government organisations (such as private psychologists and local NGOs).
D. The psychologist focuses only on the student's academic performance.

Question 3 (4 marks)

Explain how person-centred care differs from a more conventional, disease-focused approach to healthcare.

Question 4 (6 marks)

Discuss how the collaboration between government and non-government organisations can provide effective person-centred care. Use examples to support your answer.

Question 5 (5 marks)

Source: *HSC 2022, PDHPE Exam, Section I, Part B, Q.23*

Explain how individuals, communities and governments can work in partnership in health promotion to improve the health of Australians. Provide examples to support your answer.

3.5 Health expenditure and its impact

Syllabus: Discuss health expenditure and its impact on current and future populations

Including:
- healthcare versus prevention
- sustainability, access and equity
- Medicare, private health insurance and related Commonwealth-funded programs

3.5.1 Healthcare versus prevention

Healthcare expenditure is the allocation of funding and other economic resources for the provision and consumption of health services. It includes spending by Australian state and territory governments, as well as private health insurance, households and individuals. The Australian government continues to invest in the health system with a commitment of $537 billion between 2022–26. In 2023–24, the Australian government budget included strengthening Medicare ($5.7b) and health prevention and protection ($1.1b).

FIGURE 3.15 The cost of prevention is usually small in terms of the cost of cure.

Healthcare expenditure in Australia has been steadily increasing, largely due to a focus on curative medicine — treating diseases after they develop rather than preventing them. For instance, curing coronary heart disease is more expensive than funding preventive measures such as education, healthy eating, weight control and active lifestyles. Curative treatments for conditions such as heart disease, stroke and kidney failure are costly and significantly contribute to health expenditure.

Despite increased funding for health promotion and illness prevention, these areas remain undervalued and under-resourced. The majority of healthcare spending is still directed towards medical treatments rather than prevention. For example, lifestyle factors are estimated to cause up to 70 per cent of premature deaths, yet over 90 per cent of health expenditure is on treatment and cure. Preventive programs for cardiovascular disease, cancer and traffic accidents, such as QUIT, SunSmart, the 'Girls make your move' initiative, national cervical and breast screening programs, Stop Revive Survive and drink-driving campaigns, have been implemented over the past three decades. Training programs for general practitioners emphasise the importance of preventive health and promoting positive lifestyles. Since almost 9 in 10 Australians visit their GP annually, this **advocacy** is crucial for health promotion and prevention of disease. Together, treatment, early intervention and prevention programs have contributed to significant reductions in mortality and morbidity rates.

healthcare expenditure the allocation of funding and other economic resources for the provision and consumption of health services

advocacy the act of championing or arguing for a particular issue or cause

FIGURE 3.16 It may take some time to see the benefits of expenditure on preventative programs.

Strategies that could be used to prevent illness and death in the community include:

- educating school children about positive health behaviours
- better coordination among the various levels of government
- restrictions on advertising
- legislation
- higher taxes on products such as alcohol and tobacco
- the provision of support programs to help people give up addictive habits such as smoking and high alcohol consumption
- promoting early intervention strategies such as vaccines and screenings.

Arguments for increasing the funding and support for preventative health strategies include:

1. *Cost-effectiveness* — preventing illness and injury would result in huge savings in funds and resources used for acute healthcare.
2. *Improvement to quality of life* — the positive health outcomes for individuals that result from prevention include improvements in morbidity rates and longevity; that is, a longer and healthier life.
3. *Containment of increasing costs* — prevention is the best way of containing the continually increasing costs of healthcare. Otherwise, these costs could result in adequate healthcare being unaffordable for ordinary Australians.
4. *Maintenance of social equity* — a policy of prevention helps to provide greater equity (in the healthcare system), which otherwise would be under threat as health costs continue to rise significantly.
5. *Use of existing structures* — prevention activities use existing and accessible community structures (such as GPs) rather than relying on special services and technological procedures. General practitioners are in a good position to measure risk factors and educate their patients on illness prevention and health promotion.
6. *Reinforcement of individual responsibility for health* — the use of prevention strategies empowers individuals to take control of their personal health by modifying their behaviour.

The arguments for preventing lifestyle diseases are compelling. However, the quality of the extended lifespan is a concern. Some researchers are examining whether delaying illness through preventive strategies and extending lifespan increases sickness rates and prolongs illness in later years.

As a result, more needs to be done now to plan for the potential issues of the future. The AIHW identifies a modest reduction in premature deaths between 2003 and 2023, possibly assisted by a greater emphasis on prevention of illness and injury (figure 3.17 and figure 3.18). Chronic diseases, such as cancer, musculoskeletal conditions and mental health and substance use issues, collectively accounted for 64 per cent of the total burden of disease. Continued effort in prevention is needed as well as working towards treatments and cures.

FIGURE 3.17 Just over half the burden is attributed to living with illness or injury.

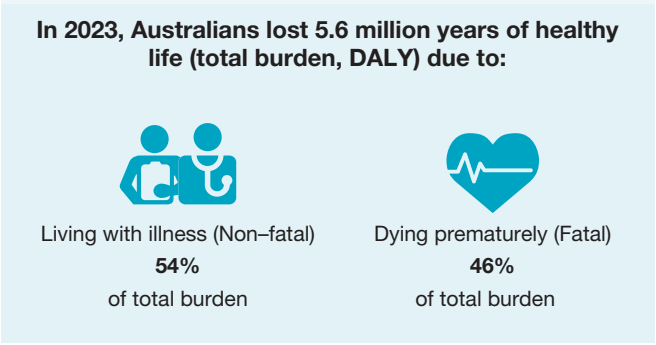
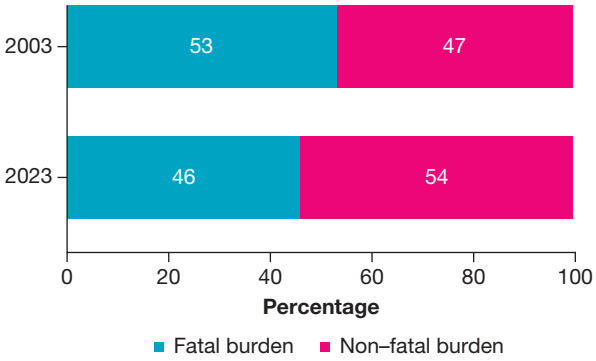


FIGURE 3.18 Proportion (%) of total burden due to fatal and non-fatal burden in 2003 and 2023



Source: Australian Institute of Health and Welfare.

CASE STUDY 2

National Research Emphasises the Benefits of Prevention Over Cure

The University of Queensland and Deakin University have unveiled a groundbreaking study, offering numerous recommendations to bolster preventive health measures. However, they also caution that not all current preventive practices are cost-effective.

The ACE-Prevention project

The Assessing Cost Effectiveness of Prevention (ACE-Prevention) project represents five years of meticulous research, funded by the National Health and Medical Research Council. It stands as the most comprehensive evaluation of preventive health measures globally, with contributions from 130 leading health experts.

Significant findings and recommendations

Under the leadership of Professor Theo Vos from the University of Queensland and Professor Rob Carter from Deakin University, the research team analysed 123 preventive health measures. Their objective was to identify strategies that would not only prevent the most illnesses and premature deaths but also offer the best value for money.

Key recommendations

- Implementing a 10 percent tax on junk food
- Setting mandatory salt limits in bread, margarine, and cereals
- Increasing the tax on alcohol by 10 percent for spirits and addressing the tax loophole that makes cask wine cheaper than soft drinks. Additionally, banning alcohol advertisements and raising the legal drinking age to 21
- Raising the tobacco tax by an additional 5 percent on top of the April 2010 25 percent increase and subsidising smoking cessation aids
- Launching an intensive SunSmart campaign to raise skin cancer awareness
- Introducing a four-in-one 'poly-pill' for at-risk individuals and Aboriginal and Torres Strait Isalnder people aged 35+, containing three low-dose blood pressure medications and a cholesterol-lowering drug, at an affordable price
- Screening for early signs of diabetes and chronic kidney disease starting at age 45, considering that dialysis costs an average of $70 000 per person per year
- Providing lap band surgery for the severely obese
- Conducting bone mineral density tests for older women to detect early stages of osteoporosis
- Implementing early intervention screening and enhanced follow-up programs for mental health issues
- For Aboriginal and Torres Strait Islander Peoples, screening for early signs of diabetes and chronic kidney disease starting at age 25

Urgency and economic justification

Professor Theo Vos of the University of Queensland emphasised the urgent need for reliable information to optimise health budget allocations. He argues that reliable information is needed by governments so health budgets can be used efficiently. There are only limited resources, so data is needed to make sure money is spent where it can have the most impact on health outcomes. He elaborated that an initial investment of $4 billion, with less than $1 billion in subsequent years, could implement the 43 most cost-effective prevention measures, granting Australians an extra million healthy years over their lifetime. The savings from avoided disease treatment would more than offset these costs.

Reevaluating current practices

The ACE-Prevention research team identified several current preventive practices in Australia that offer limited benefits and warrant reconsideration. These include:

- Inefficient cardiovascular preventive treatments with expensive drugs favored over cheaper alternatives
- Prostate-specific antigen (PSA) testing for prostate cancer
- Aspirin use for heart disease prevention
- Weight loss programs
- School-based illicit drug awareness campaigns

Expert opinions

Deakin University's Professor Rob Carter highlighted the importance of reallocating resources towards more cost-effective measures, despite the compelling economic case for increased health promotion funding. Todd Harper, CEO of VicHealth, Australia's first health promotion organisation, stressed that public health currently receives only 2 percent of the health budget and called for greater emphasis on proven prevention strategies to avoid a surge in preventable illnesses in the coming decades.

Conclusion

Professor Mike Daube, President of the Public Health Association of Australia, underscored the potential to prevent a million premature deaths by taking action now. He noted that the primary opposition to these measures would come from commercial interests, making it imperative for governments to act decisively to safeguard the health and longevity of Australians.

Funding and support

The ACE-Prevention project received funding from the NHMRC and is backed by VicHealth, the Public Health Association of Australia, and the Lowitja Institute for Aboriginal and Torres Strait Islander Health Research, which encompasses the Cooperative Research Centre for Aboriginal and Torres Strait Islander Health.

Source: Adapted from Victorian Health Promotion Foundation VicHealth.

Case study questions

1. What strategies are suggested for improving illness prevention measures?
2. What problems make it difficult for governments to spend money wisely on healthcare?
3. Do you think that spending on health promotion and illness prevention is a good investment for the Australian people? Why or why not?
4. Use the case study and figure 3.17 and figure 3.18 to answer the following.
   Based on the statistics presented, create a For and Against table listing the arguments that support greater spending on health promotion and illness prevention and those that are against greater spending.

EXAM TIP

Health expenditure, healthcare vs prevention

In an exam question addressing the allocation of funding to healthcare vs prevention, it is important to consider the specific health needs of the Australian population; for example, *allocating funding to the treatment and reducing the incidence of chronic conditions (such as cancer and heart disease) considers the specific health need of national health priorities.*

It is also important to address this question with consideration of groups experiencing inequity so that, ideally, allocation of funding supports the social justice principles; for example, *the Better Cardiac Care for Aboriginal and Torres Strait Islander Peoples project illustrates how the government is allocating funding to promote regular heart check-ups and introduce lifestyle strategies to a priority population group.*

While often an exam question will be focused on distributing health budget funds responsibly, consider the long-term benefits of allocating funding to preventative practice in reducing trauma to support longevity and better quality of life.

3.5.2 Sustainability, access and equity

A focus on prevention of illness and disease can significantly improve the health of all Australians. However, there are still notable differences in patient outcomes based on cultural, ethnic, socioeconomic and geographic factors. These disparities can affect health literacy and limit access to essential health tools, such as telehealth services or advanced medical technology.

There is also a significant gap in healthcare services between rural and urban areas. Rural and remote populations often lack adequate health services and facilities, leading to inequities in healthcare access and outcomes.

Additionally, the ageing population will impact the sustainability of the healthcare system in the future. It is predicted that there will be a 54 per cent increase in Australians aged 65 and older between 2021 and 2041, and a 140 per cent increase in Australians aged 85 and older. This demographic shift will place greater pressure on the healthcare system, as more Australians will need access to healthcare. This increased demand will result in higher healthcare costs and a need for a larger workforce, making the healthcare system less sustainable in the future.

3.5.3 Medicare, private health insurance and related Commonwealth-funded programs

Accidents and illness can cost individuals a considerable amount of money. The Australian government is committed to providing equitable health services for all people, which it attempts to achieve through its basic health insurance scheme, Medicare (introduced in 1984).

Medicare

Medicare is Australia's universal healthcare system, established to provide Australians with affordable and accessible healthcare. The funds to operate the Medicare system are obtained from income taxes and the Medicare levy that is paid according to income level. This is currently 2 per cent of a person's taxable income, but can vary according to individual circumstances. You can find further details by accessing the **Medicare levy** weblink in the Resources panel.

Medicare Australia's public-funded universal healthcare system, ensuring all Australians have access to free or low-cost medical, optometric and hospital care

Medicare provides individuals with access to:

- free treatment as a public patient in a public hospital
- free or subsidised treatment by medical practitioners, including GPs, specialists, and some specified services of optometrists and dentists.

In Australia, the government sets a standard fee for medical services, known as the 'schedule fee'.

However, some doctors charge more than the scheduled fee. In these cases, the patient will have to pay the difference between the doctor's fee and the amount covered by Medicare.

Some doctors choose to '**bulk bill**' their patients. This means that the doctor accepts the Medicare payment as full payment for their services, and the patient does not have to pay anything out of pocket. For general practitioners, this can be up to 100 per cent of the scheduled fee, while for specialists, it is 85 per cent of the scheduled fee.

Medicare benefits also cover optometrist services and oral surgery, but not private dentistry, physiotherapy, chiropractic treatment and appliances.

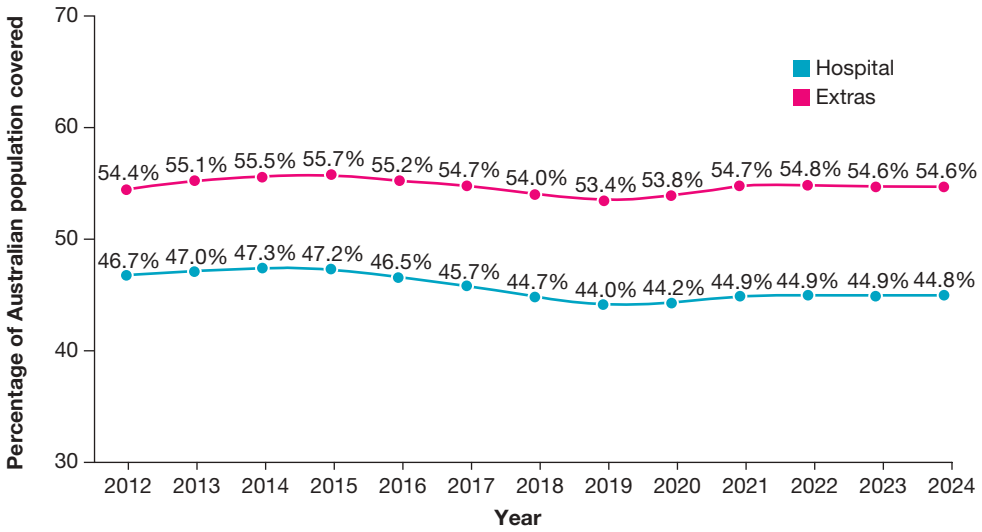
Private health insurance

Many people choose to 'top up' their health cover by taking out private health insurance. The extra insurance allows people to cover private hospital and ancillary expenses (such as dental, physiotherapy and chiropractic services) and aids and appliances (such as glasses).

People choose private health insurance for a number of reasons, including:

- shorter waiting times for treatment
- being able to stay in a hospital of their own choice
- being able to have a doctor of their own choice in hospital
- ancillary benefits, such as dental cover
- security, protection, peace of mind
- private rooms in hospital
- insurance cover while overseas.
- the reduction in taxable income for middle to high income earners.

FIGURE 3.19 Percentage of the Australian population covered by private hospital insurance, 2012–24



Source: Copyright © Australian Prudential Regulation Authority (APRA).

Lower levels of private health insurance are found among the young, the elderly and other groups that have less available income. After the introduction of Medicare in 1984, many people opted out of private health insurance and figures declined through the 1990s. The fall in the membership of private health insurance funds created pressures on the public health system, leading to lengthy debate by politicians and health authorities. The strain on the health system was caused mainly by the increasing demands for service from an ageing population and the increased numbers of 'free' Medicare patients.

bulk billing a payment option in the Medicare system. The service provider (doctor) bills Medicare directly for the consultation fee, thereby accepting the Medicare benefit as full payment for the service, and the patient pays no fee to the doctor.

In 1998, to decrease this burden on the public health system, the Australian government introduced a rebate for people who have private health insurance. The rebate is income-tested across four tiers, or bands, of income. It also introduced a Medicare **levy** surcharge (on top of the 2 per cent Medicare Levy) on individuals who earn more than $93 000 (in 2024) and families who earn $186 000 or more (in 2024), and do not have an appropriate level of hospital insurance.

A further change was the lifetime healthcare incentive, which was introduced from 1 July 2000. This incentive gives lower lifetime premiums to people who join a health insurance fund early in life and maintain their hospital cover, compared with the premiums for someone who joins after age 30. These policies are aimed at attracting people to private health insurance.

The number of Australians covered by basic private hospital insurance has remained around 44 per cent since 2018. General trends in basic private hospital insurance are shown in figure 3.19.

levy a payment collected by the government from a person's income

TABLE 3.2 A comparison of Medicare and private health insurance

	Medicare	Private health insurance
Who pays?	• Australian government • Taxpayers	• Australian government • Private contributors
How paid for?	• Levy or tax linked to salary	• Monthly premiums for various forms of cover

What benefits?	• Basic medical services (doctors and specialists)
	• Choice of general practitioner
	• Basic hospital services in public hospitals
	• Specialist healthcare
	• Cover for 85 per cent of the scheduled fee for medical services
		• Hospital cover
		  ◦ hospital services
		  ◦ doctor of choice
		  ◦ hospital of choice
		  ◦ private or public hospital
		• Ancillary services; e.g. dental, optical, chiropractic
		• Some special benefits; e.g. sports equipment
		• Cover while overseas

CASE STUDY 3

Do you need health insurance?

We look at whether private health insurance will save you money at tax time

Many Australians took out private health insurance during COVID-19, but with household budgets now stretched by cost-of-living pressures, it's time to take stock.

You can compare health insurance policies to check whether you could get a better deal, or consider dropping your health insurance altogether.

The two main reasons why you might want to keep your health insurance are to save money on tax and to avoid lengthy elective surgery waiting lists.

Tax and health insurance

Depending on your income, you have to pay extra tax if you don't have private health insurance.

Medicare levy surcharge

The Medicare Levy Surcharge (MLS) is an additional 1–1.5 per cent tax paid by singles earning over $97 000 and couples/families earning over $194 000 who don't have private hospital cover. It begins at $970 a year for singles and increases the more you earn.

If you only want health insurance for tax reasons, you can simply take out the cheapest hospital policy in your state or territory, which can cost less than paying the Medicare levy surcharge. The more you earn, the more you'll save.

Lifetime health cover loading

The Lifetime Health Cover (LHC) loading affects you if you take out hospital cover after your 31st birthday, or if you have any long gaps between cover. If you take out hospital cover for the first time after you turn 31, you'll pay an extra 2 per cent on your premiums for every year you waited up to a maximum loading of 70 per cent, and you'll pay the loading for 10 years.

If you never get private health insurance, the LHC loading will never affect you.

Keep in mind that you don't need to get extras cover (dental, optical, etc.) to avoid either of these penalties – getting hospital cover will do just fine.

Elective surgery waiting lists

In 2022–23 elective surgery waiting times were at the highest level in 20 years with nearly 10 per cent of patients waiting for surgery for a year or more, according to the Australian Institute of Health and Welfare.

If you have private health insurance, you can get your surgery done by the doctor of your choice in a private hospital with normally much shorter waiting times.

If you turned 31 after 1 July 2023, you have until 1 July 2024 to take out hospital cover without a surcharge.

If surgery is called 'elective', it just means it's not emergency surgery and isn't immediately needed to save your life.

Elective surgery is necessary surgery and even includes cancer surgery, and your condition could worsen if you have to wait too long. It's even possible that you could become disabled while waiting, like for hip or knee replacement surgery, or your ability to enjoy and live your life could be severely limited, like if your eyesight worsens while waiting for cataract surgery.

Do you need extras cover?

Unlike hospital insurance, which covers you for treatment in hospital, extras insurance helps pay for services outside of hospital, like dental care, glasses and treatments like physio or chiro. When you take out health insurance, your insurer will probably sell you a hospital and extras policy.

What health funds don't tell you is that you aren't required to have extras insurance to avoid paying tax and loadings. And while you get benefits paid when you have treatments, it's often less than what you pay in premiums.

Most extras policies only pay a percentage or a capped amount towards the cost of these services. According to APRA*, on average:

- you're out of pocket by about $59 for each extras service
- the benefit for a service is $66 for dental, $39 for physiotherapy and $81 for optical
- you only get $463 per person per year in total from your extras policy, so for the average person, a premium of over $39 per month for extras insurance means you're paying too much.
  If your extras insurance doesn't pay out more than your extras premium, it's worth either switching to a better policy or dropping it altogether.
  *APRA quarterly health insurance statistic, December 2023.

Source: Graham, D. & Mihm, U. (2024), 'Do you need health insurance?' *Choice*, 21 June, https://www.choice.com.au/money/insurance/health/articles/do-you-need-private-health-insurance.

Case study questions

1. What are some reasons to keep your private health insurance?
2. What should you look for in a health insurance policy?
3. Do you need extras insurance to avoid paying tax and loadings?

3.5.4 Commonwealth-funded programs

National Disability Insurance Scheme (NDIS)

The NDIS is Australia's national scheme for people with disability and provides funding for support services to an estimated 500 000 Australians. The funding is provided directly to individuals and helps to access supports and fee-for-service providers. In 2023–24, the Australian government's estimated expenditure was $41.9 billion. It is projected that NDIS costs will moderate in 2026–27 and will cost $59 billion over seven years between 2027–28 to 2033–34.

FIGURE 3.20 Five ways that the NDIS supports Australians

My Aged Care

My Aged Care gives access to government-funded aged care services. It provides services such as help at home so that older Australians can stay at home longer, short-term care such as respite care after being in hospital and aged care homes for those who are no longer able to live independently at home. To access the funding, participants need to be eligible, an assessment of needs happens in order to see what government-funded services might be available to help and how much it might cost the individual.

FIGURE 3.21 An aged care worker listening to an older woman in an aged care home.

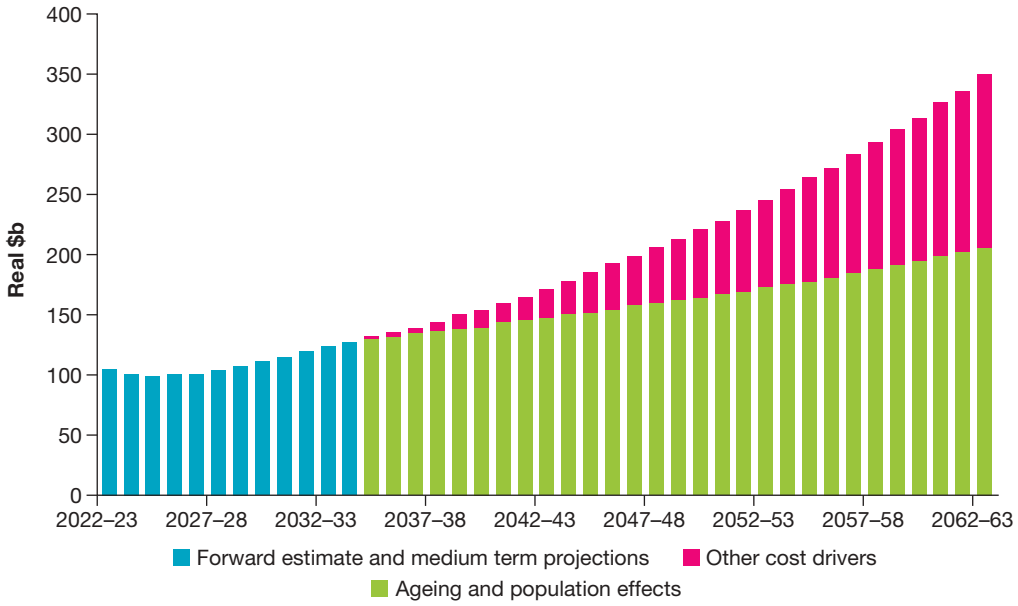
Impact on current and future generations

Australia's future health spending will face pressures from a growing and ageing population, leading to increased demand for health services and innovative healthcare technology.

Figure 3.22 illustrates that the Australian government's health expenditure will rise significantly between now and 2063, with total health spending on those aged over 65 expected to increase approximately six-fold over the next 40 years. This trend will place additional pressure on the healthcare system, services and workforce.

To address these challenges, it is crucial to ensure that Australia's healthcare system innovates to provide quality, person-centred and sustainable services for communities. This will require substantial funding for preventive and evidence-based health services.

FIGURE 3.22 The *2023 Intergenerational Report* shows the Australian government Health expenditure to 2063.



Source: The Treasury.

DEPTH STUDY IDEA

Method: Secondary sourced investigation

Type: Portfolio of evidence

Gather evidence through a secondary sources investigation to analyse the impact of health expenditure on current and future populations.

How: Provide a critique of the Federal health budget by accessing the Budget overview (current year) and evaluating the impact of spending forecasts by answering the following:

a. is the health funding well spent?
b. could there be shifts in spending to better address inequity?
c. is there adequate focus on financial support for preventative practice?

If you were in charge of health expenditure, where would you argue was the most important avenue for health expenditure and why?

Present your argument with a portfolio of evidence.

3.5 ACTIVITIES

1. Complete the following table to summarise the advantages and disadvantages of Medicare and private health insurance, particularly in terms of cost, choice and benefits.

	Medicare	Private health Insurance
Advantages		
Disadvantages		

Health prevention

2. Access the **National Preventative Health Strategy 2021–2030** weblink in the Resources panel and read the report.
   a. Identify two actions from the Australian government that aims to enhance prevention.
   b. Choose a priority population group who experiences health inequities. Identify and create a presentation on ways that the health status of the population group can be enhanced through preventative healthcare.
3. Hold a class debate with one side of the class arguing that prevention is better than cure and the other half arguing that cure is better than prevention.

Health promotion

4. Visit the **AIHW Health Promotion and Health Protection** weblink in the Resources panel and answer the following questions.
   a. What are some of the health promotion activities that can enhance early intervention and disease prevention?
   b. What role does the government (federal, state and territory, and local) play in overseeing health promotion and health protection?
   c. Assess the role non-government organisations play in overseeing health promotion and health protection.
   d. Describe how the health expenditure into tobacco and e-cigarettes have helped to make Australians healthier.
5. As a class, discuss figure 3.17. Think and reflect on the statistic that in 2023, Australians lost 5.6 million years of healthy life. What does this mean? How can we change these statistics?

on Resources

Weblinks National Preventative Health Strategy 2021–2030
AIHW Health Promotion and Health Protection
Medicare levy

3.5 Exercises

learnon

3.5 Quick quiz on | **3.5 Exercise**

Learning pathways

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

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Revise your knowledge

1. Explain how Medicare works.
2. Outline the benefits of the Medicare system.
3. Explain how private health insurance might benefit some people.

4. Read the case study 'Do you need health insurance?'. What are the advantages of having private health insurance?
5. Use figure 3.19 to describe trends in private hospital insurance.
6. Outline government strategies for attracting people to private health insurance.

Apply your knowledge

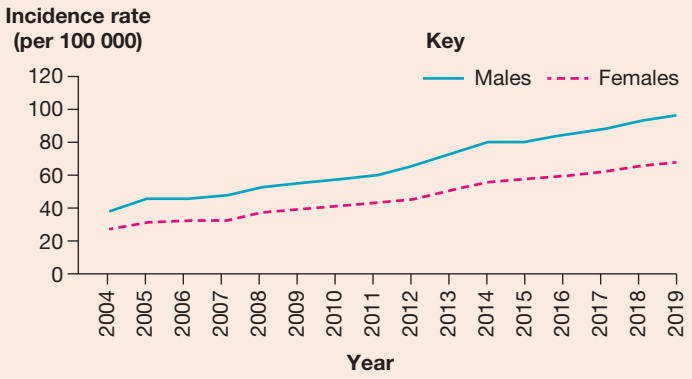
7. Figure 3.22 outlines the upward trend in spending from the Australian government for the next 40 years. What will the impact of this be on future populations?
8. An increasing aged population will affect healthcare spending in Australia over the next 40 years, as seen in figure 3.22. How can Australian-government-funded programs such as My Aged Care help?
9. Assess how the NDIS is a worthwhile Australian government expenditure.
10. A patient requires hip replacement surgery. Compare and contrast the options available to them within the public and private healthcare systems in Australia, including waiting times, costs and choice of surgeon.

3.5 Exam questions

Question 1 (1 mark)

Source: *HSC 2021, PDHPE Exam, Section I, Part A, Q.19*

The graph shows the trends in the incidence of a type of cancer for males and females in Australia from 2004 to 2019.



Source: *Cancer in Australia 2019*, Australian Institute of Health and Welfare.

Which row of the table identifies the type of cancer represented in the graph and the most effective strategy for the federal government to implement in order to reduce its overall expenditure on this type of cancer by 2040?

	Type of cancer	Strategy
A.	Lung	Increase the Medicare rebate for screening consultations with a general practitioner
B.	Lung	Build more healthcare facilities in each state to provide greater access to quit smoking services
C.	Skin	Provide funding to state governments to implement prevention initiatives in education, workplace and community settings
D.	Skin	Send an annual reminder letter to Australians aged over 40 years to participate in screening tests

Question 2 (1 mark)

Source: *HSC 2023, PDHPE Exam, Section I, Part A, Q.10*

Which of the following incentives was introduced by the Australian Government to encourage individuals to take out private health insurance?

A. Entitlement to a mental health treatment plan
B. Guaranteed 50% rebate on all ancillary services
C. Free admission for treatment in private hospitals
D. Exemption from paying the Medicare levy surcharge

Question 3 (1 mark)

Source: *HSC 2021, PDHPE Exam, Section I, Part A, Q.8*

What could be an advantage for an individual who has private health insurance?

A. The Medicare Safety Net is decreased.
B. The Medicare levy surcharge needs to be paid.
C. The cost of some ancillary health services is reduced.
D. The recovery time after elective surgery in a private hospital is decreased.

Question 4 (5 marks)

Source: *HSC 2020, PDHPE Exam, Section I, Part B, Q.25*

Describe the advantages and disadvantages of having private health insurance for the individual.

Question 5 (8 marks)

Source: *HSC 2022, PDHPE Exam, Section I, Part B, Q.25*

Organisations suggest that governments should increase the funding for early intervention and prevention strategies for cancer.

Analyse the effects this increased funding would have on Australia's future healthcare expenditure. Provide examples to support your answer.

3.6 Complementary healthcare approaches

Syllabus: Explain complementary healthcare approaches

Including:

- products and services available
- as a preventative measure
- treating the health issue
- as a supplement to other medical treatments

Complementary healthcare approaches refer to healing practices that do not fall within the area of conventional medicine; see examples in table 3.3. Approximately 70 per cent of Australians use complementary medicines and the use has remained high over time. Contributing $5.2 billion to the economy, there is strong evidence that complementary medicines are a cost-effective option for preventative care.

Interest in alternative treatments and medicines has been steadily growing over the past decade. For example, herbal medicines are becoming a popular alternative to modern medicine in high-income countries, resulting in an increase in international trade in herbal medicines. Each year, Australians spend about $4 billion on complementary medications or practitioners such as chiropractors, homeopaths, naturopaths and Chinese herbalists.

Practitioners of traditional western medicine are starting to recognise the value of complementary healthcare approaches and are incorporating some of these into their treatments of clients. The World Health Organization supports countries in their development of national policies on complementary medicine to study their potential usefulness.

TABLE 3.3 Types of complementary medicines and examples

Type	Examples
Alternative systems and therapies	• Acupuncture • Homeopathy • Chinese or Oriental medicine
Body movement and massage	• Massage • Alexander technique • Pilates • Yoga
Herbs and supplements	• Vitamin and mineral supplements • Aromatherapy • Nutrition/diet • Chinese herbal medicine
Mind–body practices	• Meditation • Biofeedback • Hypnosis • Tai chi

Source: Adapted from Betterhealth.vic.gov.au.

3.6.1 Range of products and services available

The following examples are from the wide range of complementary healthcare approaches.

FIGURE 3.23 Acupuncture can assist with pain management.

- *Acupuncture* is an ancient system of healing that has developed over thousands of years as part of the traditional medicine of Eastern countries. Acupuncture treatment involves inserting very fine needles into the skin. They are left in either briefly or for up to 20–30 minutes. Acupuncture is claimed to be effective in a wide range of conditions, stimulating the mind and the body's own healing response.
- *Naturopathy* focuses on the holistic treatment of the individual by seeking to address symptoms of illness as well as resolving underlying causes of illness. Naturopaths recognise the importance of developing a partnership with their clients, because it is important for the individual to take responsibility for making positive lifestyle changes.
- *Massage* is one of the oldest and simplest forms of therapy. It is an excellent method of inducing relaxation. It helps reduce blood pressure, stress and anxiety levels, and overall it is beneficial to the immune system. Forms of massage include remedial massage, therapeutic massage, sports massage and Swedish massage.
- *Meditation* is a state of inner stillness. It involves focusing on an object, and breathing or verbally repeating a word (a mantra). With practice, the individual can reach a meditative state, in which they experience inner peace and stillness. The benefits of meditation include strengthening of the immune system, improved sleep, lower blood pressure and increased motivation and self-esteem.

Health apps and websites

Although complementary medicine has existed for centuries, recent technological advancements have bridged the gap between conventional and complementary healthcare. Various apps and websites now help consumers easily access and choose complementary health options. These resources are often free, mobile-friendly, and regularly updated with diverse health information.

FIGURE 3.24 Health apps are an accessible option to complement healthcare for many Australians.

Examples include:

- *Calm* includes calming background sounds which prompt relaxation and sleep.
- *headspace* includes meditation guides for all levels in an app which promote mindfulness, better sleep and reduced stress.
- *Blys mobile* helps people to book a massage from a qualified and vetted Blys professional who can come to the home and deliver the service while the person relaxes in their own home. It is also easy to rebook in the app for the next session with the preferred professional.
- *HerbList* from the National Library of Medicine provides detailed information about each herb or botanical. It includes an identifying picture, common names and scientific information about each herb. The app offers reliable and regularly updated information on potential side effects, cautions, and additional resources for further information.
- *Chinese Medicine Board of Australia* is a website which publishes regulatory standards, codes and guidelines for Chinese medicine to the public, including practitioners. It works to ensure public safety through provision of information about suitably qualified and trained practitioners of Chinese medicine in Australia.
- *Complementary Medicine Australia* is a website that helps consumers to have access to safe information, high quality products and the research and innovation that is happening in complementary medicines.

FIGURE 3.25 Herbal medicine is a natural plant-based option for complementary healthcare.

3.6.2 How complementary medicine is used

There is growing interest in complementary healthcare as a means of preventative healthcare. Evidence suggests it can help prevent the worsening of illnesses, optimise nutrition and wellbeing, and manage chronic diseases. Complementary medicines are often cost-effective and can improve health outcomes. For example, the FoodSwitch app helps Australians make better food choices, improving nutrition and preventing major health issues such as obesity, cardiovascular disease and diabetes.

Complementary healthcare can also serve as an alternative to conventional methods by treating health issues directly. This approach is often less costly and more accessible for patients, allowing for quicker and more localised treatment. For instance, a patient with back pain might see a chiropractor and physiotherapist instead of relying on medications and surgery.

Additionally, complementary healthcare can supplement other medical treatments. While traditional healthcare methods may still be necessary, complementary medicines can enhance patient recovery. For example, a patient who has undergone surgical cancer treatment might consult a naturopath to develop a holistic treatment plan, balancing pharmaceutical and herbal medicines to improve overall health.

FIGURE 3.26 A physiotherapist treating back pain

CASE STUDY 4

Ngangkari healers: 60 000 years of traditional Aboriginal methods make headway in medical clinics

By ***Sowaibah Hanifie***

28 March 2018

Ngangkari healers were considered the treasure of Aboriginal communities, and now their 60 000-year-old tradition has made its way to South Australia's Royal Adelaide Hospital and rural clinics.

Eighteen registered Ngangkari healers set up the Anangu Ngangkari Tiutaky Aboriginal Corporation (ANTAC) more than seven years ago.

Chief executive Francesca Panzironi heads a team visiting major hospitals and rural clinics in Victoria, New South Wales, South Australia and Western Australia.

'It all started with friendly chats, a cup of tea and kangaroo tails,' she laughed.

More recently they have been working in regional clinics across country SA and the new Royal Adelaide Hospital. 'I think about 95 per cent of the Australian population doesn't know this knowledge system exists,' Ms Panzironi said.

Getting recognition in mainstream health

ANTAC's objective is to provide a platform for Aboriginal healers to be recognised in the mainstream healthcare system as a form of complementary alternative medicine.

While she was a university lecturer, Ms Panzironi identified a gap in literature on Australian Aboriginal healing. She said the most comparable form of alternative medicine to Ngangkari healing was reiki, a Japanese technique for stress reduction.

Depending on a client's problems, Ngangkari healers offer three main techniques — a smoking ceremony, bush medicines or spirit realignment. 'The healer identifies where the issues are and, through a specific method of healing, which is called panpooni, they take away whether it's pain, a blockage, or some kind of obstruction, with their hands' Ms Panzironi said.

'The most unique method of healing they use is the realignment of the human spirit. They see the spirit as the core component of the human body. If it's not in the right place it can cause problems, whether physically, emotionally, mentally. With their healing touch they push it back in the right place.'

Complementary treatment for clients

The Ngangkari healers are popular with clients of all backgrounds.

Ms Panzironi said some people who used the healing technique for pain management experienced relief of their symptoms.

But for Indigenous people especially, the healers have been making a world of a difference by improving attendance rates at medical appointments.

Ms Panzironi said the treatment did not replace the role of mainstream medicine, but it could be used in conjunction with other treatments. 'I remember once the manager of the hospital said to me "Oh my god, I have never seen so many Aboriginal people in the hospital smiling and being so happy to be here",' she said.

Riverland Community Health has been inviting the Aboriginal healers to its clinic for only a few months, and the results have been life-changing for some. Aboriginal health consultant Kelly Matthews said before the healers' involvement, it was a struggle to get Indigenous clients to see a conventional doctor.

'It's a fear. It's how a doctor communicates. The first thing is to listen and not be judgemental,' she said. 'Sitting in the sitting room they feel self-conscious. I hate it myself and my skin is pale. I'd rather go to the Aboriginal clinic where you sit back, can have a yarn, catch up with family and friends.'

Since the healers have been involved with the clinic, appointments have been completely booked.

Respect between healer and client

Lyn Ackerman has had more than nine heart attacks, and after one occasion she contracted an infection from the surgical supplies used to unblock her arteries.

The Darumbal woman lives in Berri, miles away from her Queensland mob, and said the distance left her feeling spiritually empty. She said the healers' power for Indigenous people lay with their ability to reconnect them to culture, the lifeblood of their spiritual being.

Ms Matthews believed traditional medicines were a pathway to improving Aboriginal health. 'They're more open. Because they are traditional they're respected. The healers also respect the clients,' she said.

Making hospitals culturally acceptable

Ms Panzironi has been advocating for mainstream doctors to better understand the role Aboriginal healers can play in complementing other treatments.

It is an opinion shared by Jon Wardle, a senior lecturer in public health at the University of Technology Sydney. He said having the Ngangkari healers in a hospital setting would educate other staff about how Aboriginal healers could make the space culturally acceptable.

'A lot of GPs don't understand traditional medicine, so automatically they have to be sceptical of something they don't understand,' Dr Wardle said. 'This gives a good insight into how effective these treatments can be.'

He said including healers in a hospital setting could also reduce the risks alternative medicine could have, such as physical trauma caused by under-qualified therapists, or interactions with prescriptions drugs if a patient was offered herbal medicine.

The Ngangkari healers have their own form of registration, which Dr Wardle said would reduce these potential harms. 'Really people shouldn't expect a miracle cure, they shouldn't reject other treatments,' he said.

'The important thing is to have all options on the table, so if those other options are needed, they are available.'

Source: Hanife, S. (2018), 'Ngangkari healers: 60 000 years of traditional Aboriginal methods make headway in medical clinics'. *ABC News*, 28 March, https://www.abc.net.au/news/2018-03-28/aboriginal-healers-complementary-medicine-finds-its-place/9586972.

Case study questions

1. What are the three main healing techniques used by Ngangkari healers, and how do they address a client's problems?
2. According to the case study, how does the incorporation of Ngangkari healers in healthcare settings benefit both Aboriginal and Torres Strait Islander Peoples and all other clients?
3. What are some of the challenges and potential risks associated with integrating traditional healing practices like Ngangkari into mainstream healthcare, and how can these be addressed?

3.6 ACTIVITIES

Complementary healthcare

1. As a class, brainstorm all of the different types of complementary healthcare options that exist in Australia.
2. Choose one type of complementary healthcare. Use the internet to research it fully, using the following keywords:
   a. history
   b. nature (including what it is, how it works and who practices it)
   c. benefits
   d. treatment
   e. cost
   f. groups who would benefit
   g. endorsement (either of qualifications of the practitioner or accreditation authroity of the app/website).
3. If you were going to introduce a new complementary health app onto the Australian market, what would it be? Create a presentation around the parts of the app. You must give it a name and include:
   - Visuals
   - What the app aims to do
   - Cost
   - Benefits
   - Target audience
   - How this app helps to prevent illness and disease.
4. In small groups or in pairs, create a PMI chart (shown below) to summarise the advantages and any drawbacks of complementary medicines.

Plus	Minus	Interesting

5. Access the **Health Direct** weblink in the Resources panel for more examples of products and services available in the area of complementary and alternative medicines.

on Resources

Weblink Health Direct

3.6 Exercises

learnon

3.6 Quick quiz on | **3.6 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
1, 2, 3, 4	5, 6, 7, 8	9, 10, 11

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Revise your knowledge

1. Define a complementary healthcare approach.
2. Explain how a complementary healthcare approach is different to a conventional healthcare approach.
3. Describe how the Calm app and HerbList app can complement conventional medicine.
4. Identify two healthcare apps and describe how they prevent health issues.
5. While Australians continue to use conventional medical treatments, there's a growing trend towards complementary medicine. Discuss the reasons behind this trend, including the use of herbal remedies and consultations with practitioners such as acupuncturists, naturopaths and Chinese herbalists.

Apply your knowledge

6. Explain how technology has enhanced the use of complementary medicine. Use a website and a health app as examples in your answer.
7. Youssef has been diagnosed with type 2 diabetes. He has been given conventional medicine to use but wants to try other health approaches. How could complementary medicine be used to prevent diabetes, to treat his diabetes and to also supplement his conventional medicine?
8. Why does a multifaceted approach (with many different approaches used not just one) better support positive health outcomes? Use examples to support your answer.
9. Analyse the potential benefits and limitations of relying on complementary medicine apps and websites as a primary source of health information. Consider factors such as accuracy, reliability, regulation and the potential for misinformation.
10. Critique how complementary medicine options may not be suitable as a substitute for all medical situations.
11. Evaluate how complementary medicine can be used as a preventative measure.

3.6 Exam questions

Question 1 (1 mark)

A complementary healthcare approach is described as:

A. healing practices that are all harmless.
B. healing practices that are not evidence-based.
C. healing practices that don't fall within conventional medicine practices.
D. healing practices that don't have any side effects.

Question 2 (1 mark)

An example of a complementary healthcare approach is:

A. medicine
B. surgery
C. naturopathy
D. paracetamol

Question 3 (1 mark)

Which governing body regulates complementary medicines in Australia?

A. Therapeutic Goods Administration
B. Complementary Medicines Australia
C. General Practitioners Australia
D. Medical Board of Australia

Question 4 (6 marks)

Discuss the potential benefits of using complementary healthcare approaches for preventative health measures. How can these approaches contribute to overall wellbeing and disease management? Use examples to illustrate your answer.

Question 5 (8 marks)

Explain how complementary healthcare can be used as both a substitute for and a supplement to conventional medical treatments. Provide specific examples to demonstrate each approach.

3.7 Being a critical health consumer

Syllabus: Explain the importance of being a critical health consumer

Including:

- how do you know whom to believe?
- what do you need to know to make informed decisions?
- how do you assess the accuracy and credibility of health information, products and services?

A health consumer is someone who uses a health service or provides advice or support to someone who uses a health service, such as a patient, carer or family member. When someone engages with a health service they have the right to be an equal partner in healthcare that meets their needs. Speaking honestly and openly with a clinician will help the right treatment options to be made available. But sometimes it's hard to know what the right decision is to treat the health issue. Reflecting on the following questions may help to critically think about the health decisions needed for treatment of a health issue.

3.7.1 How do you know whom to believe?

When someone receives health information, it is important to verify its accuracy. This can be done by seeking a second opinion from another qualified healthcare practitioner. Consumers can also research credible sources, such as government organisations as they undergo rigorous accreditation processes. Look for URLs ending in .gov, .au, or .org. Health advice found on social media may not be accurate or could be a paid testimonial — so it is important to verify with other reliable sources.

By doing this, consumers become more informed about both the illness and the treatment options, which helps them to make well-informed decisions. A critical health consumer will also check the credentials and qualifications of the healthcare provider to ensure they have received adequate and up-to-date training. For example, if a psychologist is registered with the Australian Health Practitioner Regulation Agency (AHPRA), it means they are endorsed as suitably trained and safe to practice.

3.7.2 What do you need to know to make informed decisions?

People seek health advice for various reasons. Choosing the right option can depend on personal preferences, such as wanting to see a female doctor or selecting a service that is open late and is nearby.

FIGURE 3.27 A female patient may prefer to consult a female doctor.

Other considerations include:

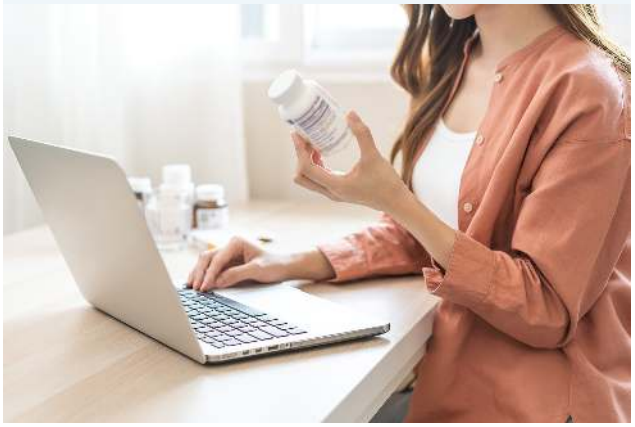
- *health information*. Understanding the severity, location on the body, and the impact on lifestyle of the health issue.
- *treatment options*. Exploring conventional treatments such as surgery or medicine, complementary options such as physiotherapy or herbal medicine, or a combination for the best outcomes.
- *cost and availability*. Considering whether treatments are covered by the Pharmaceutical Benefits Scheme (PBS), private health insurance, or if there are long wait times for public health treatments, such as knee replacements in public hospitals.
- *side effects and effectiveness*. Evaluating potential side effects, the effectiveness of treatments, time off work, and improvements in mobility if the treatment is successful.

3.7.3 How do you assess accuracy and credibility?

When receiving health information or products, it is important to assess their accuracy and credibility to ensure you receive the best care. This involves:

- *evidence support*. Checking if the information is backed by scientific studies, large sample sizes, and identifying any limitations or weaknesses.
- *credible sources*. Verifying advice from friends with credible sources, such as a GP, especially since research from Mission Australia shows young people often seek health advice from peers.
- *product verification*. Ensuring products are endorsed by government websites or peak industry bodies, such as the Australian Medical Association, to work out if they address the health issue or merely alleviate symptoms.
- *skepticism of testimonials*. Being cautious of health products promoted on social media with testimonials, as these may be from paid actors or not meet therapeutic standards. If a product sounds too good to be true, it usually is.

FIGURE 3.28 Double-checking the product information with credible websites is an important part of being a critical health consumer.



Being a critical health consumer means approaching products and information with skepticism and verifying their accuracy and credibility.

EXAM TIP

Complementary healthcare approaches / critical health consumerism

When responding to an exam question that addresses both syllabus components, recognise that complementary approaches are non-mainstream and are used alongside mainstream practices. This could suggest that these practices may lack clear evidence of success which can give opportunities to be a critical health consumer. It's important to have concrete examples in an exam response to show you have a good understanding of the diversity of these practices and the conditions they aim to support with presenting evidence; for example,

acupuncture can be used as a Complementary therapy to address the pain associated with osteoarthritis; this could be used alongside other mainstream inflammatory reducing drugs; however, evidence has been inconsistent in the success of this treatment with data showing some positive impacts, although not conclusive.

This example shows one method in assessing the accuracy and credibility of the service for those suffering arthritic conditions.

Ensure you address these questions with a critical lens to question claims and look at clear evidence to make informed health decisions.

DEPTH STUDY IDEA

Imagine you have a health issue and you want to seek health advice. Demonstrate through role play the steps you would take to be a critical health consumer by answering the questions:

- how do you know whom to believe?
- what do you need to know to make informed decisions?
- how do you assess the accuracy and credibility of health information, products and services?

Present your ideas through a structured viva voce.

3.7 ACTIVITIES

Be a critical health consumer

1. You have chronic lower back pain from a previous injury. You've tried physiotherapy and massage with limited success, and now you're considering cupping therapy. You found a local practitioner offering cupping for back pain and want to be a critical consumer before booking a session. Use this example scenario to be a critical health consumer in the following areas:
   a. products
   b. services
   c. information.

Asking questions role play/scenarios

2. Use the **Health Direct Question Builder** to prepare for a medical appointment by building a list of questions to ask a health professional in the following two scenarios.
   a. GP: routine check up
   b. Specialist: first visit
   c. Conduct a role play with a partner for the scenarios and make sure you both take turns role playing a critical health consumer.
3. Develop a scenario of a young person who is provided with either health information, products or services. One idea might be a product advertised on social media by a teenager from a different country. Divide the classroom into three stations. Each group takes their scenario to each of the stations and answers the following questions:
   - how do you know whom to believe?
   - what do you need to know to make informed decisions?
   - how do you assess the accuracy and credibility of health information, products and services?

Making informed consumer choices

4. a. When selecting an alternative medicine, what information would you require to make an informed choice?
   b. Discuss methods of accessing correct and relevant information about alternative medicines in your local area.
   c. How do you know which practitioners and healthcare organisations to believe?
   d. In small groups or in pairs, create a PMI chart (shown below) to summarise the advantages and any drawbacks of alternative medicines.

Plus	Minus	Interesting

on Resources

Weblink Health Direct Question Builder

3.7 Exercises

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3.7 Quick quiz on | **3.7 Exercise**

Learning pathways

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

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Revise your knowledge

1. Define 'critical health consumer'.
2. To be an effective critical health consumer, what are the three big questions you need to ask?
3. Outline why it is important to be a critical health consumer.
4. What could happen if someone wasn't a critical health consumer?
5. What is one way that you can check the credibility of health information, products and/or services?

Apply your knowledge

6. What are some ways you can verify the information you are being told is reliable?
7. Describe three ways you can make informed decisions about your own healthcare.
8. Explain the actions you can take to assess the accuracy and credibility of health information, products and services. Use examples from your own life.
9. Critically analyse the factors that influence decision-making in relation to health information, products and services.
10. Assess the skills that a young person needs in order to be a critical health consumer.

3.7 Exam questions

Question 1 (1 mark)

Which of the following is NOT a reliable indicator of the credibility of a health information source?

A. Information supported by evidence from scientific studies with large sample sizes.
B. Information provided by a government health organisation like the Australian Department of Health.
C. Testimonials from individuals on social media about a health product.
D. Information from a healthcare practitioner registered with APHRA.

Question 2 (3 marks)

Define the term 'critical health consumer' and explain why it is important for individuals to adopt this approach when engaging with healthcare services.

Question 3 (5 marks)

Source: Adapted from *HSC 2023, PDHPE Exam, Section I, Part B, Q.25*

Choose ONE complementary healthcare approach.

Describe strategies consumers could use to help them make an informed decision prior to using this approach.

Question 4 (5 marks)

A friend recommends a new herbal supplement that they claim cured their chronic headaches. **Describe** THREE steps you would take as a critical health consumer to evaluate the accuracy and credibility of this information.

Question 5 (6 marks)

Assess the factors a critical health consumer should consider when evaluating different treatment options for a health issue. Include examples to support your answer.

3.8 Emerging changes and challenges

Syllabus: Investigate the current and emerging changes and challenges to the healthcare system

The healthcare system in Australia is complex, serving millions of people across diverse cultural, geographic and socioeconomic backgrounds. As the nation continues to develop, the healthcare system will need to adapt and overcome challenges due to:

- *increasing population*. This places additional pressure on existing healthcare systems.
- *geographic location*. The need to support Australians across a diverse area including urban areas, rural capital cities and remote locations.
- *ageing population*. As the population ages and remains healthier, the system must meet new demands. More training for healthcare workers on conditions affecting the elderly will equip the workforce to handle these demands more effectively.
- *rising rates of chronic conditions*. Conditions such as cancer and diabetes require more person-centred care. This necessitates greater sharing of health information among those caring for the patient.
- *cost of medical research*. Ensuring improved treatments and preventative care requires significant investment. The balance between prevention and cure will become more challenging as the health system faces increasing pressure over time.
- *emerging health technologies*. These technologies can reduce patient readmissions, increase access to healthcare through telehealth, and provide innovative solutions to previously ineffective services.
- *health data*. The integration of health systems has generated valuable data that can enhance health policies.

FIGURE 3.29 Emerging health technologies means that sharing health information is more efficient and leads to better health outcomes.

Globally, Australia shares concerns about rising healthcare costs, the ability to respond to new health issues, and inequalities in access to basic healthcare and hospital waiting times.

As a result, the privatisation of healthcare — through private health insurance, private hospitals, and private medical treatments such as vaccinations — is necessary to balance public health needs. This may lead to a greater divide in access due to the costs of private healthcare. However, it can also offer more patient choice, increase public hospital availability for those without private insurance, and drive innovation through private funding, ultimately improving the health status of all Australians.

CASE STUDY 5

First-of-its-kind data tool puts Australia's international health performance in the spotlight

For the first time, the Australian Institute of Health and Welfare (AIHW) has built a tool that can be used to compare Australian data on health and healthcare with comparable international data.

The data tool, *International health data comparisons 2018,* provides a new way of comparing Australia's performance across a range of health-related measures from the data of 36 Organisation for Economic Co-operation and Development (OECD) member countries.

The tool provides users with interactive data visualisations to give a snapshot comparison of key health indicators including life expectancy, health risk factors and causes of death. It also gives insights into how Australia's healthcare system compares, including data on our pharmaceutical market, health insurance coverage, and waiting times for elective surgery.

'The data show that Australia performs relatively well across most of the indicators. For example, Australia has a life expectancy at birth of 82.5 years — above the OECD average of 80.6 years, and sixth highest among OECD countries,' said AIHW spokesperson Claire Sparke.

Australia also had the sixth lowest proportion of daily smokers (12 per cent) across OECD countries, well below the OECD average of 18 per cent.

'However, the data show that there are some areas were Australia could be doing better, such as rates of overweight and obesity,' Ms Sparke said.

Overall, Australia has the ninth highest rate of overweight and obesity (63 per cent). This is even more notable for men, with Australian men having the third highest rate of overweight and obesity, behind the United States and Chile.

When it comes to our healthcare system, the data shows waiting times for most elective surgery procedures are below the OECD average. For example, Australians waited a median of 13 days for coronary bypass compared to the OECD average 22 days.

'This new data tool is an important resource, facilitating international comparative reporting, supporting policy planning and decision-making, and enabling new types of research and analysis,' Ms Sparke said.

Source: Australian Institute of Health and Welfare.

Case study questions

1. What is the purpose of the AIHW's new international health data comparison tool, and how does it contribute to understanding Australia's health performance?
2. Based on the data presented, identify two areas where Australia performs well in comparison to other OECD countries and one area where there is room for improvement.
3. How does Australia's healthcare system compare to other OECD countries in terms of waiting times for elective surgery, and how can this challenge be overcome to improve the healthcare system of Australia?

DEPTH STUDY IDEA

Complete an open-ended problem by predicting what the impact of the emerging changes and challenges to the healthcare system will have on Australia. Present your prediction in the form of a journal article.

3.8 ACTIVITIES

New approaches to healthcare

1. Access the **New approaches to healthcare** weblink in the Resources panel to watch a video. As a class, use the 'Predict, Observe, Explain' sequence to share your thoughts with the class. This can be achieved by:
   - Predict: individually make your prediction and write down and/or discuss what will happen and why.
   - Observe: as a class watch the video and take notes throughout to use later as examples.
   - Explain: review your prediction considering your observation and your knowledge from this topic, and put together your explanation of how this approach could help overcome the challenges of the future of the health system in Australia.

Challenges to healthcare

2. Access the **Consumers health forum of Australia** weblink in the Resources panel and read about the privatisation of the healthcare system. Hold a class debate about whether we should continue with the privatisation of healthcare.
3. Investigate one type of change or challenge to Australia's healthcare system. Your investigation methods may include:
   - gathering information from local practitioners
   - researching chronic health conditions
   - contacting training organisations to collect information
   - interviewing people who regularly use innovative and emerging treatments.

   Present your findings as a report and share this with the class.

on Resources

Weblinks New approaches to healthcare
Consumers health forum of Australia

3.8 Exercises

learnon

3.8 Quick quiz on | **3.8 Exercise**

Learning pathways

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

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Revise your knowledge

1. Name three current or emerging changes or challenges to the healthcare system. Explain why they are a change or challenge.
2. Explain how Australia could overcome one challenge to provide better health to all Australians by the year 2050.
3. How is an increasingly ageing population impacting the healthcare system?
4. Describe how emerging technologies may assist the healthcare system in the future.
5. Outline the challenge of the cost of the development of medical research.

Apply your knowledge

6. Explain the potential benefits and drawbacks of increasing privatisation within the Australian healthcare system. How might these changes impact equity of access to care?
7. In your opinion, what strategies would be most effective in addressing the rising cost of healthcare in Australia while ensuring equitable access for all?
8. How can the Australian healthcare system better prepare for emerging health issues and pandemics in the future, considering the lessons learned from recent global health crises?
9. Analyse the impact of Australia's increasing population on the healthcare system.
10. Analyse the role of emerging health technologies in improving the efficiency and accessibility of healthcare services in Australia. Use examples to support your answer.

3.8 Exam questions

Question 1 (1 mark)

Source: *HSC 2021, PDHPE Exam, Section I, Part A, Q.13*

The chance of being alive for five years after being diagnosed with a condition, compared with the general population, is called the 5-year relative survival rate.

The table shows data for breast cancer and lung cancer in Australia, 2011–2015.

Cancer	5-year relative survival rate
Breast	90.8%
Lung	17.4%

Which of the following provides the most likely reason for the difference in these 5-year relative survival rates?

A. Health promotion strategies in schools have been more effective in reducing risk factors for lung cancer compared to breast cancer.

B. There was a higher hospitalisation rate and greater demand for emerging treatments for lung cancer compared to breast cancer.

C. There was a higher demand for palliative care services when individuals were diagnosed with breast cancer compared to lung cancer.

D. Technology advancements have increased early detection and provided more successful treatment options for breast cancer compared to lung cancer.

Question 2 (4 marks)

Source: *HSC 2023, PDHPE Exam, Section I, Part B, Q.22*

How does a healthy, ageing population affect Australia's healthcare system?

Question 3 (3 marks)

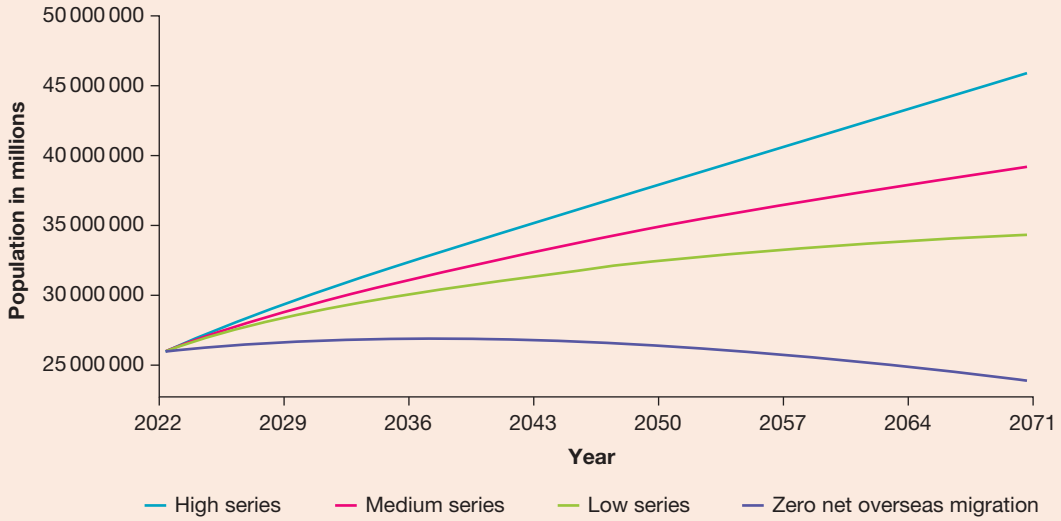
Identify and briefly **outline** THREE factors contributing to the changing demands on the Australian healthcare system.

Question 4 (5 marks)

Discuss the potential impact of privatisation on equity of access to healthcare in Australia. Your answer should consider both the potential advantages and disadvantages.

Question 5 (8 marks)

The graph is from the Australian Bureau of Statistics and shows that by 2071, there is projected to be almost 46 million Australians. **Explain** how this population growth might exacerbate the challenges of the healthcare system of Australia. How can we be socially and economically prepred for this?



Source: Australian Bureau of Statistics.

3.9 Sample exam question response

Question

Assess the effectiveness of the healthcare system in Australia. **(12 marks)**

Criteria	Marks
• Provides a comprehensive assessment of the effectiveness of the healthcare system in Australia • Presents a logical and cohesive response • Provides a range of relevant examples to support response	11–12
• Provides a sound assessment of the effectiveness of the healthcare system in Australia • Presents a logical response • Provides relevant examples	8–10
• Provides some assessment of effectiveness of the healthcare system in Australia • Presents a structured response • Provides example(s)	5–7
• Demonstrates some understanding of the effectiveness of the healthcare system in Australia	3–4
• Provides some relevant information	1–2

Sample response

Breaking down the question

Assess the effectiveness of the healthcare system in Australia.

Identify the action word: Assess — make a judgement of value, quality, outcomes, results or size

Syllabus terminology: healthcare system in Australia

Mark allocation: 12 marks — according to HSC past papers, questions worth 12 marks require answers that include multiple body paragraphs, each addressing the action word, demonstrate a comprehensive understanding and provide detailed and relevant examples.

Answering question using PEEL structure

P Identify the **Point** being raised/state topic sentence/what is this paragraph 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 healthcare system in Australia is comprehensive in its role in providing healthcare to all Australians. It includes various services and facilities such as GP's and hospitals, but there remains an issue of equity for those Australians who find it difficult to access for various reasons. While there are parts of the healthcare system that are effective, improvements can be made to help Australians who are rural and remote, Aboriginal and Torres Strait Islander Peoples and Australians with disability.

The healthcare system in Australia is designed to provide effective healthcare to all Australians.[1] It includes both primary and secondary healthcare in the diagnosis, treating, rehabilitation as well as prevention of disease and illness to promote good health. As our nation ages in a healthy way, nursing homes and various medical services are vital to keeping Australians healthy. The cost of these services could potentially be a barrier to people being able to access them if there was no system in place to address this. The nation's public health insurance, Medicare, allows for affordable access to healthcare, meaning that healthcare is more equitable for Australians.[2] For example, the Pharmaceutical Benefits Scheme provides medical prescription drugs which are subsided by the federal government so that prescription medicines are available at a more cost-effective price. The provision of many public and private healthcare services across the nation is also of benefit to Australians.[3] This means that there is more access for Australians to quality healthcare and afford able prescription medication making Australia's healthcare system effective for improving Australians' health. Despite this, there are still issues of equity that exist for some Australians.[4]

The effectiveness of Australia's healthcare system relies on its ability to have equitable distribution of healthcare facilities and services to all sections of the Australian population.[1] Australia is a multicultural society spread across a large land mass and has a variety of socioeconomic and cultural determinants that have an impact on people. As a result, access to healthcare is impacted by geographic location, knowledge and understanding of culturally appropriate services, waiting times for surgery in hospitals, and staff shortages.[2] For example, a migrant woman who is expecting a child and who is new to Australia may not know about the health services available in her local area, may not be able to understand the language spoken by the health professional and as a result, may not receive the healthcare needed.[3] Despite the availability of the service, in this instance healthcare was not accessible due to the patient's specific needs. The lack of culturally sensitive, person-centred care, such as the need for a translator, made the service ineffective in addressing the healthcare concerns. As not all services are effectively communicated to sub-groups of Australia's population, the healthcare system is not completely effective in meeting the needs of all Australians.[4]

In order to achieve effective healthcare in Australia, further opportunities exist and improvement is needed for populations such as rural and remote Australians, Aboriginal and Torres Strait Islander Peoples and Australians with disability.[1] Rural and remote Australians could have better healthcare with a strengthening of the digital infrastructure. This will enhance the availability of telehealth appointments giving greater access to specialist health practitioners. This will help prevent further health issues and lower the need for healthcare in the future. For example, if telehealth infrastructure was more accessible to Australians living in rural and remote locations, they could engage with counselling and social support services to decrease the high incidence of depression and suicide in these areas.[2] As the majority of healthcare services are in urban areas, rural and remote healthcare workforces need to be strengthened through greater funding and incentives so that rural and remote Australians can get quality care from trained professionals such as GPs and mental health practitioners. This further demonstrates Australia's healthcare system does not completely meet the needs of all sub-groups of the Australian population.[3]

Therefore, while Australia has a healthcare system which helps many Australians through the extensive services and facilities it provides at low or sometimes free of cost, there are still inequities that exist which are barriers to the healthcare system being effective for all Australians. If improvements were made to more greatly meet the needs of all sub-groups of the population, then the health system of Australia would be even more effective by addressing the inequities experienced by rural and remote populations, Aboriginal and Torres Strait Islander Peoples and Australians with disability.[4]

3.10 Review

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3.10.1 Topic summary

3.2 Healthcare system in Australia

- The role of healthcare in Australia is to provide quality health facilities and services that meet the needs of all Australians.
- The healthcare system involves the interrelationship between federal, state and local governments, health insurance funds, public and private providers, primary and secondary healthcare, and other organisations.
- Healthcare facilities and services are essential in diagnosing, treating and rehabilitating the ill and injured. They also play an important role in preventing illness and promoting health.
- The range of healthcare facilities and services in Australia include public and private hospitals, mental health services, nursing homes, medical practitioners and specialists, community programs, health promotion services and other health professionals who offer complementary healthcare.
- Access to healthcare facilities and services is affected by a number of factors, including affordability, location, knowledge of service and language barriers. These factors result in inequity in access to healthcare.
- Efficient and effective healthcare services, along with adequate public housing, employment, education, hygiene and environmental safety, are all crucial factors that have an impact on levels of health.
- Future opportunities exist to increase the effectiveness of the healthcare system including increased digital infrastructure for rural and remote Australians to access telehealth consultations, more culturally appropriate health services for Aboriginal and Torres Strait Islander Peoples and lowering the cost of health services for people with disability.

3.3 Shared responsibility for the health system

- The levels of responsibility include the government (federal, state and territory, local) and the non-government sector (private and not-for-profit community groups).
- The government sector provides important policy, funds via taxes for public hospitals, health research, some pharmaceuticals, women's health programs, health promotion, rehabilitation programs and public health activities.
- The non-government sector plays an important role in providing healthcare services, such as the health-promotion strategies undertaken by the Heart Foundation.
- Individuals have a responsibility to take actions to promote their own health, thus reducing the financial burden on taxpayers.

3.4 Collaboration between government and non-government organisations

- Person-centred care is an approach to care that places the needs and preferences of the patient first.
- Government and non-government organisations work together to provide person-centered care.

3.5 Health expenditure and its impact

- Medicare is the national health insurance program that was introduced to support the health of all Australians. It covers a proportion of basic medical and public hospital expenses. Medicare is funded by Australian taxpayers.
- Private health insurance allows people to be covered for extra medical and private hospital costs.

- The Australian government's income-tested rebate is an incentive for people to join private health insurance. There is a Medicare levy on high earners who do not have private health insurance. The 'lifetime health cover' scheme is there to encourage membership.
- A large proportion of health expenditure in Australia is spent on curative services, with a small amount allocated to health promotion. Ill health is expensive for the government and the individual. Taxes fund the bulk of the medical systems within Australia.
- Health promotion is a much more cost-effective way of reducing disease and illness in the long term.
- Australian government-funded programs such as the NDIS and My Aged Care provide support to Australians to live healthier lives.
- A healthier ageing population will have a large impact on current and future generations, so there is a need to continue to innovate in health technology and to place a greater focus on person-centered care.

3.6 Complementary healthcare approaches

- Complementary medicine is an established part of healthcare in Australia.
- There are a range of complementary healthcare approaches, such as acupuncture, chiropractic, herbalism, naturopathy and massage. There are also technology-based options such as apps and websites which help to prevent, treat and supplement other medical treatments.

3.7 Being a critical health consumer

- It is important to be a critical health consumer to be able to make informed decisions when choosing the right healthcare approach.
- The individual needs to investigate the services on offer, the costs, qualifications and experience of the practitioner, and the health claims being made to ensure reliability and credibility before committing to products or services.

3.8 Emerging changes and challenges

- The healthcare system in Australia is complex and serves a diverse population.
- Challenges include:
  - increasing population
  - geographic diversity, including urban, rural and remote areas
  - ageing population requiring more training for healthcare workers
  - rising rates of chronic conditions like cancer and diabetes
  - high cost of medical research
  - emerging health technologies like telehealth
  - integration of health data to enhance policies.
- Privatisation of healthcare is necessary to balance public health needs, but may lead to greater divide in access.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Investigation — Current and future healthcare and the changing role of the doctor-patient relationship

Time: 5 hours

Task description: Investigation with a choice of presentation modes (written, verbal or multi-modal).

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) list and marking rubric are available in the Teacher resources.

Resources

Digital documents Topic 3 summary (doc-43050)
Key terms glossary (doc-43051)
Revision quiz (doc-43052)

Interactivity Missing word interactive quiz (int-9360)

3.10 Exercises

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3.10 Revision quiz | **3.10 Exam questions**

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3.10 Exam questions

Section I

Question 1 (1 mark)

Which of the following is NOT a major type of healthcare in Australia?

A. Primary healthcare
B. Secondary healthcare
C. Tertiary healthcare
D. Hospitals

Question 2 (1 mark)

Which of the following factors can contribute to inequitable access to healthcare services in Australia?

A. Geographic location
B. Socioeconomic status
C. Cultural background
D. All of the above

Question 3 (1 mark)

Which of the following statements best describes the primary goal of the National Disability Insurance Scheme (NDIS)?

A. To provide income support for people with disability.
B. To fund research into the causes and cures of disability.
C. To offer free healthcare services to people with disability.
D. To provide funding for support and services that help people with disability achieve their goals.

Question 4 (1 mark)

How might the privatisation of healthcare in Australia contribute to improvements in the healthcare system in the future?

A. By increasing competition and encouraging innovation in healthcare services.
B. By reducing the overall cost of healthcare for individuals and the government.
C. By eliminating waiting times for elective surgeries and procedures.
D. By ensuring equitable access to healthcare services for all Australians.

Section II

Question 5 (3 marks)

Outline the range and type of healthcare facilities and services that exist in Australia.

Question 6 (4 marks)

Explain the role of healthcare within Australia.

Question 7 (4 marks)

Compare primary and secondary healthcare. What services does each provide to promote health? Use examples to help illustrate your response.

Question 8 (4 marks)

Describe the roles and responsibilities of the Australian government in the provision of health services.

Question 9 (5 marks)

Discuss the issue of equitable access to healthcare facilities and services across the Australian population.

Question 10 (5 marks)

Using examples, **discuss** the level of responsibility a community should assume for individual health problems and suggest what should be done.

Question 11 (3 marks)

Outline the benefits of early intervention in terms of healthcare expenditure.

Question 12 (5 marks)

Discuss the benefits of collaboration between government and non-government sectors for person-centred care.

Question 13 (5 marks)

Explain how Medicare attempts to provide equity in access to healthcare.

Question 14 (4 marks)

Discuss the benefits of private health insurance.

Question 15 (5 marks)

Describe how health expenditure that supports preventative healthcare will impact future populations.

Question 16 (4 marks)

Explain the importance of being a critical health consumer.

Question 17 (5 marks)

Explain why complementary healthcare approaches have grown in popularity in developed countries over recent years.

Section III

Question 18 (12 marks)

Evaluate the strategies employed by Australia's healthcare system to achieve better health outcomes for all Australians.

4 Technology and data in Australia's healthcare system

LEARNING SEQUENCE

4.1 Overview 173
4.2 The relationship between technology and health 174
4.3 New technologies and treatments 181
4.4 The impact of digital health on the healthcare system 191
4.5 How big data is shaping the health of Australians 201
4.6 Sample exam question response 208
4.7 Review 210

4.1 Overview

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Key inquiry question

How is the growing and changing use of technology and data impacting Australia's healthcare system?

Syllabus

	Syllabus content	Subtopic
○	■ Discuss the relationship between technology and health **Example(s):** Measuring. Monitoring. Early diagnosis. Precision surgery.	**4.2**
○	■ Investigate new technologies and treatments in the healthcare system **Example(s):** Health apps. Artificial intelligence. Assistive technology.	**4.3**
○	■ Evaluate the impact of digital health on the healthcare system **Including:** • what is digital heath? • what services exist? • to what extent has digital health been successful in connecting health information? • what challenges and opportunities does digital health provide for individuals and organisations?	**4.4**
○	■ Examine how big data is shaping the health of Australians **Including:** • how is it being used? • how is it reducing healthcare spending? • how is it being used to cure and manage diseases? • what measures need to be taken to ensure privacy and confidentiality of personal information?	**4.5**

Outcomes

- examines how technology and data can achieve better health for all Australians HM-12-02
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

4.2 The relationship between technology and health

Syllabus: Discuss the relationship between technology and health

Technology has become an important part of the healthcare of Australians. It includes any technology such as medical devices, IT systems, algorithms, artificial intelligence (AI), cloud and blockchain and is designed to help healthcare organisations and individuals. Technology has improved access to healthcare, changed the way people manage health, reduced the burden of travelling for health and wellbeing reasons and empowered people to manage their own health conditions.

technology the application of scientific knowledge for practical purposes, especially in industry. In the context of healthcare, this includes medical devices, IT systems, algorithms and AI.

4.2.1 Measuring health

Technology has enabled the measurement of health outside traditional health settings such as doctor's surgeries and hospitals. Healthcare workers can now use everyday technology to better measure the health of their patients. Examples include a doctor using a small portable ultrasound device which plugs into a smartphone to see high quality images without the need of big, cumbersome and expensive machines.

Smartwatches and other wearable devices can be used to:

- track someone's activity, and manage physical activity levels and training regimes
- track symptoms and measures such as heart rate, blood pressure, kilojoule intake
- monitor and receive notifications about an individual's health. This data can lead to the risk of heart attacks and other heart problems being flagged.

FIGURE 4.1 Wearable devices such as smartwatches can connect to other devices as a way of constantly measuring health.

4.2.2 Monitoring health

Once a health concern is measured, technology can help someone to monitor their health. For example, if someone isn't sleeping well, technology can help to track sleeping patterns including time awake, time asleep, how long you sleep in different stages of the sleep cycle, breathing patterns, heart rate and oxygen level. All this data combined may provide a clearer picture of sleeping issues and help a doctor to know which course of action to take next. The ability to monitor health is improving as emerging technologies continue to improve. For example, the smart contact lens can continuously monitor glucose levels, providing a minimally invasive way of monitoring health for those with diabetes.

FIGURE 4.2 Apps help to monitor aspects of health such as diet by tracking what someone eats and the nutrients that are consumed.

FIGURE 4.3 A smart ring monitoring brain waves.

FIGURE 4.4 A smart contact lens which can help to monitor glucose levels in patients with diabetes.

4.2.3 Early diagnosis of health issues

Medical professionals use technology in the early identification and diagnosis of health issues.

Through use of technologies such as MRI, PET scan and CT scan, health professionals can better pinpoint the correct diagnosis and detect it earlier.

For example, innovations in health technology mean that doctors can use 3D holographic models for the first time to see detail of a patient's anatomy such as a heart, allowing for clarity of diagnosis and a better prognosis for the patient.

Another example is the ACEMID system which is used to get a better diagnosis of melanoma. It does this by using 92 cameras to build a 3D model of your body. It creates an avatar which identifies every mole and determines its size within 1 second. The clarity in imaging and identification of unique features of each human body means that people are diagnosed earlier and can seek medical advice more quickly.

FIGURE 4.5 Diagnostic imaging and holographic models are allowing doctors to see more than ever before, leading to earlier diagnosis.

4.2.4 Precision surgery

precision surgery a surgical approach that uses advanced technologies such as robotics and imaging to improve accuracy and minimise invasiveness

Precision surgery is a type of surgery that uses advanced technology to make operations more accurate and less invasive. It is part of a broader approach called precision medicine, which tailors medical treatment to the individual characteristics of each patient.

Key elements of precision medicine:

- *advanced imaging.* Surgeons use high-resolution imaging techniques, such as 3D scans and augmented reality, to get a detailed view of the area they are operating on. This helps them plan and perform the surgery with greater precision.
- *personalised treatment.* Instead of using the same treatment for everyone, doctors look at your genes, environment and lifestyle to find the best approach for you. This helps make treatments more effective and can reduce side effects.
- *robotic assistance*. Surgical robots can perform delicate and complex tasks with a high degree of accuracy. These robots are controlled by surgeons and can make smaller, more precise movements than human hands.
- *minimally invasive techniques.* Precision surgery often involves minimally invasive procedures, which use smaller cuts. This reduces recovery time and minimises the risk of complications.

FIGURE 4.6 Precision surgery techniques using robots are being used to enhance medical procedures and reduce recovery time for patients.

Examples of precision surgery technology:

- *NuVasive Pulse System*. Helps neurosurgeons with image assistance and more efficient surgical approaches in spine procedures.
- *daVinci Robotic Surgical System.* Enhances surgical senses and provides advanced data analytics for better-informed cancer surgery.
- *LASIK laser eye surgery*. Uses a laser to improve vision by changing the way light is bent as it passes through the cornea.

FIGURE 4.7 LASIK laser eye surgery is an example of a precision surgery technique.

Precision surgery aims to improve surgical outcomes by making procedures safer, more effective and less invasive.

The overall impact of precision surgery is significant. It enhances efficiency, allows for easy manoeuvrability, and enables precise steps without the fatigue and tremors that can affect surgeons. The use of robotic assistance for stitching further improves the quality of the procedure, making it superior to traditional open or laparoscopic surgery techniques.

Additionally, training consoles and interactive video monitoring provide surgeons with up-to-date training, so they have access to the latest techniques and knowledge. This increases the likelihood of successful outcomes.

For patients, precision surgery offers the most advanced imaging technology, reduces exposure to radiation, and boosts confidence in the surgical results. It also decreases recovery times and minimises complications, allowing patients to return to their daily lives more quickly, thereby enhancing their overall health and wellbeing.

CASE STUDY 1

Remote monitoring

The challenge

Managing the rising cost of delivering healthcare is a major challenge for Australia.

Targeting health services to assist the chronically ill and ageing population can help to reduce the load on our health system and hospitals.

'Frequent flyers' are high-cost patients to the health system, who typically have a combination of complex medical conditions such as lung disease, cardiovascular disease or diabetes and visit the hospital two or more times per year.

Our response

Funded by the Australian Government Telehealth Pilots Program and CSIRO, we built on our e-health expertise and partnered with NGOs, local health districts, hospitals and industry partners TeleMedCare, iiNet and Samsung to deliver a national telehealth trial of home monitoring of chronic disease for aged care.

Patient and clinician using monitoring equipment

Trial partners across the country including the ACT, Townsville, Bacchus Marsh, Melton, Launceston and Greater Western Sydney meant this was Australia's first large scale telehealth clinical trial.

In total, 287 patients participated in the trial across the six sites. Test patients were provided with a telehealth device that included participant/clinician video conferencing capabilities, messaging features and the delivery of clinical and study-specific questionnaires, as well as vital signs devices to monitor their ECG, heart rate, spirometry, blood pressure, oxygen saturation, body weight and body temperature, with glucometry an optional add-on.

The 12-month trial enabled chronic disease patients to self-manage their conditions at home through the provision of telehealth services. Health workers could assess changes in their patient's conditions remotely and provide appropriate care interventions earlier to help them stay out of hospital and improve their quality of life.

The results

Home monitoring saves healthcare dollars and patient lives.

Our research showed savings of 24 per cent over the year to the healthcare system made through falls in the number and cost of GP visits, specialist visits and procedures carried out. Patients in the trial also reported improvements in anxiety, depression and quality of life, with many finding that home monitoring gave them a better understanding of their chronic conditions.

In addition, the trial also showed a substantial 53 per cent decrease in hospital admission and most importantly a 76 per cent reduction in length of stay if admitted to hospital during the 12-month trial. This is a huge saving when you consider the cost of a hospital bed per day is estimated to be about $2051 in Australia.

Patients also had a reduced mortality rate of more than 40 per cent.

Our research showed the return on investment of a telemonitoring initiative on a national scale would be in the order of five to one by reducing demand on hospital inpatient and outpatient services, reduced visits to GPs, reduced visits from community nurses and an overall reduced demand on increasingly scarce clinical resources.

Source: CSIRO, Home monitoring of chronic diseases, https://www.csiro.au/en/research/health-medical/diagnostics/Home-monitoring.

Case study questions

1. What is the main challenge facing the Australian healthcare system, as described in the text?
2. Who are 'frequent flyers' and what are some of the medical conditions they typically experience?
3. List three ways in which the telehealth trial helped patients manage and monitor their chronic conditions at home.
4. How can we use the information in this study to support the use of telehealth services to all aged and rural and remote communities?

DEPTH STUDY IDEA

Investigate the use of robotic surgery (such as the da Vinci Surgical System) and examine the social, economic, physical and emotional benefits and limitations of robotic surgery. Develop a case study using a specific procedure. Present your findings as a portfolio of evidence or journal article.

EXAM TIP

Discuss the relationship between technology and health

An exam question may ask you to show the interrelationship between an example of technology and how it impacts on the PEMM parameters. The PEMM syllabus parameters include: Precision surgery, Early diagnosis, Monitoring and Measurement. It is beneficial to use a technological example that has an impact on these factors. The example below shows this bolded.

The use of 3D holographic technologies can provide a clear vision of a patient's heart to determine potential issues regarding the circulation of blood. This has a dramatic impact on providing an ***early diagnosis*** *of possible blood clotting and informs health practitioners with opportunities for heart health to be* ***monitored and measured*** *through prescribed medication (blood thinners). This may influence the viscosity of blood to reduce the risk of heart attack. This preventative action may remove the* ***need for surgery*** *and long hospital stays to overall reduce the burden on the public health system.*

It is helpful to use technological examples that are current and highly innovative to support your arguments in responding to this sort of exam question.

4.2 ACTIVITIES

Technology brainstorm

1. As a class, brainstorm the different types of technology that helps you to measure and monitor health.

Medical imaging

2. a. Discuss the importance of early disease detection and diagnosis.
   b. Discuss how using medical images such as MRI, PET scan and CT scans can help visualise what is going on inside the body.
   c. Have a class discussion about the benefits of medical imaging in:
   - early detection
   - accurate diagnosis
   - personalised treatment planning
   - improved patient outcomes.

Precision surgery

3. Develop an infographic about precision surgery including:
   - definition of precision surgery
   - an example of precision surgery
   - benefits of precision surgery.

Examples of precision surgery

4. Use the weblinks **LASIK laser eye surgery, NuVasive** and **daVinci** (or other up-to-date examples) in the Resources panel to explore the examples of precision surgery and answer the following questions.
   a. Describe the features and characteristics of the technology.
   b. Identify what part of the human body the technology is used for.
   c. What are the benefits of the technology to the patient and the healthcare system?
   d. What are the limitations of the technology to the patient and the healthcare system?

Technology tools

5. Use the **ACEMID system** weblink in the Resources panel to determine how this technology aids in early diagnosis of skin cancer such as melanoma.

on Resources

Weblinks LASIK laser eye surgery
NuVasive
daVinci
ACEMID system

4.2 Exercises

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4.2 Quick quiz on | **4.2 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
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Revise your knowledge

1. How can technology help an individual to measure their own health?
2. How are advancements in technology, such as portable ultrasounds and wearable health trackers, changing the way healthcare is delivered and monitored?

3. Explain how technology can be used to monitor sleep patterns and assist in early diagnosis of sleep disorders.
4. Identify three technological advancements and describe how they assist medical professionals in diagnosing health issues.
5. Outline the benefits of precision surgery techniques for both the patient and the healthcare system.

Apply your knowledge

6. Evaluate the impact of technology on health in relation to two of the following areas:
   - Measuring physiological indicators
   - Monitoring health data
   - Early diagnosis of disease
   - Precision surgery

   In your response, consider both the benefits and limitations of technology in each chosen area. Support your arguments with specific examples.
7. Discuss how precision surgery technology is changing the healthcare system. Be sure to mention impacts for the patient, healthcare worker and the healthcare system in Australia.
8. Assess the social impacts of technology on doctor/patient relationships.
9. Evaluate the claim that LASIK surgery is a safe, reliable and painless procedure that effectively improves vision.
10. To what extent does health rely on technology? Use examples to support your answer.

4.2 Exam questions

Question 1 (1 mark)

Which of the following is an example of how technology can be used to monitor health patterns?

A. Using a smartphone to measure blood pressure
B. Tracking the number of steps taken each day
C. Monitoring blood glucose levels with a smartwatch
D. All of the above

Question 2 (1 mark)

Which of the following is NOT a benefit of precision surgery?

A. Reduced surgeon fatigue and tremors
B. Increased radiation exposure for the patient
C. Enhanced surgical senses and greater surgeon autonomy
D. More efficient and precise surgical steps

Question 3 (5 marks)

Explain how advancements in medical imaging technology have improved the early detection and diagnosis of health issues.

Question 4 (8 marks)

Analyse how technology has enabled the measurement of health outside traditional health settings, and discuss the implications of this for both healthcare workers and individuals.

Question 5 (8 marks)

Evaluate the impact of precision surgery on both surgeons and patients, considering its advantages over traditional surgical techniques.

4.3 New technologies and treatments

Syllabus: Investigate new technologies and treatments in the healthcare system

The landscape of new and emerging technologies in healthcare is constantly evolving and expanding. An example of this is neurotechnology, where a device is embedded in the human brain to remotely transmit data about brain activity. This data is hoped to aid in curing Alzheimer's and Parkinson's diseases.

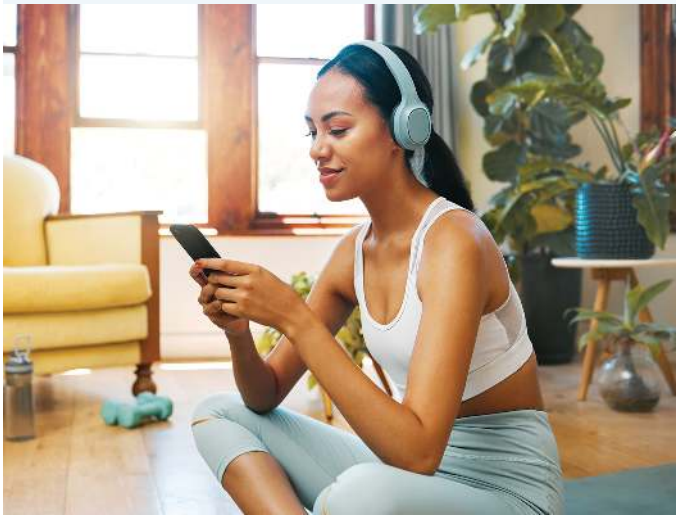
Other examples include the use of 3D printing to create joints or implants for surgical use, gene-editing technology to treat diseases such as cystic fibrosis, and health wearables such as smartwatches that track steps, physical fitness, heartbeats and sleeping patterns.

Future advancements may include 'insideables' and 'implantables', which would operate from within the body to assist organs such as the brain and heart. Smart pills, which are swallowed, could help diagnose health issues by transmitting data from images inside the body or measure values such as blood glucose levels.

There has also been significant growth in the development and use of health apps, artificial intelligence and assistive technology. These advancements aim to improve health outcomes and achieve better health status for all Australians.

FIGURE 4.8 The 3D printed joints in this knee are an example of how 3D printing can be used to show the precise and unique parts of a skeleton.

FIGURE 4.9 Health apps are an easily accessible way to track the health of an individual by giving real-time feedback.



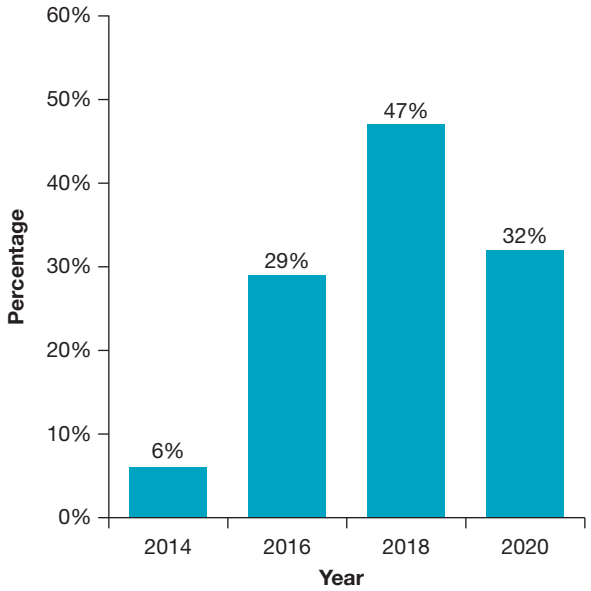
4.3.1 Health apps

The National Institute of Health defines **health apps** as software programs on mobile devices that process health-related data on or for their users. They can be used to maintain, improve or manage the health of an individual or a community.

The use of health apps by Australians has grown steadily over the past decade, despite a brief drop in 2020 due to the COVID-19 pandemic. During that time, apps were used for checking into places and digital contact tracing, like the COVIDSafe app. Even so, about one-third of Australians use health apps regularly now.

health apps software programs on mobile devices that process health-related data for users, helping them manage their health and wellbeing

FIGURE 4.10 The use of health apps has continued to rise with almost a third of Australians using health apps.



Source: Statista 2025.

Globally, the estimated number of mobile health applications (also known as mHealth apps) ranges between 54 000 to 350 000 apps. Due to the amount and accessibility of these apps, it can be challenging for individuals to work out which information is accurate and useful.

FIGURE 4.11 Health apps provide a wide variety of services including access to medical advice at a person's fingertips.

In response, the Australian government has developed an Assessment Framework for mHealth apps. This framework is designed to guide mHealth app developers in Australia. Its primary objective is to enhance the credibility of these apps and assist users in identifying reliable and trustworthy apps. Find out more by using the weblink **Assessment Framework for mHealth apps** in the Resources panel.

The range of health apps is continually expanding, and various Australian health app examples are listed and described in table 4.1.

TABLE 4.1 Examples of mHealth apps

Health area	Name of the app	Description
Mental health	beyond now safety planning	Created by Lifeline, this app helps to develop an easy to follow plan for someone who is having trouble coping or for someone who is experiencing suicidal thoughts or feelings.
Pregnancy and parenting apps	Feed Safe	Helps mothers to make the best decisions about alcohol consumption and breastfeeding.
Concussion	HeadCheck	Helps managers, parents and trainers to check for concussion in children and helps them to manage the recovery from concussion.

Health area	Name of the app	Description
Nutrition	FoodSwitch	Helps someone make better food choices through using their phone to scan a product and it then suggests healthier alternatives.
Management of prescription medicine	MedicineWise	Helps someone to scan or search for medications, create lists, schedule reminders, store and share medication information and gain more understanding about medications.
Physiotherapy	PhysiApp	The app allows physiotherapists to set, manage and track the exact exercises for their client with an easy-to-use visual, auditory and written step-by-step guide. It also allows patients to submit to their physiotherapist the completed exercises so that tracking can happen.
First aid	First Aid App	Helps you to know what to do in common first aid situations through step-by-step advice.
Brain health	BrainTrack	Helps someone to explore and understand changes in cognition over time through playing a set of fun travel-themed games which are adapted from validated cognition testing.

FIGURE 4.12 Health apps are not just about traditional medical services. They also include first aid, pregnancy information and can help in the management of prescription medicine.

4.3.2 Artificial intelligence

Artificial intelligence (AI) is a technology that can enhance patient care and improve quality of life. By integrating AI advancements into clinical practice, healthcare professionals gain essential knowledge and tools. AI operates on large datasets and uses algorithms that learn from patterns and features within this data.

Artificial Intelligence (AI) the simulation of human intelligence processes by machines, especially computer systems. In healthcare, AI is used for tasks such as diagnosis, treatment planning and drug discovery.

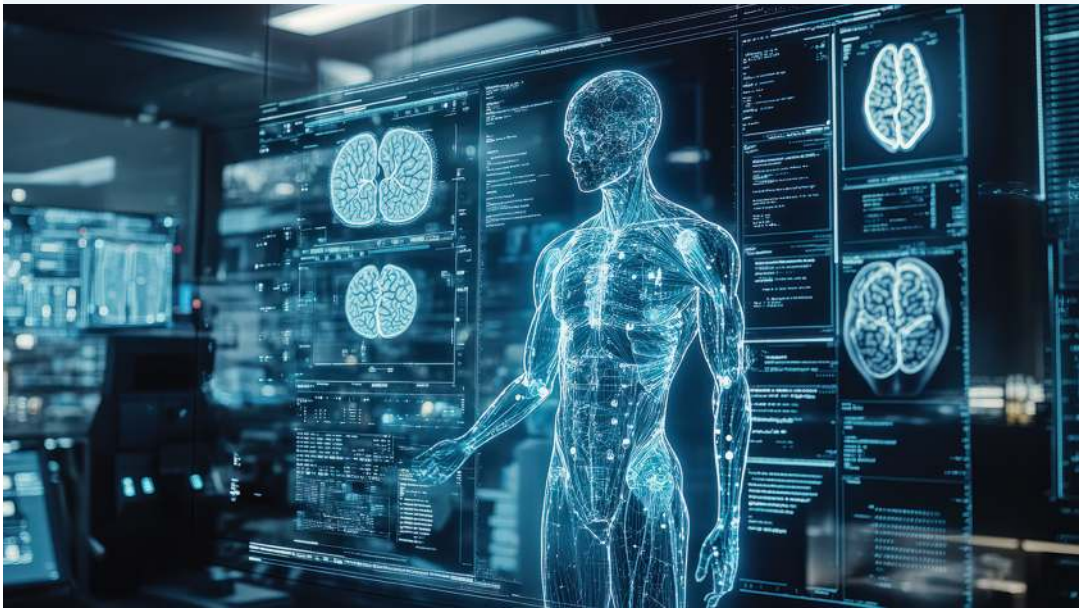
There are many benefits of using AI in healthcare, such as:

- Speeding up the discovery process of new medicines. AI tools help researchers to understand diseases better through the various datasets to identify underlying causes. Once these are identified, AI designs molecules which can target the cause to better combat the disease.
- Delivering more personalised care. AI tools can read the combined dataset of various diagnostic tests, such as scans, MRIs and X-rays, to create a more personalised treatment plan according to the genetic makeup of the patient.
- Helping treatments get to the patients who need them quicker. AI tools can help understand a geographic area and the needs of the people who live in it, meaning that more stock can be sent to those places such as hospitals, health centres and pharmacies where it is needed the most. For example, if an algorithm detects that a local hospital is seeing more asthma patients than another area, more asthma medication can be sent to that hospital, allowing patients to receive their medication more quickly.

Current examples of artificial intelligence being used in healthcare include:

- Machine learning — applying models to patient data to predict which treatment protocols are most likely to succeed based on individual contexts.
- Neural network — determining the likelihood of a patient acquiring a disease based on datasets.
- Deep learning — used in radiology to recognise potential cancerous tissue beyond what the human eye can see, increasing precision in diagnosis and treatment.

FIGURE 4.13 Deep learning involves layering lots of layers of patient data to analyse patterns from sources such as medical imaging and electronic health records.



- Robots — physical robots equipped with AI technology act as a 'brain' and are used as surgical robots. This increases precision, reduces invasiveness and enhances the surgeon's ability to see more clearly. These robots are commonly used in head and neck, prostate and gynaecological surgeries.

FIGURE 4.14 Surgical robots are being used in various types of medical procedures powered by the knowledge obtained through artificial intelligence.

- Diagnosis and treatment — prediction models using big data can determine whether someone is likely to develop conditions such as heart disease or sepsis (the body's extreme reaction to an infection).
- Messaging alerts and relevant, targeted content.
- Chatbots for patient interaction to fill prescriptions and make appointments to see a medical professional.

FIGURE 4.15 Artificial Intelligence is being used to inform doctors more about the patient and medical needs, leading to better diagnosis and treatment options.

While advancements in AI technology show great potential to improve health outcomes for Australians, experts urge caution. AI algorithms can still exhibit race and gender biases. For instance, there is more data available for male-dominated diseases, putting women at greater risk. Doctors may misdiagnose a heart attack in women because their symptoms can present differently.

Another concern is the privacy of health data. AI tools require vast amounts of data for training, which can lead to the memorisation and retention of information, potentially giving third parties access to private health data. Therefore, healthcare entities must ensure proper privacy safeguards to minimise the risk of data breaches and protect private information.

CASE STUDY 2

WHO calls for safe and ethical AI for health

16 May 2023 Departmental update

The World Health Organization (WHO) is calling for caution to be exercised in using artificial intelligence (AI) generated large language model tools (LLMs) to protect and promote human wellbeing, human safety, and autonomy, and preserve public health.

LLMs include some of the most rapidly expanding platforms such as ChatGPT, Bard, Bert and many others that imitate understanding, processing and producing human communication.

…

[Incautious] adoption of untested systems could lead to errors by healthcare workers, cause harm to patients, erode trust in AI and thereby undermine (or delay) the potential long-term benefits and uses of such technologies around the world.

Concerns that call for rigorous oversight needed for the technologies to be used in safe, effective and ethical ways include:

- the data used to train AI may be biased, generating misleading or inaccurate information that could pose risks to health, equity and inclusiveness;
- LLMs generate responses that can appear authoritative and plausible to an end user; however, these responses may be completely incorrect or contain serious errors, especially for health-related responses;
- LLMs may be trained on data for which consent may not have been previously provided for such use, and LLMs may not protect sensitive data (including health data) that a user provides to an application to generate a response;
- LLMs can be misused to generate and disseminate highly convincing disinformation in the form of text, audio or video content that is difficult for the public to differentiate from reliable health content; and
- while committed to harnessing new technologies, including AI and digital health to improve human health, WHO recommends that policy-makers ensure patient safety and protection while technology firms work to commercialise LLMs.

WHO proposes that these concerns be addressed, and clear evidence of benefit be measured before their widespread use in routine healthcare and medicine – whether by individuals, care providers or health system administrators and policy-makers.

WHO reiterates the importance of applying ethical principles and appropriate governance, as enumerated in the WHO guidance on the ethics and governance of AI for health, when designing, developing, and deploying AI for health. The 6 core principles identified by WHO are: (1) protect autonomy; (2) promote human well-being, human safety, and the public interest; (3) ensure transparency, explainability, and intelligibility; (4) foster responsibility and accountability; (5) ensure inclusiveness and equity; (6) promote AI that is responsive and sustainable.

Source: WHO (2023), WHO calls for safe and ethical AI for health, 16 May, https://www.who.int/news/item/16-05-2023-who-calls-for-safe-and-ethical-ai-for-health.

Case study questions

1. The article mentions that AI 'may be biased and generate misleading or inaccurate information'. How could bias in AI algorithms used for healthcare potentially impact different groups of people?
2. The WHO calls for 'safe and ethical AI for health'. What ethical considerations do you think are important when developing and using AI in healthcare, particularly in relation to patient privacy and data security?
3. How might the increasing use of AI in healthcare affect the roles and responsibilities of healthcare professionals in the future?
4. Explain the importance of the 6 core principles of AI as identified by WHO.
5. If an AI system makes a mistake in a healthcare setting, who do you think should be held responsible? How can we ensure accountability when AI is involved in healthcare decisions?

4.3.3 Assistive technology

Assistive technology is the various products, systems and services designed to enhance accessibility, independence, learning, working, participation and inclusion. Globally, 2.5 billion people require one or more assistive products. In Australia, the Australian Bureau of Statistics reports that 2.3 million Australians with disability use some form of assistive technology.

assistive technology any item, piece of equipment or product system that is used to increase, maintain or improve the functional capabilities of the healthcare system

Assistive technology can be classified as either low-tech, such as large print books, or high-tech, such as smart home devices and power wheelchairs. Those who most commonly need assistive technology include older adults, children, people with disability, and individuals with chronic health conditions.

TABLE 4.2 Summary of assistive technology

What does assistive technology do to help?	How does it help?	Examples of assistive technology
Enhances independence	Increased mobility helps someone to move around freely, reducing the reliance on others.	Wheelchairs, walkers, prosthetics
	Through better control of someone's environment, everyday activities are easier.	Adaptive utensils such as cutlery with weights which helps steady a hand to eat the food off the cutlery, dressing aids such as button hooks that allow someone to close a buttoned shirt easily
	Through technology which allows for better expression of themselves.	Text-to-speech software and communication boards for someone with a speech impairment
Improves learning and working	People with learning difficulties can access information and complete assignments for their education.	Screen readers and mind-mapping tools
	Workplaces can accommodate technologies to help people participate fully in their employment.	Ergonomic keyboards, screen magnifiers, voice recognition software
Fosters participation and inclusion	Helps people to communicate better which enhances social interaction and connection to build positive relationships.	Closed captioning services, augmentative and alternative communication (AAC) such as a speech-generating device with a voice, hearing aids
	Helps people to participate in community life.	Accessible transportation, navigation aids, accessible websites and apps
Boosts wellbeing	Through increasing confidence, self-esteem and quality of life, as there is less frustration, an increased independence of daily tasks and further promoting someone's full potential to participate actively in all aspects of life.	Vehicle modifications such as hand controls instead of foot pedals, systems designed to remotely control appliances, speech output software and phones with large tactile buttons

FIGURE 4.16 Wearable pieces of assistive technology, such as hearing aids and prosthetics, allow for full participation and inclusion in everyday activities.

FIGURE 4.17 Text to speech software and technology which allows for vehicle modifications can boost wellbeing and participation in community life.

In Australia, assistive technology is part of Australia's Disability Strategy 2021–2031. The strategy aims to prioritise providing better availability of assistive technology by improving access for more National Disability Insurance Scheme (NDIS) participants. While this is beneficial for those eligible for the NDIS, the 2022 *Assistive Technology for All* report found that the NDIS only funds assistive technology for 10 per cent of Australians with disability. This leaves 90 per cent of Australians with disability ineligible for NDIS funding and having to navigate over 100 other funding avenues. This is concerning, as many Australians lack access to assistive technologies that could enhance their health and wellbeing.

Better and more equitable access to assistive technology supports the full achievement of the United Nations' Sustainable Development Goals. To help assess the usefulness of assistive technology, the World Health Organization developed the GATE (Global Cooperation on Assistive Technology) framework. GATE's vision is to create 'a world where assistive technology is universally accessible to everyone, everywhere'. It outlines the 5Ps: People, Policy, Products, service Provision, and Personnel, as the framework to achieve equitable access to assistive technology worldwide.

FIGURE 4.18 The World Health Organization's GATE framework used to assess the equitable accessibility of assistive technology for everyone.

DEPTH STUDY

Investigate one new assistive technology and determine how it can help to better achieve a Sustainable Development Goal. Show your understanding in the form of a multimodal presentation or video.

4.3 ACTIVITIES

Health technology presentation

1. **a.** As a class, complete a Jigsaw activity about new technologies and treatments by forming groups of three. Number each member of the group 1–3 and move students into their numbered groups:
   Person 1: Health apps
   Person 2. Artificial Intelligence
   Person 3: Assistive technology.
   Allow time for each group to research their given health technology and then to compile a presentation about the type of technology using specific examples. You may use the weblink **healthdirect Health and wellbeing apps** in the Resources panel to help get you started in your research.
   - **i.** Describe what the technology is.
   - **ii.** Outline what the technology does for someone.
   - **iii.** Pick one example and outline how this technology is assisting someone's healthcare.

   b. Go back to your original group of three and share with them the details about your technology.

Access to health technology

2. Use the **WHO GATE** weblink in the Resources panel to determine how equitable the access to assistive technology is in Australia.
3. Provide an example of how the World Health Organization's GATE framework could promote health equity for a group who experience poor health outcomes.

on Resources

Weblinks Assessment Framework for mHealth apps
healthdirect Health and wellbeing apps
WHO GATE
Australia's Disability Strategy 2021–2031

4.3 Exercises

learnon

4.3 Quick quiz on | **3.3 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
1, 2, 3, 6	4, 5, 7	8, 9, 10, 11, 12

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Revise your knowledge

1. Identify one health app and outline how it can help someone to maintain, improve or manage their health.
2. What challenges do consumers face when using health apps? How is the Australian government addressing this issue?
3. What are the potential benefits and risks associated with the use of AI in healthcare? Give examples to support your answer.
4. Explain how assistive technology can enhance independence and improve learning and working for individuals with disability.
5. How can the government and medical experts ease community perceptions about the use of AI technologies?

Apply your knowledge

6. Use figure 4.10 to identify what is the main trend in health app usage among Australians over the past ten years. What possible explanation is given for the change observed in 2020?
7. About one in three Australians use a health app as part of their everyday life. Predict what this rate will be in 10 years' time and explain why you made that prediction.
8. Discuss the current state of access to assistive technology in Australia, highlighting the disparity in funding and its potential impact on the health and wellbeing of Australians with disability.
9. a. Explain how AI is being used to improve healthcare outcomes.
   b. Discuss at least two different applications of AI in the healthcare system and analyse their potential benefits and challenges. Provide specific examples to support your answer.
10. How might the ethical implications of using AI in healthcare influence its adoption in medical decision-making?
11. Evaluate the impact of health apps on individual and population health. Consider factors such as accessibility, effectiveness and privacy concerns.
12. Analyse how assistive technology can enhance the quality of life for people with disability. Discuss at least two different types of assistive technology, explaining how they can help individuals overcome challenges and participate more fully in society.

4.3 Exam questions

Question 1 (1 mark)

Which of the following is NOT a primary benefit of assistive technology for a person with disability?

A. Enhanced independence
B. Improved learning and working
C. Increased reliance on others
D. Fostering participation and inclusion

Question 2 (1 mark)

What is a key concern regarding the use of Artificial Intelligence (AI) in healthcare, despite its potential benefits?

A. AI algorithms may perpetuate existing biases, leading to unequal treatment.
B. AI technology is too expensive to implement in most healthcare settings.
C. AI systems are not capable of processing complex medical data.
D. AI will replace healthcare professionals, leading to job losses.

Question 3 (4 marks)

How can artificial intelligence (AI) be used to improve the delivery of healthcare services?

Question 4 (6 marks)

Investigate two examples of emerging technologies in healthcare, outlining their potential applications and benefits for improving health outcomes.

Question 5 (8 marks)

Analyse the impact of limited access to assistive technology on the health and wellbeing of Australians with disability. In your response, consider the following:

- physical health
- emotional health
- social health
- economic opportunities.

4.4 The impact of digital health on the healthcare system

Syllabus: Evaluate the impact of digital health on the healthcare system

Including:

- what is digital heath?
- what services exist?
- to what extent has digital health been successful in connecting health information?
- what challenges and opportunities does digital health provide for individuals and organisations?

4.4.1 What is digital health?

The Australian Institute of Health and Welfare (AIHW) defines **digital health** as 'systems, tools and services based on information and communications technology that can be used to treat patients and collect and share a patient's health information'. It includes:

- mobile health apps
- **electronic health records**

digital health the use of digital technologies to improve health and healthcare. This includes electronic health records, telehealth and mobile health apps.

electronic health records (EHRs) digital versions of a patient's paper chart, containing their medical history, diagnoses, medications, treatment plans, immunisation dates, allergies, radiology images, and laboratory and test results

- **telehealth** and telemedicine
- electronic referrals
- electronic prescriptions
- robotics
- artificial intelligence.

telehealth the use of telecommunications technology to provide healthcare services remotely

Connecting sources of health information digitally can improve health outcomes for Australians by:

- supporting more efficient clinical decision-making
- enabling quality improvements through data-driven insights
- allowing both health consumers and clinicians to access health data at any time, leading to more informed health practices.

FIGURE 4.19 The use of digital health is connecting health information, such as mobile health apps, doctors' visits, prescriptions and medical imaging, like never before.

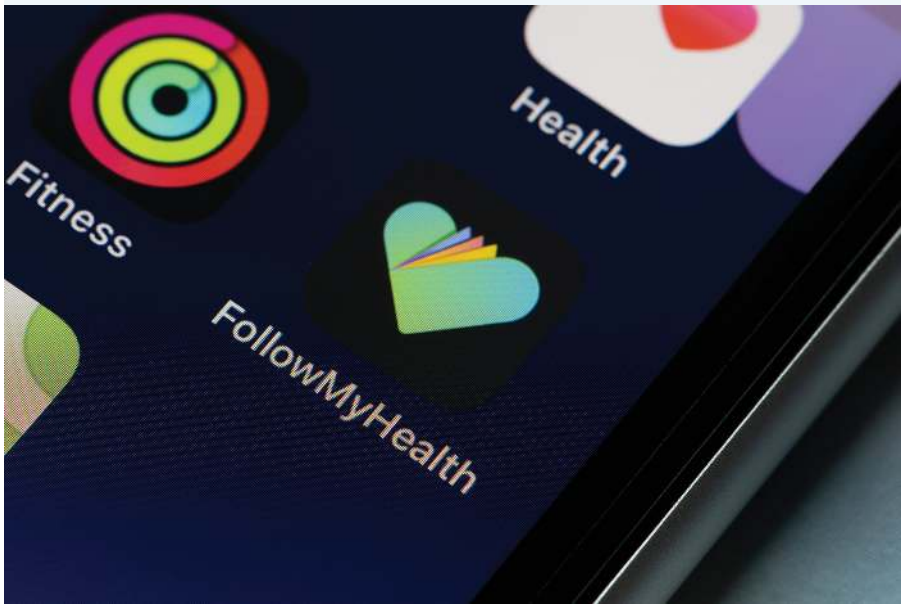
FIGURE 4.20 Digital health allows for greater access to health through online prescriptions.

4.4.2 What services exist?

The variety of digital health services in Australia help individuals access up-to-date health information easily. These services include:

- electronic prescribing — provides the option of digital prescription rather than paper prescriptions
- electronic referrals — provides the option for digital referrals to other physicians rather than paper copies
- electronic medical records — provides the option for both the doctor and the patient to access medical records from a digital platform
- SMS vaccination reminders and patient surveys — allows for reminders and timely feedback to improve quality of care
- telehealth and virtual care — allows for ease of access and on-the-go connection
- wearable devices such as smartwatches — allows health information, such as heart rate, steps taken and hours of sleep, to be made available on demand to both doctor and patient

FIGURE 4.21 Various health apps are available, collecting large amounts of data about a person and are accessible by both the patient and the doctor upon demand.



- robotics and artificial intelligence — help to make fewer human errors in medicine and more precise judgement on healthcare based on data
- Medicare online — an online account designed to help someone make a claim, update and access health statements
- secure messaging of clinical information — information is encrypted, secure and sent between necessary health professionals
- My Health Record — Australia's digital online secure health record where health information can be stored and accessed by the patient. This can be accessed by authorised personnel in medical situations such as emergencies and helps target treatment of the patient.

Digital health can lead to better health outcomes for patients by providing digital systems to deliver better patient care. It also allows doctors and nurses to securely access a patient's important health information whenever and wherever it is needed.

With the growth of digital health data, the Australian Digital Health Agency was established to provide connected digital solutions and technology services to support health system infrastructure. The Agency develops policies that enhance national programs, such as the Australian Immunisation Register.

The Australian Digital Health Agency also created My Health Record, which stores health information in one place, accessible at any time by both consumers and healthcare providers. This is useful in emergencies and appointments, aiding decision-making by providing comprehensive information. For example, if someone needs emergency care and is unconscious, a doctor can access their health information to make informed decisions about treatment and rehabilitation based on known allergies, past surgeries, specialist information and current medications. Similarly, during a GP appointment, both the GP and patient can collaborate more effectively, considering immunisation history, local health district facilities and previous treatments.

CASE STUDY 3

New mobile app addresses surging consumer demand for key health information

The Australian Digital Health Agency has launched its first consumer mobile application, **my health**, powered by My Health Record.

With consumer views of My Health Record increasing by 292 per cent in the last financial year, the **my health** app makes it more convenient than ever for Australians to securely and instantly access key health information in My Health Record in the palm of their hands.

The user-friendly interface provides direct visibility of key health information, available whenever and wherever it is needed.

my health is an easy-to-use digital health tool that offers users greater autonomy over their health journey and supports active participation in everyday health management.

From the home screen users can quickly:

- see medicines information history
- check pathology results including COVID-19 and respiratory test results
- view vaccination history and upcoming immunisations for themselves and authorised family members
- track allergies and reactions information
- view hospital discharge summaries
- keep track of advance care planning documents
- share their documents with others
- view multiple records, such as records for children under 14 and any other records with authorised access.

…

The accessibility of a consumer-facing app further enhances the way people engage with their health and equips users with a simplified way to efficiently see, store and share documents. Having this information right at users' fingertips can help facilitate greater engagement and support throughout the entirety of their health and wellness journey.

'We know from our own research that almost two-thirds of Australians regularly use their mobile phones to access, share and manage their health information, so the release of a consumer-facing app is not only a logical technical development but also a direct response to consumer demand for access to health information when and where they need it,' Ms Cattermole said.

In order to provide the most user friendly and accessible app experience, The Agency conducted interviews, surveys, accessibility and usability testing with consumer users and medical professionals from a range of ages, locations, cultural backgrounds and varying complexity of health needs.

my health is fortified with robust data protection mechanisms to secure consumers' health information against external interference and is fully integrated with end-to-end encryption with the My Health Record platform. A seamless connection between the app and the platform is made by leveraging the new Health API Gateway. New health data is automatically downloaded onto the app's interface as soon as it is available on My Health Record.

Source: digitalhealth.gov.au (2023) New mobile app addresses surging demand for key health information, 3 March, https://www.digitalhealth.gov.au/newsroom/media-releases/new-mobile-app-addresses-surging-consumer-demand-for-key-health-information.

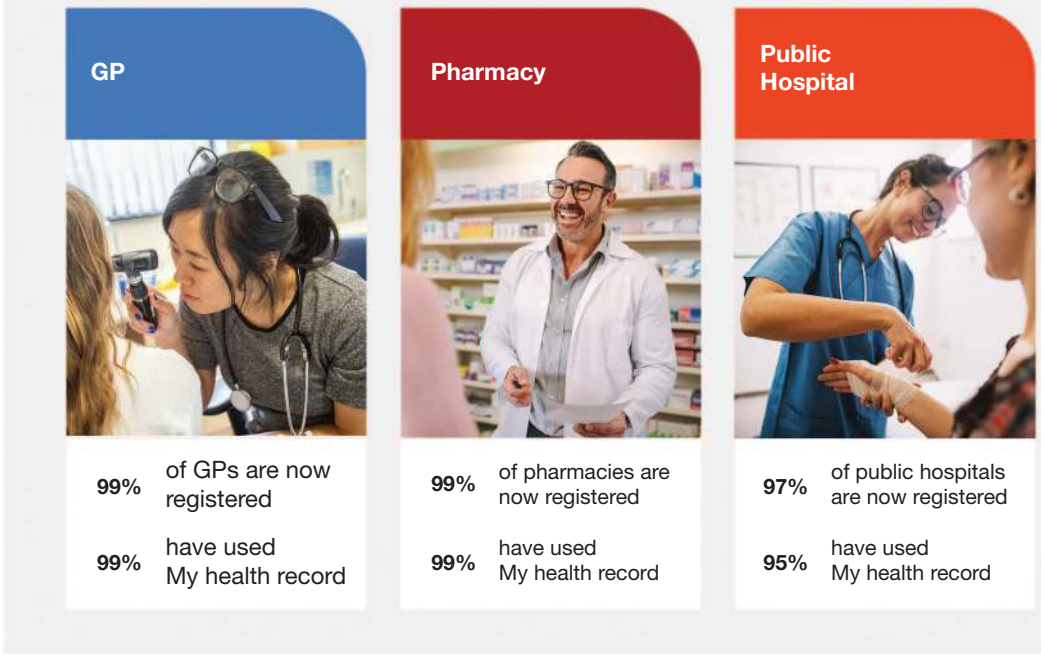
Case study questions

1. How does the availability of a mobile app like 'my health' empower individuals to take greater control of their own health and wellbeing?
2. What are the potential benefits and challenges of using digital health technologies, such as the 'my health' app, to access and manage personal health information?
3. How can digital health technologies like the 'my health' app be used to improve health literacy and promote informed decision-making about health and wellbeing?
4. What barriers or limitations do you perceive in the use of digital technologies?

4.4.3 To what extent has digital health been successful in connecting health information?

As of 2024, Australia's digital health platform, My Health Record, contains 24 million records out of a possible 27 million Australians. The high rate of record creation is likely due to the 2018–19 policy change requiring Australians to opt-out if they did not want a My Health Record, resulting in automatic creation for those who did not opt-out. These records hold millions of clinical, medicine and consumer documents. Consequently, healthcare providers such as public hospitals, pharmacists, and GPs can access extensive health data simultaneously with patients (see figure 4.22).

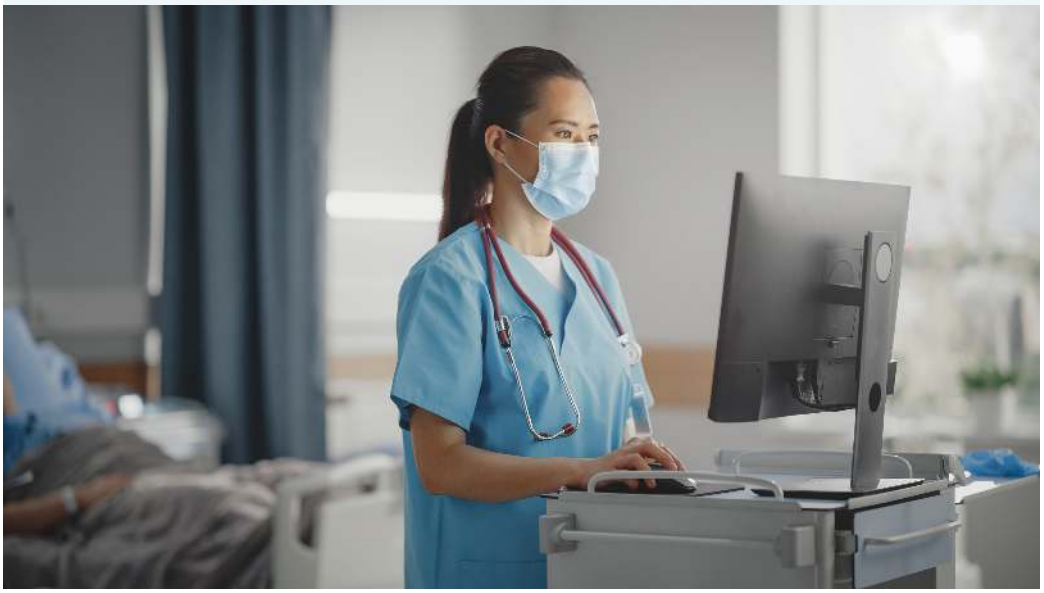
FIGURE 4.22 Almost all GPs, pharmacies and public hospitals have registered and use My Health Records.



Source: https://www.digitalhealth.gov.au/initiatives-and-programs/my-health-record/statistics.

Information such as pathology reports, specialist letters and diagnostic imaging reports have all increased in views in the 13 months between August 2023 and August 2024 (see figure 4.23).

FIGURE 4.23 There has been an increase in pathology reports, specialist letters and diagnostic imaging reports being viewed.



Source: https://www.digitalhealth.gov.au/initiatives-and-programs/my-health-record/statistics.

Of the 24 million My Health Records, over 98 per cent contain some information, but only 20 per cent of diagnostic imaging, such as MRI scans or ultrasounds, have been uploaded. Most of the data in these records is limited to Medicare and Pharmaceutical Benefits Scheme information, making it less useful and detailed about a patient's health. Although the amount of available information is increasing, as of 2024, only 6.31 million records have been viewed, meaning only about 27 per cent of Australians are using this digital health information.

To address this, the Australian government allocated $951 million in the 2023–24 budget to upgrade and modernise My Health Record, making it easier for patients to use and improving health outcomes by reducing system duplication. There are further opportunities for more specialists and aged care agencies to connect records through My Health Record, allowing more Australians to access their data over time.

The connection of health data into one accessible source is limited at present but is growing. Other digital health technologies, including wearable devices, continue to increase with popularity and could one day add to the data available to a physician or patient.

What challenges and opportunities does digital health provide for individuals and organisations?

Digital health has the potential to improve patient outcomes and lead to better quality of life. It can support the healthcare system to be more efficient and keep Australians as healthy as they can be. Many challenges and opportunities exist to make this a reality and some of these are outlined below.

Equity of access

Australia's diverse population and varying geographic locations mean that access to the internet and the latest technology differ for various population groups. Less reliable internet in rural and remote areas leads to access issues, making some Australians in these areas less familiar and less confident in using digital health information compared to their metropolitan counterparts. Socioeconomic status,

equity of access ensuring that everyone has fair and equal access to healthcare services, regardless of their location, socioeconomic status or other factors

disability, and a lack of knowledge and experience with new technology also affects people's ability to use the digital health system. The National Data Health Strategy aims to overcome these barriers and improve access for all Australians.

Interoperability and data standards

Interoperability is the ability for software and systems to share and use information. As technology supporting interoperability improves, so does the capability for health information to reach the right person at the right time. The Australian government's Digital Health Blueprint and Action Plan 2023–2033 outlines a ten-year vision for a sustainable and connected healthcare system, fostering innovation and secure data sharing.

interoperability the ability of different information systems, devices and applications to connect, exchange and use information in a coordinated manner

data citizenship the responsible and ethical use of data

data literacy the ability to read, understand, create and communicate data as information

Data literacy and data citizenship

Providing Australians with digital health records requires engagement with these tools (known as **data citizenship**). Increasing **data literacy** levels is essential for understanding how health data can improve health outcomes. This can be achieved through better education, familiarisation and active participation with digital health tools.

Security and privacy

One of the barriers Australians face in using digital health is the concern over the security and privacy of health data, including the storage and sharing of sensitive information. Despite legislative requirements to protect data and uphold privacy, there remains a need for improved safety measures to guard against hackers and misuse of this data.

FIGURE 4.24 Data security measures need to remain a priority to enable the privacy of Australian's sensitive health records.

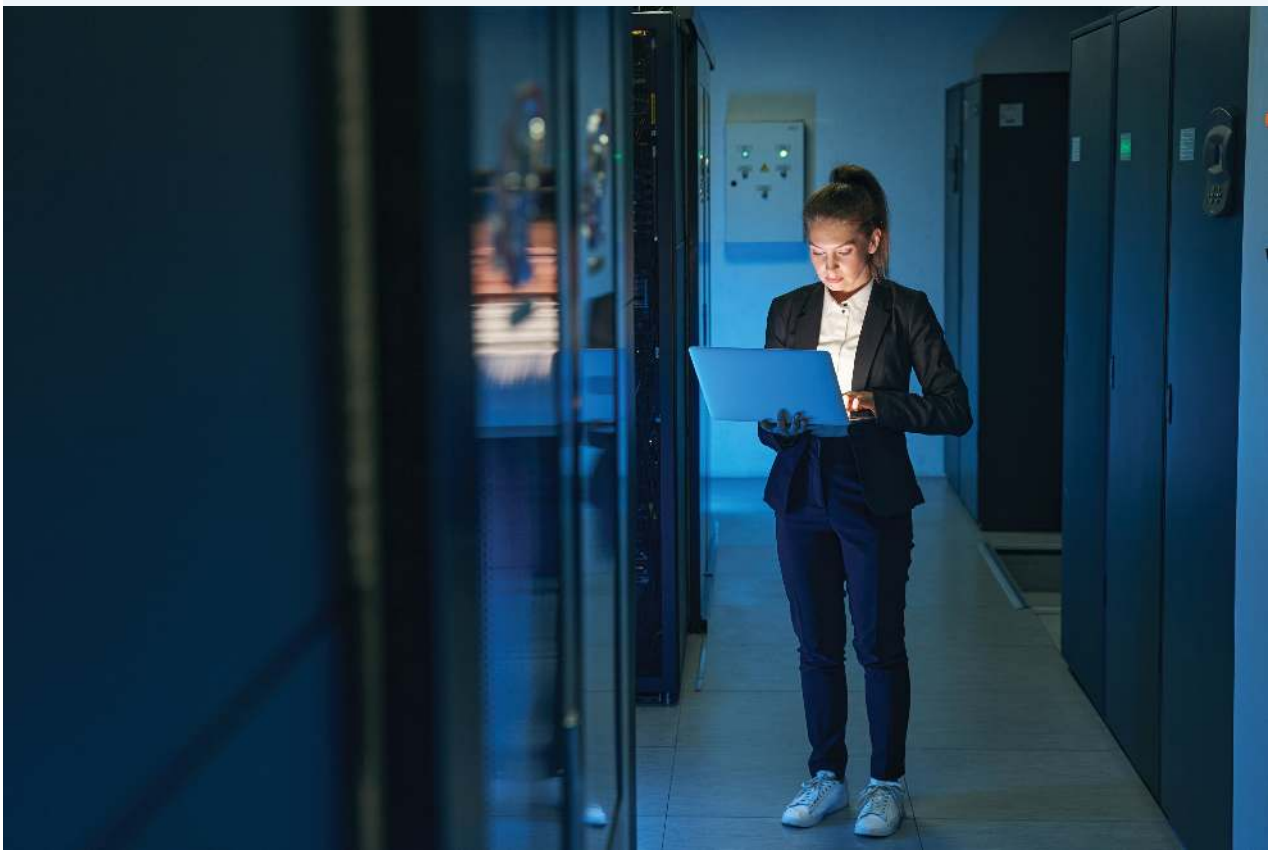


FIGURE 4.25 The Australian government's Digital Health Blueprint and Action Plan aims to connect the health system in Australia.

Source: https://www.health.gov.au/resources/publications/the-digital-health-blueprint-and-action-plan-2023-2033?language=en.

DEPTH STUDY IDEA

a. Through the following open-ended problem, critically evaluate My Health Record, weighing its potential benefits against potential risks and proposing solutions to address existing limitations and ethical concerns.
b. Present your findings by developing a portfolio of evidence including a collection of research articles, policy documents, expert opinions and case studies to demonstrate a comprehensive understanding of the topic.
c. Include reflective writing to analyse the ethical and practical dimensions of My Health Record.
d. Alternative options to present your finding are:
   i. a health report to a government body
   ii. a hypothetical information seminar to health providers/local communities.

Open-ended problem:

My Health Record, Australia's national digital health record system, aims to improve healthcare efficiency and patient outcomes by providing a centralised platform for storing and sharing health information. However, its implementation has been met with both enthusiasm and apprehension, raising critical questions about data privacy, data security and equity of access.

EXAM TIP

Evaluate the impact of digital health on the healthcare system

An exam question addressing the syllabus area, *identifying the challenges and opportunities of digital health for individuals and organisations*, will require a strong understanding of platforms such as Australia's Digital Health Agency and My Health Record to inform and monitor health conditions. Think about the potential power of these platforms holding vast amounts of medical records that are transferable and allow for communication of medical history and health status to address health priorities. Provide a strong critique of the potential and limitations of this data being available, thinking about issues of accessibility, data literacy and security and confidentiality. Examples within these technologies can be used to support this.

For example: *The myhealth app provides a medical history profile that allows doctors to view personal and family history, view medication intake and track allergies. This can inform the correct prescription of medications and support more efficiency in diagnosis and treatment. While this is beneficial in addressing health conditions, it may create an easy target for hackers to access your private information and may be futile if doctors are lacking training in navigating the myhealth system or if some smaller hospitals or specialists are not utilising My Health Records, creating levels of health inequity.*

4.4 ACTIVITIES

Digital health definition

1. As a class, discuss the definition that the AIHW gives to digital health. Brainstorm a list of digital health service examples.

Case study scenarios

2. Divide the class into small groups. Present each group with a case study scenario involving a patient who has a My Health Record. Scenario examples:
   - A patient with a complex medical history is admitted to the emergency department unconscious.
   - A patient with a chronic illness sees a new specialist for the first time.
   - A patient travels interstate and needs to see a doctor for an unexpected illness.

   Each group is required to analyse how My Health Record could be beneficial in their assigned scenario by answering the following questions.
   a. How does it improve communication and coordination of care?
   b. How does it facilitate informed decision-making?
   c. How does it potentially improve patient outcomes?

National Digital Health Strategy

3. Access the **National Digital Health Strategy** weblink in the Resources panel and read about the strategy. Use your knowledge to answer the following questions.
   a. According to the National Digital Health Strategy, what is a key focus for improving digital health literacy among Australians?
   b. How does the National Digital Health Strategy aim to address the issue of varying levels of internet access and digital literacy across different populations in Australia?
   c. What role does interoperability play in achieving the goals of the National Digital Health Strategy?

Using health data

4. Access the latest data behind **My Health Record statistics** in the Resources panel. Use the data to justify how well Australia is utilising health data and propose how it can continue to improve.

on Resources

Weblinks National Digital Health Strategy
My Health Record statistics

4.4 Exercises

learnon

4.4 Quick quiz on | **4.4 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
1, 2, 3, 4, 6	5, 7, 9	8, 10, 11

Revise your knowledge

1. Provide a brief overview of the Australian Digital Health Agency and its role in developing digital health solutions.
2. Explain the purpose of the My Health Record as a centralised repository of health information.
3. What types of information does it contain?
4. Who can access it?
5. Analyse the role of the Australian Digital Health Agency and My Health Record in improving the efficiency and effectiveness of the Australian healthcare system.

Apply your knowledge

6. How can using data from various sources, such as specialists and aged care agencies, help the My Health Record become a more comprehensive and integrated platform?
7. What are the challenges in having equitable access to digital health services in Australia? In your answer discuss factors such as geographical location, socioeconomic status and digital literacy.
8. Evaluate the impact of digital health services on patient care and health outcomes in Australia. Use specific examples of digital health technologies and initiatives.
9. Explain how the ability for software and systems to share and use information contributes to the effective functioning of a digital health ecosystem.
10. How can initiatives like the Australian government's digital health blueprint contribute to improving healthcare outcomes?
11. Discuss the importance of data security and privacy in the context of digital health.
    Outline the potential risks associated with the collection, storage and sharing of sensitive health information.

4.4 Exam questions

Question 1 (1 mark)

What is the primary purpose of the Australian Digital Health Agency?

A. To develop mobile health applications for consumers
B. To provide connected digital solutions and technology services for the healthcare system
C. To conduct research on digital health technologies
D. To regulate the use of digital health technologies in Australia

Question 2 (1 mark)

Which of the following statements best reflects the current state and potential of My Health Record in Australia's digital health landscape?

A. My Health Record has achieved widespread adoption and comprehensive data integration, effectively connecting all aspects of patient health information.
B. Despite high enrollment rates, My Health Record faces challenges in data comprehensiveness and active utilisation, indicating a need for further development and engagement to realise its full potential.
C. My Health Record is primarily limited to storing Medicare and Pharmaceutical Benefits Scheme data, rendering it largely irrelevant for broader healthcare applications.
D. The Australian government has ceased further investment in My Health Record due to limited uptake and concerns about data security and privacy.

Question 3 (3 marks)

Outline the intended purposes of My Health Record and its role in the Australian healthcare system.

Question 4 (4 marks)

Discuss the types of information commonly found in My Health Records and how this information can be useful for patients and healthcare providers.

Question 5 (8 marks)

Analyse how legislation, technology and individual responsibility can contribute to safeguarding patient data and maintaining trust in digital health services.

4.5 How big data is shaping the health of Australians

Syllabus: Examine how big data is shaping the health of Australians

Including:

- how is it being used?
- how is it reducing healthcare spending?
- how is it being used to cure and manage diseases?
- what measures need to be taken to ensure privacy and confidentiality of personal information?

Big data are extremely large datasets that may be analysed through computer programs to reveal patterns, trends and associations. There has been a rapid growth and reliance on technology for everyday tasks including ones related to healthcare. As a result, much data exists and is available for use. This is known as big data, which can be mined (or analysed and used) to understand the factors affecting Australians' health and potentially transform healthcare for individuals and the system as a whole.

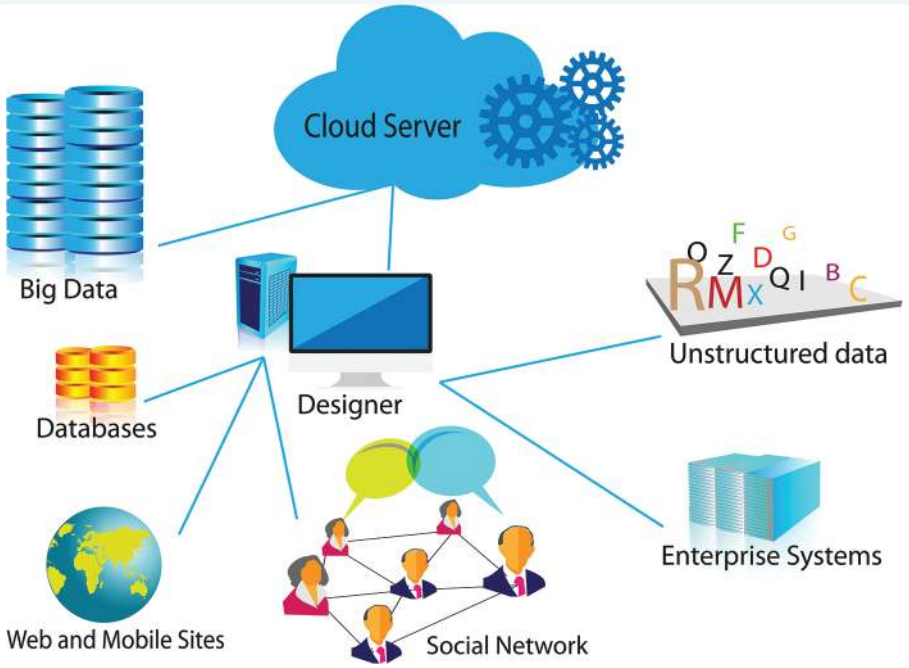
big data extremely large data sets that may be analysed computationally to reveal patterns, trends and associations, especially relating to human behaviour and interaction

The McKell Institute characterises big data by the three Vs:

- high Volume: which is about the large amount of data available
- high Velocity: which refers to the fast speed of how the data can be accessed, processed and utilised through analysis
- high Variety: which points to the variety of formats and sources of data.

Experts are just beginning to realise the possibilities of using big data. It is estimated that only about 0.5 per cent of all data produced is currently analysed and used. This is partly due to the sheer volume of data and the fact that about 80 per cent of it is unstructured, making it difficult for computers to read consistently.

FIGURE 4.26 Big data is compiled from lots of different places, comprised of both structured and unstructed data, and stored in large storage areas ready to be used.



Big data sources can be found in spreadsheets, text files, databases such as the Australian Bureau of Statistics, Health Data Australia, and could also include data found in emails, messages, PDFs, digital images, social media posts and more. Big data is almost always digital and is stored in data storage centres. It can be collected from surveys; appointments between patients and doctors; hospital visits; electronic health records; diagnosis patterns; genetic data; records of online purchases; fitness monitoring systems; existing research data; legal data about deaths, births and marriages; immigration rates and more. Collectively, this creates a lot of data (known as big data) and can be used in various ways to increase the health status of Australians.

4.5.1 How is big data being used?

The use of healthcare big data has benefits for both the individual and the healthcare system.

The connections between various sources of data mean that big data is being used to better understand patients and improve their healthcare treatment plans. Further research into large datasets may help researchers find medical breakthroughs and facilitate cures for diseases. For example, if the government reviewed aged care services, they could include data from My Health Record, hospital admissions, government and non-government organisations, residential data and data from NDIS to better understand the needs of aged care patients and related services.

Big data is being used for the development of healthcare technology and disease prevention. This is specifically facilitated by Australia's electronic health record system, My Health Record, a digital platform that securely stores individual health information. Both individuals and healthcare workers can access these records when a health issue arises, whether inside or outside traditional settings such as doctors' surgeries.

FIGURE 4.27 A patient and doctor accessing big data sources to further understand about the treatment options for a disease.

Additionally, big data is improving health policy by providing larger volumes and higher quality data. Policy developers can use this data to make informed decisions about the direction of healthcare in Australia, such as emphasising preventative healthcare and implementing effective prevention strategies. The National Health Data Hub, a unique national data system, links data between government administrative health and aged care datasets. It has been effectively used to determine policy, research and direction for aged care and other healthcare forms in Australia.

By enabling patients and physicians to make better evidence-based decisions, big data is improving health outcomes through more effective diagnosis and treatment plans.

4.5.2 How is big data reducing healthcare spending?

The Australian government spent $137.6 billion on healthcare in 2023–24 and costs are rising every year. Big data can be used to reduce the spending on healthcare through predictive analytics which will improve early diagnosis of health issues. Through the use of statistical analysis, healthcare modelling can both forecast the course of a disease, predict the outcome in the future and help patients to better stick to their medical treatment plan. For example, by analysing large datasets such as patient records, genetic information and lifestyle data, predictive models can identify patients most at risk of a disease such as diabetes. This means that early intervention and preventative measures can help a person to identify lifestyle behaviours and receive early treatment, which is often less expensive than treating advanced stages of a disease.

It can also help to prevent medical errors leading to infection or further medical complications and therefore reduces the need for a patient to stay longer in hospital.

Big data helps physicians understand the unique features of their patients, enabling personalised treatment options and improving patient experience. This encourages patients to seek help sooner for their health needs. A preventative approach reduces healthcare spending, as early treatment is often less costly, and tailored treatment plans allow for more targeted resource allocation.

Australia's Primary Health Care 10 Year Plan 2022–2032 highlights the use of big data to evaluate innovations and target areas where the most impact can prevent health issues, leading to greater investment in essential primary healthcare areas.

4.5.3 How is big data being used to cure and manage diseases?

The AIHW's ***Australia's health 2024: Australia's health data landscape*** report mentions the importance of data for evidence-based decision-making, aiding early detection and diagnosis of medical conditions. Big data personalises treatment by considering each individual's unique genetic makeup, lifestyle factors and medical history, leading to better care through precision medicine. For example, someone in remote Australia can have their condition managed and monitored remotely with real-time alerts to medical staff.

Big data also accelerates research into cures for major health issues such as cancer, diabetes and heart disease. It provides doctors with additional information, enhancing their knowledge and understanding to make accurate diagnoses and start treatment plans sooner. Lissie's example is shown below.

Lissie is a 30-year-old woman who has been experiencing persistent fatigue, muscle weakness and occasional dizziness for the past six months. She has visited multiple doctors, had many tests including blood tests and tests for thyroid function but the tests have come back inconclusive for a diagnosis. Lissie's doctor decides to the leverage the power of big data to gain a better understanding, so he gathers data through Lissie's:

- electronic health records such as medications, past diagnosis and family history
- lab results including the blood tests and thyroid function test
- wearable device data such as sleep patterns, variety in her heart rate and physical activity levels
- reported data through the use of a health app in which he asks her to log her symptoms at various points, including any triggers and the level of severity of the symptoms.

Lissie's doctor then collates the data into one platform and uses the ability of the computer to conduct advanced analytics to determine patterns and correlations within the data. The machine learning algorithm uses Lissie's health data and compares it to other health databases including clinical trials, medical literature and deidentified patient records to uncover any patterns or possible connections.

The analysis is able to determine that when Lissie's fatigue gets worse it is directly after increased activity and that her heart rate shows signs of dysautonomia (a condition that affects the autonomic nervous system) and a potential connection to a disease called Postural Orthostatic Tachycardia Syndrome (POTS). This may have been overlooked prior to the use of big data analysis. The doctor orders another test which confirms the diagnosis of POTS and then uses this data to tailor the treatment in a more targeted way, thereby helping Lissie to manage her healthcare better.

4.5.4 What measures need to be taken to ensure privacy and confidentiality of personal information?

With so much personal and collective data available, privacy and confidentiality is of the utmost importance. This is from both a human and system perspective.

Systematically, ways that this can happen include through robust security measures such as data encryption which makes the data unreadable to people who aren't supposed to have the data, access controls and regular, thorough security audits to protect against threats. These measures must be supported by strong policies that have comprehensive privacy policies, establish data retention guidelines and include the secure disposal of data when no longer needed. Additionally there should be clearly stated plans of action in response to a data breach.

From a human perspective, individual control and empowerment should be improved through informed consent, the right to access and correct any inaccuracies in personal health data, and the right to withdraw consent at any time. Further education and training for staff members who handle information are essential, as is public awareness about their responsibilities in protecting their own data and keeping it up to date. For example, integrating a two-step authentication system ensures that personal data is only accessible to the rightful owner.

FIGURE 4.28 Security measures that a person can put in place include two-step authentication which requires two forms of identification to access data.

Australia is still developing its understanding of securely using big data in healthcare. Therefore, regular reviews and updates to privacy information and compliance with relevant authorities and regulations are recommended.

DEPTH STUDY IDEA

Contact the **UNSW Centre for Big Data Research in Health** (CBDRH). Develop a codesigned practical investigation about a specific health issue relevant to young people. Explore the data and present your findings via a multimodal presentation or a video.

4.5 ACTIVITIES

Case study analysis

1. In small groups, use the case study that your teacher will give you.
   a. Analyse the case study and identify:
      - What types of big data could be collected to help diagnose and manage the patient's condition?
      - How could this data be analysed to reveal patterns and insights?
      - What are the potential benefits and challenges of using big data in this case?
   b. In your small group, create a presentation to show how big data is used to improve the patient's health outcomes.

Class debate

2. Hold a class debate about the ethics of big data in healthcare. One team argues for the use of big data and the benefits it can bring and the other team argues against it by identifying the challenges of using it. Use the time given to you by the teacher to develop your arguments and then conduct a formal debate.

National health data hub

3. The Australian government is considering expanding the scope of the **National Health Data Hub** to include data from private healthcare providers, wearable fitness trackers and social media platforms. This data would be de-identified and used to inform public health research and policy development. Research the National Health Data Hub and analyse the potential benefits and challenges of this proposed expansion.

Promoting My Health Record to young people

4. Imagine you are a health promotion officer working for a local health district in NSW. Your task is to develop a campaign to encourage the use of My Health Record among young adults aged 18–25.

Using big data

5. Use the example provided about Lissie to discuss how big data could support accurate diagnosis to assist early intervention of disease.

Promoting digital health

6. Using your knowledge of **Australia's health data landscape**, design a health promotion campaign that addresses the following:
   a. Current trends in digital health adoption among young adults.
   b. Common misconceptions and barriers to My Health Record use.
   c. Strategies to promote digital health literacy and data empowerment.
   d. Ethical and legal frameworks governing the use of health information.
   Present your campaign plan in a clear and concise format, including a description of your target audience, key messages, communication channels, ethical considerations and evaluation methods.

on Resources

Weblinks UNSW Centre for Big Data Research in Health
National Health Data Hub
AIHW Australia's health 2024: Australia's health data landscape
Australia's Primary Health Care 10 Year Plan 2022–2032

4.5 Exercises

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4.5 Quick quiz on | **4.5 Exercise**

Learning pathways

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

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Revise your knowledge

1. Define 'big data' in your own words.
2. Describe how the three Vs (volume, velocity and variety) characterise big data. Provide specific examples to illustrate each characteristic.
3. What percentage of big data is estimated to be used?
4. Explain how big data can contribute to a preventative approach to healthcare in Australia, and how this can lead to reduced healthcare spending.
5. Outline the key measures to ensure the privacy and confidentiality of personal health information in the context of big data and digital health technologies.

Apply your knowledge

6. Using the scenario about Lissie in section 4.5.3:
   a. Identify the big data sources that the doctor used to help Lissie.
   b. Describe the impact that using big data had on the healthcare of Lissie.
   c. Describe how big data helped the doctor to make a better decision in the provision of healthcare.
   d. Consider the dilemmas surrounding conflicting data. How can we utilise big data accurately? Which sources of data are most reliable?
7. How can big data be used to improve the efficiency and effectiveness of healthcare services in Australia?
8. Imagine you are a healthcare professional working in a busy hospital emergency department. A patient arrives unconscious and without any identification.
   a. How can access to the patient's electronic health records (EHR) assist you in providing effective and timely medical care?
   b. What specific types of information within the EHR would be most valuable in this situation, and how could this information guide your decision-making?
9. Describe how big data is used to personalise treatment options and improve the quality of care in the Australian healthcare system. Provide an example of how these benefit individuals in remote areas.
10. Evaluate the potential of big data to revolutionise healthcare in Australia.

4.5 Exam questions

Question 1 (1 mark)

Which of the following is a key benefit of using big data in Australian healthcare?

A. Eliminating the need for human oversight in medical diagnosis and treatment.
B. Guaranteeing the complete privacy and security of all patient data.
C. Enabling the development of personalised treatment plans and precision medicine.
D. Preventing all disease outbreaks and ensuring optimal health outcomes for all Australians.

Question 2 (1 mark)

How can big data analysis contribute to reducing healthcare spending in Australia?

A. By increasing the number of hospital beds and medical facilities.
B. By replacing healthcare professionals with artificial intelligence.
C. By enabling early diagnosis and personalised treatment plans, leading to more efficient resource allocation and better patient outcomes.
D. By eliminating the need for preventative healthcare measures and focusing solely on treatment of existing conditions.

Question 3 (6 marks)

Examine the potential benefits and challenges of using big data to improve the efficiency and effectiveness of Australia's healthcare system. Provide examples.

Question 4 (7 marks)

Analyse how big data contributes to advancements in medical research and the development of new therapies for health issues in Australia. Provide examples.

Question 5 (8 marks)

Evaluate the effectiveness of big data in improving the diagnosis and treatment of health conditions in Australia. In your response, **discuss** the potential benefits and challenges associated with using big data in healthcare.

4.6 Sample exam question response

Question

Analyse the impact of digital health on the healthcare system. **(12 marks)**

Criteria	Marks
• Provides a comprehensive analysis of complexities associated with achieving equitable access to digital health technologies and services in Australia • Provides an extensive analysis of how the National Digital Health Strategy addresses equity issues in diverse needs of the population • Presents a logical and cohesive response • Uses relevant examples to support response	11–12
• Provides an analysis of complexities associated with achieving equitable access to digital health technologies and services in Australia • Provides a thorough analysis of how the National Digital Health Strategy addresses equity issues in diverse needs of the population • Presents a logical response • Provides relevant examples	8–10
• Demonstrates some analysis of complexities associated with achieving equitable access to digital health technologies and services in Australia • Provides a sound analysis of how the National Digital Health Strategy addresses equity issues in diverse needs of the population • Presents a structured response • Provides examples	5–7
• Demonstrates some understanding of the complexities associated with achieving equitable access to digital health technologies and services in Australia OR • Demonstrates an understanding about how the National Digital Health Strategy addresses equity issues in diverse needs of the population	3–4
• Provides some relevant information	1–2

Sample response

Breaking down the question

Analyse the impact of digital health on the healthcare system.

Identify the action word/s: Analyse — the answer must identify components and the relationship between them; draw out and relate implications

Syllabus terminology: digital health

Mark allocation: 12 marks — according to HSC past papers, questions worth 12 marks require answers that include multiple body paragraphs, each addressing the action word, demonstrate a comprehensive understanding and provide detailed and relevant 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

Digital health technologies have created a shift within Australia's healthcare system impacting various layers of the delivery of care. Its influence extends beyond mere technological integration, affecting the dynamics between patients, providers, and the broader healthcare infrastructure.[1]

One of the greatest impacts of digital health is the way that Australians are able to access healthcare.[1] This is particularly noticed in the Australian context, where vast distances can impede access to essential medical services.[2] Telehealth platforms, for instance, have dismantled geographical barriers, enabling individuals in remote and regional areas to access specialist consultations.[3] By leveraging digital platforms, healthcare providers can extend their reach, ensuring equitable access to care regardless of location.[4]

The implementation of electronic health records (EHRs) has changed the way that information is managed within healthcare settings.[1] These digital repositories facilitate seamless data sharing among healthcare professionals.[2] For example, Australia's EHR is My Health Record and it is able to foster collaborative care and reduce the incidence of medical errors.[3] The efficiency gains derived from EHRs translate to improved patient outcomes, as clinicians can access comprehensive patient histories and make informed decisions in a timely manner.[4]

On an individual level, mobile health (mHealth) applications and wearable devices have empowered individuals to assume a more proactive role in managing their health.[1] These tools such as Sleepwatch and GoogleFit enable real-time monitoring of an individual's heart rate, blood pressure, and sleep patterns,[3] meaning that they can self-monitor and be proactive about preventative care.[2] Moreover, mHealth apps can provide personalised health education, increasing health literacy, medication reminders, and lifestyle coaching, promoting adherence to treatment plans and fostering healthy behaviours.[4]

However, the integration of digital health is not without its challenges.[1] Concerns surrounding data privacy and cybersecurity are still at large, as the sensitive nature of health information requires safeguards against unauthorised access.[2] For example, robust measures around storage and consent to sharing of information need legislative clarity.[3] The increasing reliance on interconnected digital systems also exposes the healthcare sector to potential cyberattacks, which could compromise patient data and disrupt service delivery.[4]

Additionally, the digital divide poses a significant obstacle to equitable access to digital health services.[1] Individuals lacking access to technology or digital literacy skills may be excluded from the benefits of telehealth and mHealth applications, exacerbating existing health disparities.[2] For example, those living in rural and remote regions of Australia may have lower levels of internet access to fully utilise the digital health services that are available to their metropolitan counterparts.[3] Addressing these disparities requires targeted interventions, such as digital literacy training and the provision of affordable internet access.[4]

Moreover, it is important to understand the impacts of digital health on the healthcare workforce.[1] Digital health,[2] especially AI,[3] has the ability to take on many of the mundane tasks that healthcare workers have to perform.[2] This could lead to a workforce that is able to focus on the person, and less on the data leading to more personalised care.[4]

In conclusion, digital health has emerged as a powerful catalyst for transforming the healthcare system, enhancing accessibility, efficiency and patient engagement. However, realising its full potential requires addressing the challenges, such as data security, the digital divide, and workforce impacts. By fostering a culture of responsible innovation and ensuring equitable access, we can harness the transformative power of digital health to improve health outcomes for all.[4]

4.7 Review

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4.7.1 Topic summary

4.2 The relationship between technology and health

- Technology boosts healthcare access through remote monitoring and consultations, helping those in distant areas get care without travelling.
- Wearable devices and health apps let people track their health, like sleep and activity, making it easier to manage and make informed choices.
- Advanced imaging (MRI, PET, CT scans) and 3D modelling allow for earlier and more accurate diagnoses, leading to timely treatment.
- Robotic surgeries and integrated platforms improve precision, reduce invasiveness, and enhance surgeon performance for better and faster recoveries.

4.3 New technologies and treatments

- Innovative tools like neurotechnology, 3D printing, gene editing, wearables and health apps are revolutionising healthcare, improving diagnosis, treatment, and personalised health management.
- About one in three Australians use health apps to manage various health aspects, including mental health, nutrition, concussion management and medication tracking.
- The abundance of health apps can make it hard for users to find reliable resources, so government frameworks for quality assessment are needed.
- AI enhances healthcare by speeding up medication discovery, personalising treatments and improving healthcare efficiency through predictive algorithms and medical imaging.
- There are ethical concerns about bias in AI algorithms and patient data privacy.
- Assistive technology helps people with disability or chronic conditions perform daily tasks, access education and jobs, and engage in social activities, promoting independence and participation.
- Assistive tech includes both low-tech solutions like large print books and high-tech options like power wheelchairs and smart home devices.
- Many Australians with disability face challenges accessing assistive technology due to funding limitations and complex support systems.

4.4 The impact of digital health on the healthcare system

- Digital health tools link sources of health information, making decision-making, quality improvements and access to information more efficient for both patients and clinicians.
- These tools include mobile apps, electronic health records, telehealth and AI, aimed at better patient care and information sharing.
- They enable timely access to health data, leading to well-informed healthcare practices and improved quality of care.
- Digital health can improve health outcomes and quality of life by offering greater efficiency and accessibility.
- Barriers like location, socioeconomic status and disability need to be addressed to ensure everyone has access to digital health.

- Seamless data sharing between systems is essential, requiring government efforts and innovation to improve data standards.
- Australians need to be educated and confident in using digital health tools, with strong security and privacy measures in place for trust.

4.5 How big data is shaping the health of Australians

- Big data consists of huge datasets that provide insights into health trends in Australia.
- Currently, only a small portion of this data is analysed due to its complexity.
- It helps to improve healthcare by offering better treatment plans, personalised medicine and access to health information.
- Big data supports medical research by identifying disease patterns and aiding in the development of new treatments.
- It informs healthcare policies by highlighting population health trends for better resource allocation.
- Predictive analytics, powered by big data, can lead to early diagnosis and intervention, reducing healthcare costs.
- It can identify where to invest in primary healthcare for maximum impact, aligning with Australia's healthcare plans.
- Big data aids in the early detection of diseases and accelerates research for new cures.
- Protecting privacy in digital health requires strong security measures and data governance.
- Individuals should have control over their personal health data through informed consent and the right to access and correct their information.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Investigation — NSW Ministry of Health assessment of new health technologies

Time: 5–6 hours

Task description: Assess a new health technology against the NSW Health Prioritisation and Assessment matrix. Present finding as a written response, verbal or multimodal presentation.

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents Topic 4 summary (doc-43053)
Key terms glossary (doc-43054)
Revision quiz (doc-43055)

Interactivity Missing word interactive quiz (int-9361)

4.7 Exercises

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4.7 Revision quiz on | 4.7 Exam questions

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4.7 Exam questions

Section I

Question 1 (1 mark)

Which of the following is NOT an example of how technology is used for early diagnosis of disease?

A. Artificial intelligence analysing medical images to detect anomalies.
B. Wearable sensors monitoring vital signs for early signs of illness.
C. Telehealth consultations providing remote diagnosis and treatment.
D. Precision surgery using robotic systems to minimise invasiveness.

Question 2 (1 mark)

What is a key benefit of using health apps for managing chronic conditions?

A. Increased patient engagement and self-management.
B. Eliminating the need for in-person doctor visits.
C. Guaranteed accuracy of health data collected.
D. Reduced reliance on healthcare professionals.

Question 3 (1 mark)

Which of the following best describes ‘digital health’?

A. The use of surgical robots in operating rooms.
B. The use of technology to improve health outcomes and healthcare delivery.
C. The development of artificial intelligence for medical diagnosis.
D. The collection and analysis of large health datasets.

Question 4 (1 mark)

How can big data help reduce healthcare spending?

A. By increasing the cost of medical research and development.
B. By replacing healthcare professionals with AI systems.
C. By identifying high-risk individuals for preventive interventions.
D. By limiting access to expensive treatments and medications.

Section II

Question 5 (3 marks)

Describe the role of wearable sensors in monitoring health data.

Question 6 (3 marks)

Outline ONE important important consideration when implementing digital health solutions.

Question 7 (3 marks)

How can artificial intelligence (AI) assist in early diagnosis of diseases?

Question 8 (4 marks)

Explain how precision surgery is improving patient outcomes. Provide an example.

Question 9 (4 marks)

Describe two potential benefits of using health apps.

Question 10 (5 marks)

How can privacy and security be upheld with digital health?

Question 11 (6 marks)

Examine how assistive technology can increase accessibility. Provide examples.

Question 12 (6 marks)

Explain how telehealth services can improve access to healthcare. Provide examples.

Question 13 (8 marks)

Evaluate how big data is being used to cure and manage diseases.

Question 14 (8 marks)

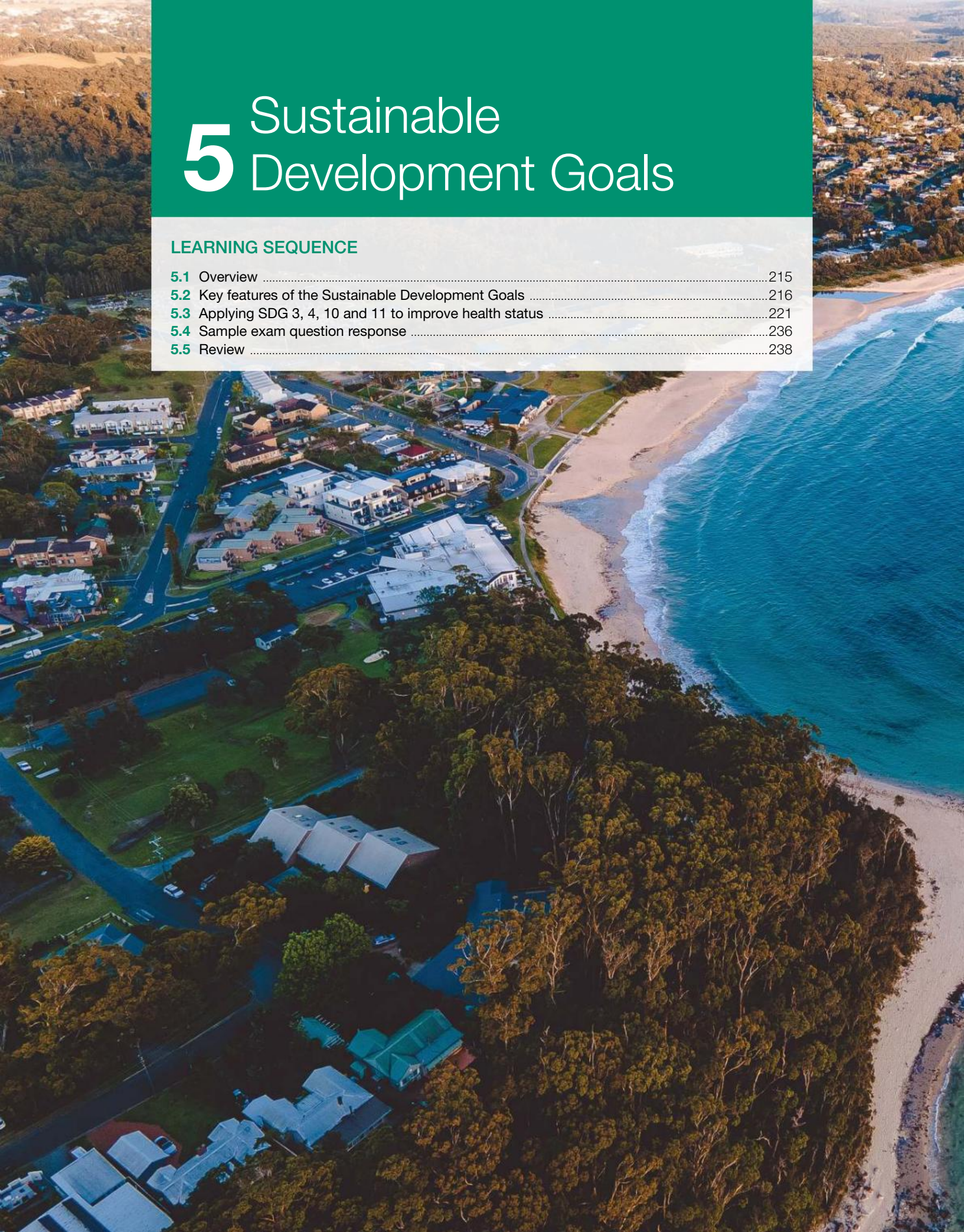
Analyse the potential benefits of using big data in healthcare.

Section III

Question 15 (12 marks)

Analyse the relationship between technology and health. Use examples to support your answer.

5 Sustainable Development Goals



LEARNING SEQUENCE

5.1 Overview 215
5.2 Key features of the Sustainable Development Goals 216
5.3 Applying SDG 3, 4, 10 and 11 to improve health status 221
5.4 Sample exam question response 236
5.5 Review 238

5.1 Overview

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Key inquiry question

What actions are needed to promote and improve the health of Australians?

Syllabus

	Syllabus content	Subtopic
○	■ Describe the key features of Sustainable Development Goals (SDGs) **Including:** • SDG 3: Good Health and Wellbeing • SDG 4: Quality Education • SDG 10: Reduced Inequalities • SDG 11: Sustainable Cities and Communities	**5.2**
○	■ Evaluate the application of SDGs 3, 4, 10 and 11 to inform strategies to improve the health status of a community **Including:** • how have these goals been applied in other communities? • what lessons can be drawn from other communities and applied to their own community context? • what are the major health issues for a community? • what strategies are needed to advocate and improve a community's health status? • how do you know these strategies may be effective? **Example(s):** **How these goals have been applied in other communities:** Healthy Cities Illawarra.	**5.3**

Source: *Health and Movement Science Stage 6* © NSW Education Standards Authority for and on behalf of the Crown in right of the State of New South Wales, 2025).

Outcomes

- evaluates how the Sustainable Development Goals can be used to improve the health of a community HM-12-03
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07

on Resources

Digital documents Topic 5 summary (doc-43056)
Key terms glossary (doc-43057)
Revision quiz (doc-43058)

5.2 Key features of the Sustainable Development Goals

Syllabus: Describe the key features of Sustainable Development Goals (SDGs)

Including:

- SDG 3: Good Health and Wellbeing
- SDG 4: Quality Education
- SDG 10: Reduced Inequalities
- SDG 11: Sustainable Cities and Communities

The **Sustainable Development Goals (SDGs)** are a set of 17 global goals created by the United Nations in 2015 to help make the world a better place by 2030. They focus on the most important challenges facing people and the planet, such as poverty, hunger, education, health, climate change and equality.

Sustainable Development Goals (SDGs) a set of 17 global goals developed by the United Nations 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.

The SDGs are important because they give everyone — governments, businesses, communities and individuals — a clear plan to create a more just, equal and sustainable world. They are designed to ensure that no one is left behind and that the world grows in a way that is fair to everyone and protects the environment.

This topic will provide further details on four specific SDGs and how the application of these goals can improve the health status of populations:

- SDG 3: Good Health and Wellbeing
- SDG 4: Quality Education
- SDG 10: Reduced Inequalities
- SDG 11: Sustainable Cities and Communities

FIGURE 5.1 The Sustainable Development Goals

5.2.1 SDG 3: Good Health and Wellbeing

SDG 3: Good Health and Wellbeing is a critical goal aimed at ensuring that all individuals, regardless of where they live or their circumstances, have access to the healthcare services and support they need to lead healthy, fulfilling lives. This goal addresses a wide range of health-related issues, from reducing child and maternal mortality to combating infectious diseases and promoting mental health. By improving healthcare systems, preventing diseases, and ensuring equitable access to medical resources, SDG 3 seeks to create a world where everyone can achieve optimal physical and mental **wellbeing**.

5.2.2 SDG 4: Quality Education

Education is a key factor in breaking the cycle of poverty and promoting equality. **SDG 4: Quality Education** emphasises the importance of providing all people, from children to adults, with access to inclusive, equitable and high-quality education. It seeks to ensure that every individual can learn the skills and knowledge they need to lead productive lives and contribute meaningfully to society. In a world where education can open doors to better opportunities, this goal aims to close gaps in learning and provide lifelong learning opportunities for everyone.

5.2.3 SDG 10: Reduced Inequalities

The widening gap between different social and economic groups is one of the most pressing global challenges today. **SDG 10: Reduced Inequalities** focuses on addressing these disparities, whether they stem from income, gender, race, disability or other forms of discrimination. The goal aims to promote the social, economic and political inclusion of all, particularly marginalised or disadvantaged groups. It stresses the need to reduce inequalities between countries, supporting fair economic systems that benefit everyone. Through its targets, SDG 10 provides a framework for reducing inequality and fostering more inclusive societies.

SDG 3: Good Health and Wellbeing a goal aimed at ensuring healthy lives and promoting wellbeing for all at all ages, focusing on reducing maternal and child mortality, combating diseases and providing universal health coverage

wellbeing a sustainable state characterised by predominantly positive feelings, attitudes and relationships. It involves resilience, self-efficacy and a high level of satisfaction with self.

SDG 4: Quality Education a goal aimed at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all, emphasising the need for access to education and quality learning environments

SDG 10: Reduced Inequalities a goal focused on reducing inequality within and among countries, promoting social, economic and political inclusion of all individuals, regardless of their background or circumstances

SDG 11: Sustainable Cities and Communities a goal aimed at making cities and human settlements inclusive, safe, resilient and sustainable, addressing urbanisation challenges and improving the quality of life for urban residents

FIGURE 5.2 Quality healthcare contributes to good health and wellbeing.

FIGURE 5.3 Improved access to public transport infrastructure can assist in reducing inequalities and promote health and wellbeing.

5.2.4 SDG 11: Sustainable Cities and Communities

With more than half of the world's population now living in urban areas, **SDG 11: Sustainable Cities and Communities** addresses the need for cities to be environmentally sustainable, inclusive and safe

for all. As cities grow, they face challenges such as inadequate housing, poor infrastructure, pollution and vulnerability to disasters. This goal aims to create urban spaces that promote wellbeing, access to basic services, and sustainable urban planning to ensure that cities are resilient in the face of natural and human-made challenges.

holistic an approach that considers the whole person, including physical, mental, emotional and social aspects, in the assessment and treatment of health and wellbeing, recognising the interconnectedness of these elements

5.2.5 Holistic nature of the SDGs

The SDGs are designed to work together to address complex global challenges in a **holistic** way, meaning progress in one goal often supports progress in others. This interconnection ensures that sustainable development happens across multiple sectors, improving the quality of life for all. Table 5.1 provides clear examples of how SDGs 3, 4, 10 and 11 mutually reinforce each other.

FIGURE 5.4 Progress in one SDG can spark progress in many.

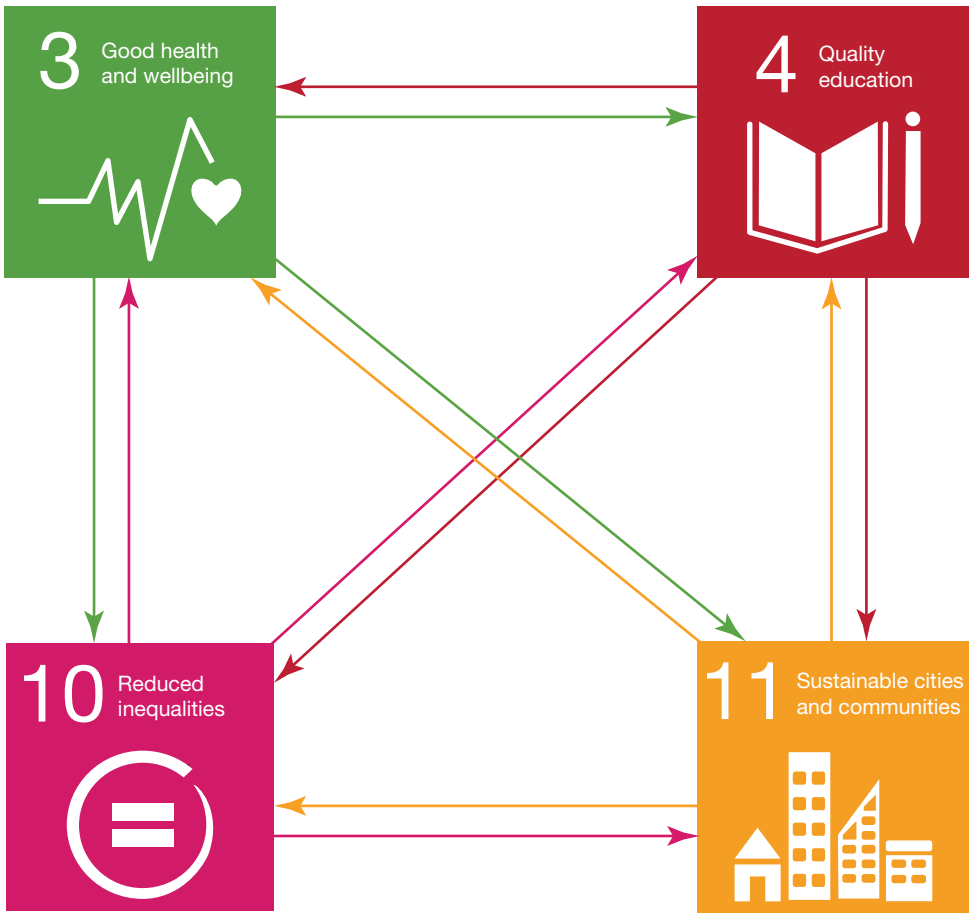

TABLE 5.1 Holistic nature of the Sustainable Development Goals (SDGs)

SDG	Key targets	How it supports other SDGs
SDG 3: Good Health and Wellbeing	• Universal health coverage • Maternal, child health • Combat diseases and promote mental health	**Supports SDG 4:** Healthy children are more likely to attend school regularly, improving educational outcomes.
		Supports SDG 10: Reducing health inequalities ensures marginalised groups have equal access to healthcare.
		Supports SDG 11: Improving urban health systems and reducing pollution contributes to healthier communities in cities.

SDG 4: Quality Education	• Improved literacy and numeracy • Improve educational attainment • Reduce education inequality	**Supports SDG 3:** Education on health topics leads to better hygiene, nutrition and reduced child mortality.
		Supports SDG 10: Quality education provides disadvantaged groups with opportunities for upward mobility, reducing inequalities.
		Supports SDG 11: Educated populations are better equipped to participate in sustainable urban development and advocate for healthier cities.
SDG 10: Reduced Inequalities	• Reduce income inequality • Improve equity among **health determinants** • Eliminate systemic issues causing inequities	**Supports SDG 3:** Reducing economic and social inequalities improves access to healthcare for vulnerable groups.
		Supports SDG 4: Equal access to education helps reduce the knowledge gap between different socioeconomic groups.
		Supports SDG 11: Ensuring inclusive urban policies reduces inequalities in access to housing, transportation and services.
SDG 11: Sustainable Cities and Communities	• Access to safe, affordable housing and transport • Reduce environmental impact of cities	**Supports SDG 3:** Healthier living environments reduce disease transmission and improve overall wellbeing.
		Supports SDG 4: Safe and accessible school infrastructure ensures that all children, especially vulnerable ones, can attend school.
		Supports SDG 10: Inclusive urban planning helps reduce inequalities by providing equal access to services, transport and public spaces.

on Resources

Weblinks Australia and the Sustainable Development Goals
Sustainable City – Copenhagen
Closing the Gap

health determinants the range of health behaviours, personal biomedical factors, environmental factors and socioeconomic factors, as identified by the Australian Institute of Health and Welfare, that determine the health status of individuals and populations

5.2 ACTIVITIES

Australia and the SDGs

1. Use the weblink **Australia and the Sustainable Development Goals** in the Resources panel to answer the following questions.
   a. How many SDGs are likely to be achieved globally by 2030?
   b. What is the current progress globally on SDGs 3, 4, 10 and 11?
   c. What is the current progress in Australia on SDGs 3, 4, 10 and 11?

Polarised debate

2. Participate in a polarised debate on the following topic, 'Investments in quality education (SDG 4) are more critical than investments in healthcare (SDG 3) for reducing inequality (SDG 10).'
3. View the weblink **Sustainable City – Copenhagen** in the Resources panel and answer the following questions.
   a. How can Copenhagen's progress on SDG 11 impact SDG 3?
   b. What lessons could be taken from Copenhagen's approach to sustainable cities and communities and applied to Australia?

Closing the gap

4. Research the Closing the Gap targets and outcomes. (You can use the weblink **Closing the Gap** in the Resources panel.)
   Outline how these targets and outcomes align with SDG 3, 4, 10 and 11. Provide examples to support your answer.

5.2 Exercises

learnon

5.2 Quick quiz on | **5.2 Exercise**

Learning pathways

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

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Revise your knowledge

1. Outline the role of the Sustainable Development Goals.
2. Identify the focus of SDGs 3, 4, 10 and 11. Provide examples to support your answer.
3. Describe the holistic nature of the Sustainable Development Goals.
4. Outline how progress in SDG 3 can spark progress in SDG 10.
5. Outline how failure to address SDG 11 impacts on the progress of SDG 4.

Apply your knowledge

6. Describe the benefits of SDG 3 on improving the health status of Australians.
7. Outline the role of SDG 4 in improving the health status of Aboriginal and Torres Strait Islander Peoples.
8. Outline the role of SDG 10 in improving the health status of one group other than Aboriginal and Torres Strait Islander Peoples.
9. What action could your community take regarding SDG 11 to improve health status?

5.2 Exam questions

Question 1 (1 mark)
Which of the following is a target of Sustainable Development Goal (SDG) 3: Good Health and Wellbeing?

A. Improved literacy and numeracy
B. Reduced education inequality
C. Access to safe and affordable housing
D. Reduced mortality rates for chronic disease

Question 2 (3 marks)
Outline the key features of Sustainable Development Goal (SDG) 10: Reduced Inequalities.

Question 3 (4 marks)
Describe the role of Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities in improving health status for all Australians.

Question 4 (5 marks)
Describe how improvements in Sustainable Development Goal (SDG) 4: Quality Education can result in improvements in Sustainable Development Goal (SDG) 3: Good Health and Wellbeing. Provide examples to support your answer.

Question 5 (5 marks)
Describe how improvements in Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities can result in improvements in Sustainable Development Goal (SDG) 10: Reduced Inequalities. Provide examples.

5.3 Applying SDG 3, 4, 10 and 11 to improve health status

Syllabus: Evaluate the application of SDGs 3, 4, 10 and 11 to inform strategies to improve the health status of a community

Including:

- how have these goals been applied in other communities?
- what lessons can be drawn from other communities and applied to their own community context?
- what are the major health issues for a community?
- what strategies are needed to advocate and improve a community's health status?
- how do you know these strategies may be effective?

By evaluating the application of these SDGs within Australian communities, we can uncover valuable insights and identify successful practices in effective health interventions. A recent report assessing Australia's progress on the SDGs shows that although there have been improvements in health (SDG 4) and education (SDG 3), there was poor performance in addressing inequality (SDG 10) and housing affordability (SDG 11) with many indicators off-track or deteriorating. This will have a significant impact on Australia's ability to meet these goals by 2030.

View the weblink **SDG Progress Report** in the Resources panel for further information on Australia's performance.

This subtopic will explore:

- the major health issues faced by communities
- how these SDGs have been implemented in various local contexts
- the lessons learned from their application
- the necessary strategies to **advocate** for and improve community health outcomes.

This explores how the SDGs can be powerful tools for promoting healthier, more equitable and sustainable communities across Australia.

advocate the process of arguing in support of a cause or position or acting on behalf of yourself or another individual to ensure that your or others' best interests are taken into account

EXAM TIP

How have these goals been applied in other communities?

When responding to a question that asks you how the SDGs have been applied to other communities, consider how well certain policies, practices and initiatives have worked to improve health, education, equity and sustainability. It is also important to recognise how these goals work together and often support each other. Since the exam question will likely ask you to evaluate, make sure you explain how an action has affected the SDG and give examples to support your points.

For example: *The introduction of the '# More than a cyclist' social media campaign promotes messages that the road is a shared space and cyclists have the right to travel safely to their destination in the Illawarra. This campaign has significant potential to reduce road accidents in the Illawarra by reshaping driver behaviour and attitudes to give way and be respectful to cyclists. It also provides valued opportunities for residents to cycle to work and form daily riding habits to support fitness and wellbeing (SDG 3). This campaign integrates educational (SDG 4) and sustainable elements (SDG 11) as it reduces greenhouse emissions from car fumes and educates drivers to provide safe passing space for cyclists.*

5.3.1 How have these goals been applied in other communities?

Healthy Cities Illawarra

The aim of **Healthy Cities Illawarra** is to promote the health, wellbeing and sustainability of communities within the Illawarra and Shoalhaven regions of New South Wales. The organisation seeks to create healthier environments and empower individuals and communities to live healthier lives by addressing the social, economic and environmental determinants of health. Table 5.2 provides further detail on specific initiatives of the Healthy Cities Illawarra program.

Healthy Cities Illawarra an initiative aimed at improving the health and wellbeing of communities in the Illawarra region of NSW, focusing on urban planning, sustainable development and community engagement to create healthier living environments

FIGURE 5.5 Health Cities Illawarra aims to improve multiple SDGs through a range of initiatives.

TABLE 5.2 Healthy Cities Illawarra initiatives

Initiative	Description	Link to SDGs
Active In-betweens	Designed to engage children aged 8–12 (the 'in-between' age group) in physical activities and healthy living. The program focuses on promoting regular exercise, developing social skills, and encouraging healthy habits in a fun and supportive environment.	SDG 3: Promotes physical activity and healthy habits among children SDG 4: Teaches healthy lifestyle choices and provides opportunities for learning social skills SDG 10: Ensures access to recreational opportunities for all children regardless of socioeconomic background SDG 11: Encourages outdoor play, fostering healthier, more active communities
Age Friendly Illawarra	An initiative aimed at making the region more inclusive, accessible and supportive for older adults. It promotes active ageing and improves seniors' quality of life by focusing on mobility, social inclusion and access to essential services.	SDG 3: Improves health outcomes for older people by promoting healthy ageing and access to health services SDG 4: Involves seniors in lifelong learning and educational programs to improve quality of life SDG 10: Reduces inequities by enhancing access to services and promoting social inclusion SDG 11: Creates age-friendly public spaces and transportation
Drug Action Teams	Community-based groups that work collaboratively to reduce the harm associated with alcohol and drug use within priority population groups such as the culturally and linguistically diverse (CALD). These teams aim to address substance misuse through education, prevention, support and community engagement.	SDG 3: Reduces harm from drug and alcohol use SDG 4: Provides education on substance abuse prevention, improving awareness and decision-making SDG 10: Addresses social inequities by offering targeted support to vulnerable groups SDG 11: Builds safe communities by reducing drug-related crime and social disruption

Safe and Active Routes to School	A community-driven program designed to encourage children and families to adopt safer and more active ways of getting to school. This initiative promotes walking, cycling and other forms of active transport, while improving the safety of routes to school.	SDG 3: Encourages walking and cycling, improving children's physical and mental health SDG 4: Promotes learning about road safety throughout the whole community SDG 10: Provides safe travel routes, reducing inequalities in access to education and safe environments SDG 11: Enhances transport infrastructure to ensure safe and sustainable school travel routes

Justice Reinvestment – Bourke

Maranguka Justice Reinvestment a strategy aimed at reducing crime and incarceration rates by redirecting funds from the criminal justice system into community programs that address the underlying causes of crime, such as poverty, lack of education and mental health issues

The Justice Reinvestment program in Bourke, NSW, known as 'Maranguka', is a pioneering initiative aimed at:

- reducing an over-reliance on the criminal justice system
- improving community outcomes
- addressing the root causes of crime through community-led, holistic approaches.

The program focuses on providing opportunities and support for young people, reducing incarceration rates, and investing in social and economic development. Nationally, **Maranguka Justice Reinvestment** is seen as a leader in community-led place-based approaches and collective impact models.

FIGURE 5.6 Justice reinvestment empowers communities to tackle systemic issues, including reducing incarceration and promoting equity and safety.

TABLE 5.3 Maranguka Justice Reinvestment program initiatives

Initiative	Example	Link to SDGs
Enhancing cultural authority	Work with the teaching faculty of Bourke public schools to attend the Maranguka Cultural Competency training. The training provides educators with insights into Aboriginal cultures, histories and perspectives, fostering respect and understanding.	SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all SDG 10: Reduce inequalities in school attendance and completion rates for Aboriginal and Torres Strait Islander children
Brokering local solutions to systemic challenges	Lead and develop tailored approaches and programs to tackle systemic issues facing the community. This includes police engaging directly with individuals known to experience domestic violence to offer support and resources before situations escalate.	SDG 3: Provides early intervention strategies to prevent domestic violence, promoting safety and wellbeing SDG 10: Addresses systemic issues of violence and trauma

(continued)

TABLE 5.3 Maranguka Justice Reinvestment program initiatives *(continued)*

Initiative	Example	Link to SDGs
Collaborative and flexible service delivery	Providing support services to members of the Aboriginal and Torres Strait Islander communities of Bourke, NSW. For example, free driving lessons to address the high rates of incarceration from driving offences.	SDG 4: Helps individuals gain confidence and qualifications that can enhance their educational and career opportunities SDG 11: Contributes to safer roads and reduced traffic-related incidents, enhancing overall community safety

CASE STUDY

'Too much money is spent on jails and policing': what Aboriginal communities told us about funding justice reinvestment to keep people out of prison

By ***Fiona Allison, Research Fellow, Jumbunna Institute of Indigenous Education and Research, University of Technology Sydney,***

Daniel Daylight, Community Manager Mt Druitt JustReinvest NSW, Indigenous Knowledge,

Thomas Duncan, Manager of community-led change, Just Reinvest NSW, Indigenous Knowledge

2 May 2023

Justice reinvestment emerged in the United States more than 20 years ago as a way to reduce mass incarceration and its vast costs by addressing the social drivers of imprisonment.

Through justice reinvestment, communities identify and develop responses to issues that feed high rates of re-incarceration locally, resourced through a 'reinvestment' of funds drawn from prison budgets. The focus is often on better access for ex-prisoners to essentials such as accommodation and reducing inequity at a community level in health, education and other outcomes.

…

But what does 'reinvestment' mean in practice? Who decides what gets funded and how?

To find out more, we spoke with Aboriginal communities in the NSW towns of Bourke, Moree and Mount Druitt.

…

This work invites government to co-design with community what 'reinvestment' means, led by those Aboriginal communities where local solutions are already underway.

Investing in Aboriginal-led solutions

We heard that current criminal justice approaches are not working in Aboriginal communities like Moree and Mt Druitt. Far too many Aboriginal people are taken off-country to be locked up away from family, employment and schooling.

This fractures community and cultural connections and other elements of a healthy, thriving Aboriginal community. The scale at which this occurs does more harm than good and drives re-incarceration. As one Moree community member told us:

They just come out worse. It's like setting them up to fail. Like, it doesn't fix it at all. Do you know anyone that's gone to jail and come out and been good, like better?

Aboriginal people in Moree and Mount Druitt know what's needed to turn this around. One Moree community member said:

As we've been saying for years, we're the only ones that can tell people what's wrong, what's the best way to fix it. And we're the only ones that can actually do it.

These communities have developed Aboriginal-led justice reinvestment governance structures and programs that strengthen culture and self-determination. They aim to improve life opportunities to keep more Aboriginal people – particularly young people – out of custody.

In Mount Druitt, justice reinvestment includes Mounty Yarns, a project led by local young people with both lived experience of incarceration and ideas about how to reduce contact with the justice system that they want heard:

We don't want the next generation to go through what we went through. We want to be a voice so others don't have to keep repeating their stories.

Aboriginal communities like Moree and Mount Druitt need increased access to resources and decision-making to implement their solutions.

They are calling for backing to put their ideas in motion, including partnerships, programs and interventions they identify as crucial to preventing offending.

These ideas, once implemented, may work well quickly, take time to succeed or perhaps struggle. Increasing community agency is a crucial outcome in itself, regardless.

…

Achieving change

The message from our report is clear: Aboriginal communities want to determine their own priorities for change and to lead that change. This is crucial to reducing Aboriginal over-representation.

Source: Allison, F., Daylight, D., & Duncan, T. (2023), 'Too much money is spent on jails and policing': what Aboriginal communities told us about funding justice reinvestment to keep people out of prison. *The Conversation*, 2 May, https://theconversation.com/too-much-money-is-spent-on-jails-and-policing-what-aboriginal-communities-told-us-about-funding-justice-reinvestment-to-keep-people-out-of-prison-200531.

Case study questions

1. What is justice reinvestment, and what are its primary objectives?
2. Identify the concerns expressed by community members about the impacts of incarceration on individuals and communities.
3. How does the idea of co-designing solutions with communities enhance the effectiveness of justice reinvestment?
4. Assess the impact voices of individuals with lived experience of incarceration have on the development of justice reinvestment programs.

5.3.2 What lessons can be drawn from other communities and applied to their own community context?

Both the Healthy Cities Illawarra initiative and the Maranguka Justice Reinvestment program in Bourke offer valuable insights into improving community health and wellbeing through targeted strategies and collaborative efforts. Important elements of these programs include:

- *holistic approach to health*. Both approaches recognise that in order to improve the health status of a community, it requires a **multifaceted approach** that goes beyond medical care. Communities should use strategies that include physical health, mental wellbeing, education and social determinants of health, such as housing and employment.
- *community engagement and ownership.* Active participation from community members leads to more effective and sustainable outcomes. By encouraging wider community involvement in decision-making processes, it allows residents to voice their needs and preferences for health initiatives.
- *collaboration across sectors.* Collaboration among sectors is crucial for comprehensive solutions. Forming partnerships between local organisations, government agencies, schools and **health services** gives the opportunity to tackle complex issues collectively, which leads to higher chances for successful outcomes.

multifaceted approach a strategy that uses multiple methods or perspectives to address a complex issue, recognising that no single solution is enough to achieve desired outcomes

health services a broad range of services provided to individuals or communities to promote, maintain or restore health, including preventive, diagnostic, therapeutic and rehabilitative services

- *focus on* **prevention and early intervention**. Proactive measures can prevent health issues and reduce the need for more intensive interventions later. Investment in preventive health programs and early intervention strategies, such as health education, counselling and support services before crises escalate reduces direct and indirect costs to individuals and communities.

FIGURE 5.7 Bowel cancer screening kits are an example of early intervention which can improve health outcomes.

5.3.3 What are the major health issues for a community?

The syllabus requires you to select a community to study. It does not have to be your own community; however, it may be one that is relevant to you. This section, along with sections 5.3.4 and 5.3.5 will use communities within Western NSW as an example.

According to the Western NSW Health Profile 2024, the Western NSW Primary Health Network:

- Covers 433 365 square kilometres, the largest in NSW
- Includes 27 local government areas with their own unique needs
- Has a population of 312 365 people
- 12.8 per cent of the population of Western NSW are Aboriginal and Torres Strait Islander Peoples, compared to 3.3 per cent nationally
- It has a greater proportion of people under 20 years and 65 years and older compared to the rest of NSW
- It is experiencing population growth in larger rural cities (Bathurst, Orange, Dubbo) but experiencing population decline in more remote areas (Walgett, Cobar)
- Has 401 general practitioners (GPs) and 113 general practices (including Aboriginal Medical services).

FIGURE 5.8 The Western NSW Primary Health Network includes two local health districts and covers over half the area of NSW.

prevention and early intervention strategies aimed at preventing health issues or addressing them early on to reduce their impact, including education, health screens and access to resources

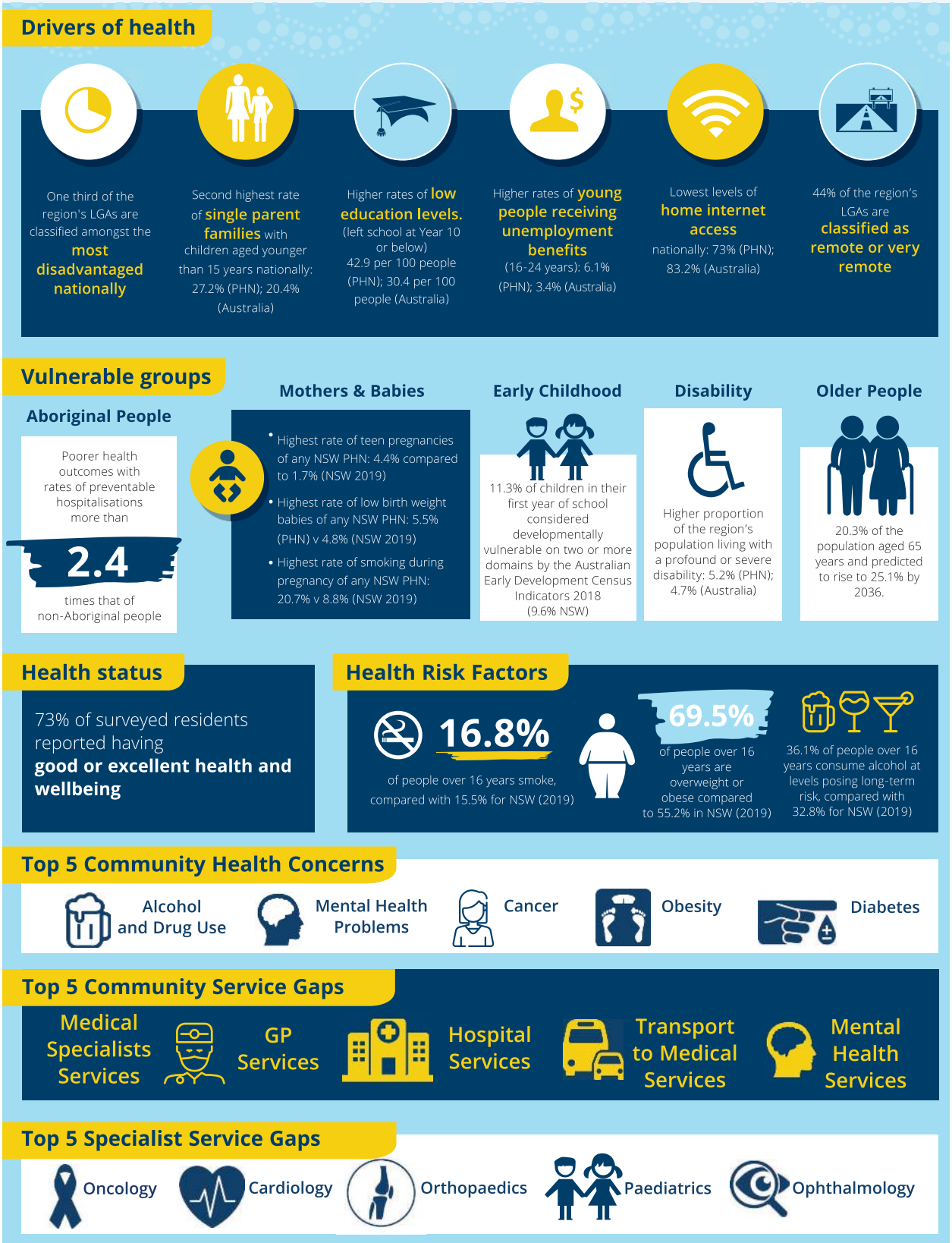
From the area health profile, it can be seen how and why many health issues and inequities exist within Western NSW communities. This has prompted a need to design strategies to achieve good health and wellbeing (SDG 3), reduce inequalities for those living in rural and remote areas (SDG 10) and improve access to health services (SDG 11) which are made worse by large distances (see table 5.4 and figure 5.10). The **Health Stats NSW** weblink in the Resources panel can also provide important epidemiological data on specific local health districts across NSW.

FIGURE 5.9 Communities in Western NSW have fewer health services than those in major cities.

TABLE 5.4 Major health issues faced in Western NSW

Health issue	Description
Access to healthcare	The region has 401 GPs and 113 general practices, which is inadequate given its vast size (433 365 square kilometres) and dispersed population. The uneven distribution of healthcare services can exacerbate health disparities between rural and remote areas as medical services tend to be concentrated in larger regional cities.
Workforce shortages	The large geographic area covered by a relatively small number of healthcare providers means that people in remote areas may face longer travel times, reduced availability of specialists and difficulty accessing timely care.
Aboriginal and Torres Strait Islander Peoples health disparities	Western NSW has a significantly higher proportion of Aboriginal and Torres Strait Islander Peoples (12.8%) compared to the national average (3.3%). Due to the ongoing impact of colonisation, disruption to culture, systematic discrimination and racism, and intergenerational trauma, Aboriginal and Torres Strait Islander Peoples in Australia often face greater health challenges. These include higher rates of chronic disease (e.g. diabetes, cardiovascular disease), mental health issues and lower life expectancy. The availability of Aboriginal Medical Services is a positive step, but the adequacy and cultural appropriateness of healthcare services remains crucial in addressing this inequity.
Age-related health needs	Western NSW has a greater proportion of people under 20 years and those over 65 years compared to the rest of NSW. These age groups tend to have distinct healthcare needs. *Children and youth:* Younger populations require services such as maternal and child health, immunisations and mental health support, which may be underprovided in remote areas. *Elderly populations:* Older residents are more likely to require chronic disease management, aged care services, and support for conditions such as dementia or mobility issues. In more remote areas, access to these services may be particularly limited, increasing the risk of poor health outcomes for elderly people living in isolation.
Chronic disease and preventable hospitalisations	People in rural and remote areas experience higher rates of chronic conditions such as obesity, cardiovascular disease and respiratory issues, particularly in populations with limited access to preventive healthcare and lifestyle interventions. Access to specialist care and health promotion activities can be challenging in these areas, resulting in worsened chronic disease outcomes. Western NSW also has the second-highest rate of preventable hospitalisations in NSW.

FIGURE 5.10 Key insights from the Western NSW Health Profile 2021.



Source: Western NSW Health Profile 2021.

The **Western NSW District Data Profile** (see weblink in the Resources panel) provides key insights into the socioeconomic determinants within these communities, such as education, employment and income.

Education

The highest level of educational attainment for people aged 15 and over was:

- Certificate III or IV (19.5%)
- Year 10 (17%)
- Bachelor degree or higher (13.1%)
- Year 12 (11.5%).

Educational attainment levels for Year 10, Year 12 and Bachelor degrees or higher were all lower than the state average.

Certificate III and IV completions were higher than the state average, which may reflect the nature of employment opportunities within these communities.

Employment

Of those in the labour force:

- 59.3 per cent were employed full-time
- 28.8 per cent were employed part-time
- 6.3 per cent were unemployed.

Employment levels decrease with increasing remoteness; for example, the unemployment rate was highest in Brewarrina (16.2%).

Income

The median weekly personal income for people aged 15 years and over in Western NSW was $582, while the NSW state average was $664. Family and household incomes were also much lower than the state average.

The socioeconomic profile of Western NSW communities is marked by lower educational attainment, higher unemployment rates and lower incomes. This suggests significant barriers to accessing quality healthcare, education and stable employment, which contributes to poorer health outcomes and reduced opportunities for long-term economic and social wellbeing.

5.3.4 What strategies are needed to advocate and improve a community's health status?

Advocating for and improving the health status of a community requires a multifaceted approach including collaboration between the local community, health services and all levels of government. For Western NSW, strategies need to be implemented in order to strengthen access to healthcare services, improve Aboriginal and Torres Strait Islander Peoples' health, address age-related health needs and enhance education and employment opportunities.

Strengthening access to healthcare services

Strategies to strengthen access to healthcare services could include the following options.

Rural medical training programs

Establishing and expanding medical schools, nursing programs and allied health education in rural areas to train health professionals locally.

Studies show that individuals trained in rural environments are more likely to remain in those areas to practice. Training **healthcare professionals** in rural environments not only gives them the skills to address the unique health challenges of these communities but also encourages them to remain in the area after graduation. This localised training model helps mitigate the effects of workforce shortages, leading to better health outcomes for residents, thus advancing SDG 3. By increasing the number of healthcare professionals who understand and are committed to the communities they serve, it contributes to SDG 10 by promoting equality in health service availability.

healthcare professionals trained individuals who provide medical services and support, including doctors, nurses, therapists and allied health practitioners, who are responsible for patient care and health promotion

telehealth the delivery of healthcare services remotely using telecommunications technology, allowing patients to consult with healthcare providers through video calls, phone calls or online messaging, enhancing access to care

Enhance telehealth infrastructure

Expanding broadband and mobile internet access in rural and remote areas can support **telehealth** consultations, diagnostics and follow-up care. It is also important to make sure rural clinics are equipped with the necessary technology and software to provide telehealth services.

FIGURE 5.11 Telehealth services can help reduce inequities faced by those in rural and remote areas.

Improving telehealth infrastructure can significantly reduce geographic barriers to healthcare access, allowing residents to receive care without the need for lengthy travel. This is particularly crucial in remote areas where healthcare facilities are sparse. By improving telehealth capabilities, communities could experience a decrease in preventable hospitalisations and better management of chronic conditions, thus aligning with SDG 3 (Good Health and Wellbeing). As telehealth services become more accessible, this can help to bridge the health gap between urban and rural areas, supporting SDG 10 (Reduced Inequalities) by ensuring that all individuals have equitable access to healthcare services, regardless of their geographic location. As a result, improved healthcare access contributes to more resilient and inclusive communities, aligning with SDG 11 (Sustainable Cities and Communities).

Improving Aboriginal and Torres Strait Islander Peoples' health

Investment in culturally appropriate healthcare

Investing in **culturally appropriate healthcare** includes expanding Aboriginal Medical Services and ensuring that healthcare providers are trained in culturally competent practices. This can include employing Aboriginal and Torres Strait Islander health workers and incorporating traditional healing practices into mainstream healthcare services.

culturally appropriate healthcare healthcare that is respectful of and tailored to the cultural beliefs, practices and needs of diverse populations, ensuring that services are accessible and effective for individuals from different backgrounds

By providing culturally tailored healthcare, Aboriginal and Torres Strait Islander Peoples are more likely to seek and engage with health services, which can lead to improved health outcomes. Culturally competent care can help reduce rates of chronic diseases and enhance life expectancy among Aboriginal and Torres Strait Islander Peoples, supporting SDG 3 (Good Health and Wellbeing). As these services are tailored to the specific needs of communities, it helps address health disparities, promoting SDG 10 (Reduced Inequalities) by ensuring that these populations receive equitable care. Additionally, enhancing the healthcare infrastructure for marginalised communities contributes to stronger, healthier community networks, aligning with SDG 11 (Sustainable Cities and Communities).

Implementing community-driven health programs

Developing and implementing community-driven health programs can specifically address chronic diseases, mental health issues and substance use within Aboriginal and Torres Strait Islander communities.

FIGURE 5.12 Culturally safe practices can improve inequities within healthcare and education.

Community-driven health programs empower populations to take charge of their health outcomes, ensuring that initiatives are relevant and effective. By focusing on chronic diseases and mental health, these programs can significantly improve health indicators for Aboriginal and Torres Strait Islander Peoples, aligning with SDG 3 (Good Health and Wellbeing). Furthermore, involving the community in the design and execution of health programs fosters a sense of ownership and responsibility, thereby reducing health inequalities, which is fundamental to achieving SDG 10 (Reduced Inequalities). As these programs strengthen community health and social networks, they contribute to building resilient and inclusive communities, thereby supporting SDG 11 (Sustainable Cities and Communities).

Addressing age-related health needs

Expanding healthcare services for younger and elderly populations

This strategy involves enhancing healthcare services tailored to the unique needs of both the younger and older populations. This includes increasing the availability of aged care services, dementia care and mental health support specifically designed for youth. Expanding the reach of healthcare through mobile health clinics for elderly populations in remote areas ensures that vulnerable groups receive necessary medical attention.

FIGURE 5.13 Appropriate aged care services helps to achieve SDG 3: Good Health and Wellbeing.

By providing targeted healthcare services for these age groups, the overall health outcomes in the population can significantly improve, addressing specific vulnerabilities associated with age. For instance, enhancing mental health support for youth can lead to lower rates of mental health issues, thereby aligning with SDG 3 (Good Health and Wellbeing). Meanwhile, making sure elderly individuals have access to appropriate care and mobile health clinics fosters a sense of security and community engagement, which contributes to the sustainability and inclusiveness of rural areas, thereby supporting SDG 11 (Sustainable Cities and Communities). Ultimately, these strategies help create a health system that recognises and meets the diverse needs of all age groups, promoting a healthier, more equitable society.

Enhancing education and employment opportunities

Increasing Year 12 attainment

Developing initiatives that encourage students to complete their Year 12 education could involve mentorship programs, tutoring services and after-school study programs tailored to help students meet graduation

requirements. Schools can also create partnerships with local businesses to offer work placements or internships that incentivise academic achievement and provide practical experience.

Higher Year 12 attainment rates correlate with improved job prospects, higher earning potential and improved health outcomes. This strategy addresses SDGs 4 (Quality Education) and 3 (Good Health and Wellbeing), by promoting educational completion and ensuring that students have the skills needed for the workforce and the health literacy to make positive health decisions into the future. Increasing educational attainment can also help reduce inequalities in the job market, supporting SDG 10 (Reduced Inequalities).

apprenticeship a system of training in which a person (the apprentice) learns a trade or skill through practical experience under the guidance of a skilled worker, often while working for a set period

traineeship structured training programs that provide individuals, often students or recent graduates, with practical experience in a specific field or profession, combining on-the-job training with educational components

Expanding apprenticeship and traineeship programs

This strategy involves implementing targeted **apprenticeship** and **traineeship** programs in collaboration with local industries to provide on-the-job training and skill development. It can include incentives for businesses that hire apprentices or trainees from local communities, ensuring that young people have access to employment opportunities.

These programs can significantly increase youth employment rates, improve skill development and reduce youth unemployment. This strategy supports SDG 3 (Good Health and Wellbeing) as young people engaged in meaningful work are less likely to experience mental health issues related to joblessness, thus leading to healthier communities overall. Young individuals will gain valuable qualifications and experience in their chosen fields, which can increase their employability and readiness for the workforce, helping to improve SDGs 4 (Quality Education) and 10 (Reduced Inequalities). A stronger local workforce can also lead to reduced migration to urban centres, helping to maintain population levels in rural areas, thereby supporting sustainable urban and rural community development (SDG 11: Sustainable Cities and Communities).

FIGURE 5.14 Apprenticeships and traineeships can improve education, income and employment opportunities.

5.3.5 How do you know these strategies may be effective?

Before implementing any strategies to address health issues within a community, there should be a planning process which includes the latest evidence-based models for effective public health interventions. This will make sure that only strategies proven to have an impact will be used, thus increasing the chances of improving the health status of a community.

It is also important to recognise that because one strategy has been effective within one area of NSW, it does not mean that it will be immediately effective in another. Each community within NSW is unique in its geographic location, demographic composition and culture. Therefore, there needs to be consultation between governments, health services and community leaders to tailor each strategy specifically to suit the needs of the targeted community.

FIGURE 5.15 Monitoring and evaluating the implementation of strategies is important to ensure successful outcomes.

To check each strategy remains effective, it is important to set up frameworks to monitor and evaluate progress. This can include:

- collecting data on key health indicators before and after the strategy is implemented to measure its impact
- engaging community members to assess how well programs are working, ensuring they stay relevant and beneficial
- collaborating with local health organisations to evaluate the success of partnerships and initiatives in improving health services and education.

An example of distinct strategies in action is the differentiation between headspace, which focuses on the mental health needs of younger people, and Older People's Mental Health Services (OPMH). headspace centres are designed to create youth-friendly environments, using outreach and communication methods that resonate with adolescents and young adults, such as online platforms and peer support programs. In contrast, OPMH services are tailored to address the specific challenges faced by older adults, such as dementia care, social isolation and age-related stigma around mental health. These services often collaborate with aged care facilities and community groups to provide accessible and relevant support. This illustrates the importance of tailoring strategies to meet the unique needs of different demographics, reinforcing the importance of planning, community consultation and ongoing evaluation.

EXAM TIP

How do you know these strategies may be effective?

An exam question focusing on this syllabus point will require an understanding of the community and the needs within that community. It may be purposeful to include a checklist to consider:

1. The goals of the community (what are its needs?)
2. How the goals/needs map to one of the four SDGs (3, 4, 10 or 11)
3. Identify a strategy that has been used to address the community's goal
4. Make a judgement regarding the effectiveness of this strategy to support one or more of the SDGs (good to consider data to support your judgement)

For example: *'Active In-Betweens' is a Health Cities of Illawarra initiative. Its aims are to promote healthy eating, and maintain positive peer and family relationships for the 8–12 preteen target group. This addresses a few Sustainability Development Goals such as SDG 3 and 4 to promote health and wellbeing of young people in schools and at home. Data suggests that this initiative has proven effective in increasing the use of recreational spaces to enhance wellbeing. Parents in the local community have noted their children have increased their levels of physical activity due to improved access to community equipment/spaces and home-based physical activity resources, although playground bullying still presents challenges, according to local primary schools. This suggests the need to develop stronger skills in forging more respectful relationships. This will support engagement and attendance at school to promote SDG 4 and assist in providing supportive, equity-based school environments to complement SDG 10 and 11.*

DEPTH STUDY IDEA

Your town has received funding to improve the health, education and equality of its residents.

a. Research the health profile of your town or region. (Use the **Health Stats NSW** weblink in the Resources panel.)
b. Outline a plan to improve the health status of your community that incorporates elements of SDGs 3, 4, 10 and 11.
c. Consider how the distribution of funding will be allocated within your plan to support your initiatives.
d. Explain how each part of your plan addresses one or more SDGs and their interconnections.
e. Determine to what extent each strategy will improve the health status of your community.

5.3 ACTIVITIES

SDG progress and connections

1. View the **SDG Progress Report** weblink in the Resources panel and determine which indicators of SDGs 3, 4, 10 and 11 are on track, needs improvement, breakthrough needed or off track.
2. Design an infographic that demonstrates the connections between SDGs 3, 4, 10 and 11. Use examples to show how progress in one goal can lead to positive impacts in another.

Major local health issues

3. Research the health profile of your Primary Health Network (PHN) or Local Health District (LHD) to determine the major health issues for your community.

Sustainable cities comparison

4. Research one of the these sustainable cities and compare similarities and differences to the Healthy Cities Illawarra initiative: **Newcastle Sustainability** or **Healthy Towns North Coast**.

Analysis of programs

5. Watch the video **ABC Four Corners: Backing Bourke** in the Resources panel and complete the following questions.
   a. Why was the Maranguka Justice Reinvestment program implemented in Bourke?
   b. How does this program align with SDGs 3, 4 and 10?
   c. View the **Just Reinvest** weblink in the Resources panel and describe how this program has now been applied in other communities such as Moree and Mt Druitt.
6. Research the Royal Flying Doctors Service (RFDS) and answer the following questions.
   a. Describe how it aligns with SDGs 3, 4, 10 and 11.
   b. To what extent could the RFDS improve the health status of rural and remote communities?

on Resources

Weblinks
SDG Progress Report
Just Reinvest
ABC Four Corners: Backing Bourke
Western NSW Health Profile 2021
Health Stats NSW
Western NSW District Data Profile
Primary Health Networks (PHN) NSW
Local Health Districts (LHD) NSW
Newcastle Sustainability
Healthy Towns North Coast

5.3 Exercises

learnon

5.3 Quick quiz on | **5.3 Exercise**

Learning pathways

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

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Revise your knowledge

1. How does one initiative from Health Cities Illawarra support SDGs 10 and 11?
2. How does the Maranguka Justice Reinvestment program support SDGs 3 and 4?
3. Describe the role of telehealth in addressing healthcare access challenges in rural and remote communities. How does this strategy align with SDG 11?

4. Explain how rural medical training programs support SDG 3 (Good Health and Wellbeing) and SDG 10 (Reduced Inequalities) in rural Australian communities.
5. Why is monitoring and evaluation critical in implementing health strategies for communities?

Apply your knowledge

6. Design an initiative aimed at improving Year 12 attainment rates in a community with high dropout rates. Explain how this initiative would support SDG 4 and contribute to better health outcomes (SDG 3) for young people.
7. Discuss the challenges of applying an effective strategy from one NSW community to another, given differences in demographic and geographic contexts.
8. Design a strategy to address SDG 4 in your community and explain how it will support SDG 10.
9. Outline a combined education and employment initiative that could help reduce youth unemployment and support SDG 4 and SDG 10. Describe one expected health benefit of the initiative.
10. Which of the SDGs (3, 4, 10 or 11) should hold greatest priority for the Healthy Cities Illawarra initiative? How does this goal support another goal directly or indirectly?

5.3 Exam questions

Question 1 (1 mark)

A local community has developed a strategy to improve health literacy and employment rates by increasing the number of Year 12 graduates. Which Sustainable Development Goal does this apply to?

A. SDG 3: Good Health and Wellbeing
B. SDG 4: Quality Education
C. SDG 10: Reduced Inequalities
D. SDG 11: Sustainable Cities and Communities

Question 2 (1 mark)

Which of the following strategies does not apply to Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities?

A. Introducing after-school programs
B. Enhancing public transport networks
C. Implementing urban green spaces
D. Developing affordable housing

Question 3 (5 marks)

Justify the importance of integrating SDGs 3 and 10 into community health initiatives aimed at addressing health disparities among Aboriginal and Torres Strait Islander Peoples.

Question 4 (8 marks)

Evaluate the application of SDGs 3 and 4 to inform strategies to improve the health status of a community.

Question 5 (8 marks)

Analyse how the promotion of educational opportunities in line with SDG 4 can mitigate the effects of health disparities identified in SDG 10.

5.4 Sample exam question response

Question

A health profile of a community identifies the following data:

- Increasing rates of obesity, particularly among children and adolescents
- Rates of cardiovascular disease at twice the state average
- Median household income lower than the state average
- Low rates of education attainment at a Year 12 level
- Increasing rates of unemployment

Analyse the application of SDGs 3 (Good Health and Wellbeing) and 4 (Quality Education) in improving the health status of this community. **(8 marks)**

Criteria	Marks
• Provides a comprehensive analysis of how SDG3 and SDG4 address the health issues in the community • Provides detailed examples	8
• Provides an analysis of how SDG3 and SDG4 address the health issues in the community • Provides examples	6–7
• Provides some explanation of how SDG3 and SDG4 address the health issues in the community • Provides relevant example(s)	4–5
• Demonstrates a basic uderstanding of the application of SDGs • May provide an example	2–3
• Provides some relevant information	1

Sample response

Breaking down the question

Analyse the application of SDGs 3 (Good Health and Wellbeing) and 4 (Quality Education) in improving the health status of this community.

Identify the action word/s: Analyse — the answer must identify components and the relationship between them; draw out and relate implications

Syllabus terminology: SDG 3: Good Health and Wellbeing, SDG 4: Quality Education

Examples: must be related to improving the health status of the community provided in the scenario

Mark allocation: 8 marks — according to HSC past papers, questions worth 8 marks require answers that demonstrate a thorough understanding and include body paragraphs, each addressing the action word and providing relevant 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]

Note: The introduction addresses the data in the scenario and previews a strategy to incorporate SDGs 3 and 4 to address the health concerns of the community.

The conclusion presents further evidence to substantiate the relationship between SDGs 3 and 4 and the improved health status of the community.

Sample annotated response

The health profile of the community indicates that there is a high level of socioeconomic disadvantage as seen by the education, unemployment and income data. Applying SDG 3 and 4 in the form of community collaboration to create effective school-to-work pathways could lead to improved health status.

The data shows that there are high levels of unemployment, coupled with a median household income lower than the state average, which suggests SDG 4: Quality Education needs to be a priority.[1] SDG 4 supports all people to have access to quality education in the form of schooling and tertiary education, such as TAFE and university.[2] For example, careers teachers in schools connecting Year 12 students with building apprenticeships can help secure employment.[3] Furthermore, connecting local students with local industries can result in increased educational attainment leading to increasing employment opportunities along with access to higher incomes which can help to address SDG 3. Through an increase in health literacy and disposable income, disadvantaged communities can improve their daily living standards as well as being able to financially engage in preventative practices such as health screens and regular GP visits which could decrease incidence of lifestyle diseases like CHD. As a result, good health and wellbeing is valued and maintained.[4]

This community is experiencing increasing rates of obesity among children and adolescents and has CVD rates twice the state average.[1] SDG 3 aims to develop good health and wellbeing through early intervention and prevention.[2] Collaboration between local businesses, the school and families to create school-to-work pathways may improve school attendance, thus enabling students to participate in health education allowing them to develop the knowledge, skills and understanding of protective risk factors such as physical activity and healthy balanced diets. To reduce the incidence of obesity the National Obesity Strategy has been created to address the dietary intake of children and adolescents targeting a reduction in sugary drinks and an increase in fruit and vegetable intake to improve energy, healthy weight maintenance and wellbeing.[3] This strategy aims to educate young Australians on the importance of good nutrition and regular exercise which has positive impacts on concentration and school attainment. As a result of increasing the health literacy of young people it may lead to lower rates of obesity and CVD thus improving health status.[4]

Creating effective school-to-work pathways shows how SDG 3 and 4 are connected. Increased levels of education, income and employment are strongly linked to an individual's ability to achieve good health and wellbeing. Therefore, the health status of the community can be significantly improved as individuals have greater access to the education and monetary resources required to achieve positive health.

5.5 Review

Hey students! Now that it's time to revise this topic, go online to:

Review your results

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Practise exam questions

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5.5.1 Topic summary

5.2 Key features of Sustainable Development Goals

- The Sustainable Development Goals (SDGs) consist of 17 global objectives established by the United Nations in 2015 to address critical global challenges by 2030.
- SDG 3: Good Health and Wellbeing — Aims to provide universal access to healthcare, reduce child and maternal mortality, combat diseases, and promote mental health for all individuals.
- SDG 4: Quality Education — Emphasises the importance of inclusive and equitable education for everyone, aiming to break the cycle of poverty and equip individuals with necessary skills and knowledge.
- SDG 10: Reduced Inequalities — Focuses on addressing social and economic disparities, promoting the inclusion of marginalised groups, and ensuring fair economic systems that benefit all.
- SDG 11: Sustainable Cities and Communities — Addresses urban challenges by promoting environmentally sustainable, safe, and inclusive urban spaces that enhance overall wellbeing.
- The SDGs are designed to work together in a holistic manner; progress in one area often supports advancements in others, reflecting the holistic nature of sustainable development.

5.3 Applying SDGs 3, 4, 10 and 11 to improve the health status of a community

- Health promotion strategies can be implemented within communities to help achieve the SDGs and improve the health status of the community.
- Healthy Cities Illawarra uses a range of initiatives to allow individuals and communities to live healthier lives by addressing the social, economic and environmental determinants of health.
- Maranguka Justice Reinvestment in Bourke aims to reduce the over reliance on the criminal justice system, improve community outcomes and address the root causes of crime through community-led, holistic approaches.
- Both initiatives focus on community engagement and ownership, involve collaboration across sectors and focus on prevention and early intervention to achieve positive health outcomes.
- Major health issues in Western NSW include reduced access to medical services; higher rates of chronic disease and preventable hospitalisations;employment, lower levels of education, income and employment along with the inequities faced by the Aboriginal and Torres Strait Islander Peoples from this region
- Strategies to improve these health issues include rural medical training programs, enhanced telehealth infrastructure, investment in culturally appropriate healthcare and increasing educational attainment.
- Strategies can be deemed effective if they have a robust evidence base, when data is collected and monitored, when community members are engaged and when collaboration occurs between all key stakeholders.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Minister for Health and Aged Care Evaluation Report — Community Case Study on SDG 3

Time: 8 hours

Task description: Evaluate a community health strategy, program or initiative in terms of SDG 3 targets. Write a report using a case study. Present your findings as a written response, verbal or multimodal presentation.

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

Resources

Digital documents Topic 5 summary (doc-43056)
Key terms glossary (doc-43057)
Revision quiz (doc-43058)

Interactivity Missing word interactive quiz (int-9362)

5.5 Exercises

learnon

5.5 Revision quiz on | **5.5 Exam questions**

5.5 Exam questions

Section I

Question 1 (1 mark)

What is a key target of Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities in Australia?

A. Increase rural employment opportunities
B. Ensure access to safe and affordable housing
C. Reduce carbon emissions from the agricultural sector
D. Improve educational outcomes for Aboriginal and Torres Strait Islander Peoples

Question 2 (1 mark)

One of the key focuses of Sustainable Development Goal (SDG) 4 in Australia is to:

A. promote mental health.
B. ensure affordable housing for all.
C. improve environmental sustainability.
D. improve literacy and numeracy rates.

Question 3 (1 mark)

A large city invests in public transport to reduce traffic congestion and lower air pollution. Which SDG does this initiative primarily support?

A. SDG 3: Good Health and Wellbeing
B. SDG 4: Quality Education
C. SDG 10: Reduced Inequalities
D. SDG 11: Sustainable Cities and Communities

Question 4 (1 mark)

Given the challenges of healthcare access in rural Australia, which strategy aligns with SDG 3: Good Health and Wellbeing?

A. Increasing urban migration
B. Reducing healthcare funding
C. Establishing mobile health clinics
D. Promoting educational institutions in metropolitan areas

Question 5 (1 mark)

A program in Australia aims to provide scholarships for underprivileged students.

Which Sustainable Development Goals does this primarily relate to?

A. SDG 3: Good Health and Wellbeing and SDG 4: Quality Education
B. SDG 3: Good Health and Wellbeing and SDG 10: Reduced Inequalities
C. SDG 4: Quality Education and SDG 10: Reduced Inequalities
D. SDG 4: Quality Education and SDG 11: Sustainable Cities and Communities

Section II

Question 6 (3 marks)

Outline ONE strategy that can be implemented to achieve Sustainable Development Goal 11: Sustainable Cities and Communities.

Question 7 (4 marks)

Outline TWO strategies that can be implemented to achieve Sustainable Development Goal 3: Good Health and Wellbeing.

Question 8 (4 marks)

Describe the relationship between Sustainable Development Goal 3 and Sustainable Development Goal 10 in improving health outcomes.

Question 9 (4 marks)

Explain the relationship between Sustainable Development Goal 11 and Sustainable Development Goal 3 in improving health outcomes.

Question 10 (4 marks)

Universities in major cities utilise medical students in hospitals to meet the ongoing workforce demands in hospitals.

How has SDG 4 been applied to improve the health status of a community?

Question 11 (5 marks)

How have Sustainable Development Goals 3 and 4 been applied in one community that you have studied?

Question 12 (6 marks)

To what extent have Sustainable Development Goals 10 and 11 been used to address the impacts of Australia's ageing population?

Question 13 (8 marks)

Justify the application of Sustainable Development Goals 3 and 4 to reduce mortality rates from cardiovascular disease.

Question 14 (8 marks)

A community in NSW has a high proportion of their population under 20 years of age, limited access to mental health services and low educational attainment.

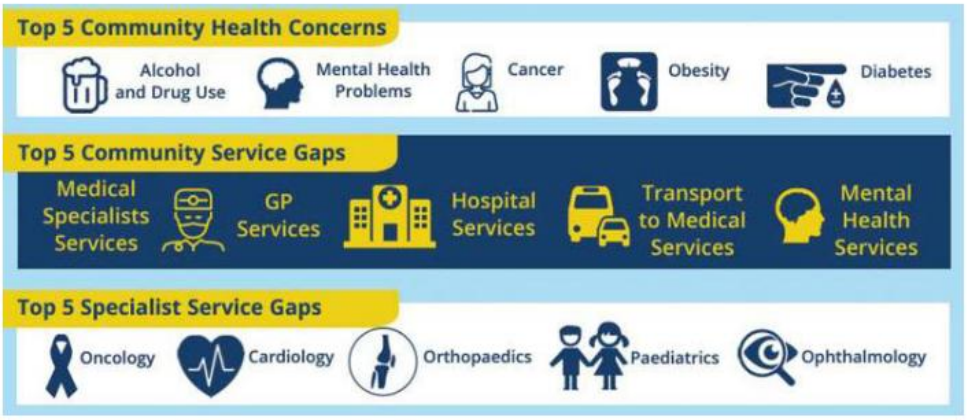
Analyse the application of SDGs 4 (Quality Education) and 10 (Reduced Inequalities) to address the health issues faced in this community.

Section III

Question 15 (12 marks)

Refer to the information below as well as your own knowledge to answer the question.

This infographic provides information on a community.



To what extent could Sustainable Development Goal 4: Quality Education and Sustainable Development Goal 11: Sustainable Cities and Communities assist in improving the health status of this community?

FOCUS AREA

2 Training for improved performance

TOPIC

6 How exercise assessment and prescription can be personalised 244

7 How training influences movement and performance 274

8 Training for individual and groups sports 326

9 The impact of sleep, nutrition and supplementation on movement and performance 364

10 How individuals train for sustained movement and performance 408

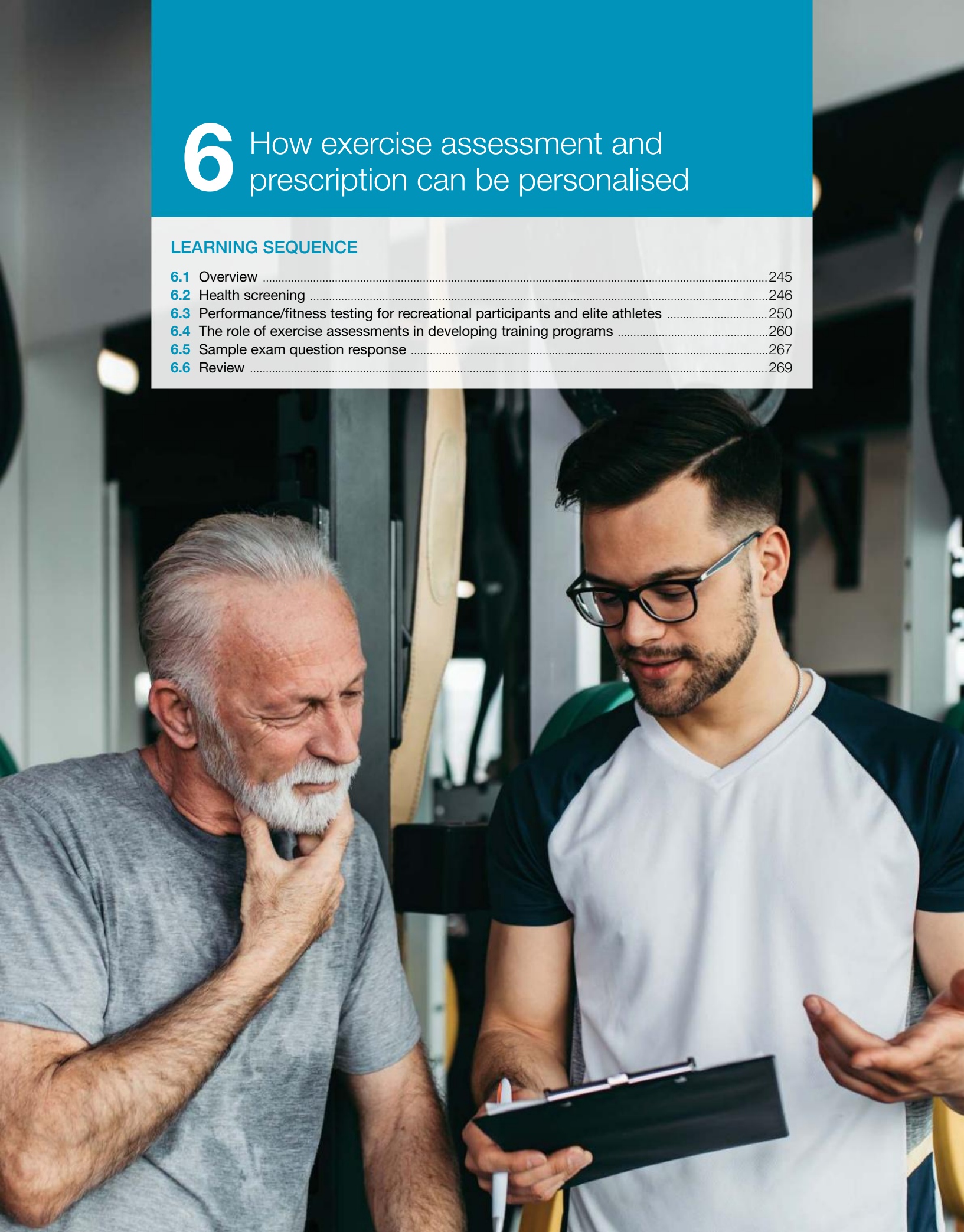
OUTCOMES

- investigates factors that impact movement and performance HM-12-04
- analyses individual and group training programs to improve performance HM-12-05
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

6 How exercise assessment and prescription can be personalised

LEARNING SEQUENCE

6.1 Overview 245
6.2 Health screening 246
6.3 Performance/fitness testing for recreational participants and elite athletes 250
6.4 The role of exercise assessments in developing training programs 260
6.5 Sample exam question response 267
6.6 Review 269



6.1 Overview

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Key inquiry question

How can exercise assessment and prescription be personalised?

Syllabus

	Syllabus content	Subtopic
○	■ Explain the importance of using a pre-exercise questionnaire and undertaking relevant health screening by exercise and fitness professionals	**6.2**
○	■ Discuss the use of performance/fitness testing for recreational participants and elite athletes to improve their health, participation and performance **Example(s):** Yo-yo test. Wingate test.	**6.3**
○	■ Explain how exercise assessment can assist in developing training programs	**6.4**

Source: *Health and Movement Science Stage 6* © NSW Education Standards Authority for and on behalf of the Crown in right of the State of New South Wales, 2025.

Outcomes

- investigates factors that impact movement and performance HM-12-04
- analyses individual and group training programs to improve performance HM-12-05
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09

on Resources

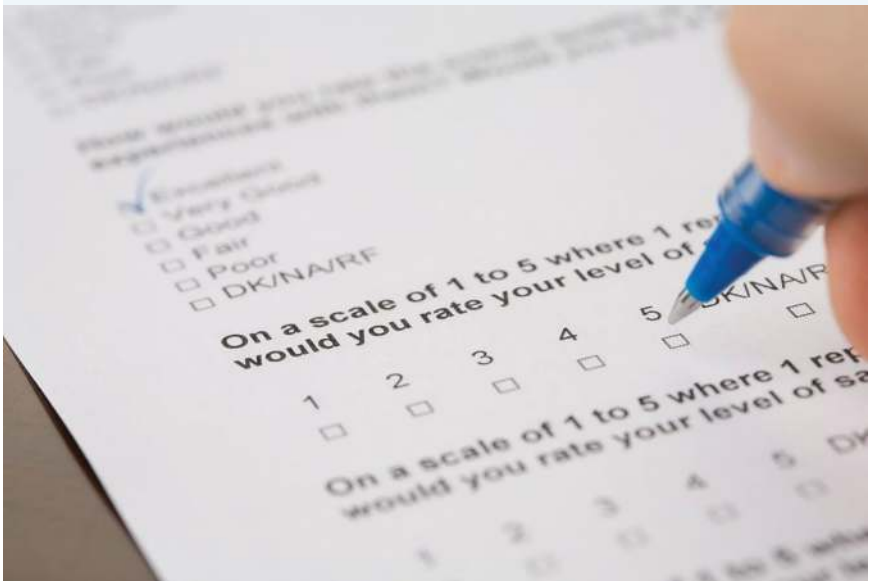
Digital documents Topic 6 summary (doc-43059)
Key terms glossary (doc-43060)
Revision quiz (doc-43061)

6.2 Health screening

Syllabus: Explain the importance of using a pre-exercise questionnaire and undertaking relevant health screening by exercise and fitness professionals

Health screening and **pre-exercise questionnaires** are essential steps before starting any exercise, sport or training program. They allow exercise and fitness professionals to identify an individual's medical history, assess any potential risks, and understand the athlete's current fitness level. This information helps set a clear starting point and ensures that a personalised program can be designed to meet the unique needs and goals of each person, whether they are a **recreational participant** or an **elite athlete**.

FIGURE 6.1 Pre-exercise questionnaires help identify any potential risks.



6.2.1 Health screening and pre-exercise questionnaires

Before starting a training program or joining a gym, exercise and fitness professionals typically ask clients to complete a questionnaire to collect vital information. This form is stored with the individual's file and is used to identify any medical conditions that may increase the risk of adverse events during physical activity. The questionnaire usually covers topics such as:

- age
- gender
- health status
- medical conditions
- family history of heart disease
- medication use
- current or past injuries to muscles, joints or bones
- current physical activity levels.

health screening the assessment of an individual's medical history, risk factors and current health status to identify any potential issues that could impact their ability to safely participate in exercise

pre-exercise questionnaires forms filled out by individuals before beginning an exercise program or assessment. They gather information about an individual's health history, current fitness levels and any concerns, helping exercise and fitness professionals design safe and effective exercise regimens.

recreational participant an individual who engages in physical activity for enjoyment, health or fitness rather than for competitive purposes

elite athlete an individual who competes at the highest levels of their sport, often requiring advanced skills, physical fitness and specialised training

In Australia, three national organisations — AUSactive, Exercise and Sports Science Australia (ESSA), and Sports Medicine Australia (SMA) — have standardised pre-exercise screening across the health and fitness industry. Together, they developed the Australian Adult Pre-Exercise Screening System, an evidence-based tool designed to identify and manage health risks associated with exercise.

6.2.2 Current physical activity/exercise levels and goals

Health screening questionnaires often ask about an individual's current weekly physical activity levels, as well as the types of exercise they've previously engaged in. These questions are typically framed around the **FITT principle**:

- Frequency — how often they engage in physical activity per week
- Intensity — the level of intensity — light, moderate or vigorous
- Time — total minutes per week spent exercising
- Type — the type of activity, such as aerobic training, strength training or sports.

FIGURE 6.2 Asking questions about personal goals helps tailor an exercise program.

Additionally, questions regarding personal goals are included to help fitness professionals tailor individualised programs. Common goals among recreational participants and elite athletes could include:

- lose weight
- improve overall fitness and wellbeing
- increase strength
- be able to compete in a fun run such as the 'City to Surf'
- run a marathon in under 3 hours
- be selected in a representative sports team such as NPL 1 for football.

Understanding a person's current activity levels and their goals is crucial for establishing a starting point and working out the appropriate level and pace of progression to help them achieve their objectives.

FITT principle Frequency, Intensity, Time and Type. It is a guideline used in designing exercise programs, emphasising how often (frequency), how hard (intensity), how long (time), and what kind of exercise (type) to engage in.

6.2.3 High-risk groups

Certain groups are at a higher risk of adverse events during physical activity. People who fall into these groups will often be required to seek guidance from an appropriate allied health professional or medical practitioner prior to undertaking exercise. These include individuals with:

- a history of heart disease or a family history of heart conditions
- hypertension or high cholesterol
- respiratory conditions, such as asthma
- diabetes or difficulty managing blood sugar levels
- previous injuries to muscles, joints, or bones
- low levels of physical activity
- those who are over the age of 45 (for men) or 55 (for women).

FIGURE 6.3 Some people will need to seek advice or testing from medical professionals before starting an exercise program.

DEPTH STUDY IDEA

Research a high-risk group from the list below.

- A history of heart disease or a family history of heart conditions
- Hypertension or high cholesterol
- Respiratory conditions, such as asthma
- Diabetes or difficulty managing blood sugar levels

Investigate how the condition can impact a person's ability to be physically active and suggest guidelines that need to be followed when planning a training program.

6.2 ACTIVITIES

Pre-screening role play

You will need to access the **Pre-exercise screening tools** weblinks and the **Adult pre-exercise screening guide** in the Resources panel in order to evaluate risk factors and recommend exercise plans. The goal is to understand how pre-exercise screening is used to ensure safe physical activity.

1. Divide into pairs. One student plays the exercise professional, and the other plays the client.
2. Use the screening tool. The 'client' fills out the Stage 1 screening tool from the PDF provided, with made-up personal details and health conditions (e.g. 'I have asthma').
3. Evaluate the responses. The 'exercise professional' assesses the client's answers and makes recommendations (e.g. 'You should consult a doctor before starting exercise' or 'You can proceed with light-moderate intensity exercises').
4. Discussion. After completing the role play, students switch roles and repeat the process.

on Resources

Digital document Adult pre-exercise screening guide (doc-43114)

Weblinks Pre-exercise screening forms
Sports Medicine Australia: health conditions and screening

6.2 Exercises

learnon

6.2 Quick quiz on | **6.2 Exercise**

Learning pathways

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

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Revise your knowledge

1. What is the purpose of a pre-exercise questionnaire and health screening?
2. Outline some of the common topics covered in a health screening questionnaire.
3. Which organisations have standardised pre-exercise screening in Australia?
4. Which groups are considered high-risk and may require medical clearance before engaging in physical activity?

Apply your knowledge

5. Explain why it is important for all exercise and fitness professionals to provide new clients with a pre-exercise questionnaire and health screening.
6. Why is it important for there to be a standardised pre-exercise screening form that is used in Australia?
7. Describe how a pre-exercise questionnaire can help establish a person's 'starting point' in their fitness journey.
8. Why is it important for an exercise or fitness professional to consider a client's current physical activity levels and goals when developing their fitness plan?
9. Analyse the negative consequences that could arise if a pre-exercise questionnaire and health screening was not conducted prior to a person commencing a fitness program.

6.2 Exam questions

Question 1 (3 marks)

Discuss how the information obtained from a pre-exercise questionnaire can influence the design of a fitness program.

Question 2 (6 marks)

Evaluate the potential consequences of neglecting health screening and pre-exercise questionnaires before beginning a fitness program. Provide examples to support your argument.

Question 3 (4 marks)

Describe the measures exercise professionals can take to ensure that their health screening processes are effective and comprehensive.

Question 4 (4 marks)

Explain how a pre-exercise questionnaire can assist in identifying an individual's readiness for physical activity.

Question 5 (6 marks)

Examine how understanding a client's family history of health conditions can guide fitness professionals in developing safe exercise programs.

6.3 Performance/fitness testing for recreational participants and elite athletes

Syllabus: Discuss the use of performance/fitness testing for recreational participants and elite athletes to improve their health, participation and performance.

Performance and fitness testing is essential for all individuals, whether recreational participants, elite athletes, or those just beginning a fitness program. It is equally valuable for individuals progressing to more advanced levels of training. These tests enable fitness and exercise professionals to design targeted, personalised training programs that effectively support the individual's health, participation and performance goals. The more tailored and specific the training program, the greater its potential for success and fitness testing plays a key role in achieving this.

FIGURE 6.4 Fitness testing helps exercise professionals to design a program that supports your individual fitness goals.

6.3.1 Importance of performance/fitness testing

Fitness and performance tests are conducted for both recreational and elite athletes to assess their current physical capabilities, identify strengths and weaknesses, and monitor progress over time. These tests provide valuable pre and post data that help fitness and exercise professionals design personalised training programs, ensuring the program aligns with the individual's specific goals, whether that's improving overall fitness, enhancing performance, or preventing injury.

For recreational athletes, fitness testing helps establish a baseline, guiding safe and effective progression, especially for those new to exercise or returning after a break. For elite athletes, these tests are critical in fine-tuning performance, identifying areas for improvement and optimising training intensity to meet competitive goals. Regular testing also helps track improvements, allowing adjustments to training programs that maximise results and minimise injury risk.

Overall, fitness testing is important because it ensures training is tailored, efficient and aligned with the individual's fitness level and objectives.

performance and fitness testing various evaluations used to measure an individual's physical capabilities in specific areas such as cardiovascular endurance, strength, flexibility and agility. These tests provide valuable data that informs training programs, ensuring they are tailored to the athlete's needs.

FIGURE 6.5 For those returning to exercise after a break, fitness testing helps set up a baseline.

6.3.2 Selecting and conducting appropriate fitness tests

Selecting the appropriate fitness tests is crucial, as each individual has unique fitness levels, health conditions and goals. The chosen tests should align with the specific objectives of the athlete to provide relevant and actionable information. Using the information gained from the health screening and pre-exercise questionnaires is essential in order to select appropriate tests that will not put individuals at risk of injury or a medical episode.

FIGURE 6.6 It's important to choose tests that match the health-related and skill-related components of fitness you want to improve.

For example, you would not ask an overweight 55-year-old to complete a VO_2 max test or multistage fitness test; rather, you might choose the Rockport 1.6-kilometre walk. An overweight 55-year-old is unlikely to have high levels of aerobic power, so completing the VO_2 max test or multistage fitness test, which are exhausting in nature, may be physically dangerous for them. In contrast, the Rockport 1.6-kilometre walk is a submaximal test and is therefore unlikely to put the participant at risk.

It's also important to consider which health-related and skill-related components of fitness want to be targeted and improved upon. For example, a recreational participant aiming to improve general strength would not benefit from the multistage fitness test, which measures aerobic capacity and offers no insight into strength levels.

Health-related fitness components include:

- cardiorespiratory endurance
- muscular strength
- muscular endurance
- flexibility
- body composition.

Skill-related fitness components include:

- power
- speed
- agility
- coordination
- balance
- reaction time.

Most recreational participants aim to improve one or more health-related components of fitness, while elite athletes often focus not only on the health-related aspects but also on specific skill-related components that enhance their performance in their sport or event. Therefore, it is essential to select fitness tests that are tailored to both the relevant fitness components and the demands of the sport. For example, an elite rugby league fullback might use the Illinois agility test to assess and improve their agility, a key skill required for their position and sport.

FIGURE 6.7 Agility tests are useful in many team sports including rugby and netball.

Similarly, while several tests may measure the same fitness component, such as aerobic capacity, some are more suited to certain athletes. For instance, the yo-yo test, which assesses aerobic power through short bursts of high-intensity effort followed by brief recovery periods, is ideal for elite soccer midfielders, as it mirrors the demands of the sport. In contrast, a cycle ergometer test, which involves cycling at a steady pace for seven minutes to assess aerobic power, may be less appropriate for a soccer player but suitable for athletes in other disciplines. Tailoring the test to the athlete's specific needs and the demands of their sport is key to obtaining useful data.

The syllabus requires you to know both the yo-yo test and the Wingate test. Both have been outlined below. However, there are many other tests that can be useful when assessing the fitness levels of both recreational participants and elite athletes based on the various components of fitness. Some are outlined in the table 6.1.

TABLE 6.1 Fitness component and its tests

Fitness component	Test/s
Aerobic power	Multistage fitness test Yo-yo test Cooper 12-minute run test Astrand–Rhyming cycle ergometer test Harvard step-test Rockport 1.6-kilometre walk
Anaerobic capacity	Phosphate recovery test 30-second Wingate test Repco peak power test
Muscular strength	1 RM test (bench press, back squat, leg press) Grip strength dynamometer Seven-stage abdominal strength test
Muscular power	Basketball throw Vertical jump Standing long jump
Muscular endurance	60-second push-up test 60-second sit-up test Curl-up (crunch) test Flexed arm hang test
Speed	20-metre sprint test 35-metre sprint test 50-metre sprint test
Agility	Illinois agility test Semo agility test 5-0-5 agility test
Flexibility	Trunk flexion (sit-and-reach) test Shoulder and wrist elevation test Trunk and neck extension test Shoulder rotation test

You can find some of these tests explained in more detail at the **Brainmac** weblink in the Resources panel. See also the example **Yo-yo test** and **30-second Wingate test** videos in the weblinks in the Resources panel.

YO-YO INTERMITTENT RECOVERY TEST

Goal

To keep up with the audio recording as long as possible.

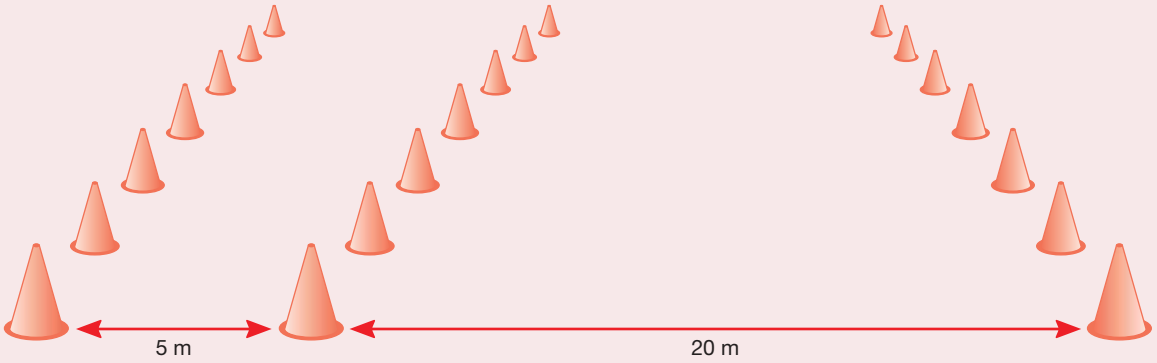
Equipment

- Measuring tape
- Cones/markers
- Yo-yo audio recording

Instructions

1. Measure out a 20-metre test course as per figure 6.8.

FIGURE 6.8 Set up for the yo-yo intermittent recovery test



2. Place markers 2 metres apart at both ends of the 20-metre test course (i.e. at the start and turning lines).
3. In addition to marking the 20-metre line, measure out a 5-metre distance behind the start line.
4. Place a marker on the recovery line aligned to the middle of the two markers on the start line.
5. Participants assume a starting position on the start line.
6. The yo-yo test audio is started. (There are two levels of audio available: level 1 is for beginners and level 2 is advanced.)
7. At the time of the first signal, the participants run forward to the turning line. At the sound of the second signal, participants arrive and turn at the turning line and then run back to the start line, arriving on the next beep. When the start marker is passed, the participants continue forward at a reduced pace (jogging) towards the 5-metre mark, where they then turn around the cone and return to the start line. At this point, the participants stop and wait for the next signal to sound. It is important that the participants are stationary on the start line before the commencement of each sprint.
8. Participants are required to place one foot either on or over the start or turning lines at the sound of each beep.
9. Participants should continue running for as long as possible, until they are unable to maintain the speed as indicated by the audio.
10. The test ends for a participant when they are unable to maintain the required pace for two trials. The first time the start line is not reached, a warning is given; the second time, the participant must withdraw.
11. When the participant withdraws, the last level and the number of 2 × 20-metre intervals performed at this level are recorded on the appropriate recording sheet. (The last 2 × 20-metre interval is included, even if the participant did not complete it at the right pace.) For valid results, participants must attempt to reach the highest level possible before stopping.
12. The yo-yo test predicts VO_2 max as follows:

$$VO_2 \text{ max (mL/kg/L min}^{-1}) = \text{IRTI distance (metres)} \times 0.0084 + 36.4$$

Refer to table 6.2 for VO_2max norms.

For example:

A 17-year-old female achieves a score of 15.6 = 1000 metres (refer to table 6.2)

$$\text{Predicted } VO_2 \text{ max} = 1000 \times 0.0084 + 36.4$$
$$= 44.8 \text{ ml/kg/min}$$

Using table 6.2, this would be considered good according to the VO_2 max norms.

Results

TABLE 6.2 Yo-yo test norms

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

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	11.2–13.2
Very poor	< 280	< 12.3	< 160	< 11.2

It is important to note that different sports will have different means and ranges for aerobic power. For example, table 6.3 lists the norms the AIS uses for a range of sports at the national and state level.

TABLE 6.3 Yo-yo test norms for various sports according to the AIS

Sport	Sex	Age	Mean level
Netball — national	Female	U17	15.7
Soccer — national	Male	U17	20.6
Basketball — state	Female	U17	15.6
Basketball — state	Male	U17	16.2

30-SECOND WINGATE TEST

Goal

To pedal as fast as possible for 30 seconds

Equipment

- Stationary exercise bike

Instructions

1. The participant should first perform a cycling warm-up of several minutes.
2. The participant is instructed to pedal as fast as possible for 30 seconds.
3. In the first few seconds, the resistance load is adjusted to the predetermined level, which is usually about 45 grams per kilogram of body weight (Fleisch) or 75 grams per kilogram of body weight (Monark) for adults.

FIGURE 6.9 Participant performing the Wingate anaerobic test

Results

Some of the measures that can be gained from this test are mean and peak power (ideally measured in the first 5-second interval of the test, expressed in watts), relative peak power (determined by dividing peak power by body mass, expressed as watts per kilogram), mean peak power, minimum peak power, and a fatigue index determined from the decline in power.

Power output (kpm • min^{-1})
= [revs × resistance (kg) × distance (m)× 60 (s)] / time (s)

Watts = kpm • min^{-1} / 6.123

Watts/kg = watts / body weight (kg)

Fatigue index =
[(peak power output – min power output) / peak power output] × 100

TABLE 6.4 Wingate norms

	Male	Female
% Rank	**Watts**	**Watts**
90	822	560
80	777	527
70	757	505
60	721	480
50	689	449
40	671	432
30	656	399
20	618	376
10	570	353

6.3 PRACTICAL ACTIVITY

Conducting fitness tests

The goal is to learn how to assess general fitness levels and understand how test results guide exercise program design.

1. Select three fitness tests:
   - Select three fitness tests from table 6.1, ensuring each test targets a different fitness component (e.g. aerobic power, muscular endurance, flexibility).
   - Example: *Multistage fitness test*, *60-second push-up test*, and *Sit-and-reach test*.
2. Perform the selected tests:
   - Conduct each test according to its standard procedure (details may be provided by your teacher or research online).
   - Record your results and observations for each test.
3. Analyse results:
   - Compare your results against fitness norms or benchmarks.
   - Reflect on what the results suggest about general fitness and how this data could influence training program design.
4. Suitable tests:
   Using table 6.1, complete research for each test in order to provide information about who the test is most suitable for, including age, fitness level and sport considerations.

6.3.3 Benefits achieved from performance/fitness testing

Performance and fitness testing have a range of purposes, from improving general health and participation in physical activities to optimising performance at the highest competitive levels. While the specific goals and outcomes may differ, fitness testing benefits all athletes by providing a structured approach to improving health, participation and performance.

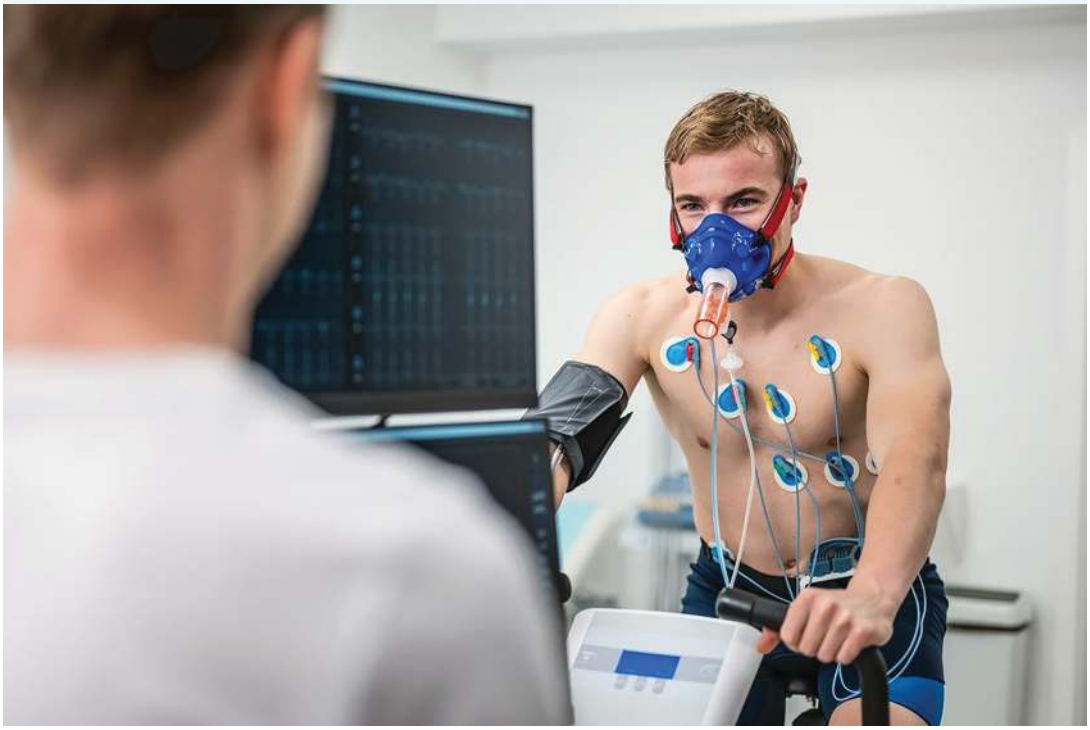
For recreational participants, the primary focus of conducting fitness testing is often in order to improve health. Many recreational participants are aiming to enhance key health-related components of fitness, such as cardiovascular endurance, muscular strength and flexibility. Fitness tests allow these athletes to understand their current fitness level and identify areas for improvement. This baseline assessment is crucial in developing personalised training programs that target specific needs, leading to overall improvements in health. Moreover, by identifying weaknesses or potential imbalances, fitness tests help prevent injury, ensuring that recreational athletes can participate consistently and safely in physical activity. The prevention of injury is particularly important at the recreational level, as setbacks can lead to a lack of motivation and long-term participation difficulties.

FIGURE 6.10 Fitness testing plays an important role in preventing injury.

In addition to health improvements, fitness testing for recreational athletes also plays a vital role in goal setting and motivation. Regular testing allows individuals to track their progress over time, offering clear, tangible evidence of improvements. This helps keep athletes motivated, as they can see the results of their efforts, which in turn encourages continued participation. Whether the goal is weight loss, improved strength or enhanced endurance, fitness tests help athletes stay on track and focused on their objectives.

For elite athletes, the benefits of performance and fitness testing are more directly related to performance optimisation. Elite athletes operate in a highly competitive environment where even marginal gains can be the difference between success and failure. Fitness tests allow these athletes to fine-tune their training programs to address sport-specific requirements. For example, while a recreational athlete may focus on general strength or endurance, an elite athlete may require more specific testing for skills such as agility, speed or power. By assessing these skill-related components, fitness testing enables coaches and athletes to adjust training to improve performance in the most relevant areas for their sport.

FIGURE 6.11 Fitness tests allow elite athletes to fine-tune their training programs.



In addition to improving specific aspects of performance, fitness testing is crucial for monitoring progress among elite athletes. Regular assessments provide detailed data on an athlete's strengths and weaknesses, allowing for continuous adjustments to training loads, intensities, and recovery strategies. This data-driven approach ensures that elite athletes are constantly improving and not **plateauing** in their development. Moreover, by identifying areas for improvement, fitness tests help athletes push their physical limits in a controlled, safe manner, reducing the risk of overtraining or injury.

plateauing a period during training when an individual experiences little to no progress in performance or fitness improvements despite continued effort

DEPTH STUDY IDEA

Create a testing model to assess the overall fitness of a recreational participant wanting to start exercising. Tests should be designed to provide data on the following health-related components of fitness:

- cardiorespiratory endurance
- muscular strength
- muscular endurance
- flexibility.

6.3 Exercises

learnon

6.3 Quick quiz on | **6.3 Exercise**

Learning pathways

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

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Revise your knowledge

1. What is the main purpose of performance and fitness testing for both recreational participants and elite athletes?
2. Outline useful information needed when selecting the appropriate fitness tests to conduct.
3. What is the difference between health-related and skill-related components of fitness? Provide examples of each.
4. Outline three benefits of performance/fitness testing for recreational participants.
5. Describe the difference between a yo-yo test and the beep test.

Apply your knowledge

6. How do fitness tests assist in designing personalised training programs for individuals at different fitness levels?
7. Explain why it is important to select appropriate fitness tests based on an individual's health status and fitness goals.
8. If a 35-year-old recreational athlete aims to improve flexibility and strength, which fitness tests would you recommend for them? Explain your choices.
9. Describe how an elite rugby player could use results from the Illinois agility test to improve their performance on the field.
10. How can performance/fitness testing improve performance in both recreational participants and elite athletes?

6.3 Exam questions

Question 1 (3 marks)

Describe how regular performance and fitness testing can increase motivation for elite athletes. Provide examples to support your argument.

Question 2 (3 marks)

Discuss the role of performance and fitness testing in improving participation for both recreational participants and elite athletes.

Question 3 (4 marks)

Explain why it is important to select fitness tests that align with an individual's goals and health status, using specific examples to support your answer.

Question 4 (5 marks)

Compare the benefits of performance testing for recreational athletes versus elite athletes, focusing on their differing goals.

Question 5 (6 marks)

Using the yo-yo test and Wingate test as examples, **evaluate** the suitability of these tests for assessing aerobic and anaerobic capacity in different athletes.

6.4 The role of exercise assessments in developing training programs

Syllabus: Explain how exercise assessment can assist in developing training programs

Health screening, pre-exercise questionnaires and performance/fitness tests are essential tools for conducting a comprehensive **exercise assessment** of individuals, whether they are recreational participants or elite athletes. These assessments provide valuable insights that inform the development of tailored and effective training programs.

exercise assessment a systematic evaluation of an individual's physical capabilities, often involving health screening, pre-exercise questionnaires and performance tests

6.4.1 Exercise assessment and training programs for recreational participants

Exercise assessments are essential for exercise and fitness professionals to complete before designing a training program for recreational participants. The main ways they assist are outlined below.

Establishing a starting point

Assessments help determine a recreational participant's initial fitness level, providing a starting point for their training. This ensures that programs are not too challenging, thereby reducing the risk of injury and burnout. For example, a sedentary individual might take part in a Rockport 1.6-kilometre walk test to assess their aerobic capacity. Based on the results, a gradual cardiovascular program can be introduced, starting with walking and building up to jogging over time.

Identifying goals

Through assessments, exercise and fitness professionals can understand individual goals, such as weight loss, improved endurance or general fitness. This clarity allows for goal-specific training programs. For example, if a recreational runner completes a Cooper 12-minute run test and covers 1.5 kilometres, their initial goal could be to increase their distance by 200 metres over the next few months through a structured running and conditioning plan.

Personalisation

By evaluating strengths and weaknesses, exercise assessments enable trainers to tailor workouts that cater to the individual's needs, preferences and any physical limitations. This personalisation enhances motivation and adherence to the program. For example, the individual might want to improve their cardiorespiratory endurance but they hate running so instead their trainer programs bike rides and swimming to achieve their goal while avoiding running.

FIGURE 6.12 Exercise assessments help trainers to tailor workouts that cater to the individual's needs, preferences and any physical limitations.

Progress monitoring

Regular assessments help track improvements over time, allowing adjustments to be made to the training program as necessary. This keeps participants engaged and motivated as they see tangible results. This is why the performance/fitness tests are often conducted prior to the program starting, during the program and also at the end of the program.

For example, a recreational participant focused on weight loss might use a **DEXA scan** to track changes in body composition. This scan provides detailed insights into lean muscle mass, fat tissue and bone density. Even if the individual's weight remains unchanged, an increase in lean muscle and a decrease in fat would show significant progress, reinforcing their motivation to continue.

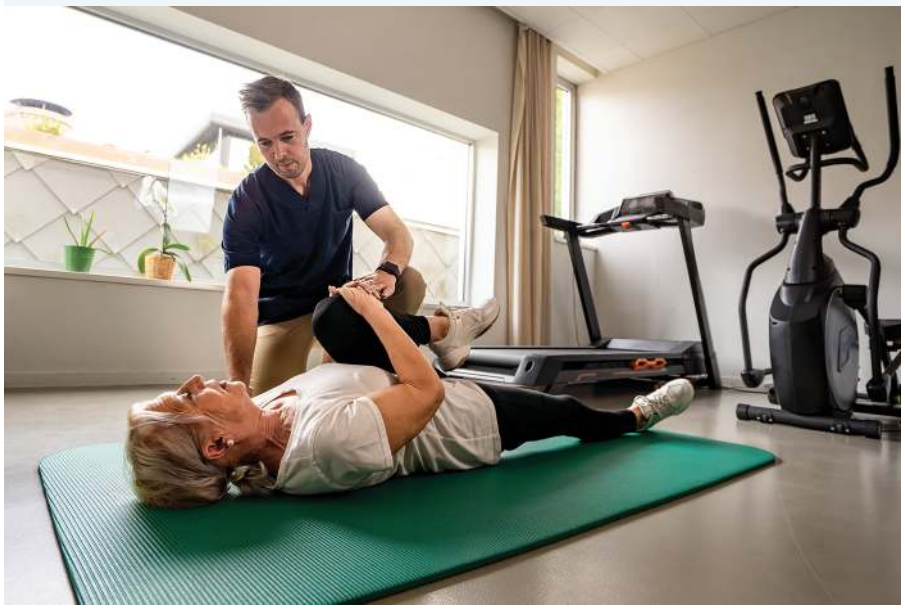
DEXA scan (Dual-Energy X-ray Absorptiometry) a medical imaging test that measures bone density and body composition, including fat and lean mass. It provides precise data, helping athletes and trainers assess body composition to tailor training programs and monitor changes over time.

Injury prevention

Assessments can identify potential risk factors, thereby helping exercise and fitness professionals design programs that minimise the likelihood of injuries or medical issues, especially for those new to exercise or returning after a long break.

For example, a recreational participant with a history of knee problems may take a muscular strength test, leading to a program that avoids high-impact activities such as jumping and instead focuses on low-impact strength exercises such as leg presses or cycling.

FIGURE 6.13 Assessments can help minimise the likelihood of injuries.



See the weblink **Self-assessment for recreational athletes** in the Resources panel for more information.

6.4.2 Exercise assessment and training programs for elite athletes

Exercise assessments are also essential for exercise and fitness professionals to complete before designing a training program for elite athletes. The main ways they assist are outlined below.

Detailed performance analysis

Elite athletes need precise evaluations of their physical capabilities, including assessments of both health- and skill-related components of fitness. These tests provide critical data for advanced performance optimisation by identifying strengths and weaknesses. With this information, training programs can be tailored to maintain the athlete's strengths while strategically improving areas of weakness, resulting in a more effective and focused approach to achieving peak performance.

For example, a sprinter may have exceptional top-end speed but show weak acceleration in a 30-metre sprint test. The program would then focus on explosive start drills, such as sled pushes and plyometrics, to enhance acceleration.

FIGURE 6.14 Elite athletes use data to improve performance.

Sport-specific training

Assessments enable exercise and fitness professionals to identify key performance indicators specific to an athlete's sport. For example, an elite kickboxer may undergo rigorous testing to measure leg power and strength. If the tests reveal a significant imbalance, such as the dominant leg being much stronger than the non-dominant leg, this insight allows for the creation of a specialised training program focused on strengthening the weaker leg. Addressing this imbalance is crucial for competition success, where good strength in both legs is essential for peak performance.

Goal setting and periodisation

For elite athletes, assessments help establish both short-term and long-term goals. Coaches and trainers can implement periodisation strategies that align with competition schedules, ensuring athletes peak at the right time. For example, a basketball player aiming to improve their vertical jump might regularly test their jump height using the vertical jump test. The trainer can set incremental goals (e.g. improving by 5 cm over a 12-week period) and adjust the program with **plyometric** and strength exercises to achieve this.

Continuous monitoring

Regular assessments offer continuous feedback on an athlete's progress, enabling real-time adjustments to training intensity and recovery strategies. This data-driven approach helps optimise performance while reducing the risk of overtraining. Elite athletes frequently undergo performance tests throughout their training to monitor improvements and ensure the program is effective. For instance, a 10-kilometre runner may complete a monthly time trial to track progress. If the results show no improvement, adjustments to the training regimen may be necessary to achieve desired outcomes.

In summary, exercise assessments are essential for both recreational participants and elite athletes. For recreational individuals, assessments focus on building a safe and engaging fitness foundation, while for elite athletes, they provide detailed insights necessary for performance optimisation. Tailoring training programs based on these assessments ensures that both groups can achieve their specific goals effectively.

plyometric plyometric exercises are high-intensity movements that involve explosive actions, such as jumping or bounding, designed to improve power and speed

CASE STUDY

Sarah's journey to run 5 kilometres without stopping

Background

Sarah is a 35-year-old office worker who has recently become interested in improving her fitness. Her primary goal is to complete a 5-kilometre run without stopping, something she has never done before. To begin her training, Sarah visits a local gym and consults with an exercise professional. Before starting the program, Sarah is required to complete a pre-exercise questionnaire and health screening to provide key information about her health and fitness background.

FIGURE 6.15 Having a goal can motivate someone to improve their fitness.

Pre-exercise questionnaire

Age:

35 years old

Gender:

Female

Health status:

Sarah considers herself to be in good general health. She works a desk job, which means she spends long hours sitting during the day. She has no known chronic illnesses but acknowledges that she is relatively unfit and has not engaged in regular exercise for years.

Medical conditions:

None currently diagnosed. However, Sarah reports occasional tightness in her lower back, which she attributes to prolonged sitting.

Family history of heart disease:

Sarah's father had a heart attack at the age of 60, which puts her in a higher risk category for cardiovascular issues. This information alerts the exercise professional to monitor her cardiovascular fitness closely and ensure that her training intensity is appropriate.

Medication use:

Sarah is not currently on any medication.

Current or past injuries to muscles, joints or bones:

Sarah mentions a minor ankle sprain two years ago, but she has fully recovered. Additionally, her lower back discomfort has never required medical treatment, but she would like to address it as part of her overall fitness improvement.

Current physical activity levels:

Sarah's current physical activity levels are low. She occasionally goes for short walks but has not committed to a structured fitness routine in several years. She rates her current fitness level as 'beginner'.

Fitness goals:

- **Primary goal:** Sarah wants to be able to run 5 kilometres without stopping.
- **Secondary goals:** Along with improving her running endurance, Sarah is also interested in increasing her overall fitness, reducing back discomfort, and losing a small amount of weight.

Fitness testing

Before designing Sarah's training program, the exercise professional conducts several fitness tests to assess her current physical capabilities. These tests help establish a baseline and provide specific insights into which areas need improvement. Since Sarah is a beginner, the focus will be on basic health-related fitness components, rather than high-intensity skill-related components that are more suited to elite athletes.

1. **Rockport 1.6-kilometre walk test (cardiorespiratory endurance)**
   - **Purpose:** This submaximal test measures aerobic fitness in a low-risk, controlled environment.
   - **Why it's appropriate:** Given Sarah's low current activity levels and lack of recent fitness training, the Rockport walk test is a safe way to estimate her VO_2 max without the intense demands of a maximal effort test like the Multistage fitness test (beep test). This test gives insight into her aerobic capacity, which is crucial for achieving her goal of running 5 kilometres.
   - **Example outcome:** If Sarah's results show low cardiorespiratory endurance, the fitness professional can implement a walk/run progression plan to gradually build up her endurance for running.
2. **Sit and reach test (flexibility)**
   - **Purpose:** Measures the flexibility of the lower back and hamstrings.
   - **Why it's appropriate:** Since Sarah reported occasional lower back tightness, assessing her flexibility is important. This test can help identify if limited flexibility in her hamstrings or lower back might contribute to her discomfort during exercise.
   - **Example outcome:** If Sarah scores poorly, her program can include regular stretching and mobility work, such as yoga or dynamic stretches, to improve flexibility and prevent injury as she increases her running mileage.
3. **Body composition analysis (e.g. DEXA scan) (body composition)**
   - **Purpose:** Provides detailed information about her body fat percentage, lean muscle mass and bone density.
   - **Why it's appropriate:** Tracking changes in body composition, rather than weight alone, will help Sarah monitor her progress towards her fitness goal. This can be particularly motivating, as she may see positive changes in muscle mass and fat reduction, even if her weight remains the same.
   - **Example outcome:** If Sarah has a higher body fat percentage, the fitness professional can incorporate strength training and interval cardio sessions to aid in fat loss while preserving muscle mass.
4. **Plank test (muscular endurance)**
   - **Purpose:** Assesses core strength and endurance.
   - **Why it's appropriate:** Strengthening Sarah's core will help support her lower back and improve her running posture and stamina. Running 5 kilometres requires not just cardiovascular endurance but also muscular endurance in the core to maintain proper form.
   - **Example outcome:** If Sarah struggles to hold a plank for longer than 30 seconds, her training program would include specific core exercises, such as planks, bird-dogs and glute bridges, to build endurance and stability.

Program development

Based on Sarah's responses to the pre-exercise questionnaire, the fitness professional tailors a training program that is gradual and safe, taking into account her low current fitness level, family history of heart disease and previous minor injuries.

- **Initial focus:** Strengthen Sarah's cardiovascular system while addressing lower back issues with targeted core and mobility exercises.
- **Progressive running plan:** Start with a walk-run program to build endurance safely. The first week involves alternating between 1-minute jogging intervals and 2-minute walking intervals. Over the weeks, the jogging intervals will increase while the walking intervals decrease.
- **Strength and conditioning:** Core strengthening exercises such as planks and glute bridges are included to support Sarah's lower back and improve overall stability.
- **Flexibility and recovery:** Gentle stretching and mobility work, particularly focusing on her lower back and ankles, are incorporated to reduce the risk of injury.

Case study questions

1. Why was it essential for Sarah to complete a pre-exercise questionnaire before starting her fitness program?
2. How would fitness tests help ensure the safety and effectiveness of Sarah's training program, especially given her beginner fitness level?
3. What role does health screening play in designing Sarah's training program, particularly given her family history of heart disease?
4. What type of fitness test would be suitable to assess Sarah's aerobic endurance, and why?
5. How does the walk-run program in Sarah's training plan help her achieve her goal of running 5 kilometres without stopping?
6. Evaluate the strengths of the program that was suggested. Consider possible areas of improvement to support Sarah's fitness goals.

DEPTH STUDY IDEA

Research and design a training program for an elite athlete in a sport of your choice.

EXAM TIP

How can exercise assessment and prescription be personalised?

When approaching an exam question in this topic, consider a range of perspectives. These include the views and intentions of the athlete, the fitness instructor, a medical practitioner or exercise physician and in the case of an elite athlete, a coach or manager. These groups of people all play a role in using the results of a pre-exercise assessment to determine how an exercise program is developed.

It is important to have a strong understanding of the relative difference between the way exercise assessment is conducted and how feedback is used between an elite and a recreational athlete to improve health, fitness and performance. You need to use examples to show this difference. For example, *a recreational athlete who has a fitness goal of improving heart health may have a fitness program designed that is gradual and includes a range of cardiovascular activities. In contrast, an elite athlete who may have a fitness goal of running a sub 4-minute 1500 metres will have a much more intense training regime with the inclusion of fartlek and interval training with fewer resting periods.*

This elite athlete example is reflective of the work of coaches, exercise physicians and athletes to enhance fitness by strategically designing activities to achieve performance goals.

6.4 ACTIVITIES

Exercise assessment and goal setting

This activity helps you set personalised exercise or sport-specific goals and explore how fitness assessments can help track progress and shape your action plans.

Activity instructions:

1. **Introduction to SMART goal setting**
   - Review the **SMART** framework to create effective goals:
     - **S**pecific: Clearly define what you want to achieve.
     - **M**easurable: Include ways to measure progress.
     - **A**ttainable: Make sure your goal is realistic.
     - **R**elevant: Connect the goal to your personal motivations and interests.
     - **T**ime-bound: Set a deadline for achieving the goal.
2. **Reflect on current fitness levels**
   - If you have previously completed fitness assessments (e.g. aerobic fitness, muscular strength or flexibility tests), review your results and think about how the data can shape your goals.
   - *What areas do you excel in? Where is there room for improvement?*
3. **Set 2–3 SMART goals**
   - Write down 2–3 goals related to exercise or sport-specific performance.
   - Examples:
     - *Increase 1RM squat by 10% in 12 weeks.*
     - *Run 5 kilometres in under 25 minutes by the end of the term.*
     - *Improve flexibility and be able to touch toes without bending knees in 8 weeks.*
4. **Develop an action plan**
   - For each goal, list at least three actions you will take to achieve it.
   - Example for a running goal:
     - *Run 3 times per week with a mix of long runs and intervals.*
     - *Track progress using a running app.*
     - *Stretch after every session to avoid injury.*

5. **Explain how fitness assessments can support goal achievement**
   - Answer the following question:
     How can fitness assessments help you stay on track with your goals?
     - Guidance: Assessments provide a baseline, highlight strengths and weaknesses, and offer measurable progress points. For example, testing aerobic fitness every 4 weeks shows improvements in stamina.
6. **Set checkpoints**
   - Choose one or two times during your goal period when you will reassess your progress (e.g. midway and at the end). Identify what fitness tests or performance measures you will use.

Reflection questions

1. How will achieving these goals benefit your overall fitness or sport performance?
2. What challenges do you expect to encounter? How can you overcome them?
3. If you do not see progress at your first checkpoint, how will you adjust your plan?

6.4 Exercises

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6.4 Quick quiz on | **6.4 Exercise**

Learning pathways

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

Revise your knowledge

1. Outline the key components of exercise assessment for both recreational participants and elite athletes.
2. How do assessments help identify a recreational participant's starting fitness level?
3. What is the purpose of identifying individual goals during an exercise assessment?
4. Why is it important to regularly monitor progress through assessments?
5. Outline the role that exercise assessments play in sport-specific training for elite athletes, using examples.

Apply your knowledge

6. Why is it crucial to personalise training programs for recreational participants based on exercise assessments?
7. In what ways can fitness tests help elite athletes improve specific areas of weakness?
8. Explain the significance of goal setting for elite athletes.
9. How do fitness assessments for recreational participants differ from those for elite athletes?
10. Identify the limitations of fitness testing and how this may alter planning.

6.4 Exam questions

Question 1 (4 marks)
Explain how exercise assessments help in developing a training program for a sedentary individual.

Question 2 (4 marks)
Discuss the importance of regular assessments in tracking progress for both recreational and elite athletes.

Question 3 (3 marks)
How do exercise assessments contribute to injury prevention in both recreational and elite athletes? Provide examples.

Question 4 (4 marks)

Describe how continuous monitoring through assessments can prevent overtraining in elite athletes.

Question 5 (5 marks)

Compare the role of exercise assessments in developing training programs for recreational participants versus elite athletes.

6.5 Sample exam question response

Question

Analyse how the identification of potential injury risks during exercise assessments influences program design for both recreational and elite athletes. **(8 marks)**

Criteria	Marks
Provides a comprehensive analysis of the implications of the relationship between identification of potential injury risks during exercise assessments and program design for both recreational and elite athletes Provides relevant and detailed examples	8
Provides a sound analysis of the relationship between identification of potential injury risks during exercise assessments and program design for both recreational and elite athletes Provides relevant examples	6–7
Provides a sound understanding of characteristics and features of how the identification of potential injury risks during exercise assessments influences program design for both recreational and elite athletes Provides example(s)	4–5
Demonstrates a basic understanding of how the identification of potential injury risks during exercise assessments influences program design	2–3
Provides some relevant information	1

Sample response

Breaking down the question

Analyse how the identification of potential injury risks during exercise assessments influences program design for both recreational and elite athletes.

Identify the action word/s: Analyse — identify components and the relationship between them: draw out and relate implications

Syllabus terminology: exercise assessment, training programs

Examples: recreational and elite athletes

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 is this paragraph 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***/ are they relevant and specific[3]

L ***Linking*** sentence that relates back to the question.[4]

Sample annotated response

The identification of potential injury risks during exercise assessments significantly influences program design for both recreational and elite athletes by enabling trainers to implement strategies that minimise injury likelihood.[1] For instance, if an exercise assessment reveals that a recreational participant has limited lower body strength, the trainer can create a program emphasising gradual strength building through low-impact exercises like bodyweight squats.[3] This approach enhances lower body strength while ensuring safety.[4]

For elite athletes, recognising imbalances is critical for optimising performance and reducing injury risk.[1] By recognising and correcting imbalances the training regimen becomes more effective and efficient, preventing injuries before they occur.[2]For example, an exercise assessment could reveal that a kickboxer has a strength imbalance between legs due to a previous knee injury. As a result, the trainer incorporates targeted unilateral exercises, such as single-leg deadlifts, in order to strengthen the weaker leg.[3] This not only prevents injuries from overcompensation but also improves overall performance.[4] Pre screening questionnaires and observations also take into account previous injury history which for an elite athlete might mean that strengthening and rehabilitation activities are a key focus.[2] For example, in the situation where a professional football player has ruptured their ACL on two occasions, the program will be designed on ensuring a gradual increase in load and stress on the knee until fitness testing shows close to pre-injury scores. This will generally be more intense than a recreational athlete who may have a longer period of more gradual rehabilitation.[3]

Assessments also help identify movement pattern deficiencies.[1] By pinpointing specific issues in an athlete's biomechanics, trainers can create programs that focus on correcting these inefficiencies, which not only enhances performance but also minimises the risk of injury.[2] For instance, if a recreational runner displays improper mechanics, the program can include corrective exercises like mobility drills and dynamic stretching to improve efficiency and reduce injury risk.[3] Ongoing monitoring allows trainers to make real-time adjustments based on an athlete's discomfort or fatigue, ensuring that training intensity is appropriate.[4]

An exercise assessment might reveal that an elite athlete has pain when doing certain movements.[2] For example, due to a previous shoulder injury, any overhead strength exercises cause discomfort.[3] The trainer then avoids programming any overhead strength exercises such as overhead press to prevent further aggravation of the previous injury.

Ultimately, recognising potential injury risks during assessments is crucial for designing effective training programs that enhance performance while prioritising safety. By tailoring programs to address individual needs, trainers foster a sustainable training environment conducive to long-term athletic success.[4]

6.6 Review

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6.6.1 Topic summary

6.2 Health screening

- Exercise and fitness professionals use health screening and pre-exercise questionnaires to gather crucial information about an individual's medical history and current health status, which helps identify any medical conditions that may increase the risk of adverse events during physical activity.
- The questionnaire includes various topics, such as age, gender, health status, medical conditions and current physical activity levels, which collectively contribute to a comprehensive understanding of the individual's readiness for exercise.
- By determining current activity levels and personal goals, exercise professionals can set appropriate levels of intensity and pace of progression, ensuring a safe and effective pathway to achieving the individual's objectives.
- Certain groups, including those with a history of heart disease, hypertension, respiratory conditions or previous injuries, are identified as being at higher risk for adverse events during physical activity and require special attention.
- Individuals in high-risk categories are often advised to seek guidance from allied health professionals or medical practitioners before commencing any exercise program to help ensure their safety.

6.3 Performance/fitness testing for recreational participants and elite athletes

- Performance and fitness testing is essential for both recreational participants and elite athletes as it enables exercise professionals to design targeted, personalised training programs that support individual health, participation and performance goals.
- Fitness tests help establish a baseline for recreational athletes, guiding their safe and effective progression, while elite athletes use these tests to fine-tune performance, identify strengths and weaknesses, and monitor progress over time to maximise results and minimise injury risk.
- Selecting appropriate fitness tests is crucial, as each individual has unique fitness levels and goals. Tests should align with health-related and skill-related fitness components and the specific demands of the sport to provide relevant and actionable data.
- For recreational athletes, fitness testing focuses on improving health and preventing injury, while for elite athletes, it optimises performance by allowing for sport-specific training adjustments. Regular assessments aid in goal setting, motivation and tracking progress.
- Performance testing provides detailed data on athletes' strengths and weaknesses, facilitating continuous adjustments to training loads, intensities and recovery strategies. This structured approach helps athletes push their limits safely while reducing the risk of overtraining and injury.

6.4 The role of exercise assessments in developing training programs

- Health screenings, pre-exercise questionnaires and performance/fitness tests are essential for conducting thorough exercise assessments that guide the creation of tailored training programs for both recreational participants and elite athletes.
- Exercise assessments provide insights into an individual's initial fitness level and specific goals, enabling fitness professionals to design safe and effective training plans that align with personal objectives.

- Assessments allow trainers to tailor workouts to individual strengths, weaknesses and preferences, fostering motivation and adherence. Regular re-assessments enable participants to monitor their progress and see tangible improvements, thereby enhancing engagement.
- By identifying potential risk factors during assessments, fitness professionals can develop training programs that reduce injury risk, particularly for those who are new to exercise or returning after a break, with a focus on low-impact activities as needed.
- For elite athletes, exercise assessments deliver detailed evaluations of physical capabilities and facilitate sport-specific training and goal establishment. Continuous monitoring through performance tests allows for ongoing adjustments to optimise training effectiveness and minimise overtraining risks.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Assessment of strength and power in athletes training for the 2032 Olympics

Time: 2–3 hours

Task description: Using the National Protocols for the Assessment of Strength and Power design an assessment for an athlete/team training for the 2032 Brisbane Olympic or Paralympic Games.

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents	Topic 6 summary (doc-43059) Key terms glossary (doc-43060) Revision quiz (doc-43061)
Interactivity	Missing word interactive quiz (int-9363)

6.6 Exercises

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6.6 Revision quiz on | 6.6 Exam questions

6.6 Exam questions

Section I

Question 1 (1 mark)

Which of the following is typically covered in a pre-exercise screening questionnaire to assess potential risks?

A. Preferred exercise equipment
B. Family history of heart disease
C. Daily meal plans
D. Time spent watching TV

Question 2 (1 mark)

Why is it important to ask individuals about their current physical activity levels and goals in health screening questionnaires?

A. To compare their performance with others
B. To encourage participation in competitions
C. To tailor exercise programs to their needs and abilities
D. To determine the best exercise equipment for them

Question 3 (1 mark)

Which group is considered at higher risk and often requires medical clearance before starting an exercise program?

A. Individuals with no previous injuries
B. People with low blood sugar levels managed through exercise alone
C. Men over the age of 45 or women over 55
D. Individuals engaging in moderate exercise 2 days a week

Question 4 (1 mark)

What is a key reason fitness testing helps recreational athletes stay motivated?

A. It removes the need for personalised training programs
B. It provides evidence of progress toward their goals
C. It focuses solely on improving agility and speed
D. It eliminates the possibility of injuries during training

Section II

Question 5 (3 marks)

Outline two key risk factors that exercise professionals should look for in a health screening questionnaire.

Question 6 (3 marks)

Outline what an exercise assessment involves.

Question 7 (5 marks)

Discuss how fitness/performance testing can aid in the goal-setting process for both recreational participants and elite athletes.

Question 8 (5 marks)

Why is it important that fitness professionals conduct relevant health screening using a pre-exercise questionnaire?

Question 9 (5 marks)

How can exercise assessment assist in developing a training program?

Question 10 (6 marks)

Consider a scenario where a client begins a fitness program without completing a pre-exercise questionnaire. **Analyse** potential health risks that could arise from this oversight, and how might it affect the client's long-term fitness journey.

Question 11 (8 marks)

Analyse the significance of tailoring fitness tests to align with specific sports demands and the unique needs of the athlete. Provide examples of tests for different sports.

Question 12 (6 marks)

Compare performance/fitness testing for recreational athletes and elite athletes. Provide examples.

Question 13 (8 marks)

Explain how fitness assessments contribute to the customisation of training programs for elite athletes.

Question 14 (8 marks)

Evaluate the impact of the goal-setting process through exercise assessments on long-term training outcomes for athletes.

Section III

Question 15 (12 marks)

Refer to the stimulus below to answer the following question:

Evaluate the importance and benefits of James completing the health screening and pre-exercise questionnaire prior to initiating his training program.

Name: James Carter

Age: 34

Gender: Male

Health status:

James is generally healthy but wants to start a structured training program to improve his muscular endurance and strength.

Medical conditions:

He has a history of mild asthma, which is usually well-controlled with a rescue inhaler that he uses as needed during physical activity.

Family history of heart disease:

James's father had a heart attack at age 58, and his mother has high blood pressure, prompting him to be cautious about his heart health.

Medication use:

Aside from his asthma inhaler, James does not take any regular medications.

Current or past injuries to muscles, joints or bones:

James experienced a knee injury from playing basketball three years ago, which required physiotherapy. Although he has fully recovered, he sometimes feels slight discomfort during high-impact activities.

Current physical activity levels:

James currently engages in light physical activity, such as walking his dog for 30 minutes most days of the week. He occasionally participates in yoga classes and enjoys cycling on weekends but has not followed a structured training program before.

7 How training influences movement and performance

LEARNING SEQUENCE

7.1 Overview 275
7.2 Types of training and training methods 277
7.3 Principles of training 298
7.4 Training principles, physiological adaptations and improved performance 307
7.5 Sample exam question response 318
7.6 Review 320

7.1 Overview

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Key inquiry question

How does training influence movement and performance?

Syllabus

	Syllabus content	Subtopic
○	■ Assess the types of training and training methods and their relevance for a variety of sports **Including:** • anaerobic training, including anaerobic interval, High Intensity Interval Training (HIIT), Sprint Interval Training (SIT), plyometric, and resistance training • aerobic training, including continuous, fartlek, aerobic interval, and circuit training • flexibility training, including static, dynamic, ballistic, and Proprioceptive Neuromuscular Facilitation (PNF) • strength training, including free/fixed weights, body weight exercises and elastics • skill and tactical development, including drills, modified games and games for specific outcomes	**7.2**
○	■ Evaluate the application of the principles of training to both aerobic and strength training **Including:** • progressive overload • training thresholds • reversibility • specificity • variety • warm-up and cool-down	**7.3**
○	■ Examine the relationship between the principles of training, physiological adaptations and improved performance **Including:** • heart rate • stroke volume and cardiac output • oxygen uptake and lung capacity • haemoglobin level • muscle hypertrophy • fast/slow twitch muscle fibres	**7.4**

Outcomes

- investigates factors that impact movement and performance HM-12-04
- analyses individual and group training programs to improve performance HM-12-05
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07

- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

Resources

Digital documents Topic 7 summary (doc-43062)
Key terms glossary (doc-43063)
Revision quiz (doc-43064)

7.2 Types of training and training methods

Syllabus: Assess the types of training and training methods and their relevance for a variety of sports

Including:

- anaerobic training, including anaerobic interval, High Intensity Interval Training (HIIT), Sprint Interval Training (SIT), plyometric, and resistance training
- aerobic training, including continuous, fartlek, aerobic interval, and circuit training
- flexibility training, including static, dynamic, ballistic, and Proprioceptive Neuromuscular Facilitation (PNF)
- strength training, including free/fixed weights, body weight exercises and elastics
- skill and tactical development, including drills, modified games and games for specific outcomes

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 sport in question. Weightlifters, for instance, have different training requirements from golfers; soccer players from tennis players; sprinters from endurance runners; and dancers from gymnasts. The five types of training are:

- anaerobic training
- aerobic training
- flexibility training
- strength training
- skill and tactical development.

7.2.1 Anaerobic training

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 short in duration, lasting less than two minutes but at a high intensity which is in excess of 85 per cent of a person's maximum heart rate. While activity is brief, effort is maximal and followed by short rest periods. 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.

Development in this area helps athletes to hit harder, jump higher, run faster and throw further. These attributes are required in a range of games, individual sports and all athletic events.

Some examples of anaerobic training include:

- anaerobic interval
- High Intensity Interval Training (HIIT)
- Sprint Interval Training (SIT)
- plyometric
- resistance training.

Anaerobic interval

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-metre sprinting and for short bursts in games such as touch football. Table 7.1 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 with the sprinting action.

anaerobic training physical activity that is performed at a high intensity for a short duration. A limited supply of stored glycogen is used as energy, not requiring oxygen.

anaerobic interval training involves short, intense exercise bursts followed by rest, enhancing power, speed and lactic acid tolerance

TABLE 7.1 Various types of anaerobic interval training

Interval	Use	Work duration	Rest duration	Work–rest ratio	Repetitions	% of maximum speed	% of maximum heart rate	Sport that this is most relevant for
Long	Anaerobic threshold training	2–5 min	2–5 min	1 : 1	4–6	70–80	85–90	Soccer midfielder
Medium	Anaerobic training	60–90 sec	120–180 sec	1 : 2	8–12	80–90	95	Boxer
Short	High energy training (anaerobic)	30–60 sec	90–180 sec	1 : 3	15–20	95	100	50-m freestyle swimmer
Sprint	Speed (anaerobic)	10–30 sec	30–90 sec	1 : 3	25+	100	100	100-m sprinter

Source: Adapted and reprinted, with permission, from R. Martens, 2004, *Successful Coaching*, 3rd ed. Champaign, IL: Human Kinetics, p. 313, Fig. 14.10.

High Intensity Interval Training (HIIT)

Recently, **High Intensity Interval Training (HIIT)** has gained increasing popularity. HIIT involves repeated bouts of high intensity anaerobic exercise followed by varying periods of complete rest or recovery at lower intensity. During this type of interval training, work periods are short and are performed at 80–95 per cent of maximal heart rate (MHR). The recovery period will depend on the type of exercise but is usually the same as, but certainly not more than, the work period. For example, doing 30 seconds of burpees, resting for 20 seconds then 30 seconds of mountain climbers, resting for 20 seconds and continuing on with multiple other stations.

Near maximal intensity is a prerequisite for work periods, making it necessary to push the body to its limits during every exercise set. HIIT can be adapted to a range of exercise modes or sports including cross-training, swimming, cardio sessions, cycling and sprinting. HIIT is beneficial for sports requiring sustained high-intensity efforts over longer periods, such as soccer, basketball, hockey and rugby. These sports involve repeated sprints, changes in direction and constant movement, mimicking the interval nature of HIIT.

FIGURE 7.1 HIIT requires near maximal effort for short periods combined with equally short rest periods. It can be adapted to a range of training types.

Sprint Interval Training (SIT)

Sprint Interval Training (SIT) is a high-intensity workout method involving short bursts of all-out effort, followed by rest or low-intensity recovery, repeated multiple times in a session. Similar to HIIT, SIT differs in its work-to-rest ratios and the intensity of effort. In SIT, individuals work at maximum intensity, such as sprinting on an assault bike at 100 per cent of their maximum heart rate for 20 seconds, followed by longer recovery periods, such as pedalling slowly for two minutes. This cycle is typically repeated about ten times before the session ends.

SIT is highly time-efficient, by improving anaerobic capacity, enhancing cardiovascular health, and promoting calorie burn even after the workout is complete. Its adaptability to different sports, fitness levels and environments, along with its ability to deliver significant fitness benefits in a short time, has made it an increasingly popular training method. SIT is highly effective for sports that emphasise maximum speed, power and explosiveness, such as sprinting, swimming, track cycling and football. The short, intense work intervals in SIT replicate the demands of explosive actions like sprinting for a goal, breaking away from opponents, or powering through a short, high-stakes effort.

High Intensity Interval Training (HIIT) involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

Sprint Interval Training (SIT) a high-intensity workout method involving short bursts of all-out effort, followed by rest or low-intensity recovery, repeated multiple times in a session

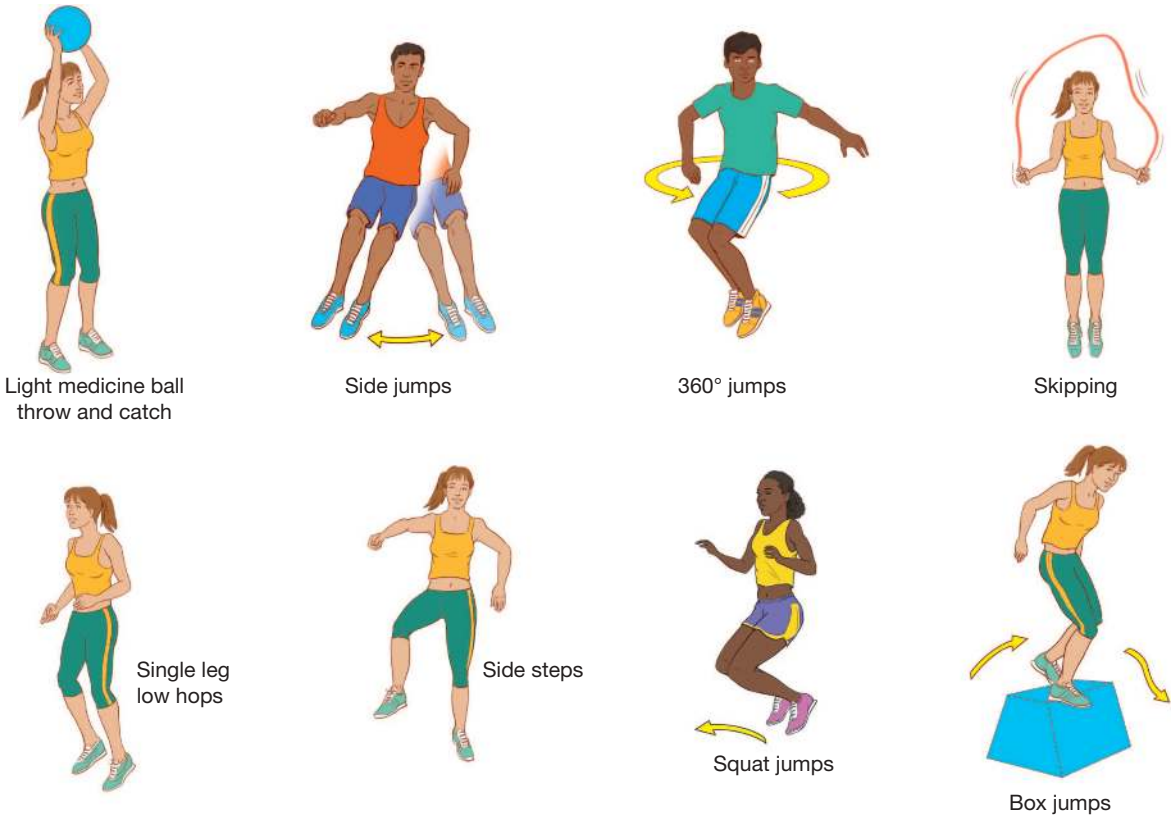
Plyometric training

Gains in strength can only be effectively converted into power through specific training methods that condition muscle fibres to contract rapidly. One of the most effective and widely used techniques for this purpose is **plyometrics**. Plyometrics involves specialised exercises where muscles undergo an eccentric contraction (lengthening) immediately followed by a concentric contraction (shortening). This rapid stretch-and-shorten cycle enhances power development, as studies have shown that preloading a muscle through stretching before contraction results in more forceful movements. The elastic recoil of muscle fibres during this process generates greater tension, enabling explosive power.

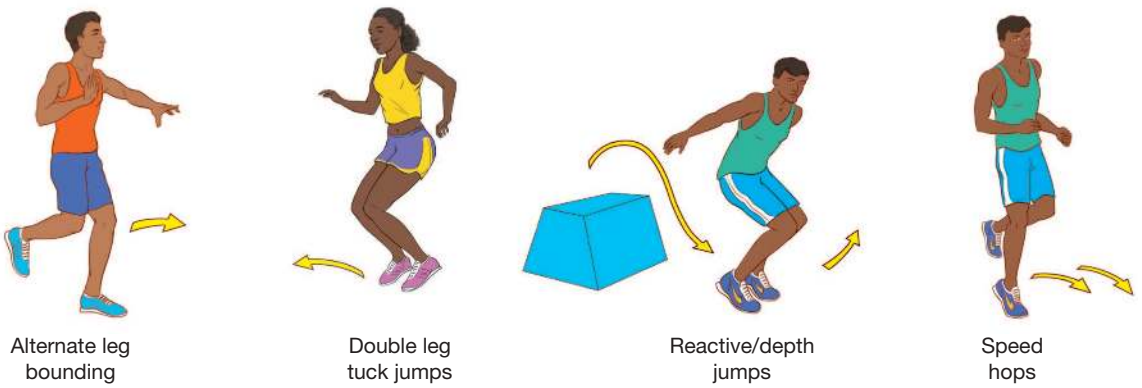
plyometrics a special range of exercises in which a muscle is lengthened using an eccentric contraction. This is rapidly followed by a shortening or concentric contraction.

FIGURE 7.2 Examples of low- and high-impact plyometric drills

(a) Low-impact plyometric drills



(b) High-impact plyometric drills



The faster a muscle is stretched, the greater the force it can produce. For decades, plyometric training has been instrumental in improving performance in sports like athletics, basketball, Australian rules football and weightlifting, where reactive power is crucial. Plyometric exercises, such as standing jumps, multiple jumps, depth jumps and bounding, use body weight and gravity to initiate the eccentric 'cocking' phase that energises the muscle's recoil ability. This principle is instinctively applied by athletes, such as high jumpers who lower their centre of gravity before a leap, or individuals preparing for a vertical jump by bending their knees and swinging their arms downward. These explosive movements are central to plyometric training and remain essential for developing power across various sports.

To find out more about dynamic stretch movement in action, use the **Upper body plyometric training** weblink in the Resources panel.

Resistance training

Resistance training enhances power by recruiting and enlarging fast twitch muscle fibres, which are crucial for anaerobic performance. Anaerobic training focuses on high-intensity, short-duration efforts, relying on stored energy sources like ATP (adenosine triphosphate) and creatine phosphate to fuel explosive movements. Power, defined as the rate of force production over time, is developed through exercises performed explosively and at high speed, prioritising the recruitment of fast twitch fibres. This approach ensures that muscles can generate force quickly and effectively, which is essential for high-intensity activities requiring bursts of power and speed. For example, a discus thrower uses strength and power to support the rotational drive and release of the discus.

Incorporating resistance into anaerobic training significantly enhances performance across a wide range of sports. For example, sprinters can use a parachute to create drag during sprints, increasing resistance and promoting explosive power in the legs. Similarly, high jumpers benefit from leg flexion and extension exercises, while basketball and soccer players require moderate resistance training to build power and endurance with a focus on speed. In sports like discus or javelin, higher resistance with fewer repetitions mirrors the explosive force needed for peak performance. By targeting the anaerobic energy system and focusing on sport-specific movements, resistance training optimises power development, speed and overall athletic performance.

FIGURE 7.3 There are many ways of creating resistance to increase power.

7.2.2 Aerobic training

Aerobic training uses the aerobic system as the main source of energy supply. It includes a number of training types, such as:

- continuous training
- fartlek training
- aerobic interval training
- circuit training.

Continuous training

In **continuous 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 must rise above the aerobic

continuous training aerobic training where there is a sustained effort that has no rest intervals and usually lasts for at least 20 minutes

threshold and remain within the target zone for the duration of the session. 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 aerobic training is most beneficial for sports that require sustained, steady efforts over longer durations, where endurance and cardiovascular efficiency are key to performance. Sports like long-distance running, cycling, swimming and rowing heavily rely on aerobic capacity, as they involve prolonged activity with moderate intensity. In these sports, continuous aerobic training helps improve the body's ability to deliver oxygen to muscles, enhance stamina and delay the onset of fatigue, enabling athletes to maintain optimal performance over extended periods. Additionally, endurance events like triathlons and marathon swimming also benefit from continuous aerobic training, as it builds the aerobic base necessary for performing at high levels for hours.

FIGURE 7.4 Continuous training requires sustained effort.

Fartlek training

The word 'fartlek' means 'speed play'. In **fartlek training**, participants vary their speed and the terrain, engaging both anaerobic and aerobic energy systems. Fartlek training resembles a combination of interval and continuous training because of its random use of variations in speed and intensity. Short, sharp surges dictate an anaerobic energy supply and the development of this system. Fartlek training is good for most aerobic athletes, but particularly beneficial for sports that require frequent changes of speed, direction and acceleration such as netball, rugby and soccer. This makes it ideal for positions like the centre in netball, a midfielder in soccer, and a half-back in rugby league, where athletes are required to perform at different intensities during a game.

fartlek training ('speed play') participants vary their speed and the terrain on which they are working, ultimately engaging both anaerobic and aerobic energy systems

For example, the centre in netball constantly moves between moderate-intensity running and high-intensity sprints to chase the ball, support team plays, and create space. Similarly, a midfielder in soccer must transition quickly between jogging during build-up play and sprinting to chase down opponents or make attacking runs. In rugby, a half-back frequently alternates between moderate jogging and explosive sprints to either position for a pass or make a quick break.

Fartlek training helps improve cardiovascular endurance while conditioning the body to rapidly switch between these energy systems, allowing the players to maintain a high level of performance throughout the game.

Some ways of incorporating speed play into continuous training are:

- regular bursts of speed every two or three minutes
- running up and down sand-hills
- group running with changing leadership
- cross-country running, covering a variety of terrain types
- sprinting the goal lines of a soccer or rugby field and jogging the sidelines and repeating for a minimum of 20 minutes.

FIGURE 7.5 Fartlek training is particularly beneficial for sports that require frequent changes of speed, direction and acceleration such as netball.

FIGURE 7.6 A sample speed play program

Speed play program

1. Warm-up jog
2. Light callisthenics such as push-ups, sit-ups and star jumps
3. Form one or two lines depending on numbers
4. Jog 400 metres with the person at the back of the line moving to the front every 50 metres
5. Walk 100 metres
6. Run 500 metres over varying terrain, changing speed between walk, jog, sprint
7. Repeat steps 4, 5, 6
8. Cool-down with some light stretching exercises

Aerobic interval training

Aerobic interval training involves alternating sessions of work and recovery. Using this method, an athlete performs a given amount of work, such as a 400-metre run, in a particular time or at a specific level of intensity. This is followed by a recovery period before the task is repeated a number of times in the same manner (see figure 7.8). The work and rest period is important in differentiating aerobic interval from anaerobic interval training. During aerobic interval training the work period is often longer, usually at least one minute and the rest period is very short, say 20 seconds, between exercise bouts. The longer work period and short rest period does not allow enough time for full recovery and thus maintains stress on the aerobic system.

aerobic interval training involves alternating sessions of work and recovery. The rest period is important in differentiating aerobic interval training from anaerobic interval training.

This training method effectively develops aerobic endurance because:

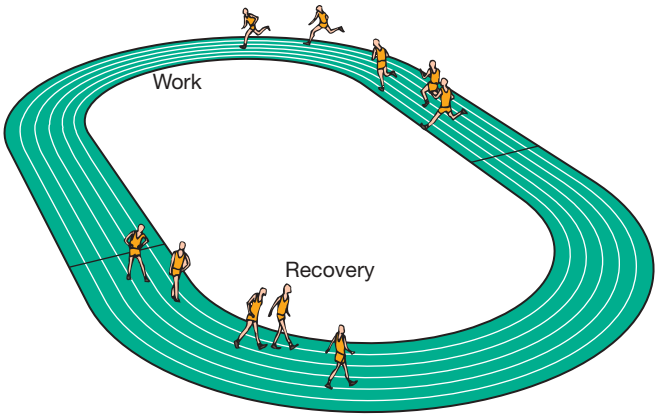
- sustained effort of moderate intensity ensures that the aerobic system is stressed but not completely fatigued
- the level of intensity can be adjusted to achieve the desired level of aerobic capacity.

FIGURE 7.7 Aerobic interval training involves alternating between periods of work and recovery.

The overload principle can easily be applied to interval training by manipulating the following four variables:

- work intensity (how difficult the exercise is to perform)
- work time (how long the exercise lasts)
- the number of repetitions
- the work–rest ratio.

FIGURE 7.8 Interval training consists of cycles where the athletes follow periods of work with periods of recovery.



Aerobic interval training is most suitable for sports that require bursts of higher-intensity activity followed by periods of moderate effort or recovery, where both endurance and the ability to recover quickly are important. For example, in soccer, a striker often sprints to get into goal-scoring positions or chase the ball, followed by periods of lighter jogging or walking to recover before the next sprint. In ice hockey, players engage in intense bursts of skating at high speed, but they frequently sub in and out of the game, allowing for recovery periods after intense efforts. In tennis, players alternate between fast-paced rallies and moments of recovery between points or games.

Aerobic interval training helps these athletes improve their ability to maintain high-intensity efforts while recovering quickly, enhancing performance during dynamic movements and sustained efforts in their respective sports.

Circuit training

Circuit training develops aerobic capacity and has the potential to make substantial improvements in strength, endurance, flexibility, skill and coordination. While it can be used anytime, circuit training is generally preferred in the pre-season to develop a solid fitness platform for the numerous physical demands of the season ahead.

A typical general conditioning circuit is illustrated in figure 7.9. Here, participants move from one activity to the next after completing the required repetitions (or performing for the specified time) for that exercise. Participants usually aim to complete the circuit in the shortest period with decreasing times indicating improving fitness levels. Circuit training can be used as an anaerobic or aerobic training program depending on the type of activity, the time spent at each activity and the number of circuits required. Once again, the effectiveness of circuit training relies heavily on how well the overload principle is applied. Progressive overload in circuit training is achieved by:

- increasing the number of stations
- increasing the time at each station
- increasing the repetitions at each station
- decreasing the time allowed for the circuit
- increasing the repetitions of the circuit
- determining the repetitions at each station on the basis of the individual's target zone for their heart rate response. Fitter athletes will do more repetitions at each station than less fit athletes.

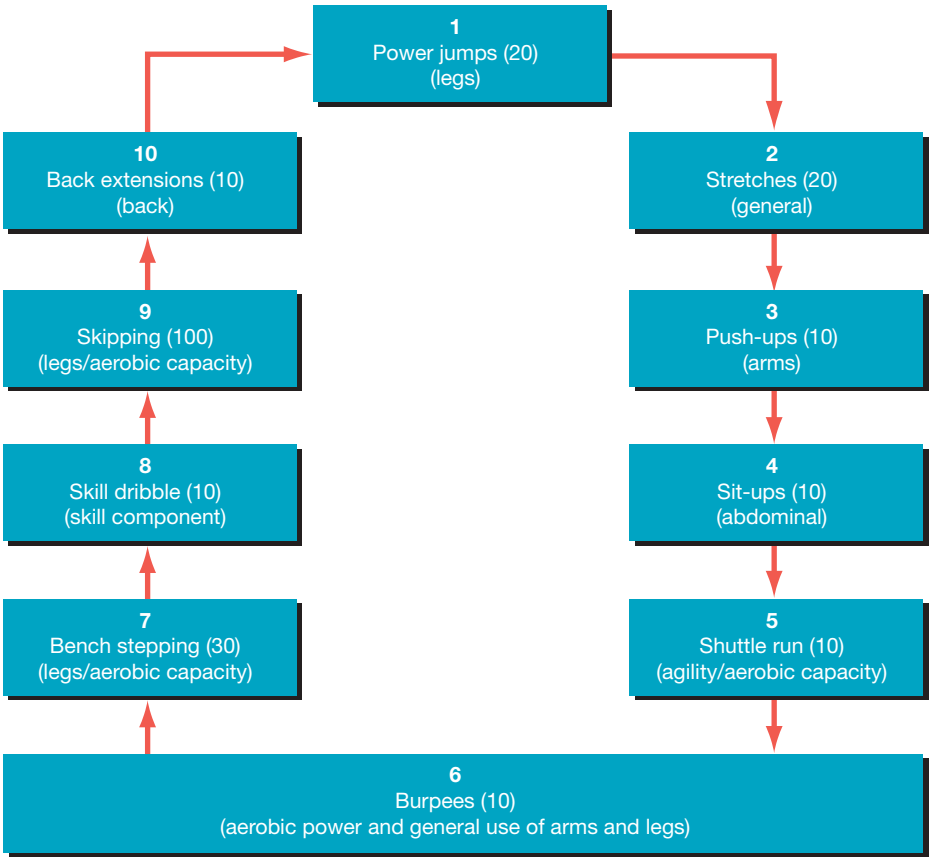
The greatest benefits are achieved when:

- the overload principle is applied
- the skills at each station concentrate on the attributes needed for a particular game/activity
- all fitness components essential to the particular sport or activity are developed
- record cards are kept to monitor improvement to keep athletes aware of their progress.

circuit training requires participants to move from one 'station' to another, performing specified exercises at each until they complete the circuit

Aerobic circuit training is beneficial for most athletes across various sports because it can be customised to target the specific fitness needs of the sport or individual athlete. The stations can be adjusted to mimic movements or actions relevant to the sport, making it a versatile and sport-specific training method. Additionally, the variety of exercises and the format of switching between stations can keep athletes motivated and engaged, enhancing their enjoyment and focus during training. For example, an aerobic circuit for basketball could include stations like dribbling through cones (for agility), sprints (for speed), jump squats (for explosive power), high knees (for cardiovascular endurance), and shooting drills (for skill and coordination). This variety ensures that the athlete develops a well-rounded fitness base while also replicating sport-specific movements, improving both physical conditioning and performance in basketball.

FIGURE 7.9 A typical conditioning circuit



7.2.3 Flexibility training

Muscles require not only strength but also length. Muscle length can be enhanced through a sound flexibility training program. A **flexibility** program is essential for:

- prevention of injury
- improved coordination between muscle groups
- muscular relaxation
- decreasing soreness and tightness following exercise
- an increased range of movement around joints, maximising performance potential.

flexibility the range through which joints and body parts are able to move

Sports such as football, basketball, netball and hockey can cause muscle tightness and shortening because the muscles do not undergo the full range of movement. Stretching during the warm-up and cool-down phases can promote the flexibility that assists these activities. Flexibility is affected by a number of factors, including:

- *age*. Muscles shorten and tighten as we grow older.
- *sex*. Generally, females are more flexible than males.
- *temperature*. Both increased atmospheric and body temperature improve flexibility.
- *exercise.* People who are frequently involved in exercise tend to be more flexible than more sedentary people.
- *specificity.* Flexibility is joint specific. The fact that a person is flexible in the shoulders does not automatically mean similar flexibility exists in the hips.

The four common types of stretching methods used in flexibility programs are:

- static
- ballistic
- dynamic
- Proprioceptive Neuromuscular Facilitation (PNF).

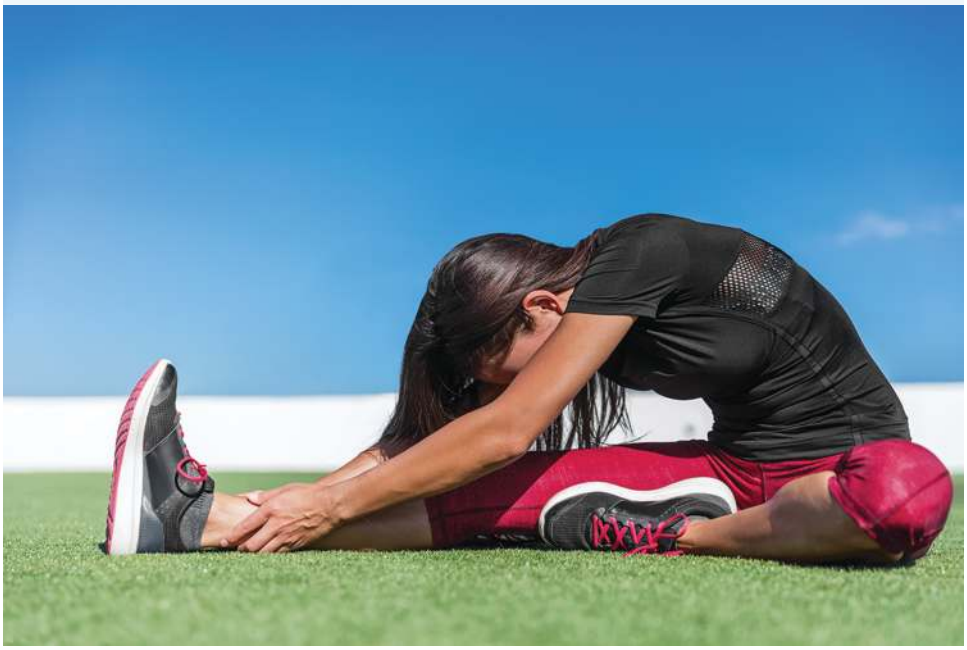
Static stretching

During **static stretching**, the muscle is slowly stretched to a position (end point or limit) which is held for about 30 seconds. The movement is smooth and performed slowly, taking the muscle to a point where there is stretch without discomfort. Static stretching is safe and is used extensively in the rehabilitation of injury and the warm-up and cool-down phases of training. An example of a static stretch is sitting down with legs extended, gently reaching forward and holding the position for 30 seconds.

static stretching a safe form of stretching in which the stretch is held for a period of 10–30 seconds

Static stretching is widely used as the predominant form of stretching in many sports. For example, in tennis, static stretching helps players increase flexibility in key areas like the hamstrings, shoulders and lower back, which are vital for performing powerful serves, swift lateral movements, and reaching for wide shots. Holding stretches for longer periods helps improve muscle elasticity and joint range of motion, allowing tennis players to move more efficiently on the court and reduce the risk of injury.

FIGURE 7.10 An example of static stretching



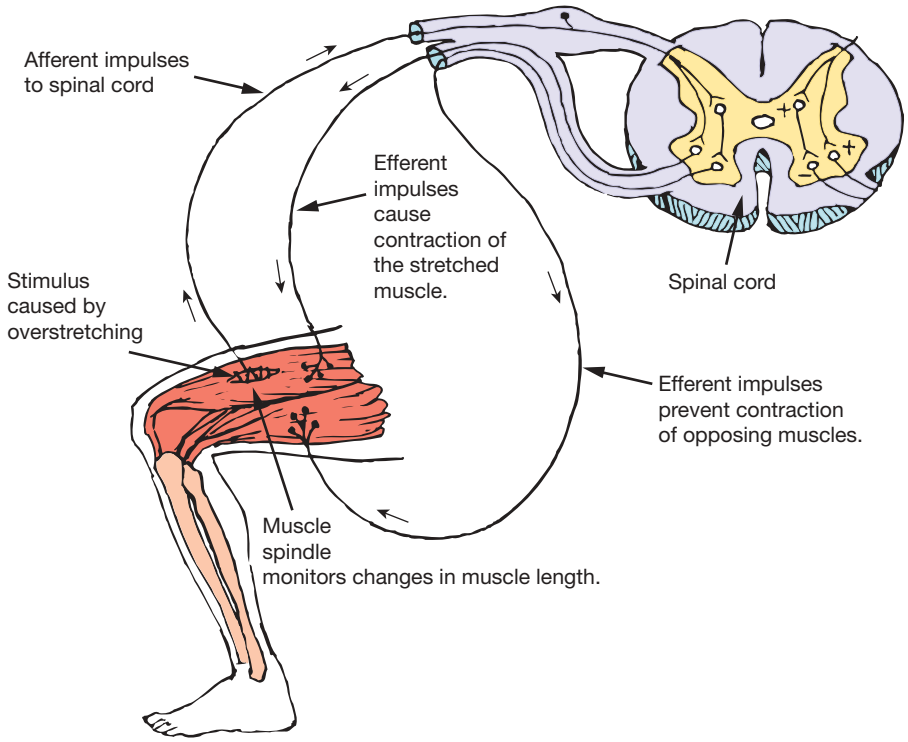
Ballistic stretching

Ballistic stretching involves repeated movements such as swinging and bouncing to gain extra stretch. This form of stretching activates a mechanism in the muscle called the **stretch reflex** (see figure 7.11), causing the muscle to contract. The force and momentum of the movement can be potentially harmful as the contracted muscle is then stretched well beyond its preferred length.

ballistic stretching involves using quick, bouncing movements to push muscles beyond their normal range of motion

stretch reflex an involuntary muscle contraction that prevents fibre damage if muscles are lengthened beyond their normal range

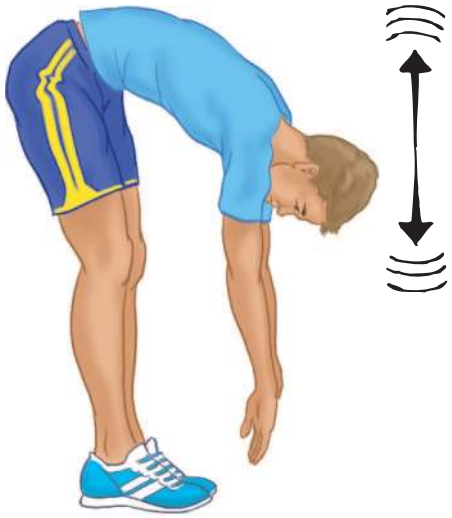
FIGURE 7.11 The stretch reflex



Ballistic stretching should be used *only* by advanced athletes and even then should follow a thorough warm-up and another form of stretching. For example, a gymnast might use ballistic stretching to improve their splits by bouncing gently in and out of the stretched position, gradually increasing the depth of the stretch. This type of stretching can enhance the gymnast's ability to perform explosive, high-impact movements, while also increasing overall flexibility and muscle responsiveness.

The movements must be executed rhythmically to avoid jerky actions and too much momentum at the end point of the stretch. An example of ballistic stretching would be touching toes using a bouncing motion.

FIGURE 7.12 Touching toes using a bouncing motion is an example of ballistic stretching.



Dynamic stretching

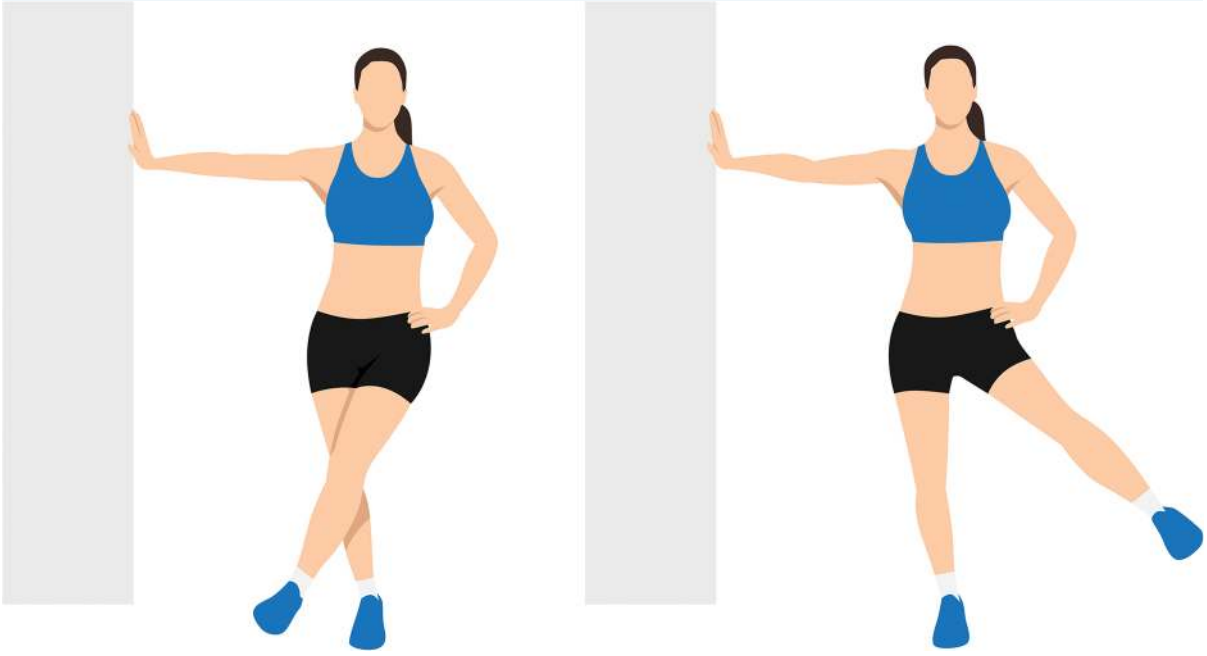
Dynamic stretching is popular for warm-ups and pre-training routines as it attempts to imitate many of the movements experienced in the game. Dynamic stretching uses movement speed together with momentum to gradually warm up muscle fibres and extend them through the degree of stretch required in the game. Bouncing movements, common in ballistic stretching, are avoided. Actions attempt to reduce muscle tightness rather than lengthen muscle fibres because this can damage the soft tissue around the joint, such as ligaments and tendons.

An example is in Australian Rules football, where dynamic stretches are crucial for preparing players to engage in sprints, sudden direction changes, and kicking the ball. Players might perform leg swings, walking lunges and high knees to loosen up their hip flexors, hamstrings and quadriceps before the game.

In contrast to static stretching, dynamic stretch movement is continuous but the end position is not held. Dynamic stretching is not as safe as static or PNF stretching due to tension exerted by specific movements on muscles and across joints. However, many prefer to use it just prior to a game because its movements simulate those required in the game. An example of dynamic stretching is arm circling.

To find out more about dynamic stretch movement in action, use the **Dynamic stretches** weblink in the Resources panel.

FIGURE 7.13 Dynamic stretching imitates movements experienced in sport



Proprioceptive Neuromuscular Facilitation (PNF) stretching

PNF stretching involves lengthening a muscle against a resistance usually provided by a partner. It incorporates static stretching, strength development using isometric contractions and periods of relaxation in a progressive sequence. The steps are:

- the muscle group to be stretched is determined
- the muscle group is stretched using a static contraction
- while in the stretched position, the person isometrically contracts the muscle (that is, he/she pushes against an immovable object, such as the ground or a partner, and holds the position for 10 seconds)
- the participant relaxes in the lengthened position for five seconds
- a further static stretch is applied followed by an isometric contraction.

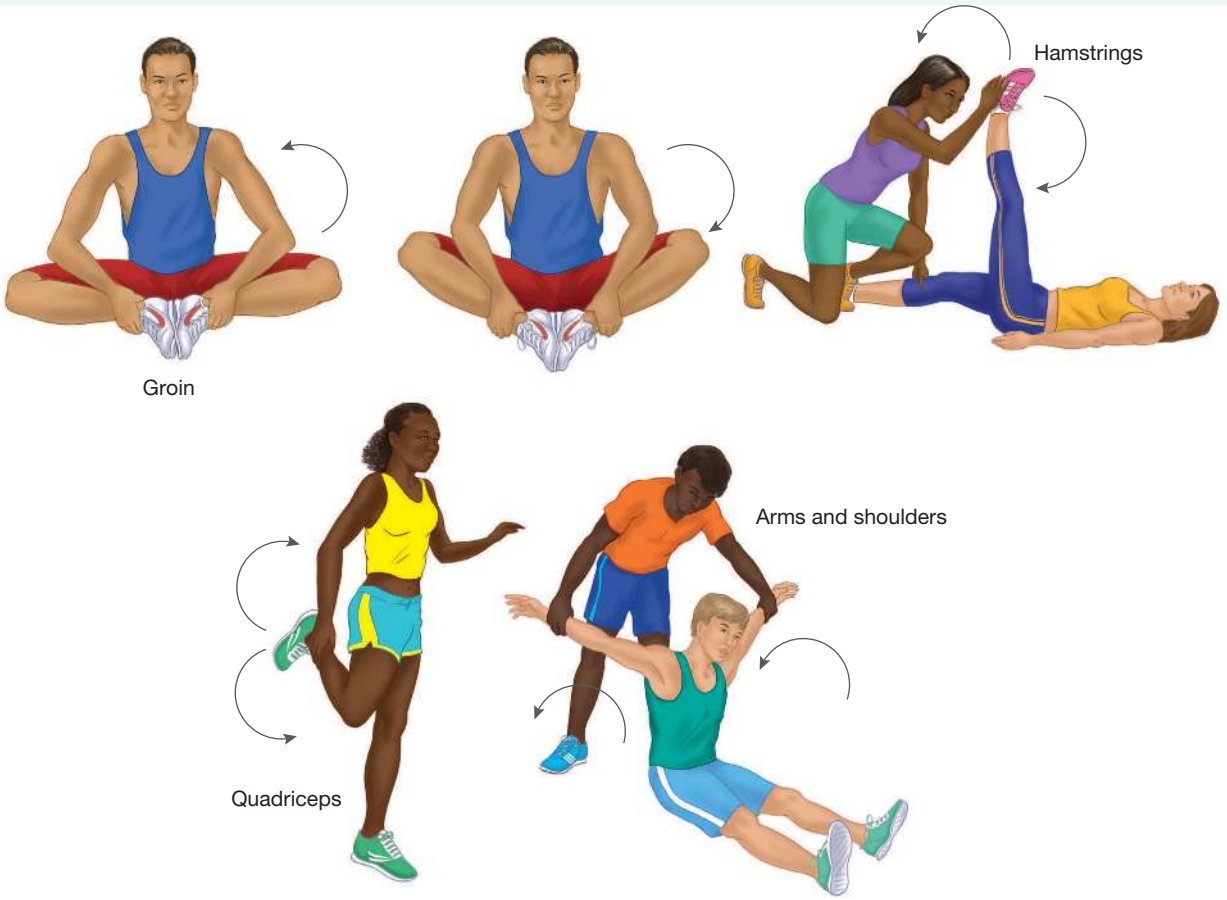
dynamic stretching uses speed and momentum with movements experienced in a game to increase flexibility

PNF stretching a progressive cycle incorporating a static stretch, an isometric contraction and a period of relaxation in the lengthened position. It is aimed at stretching and strengthening muscles in a safe movement.

PNF stretching is useful in rehabilitation programs because the isometric component strengthens the muscle fibres during the stretching process. PNF is also recommended as an integral part of the warm-up and cool-down phases of training programs because of its ability to provide added stretch under safe conditions.

For instance, a swimmer might use PNF stretching to improve shoulder rotation and reach, which are essential for performing powerful freestyle or butterfly strokes. By contracting and relaxing the muscles through specific PNF stretches, swimmers can improve their flexibility and strengthen the muscle's ability to perform at full range during each stroke, ultimately enhancing overall swimming performance.

FIGURE 7.14 PNF stretching



7.2.4 Strength training

Strength training is a form of training where muscular contraction is resisted by calculated loads, thereby building the strength of the muscle. Stimulus in the form of resistance causes **muscle hypertrophy** as more fibres are engaged to aid the movement. There are many ways of creating resistance — that is, an opposing force (as in lifting, pushing) — including:

- free weights
- fixed-weight machines
- body weight exercises
- elastics.

strength the ability of a muscle or muscle group to exert a force against a resistance

muscle hypertrophy a term that refers to muscle growth together with an increase in the size of muscle cells

Strength training programs can be used for many purposes, including:

- building strength
- developing power
- developing muscular endurance
- injury rehabilitation
- body building
- general health benefits.

Strength training is fundamental to improvement in most sports, particularly those in which lifting a weight or opposing a force (such as in rugby league) are involved.

Strength programs can be divided into two categories:

- *isotonic programs* — participants raise/lower or pull/push free weights to contract/lengthen muscle fibres. Nearly all strength training is isotonic.
- *isometric programs* — participants develop strength by applying a resistance and using exercises in which muscle length does not change. For example, performing a plank.

These programs are useful for body building, improving muscle tone, increasing strength/power and rehabilitation following injury. The differences are illustrated in figure 7.15.

FIGURE 7.15 Two types of resistance training program

Isotonic **Isometric**

Like many sports, strength training has its own terminology. The most common terms used include:

- *repetitions* — the number of times an exercise is repeated without rest
- *repetitions maximum (RM)* — the maximum weight you can lift a number of times. For example, 1 RM is the maximum weight you can lift only once; 8 RM is the maximum weight you can lift eight times. Therefore, the actual weight or mass lifted during an RM varies from one individual to another.
- *set* — a number of repetitions done in succession; for example, one set equals 10 repetitions
- *resistance* — the weight or load
- *rest* — the period of time between exercises, sets or sessions.

There are a number of principles that you need to be aware of when considering the type of strength and the method you use in its development.

- *Target specific muscle groups*. Only those muscles that encounter the resistance will benefit from the work.
- *Progressive overload*. The load (resistance) needs to be progressively increased as adaptations take place.
- *Volume.* Lifting more by increasing the number of days on which you train or the amount per session is of benefit to a point. Care needs to be taken to avoid injury and overtraining, and to allow periods of time for muscles to rest.
- *Variety.* Using different methods (free weights/machine weights), changing muscle groups, introducing new exercises and utilising a circuit format adds interest and enhances motivation.
- *Rest.* Allow rest between sets. The amount varies according to your program aims, such as power or endurance.
- *Repetition speed*. To increase power, perform repetitions quickly. Focusing on strength or bulk necessitates slower speeds.
- *Repetition numbers.* Generally, absolute strength is developed by low repetitions (3–8), anaerobic strength endurance by medium range repetitions (10–20) and aerobic strength endurance by high range repetitions (20–40 or more).
- *Recovery.* Train every second day to allow muscles to recover. If training each day, target different muscle groups to those of the previous day.

Well-balanced isotonic programs include a range of exercises that address all major muscle groups. Some of the more commonly used isotonic exercises are illustrated in table 7.3.

TABLE 7.2 Examples of strength training methods

Method	How it works
Free weights 	For example, use of barbells, dumbbells, kettlebells and medicine balls. Weights are used to develop all muscles in a group at the same time; for example, the quadriceps muscles in the upper leg. With free weights, most resistance is encountered when initiating the movement. Using free weights can be time-consuming as users may need to frequently load and unload plates. It also requires strict form and good technique to avoid injury, together with the ability to balance the weight while performing the exercise.

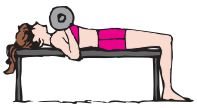
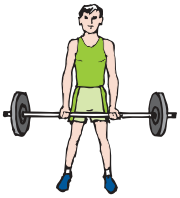
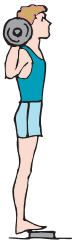
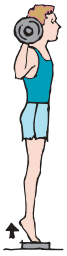
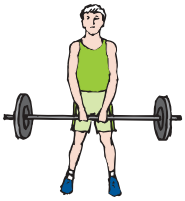
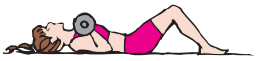
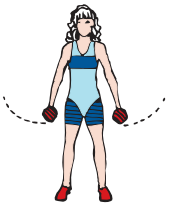
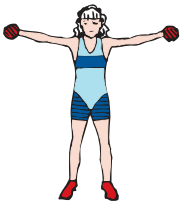
Weight machines 	There are many different types of weight machine. Resistance is usually provided by stacked weights where users can adjust loads by changing pin placements. They are often preferred to free weights by beginners as there is less chance of injury because tracks restrict the way each movement can be performed. This enhances stability and can give more confidence to first-time users. Weight machines are particularly beneficial for isolating specific muscles for development.
Body weight exercises 	There are many different types of body weight exercises, such as squats and push-ups, which use an individual's own weight as resistance to build strength and endurance. These exercises are often favoured by beginners because they carry a lower risk of injury, as no external equipment is involved, and movements can be performed with greater natural control. Body weight exercises can also be easily modified to suit individual fitness levels; for example, push-ups can be adapted by performing them on the knees instead of the toes. This versatility makes them an accessible and effective training option for a wide range of people. However, body weight exercises may not be ideal for highly conditioned athletes, as they lack the capacity for progressive overload needed to continually challenge and build advanced strength.
Elastics 	Resistance bands are a form of elastics strength training and are a cheap and portable form of resistance training, commonly used in home gyms. Most resistance bands are colour coded, with light bands being recommended for small muscle groups and heavy bands for large muscle groups. With the bands anchored by a wall fixture or against part of the body, the strong rubber elastics are stretched, creating a resistance. Most of the resistance is experienced at the end of the movement because this is where the elastic material is under the greatest tension. As a result, it is this part of the muscle where most strength gains are made.

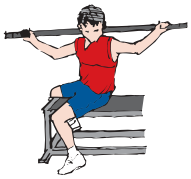
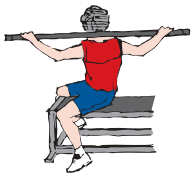
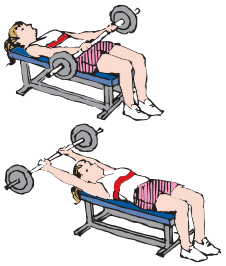
TABLE 7.3 Examples of exercises commonly used in isotonic programs

Name	Area developed	Description
1. Squats 	Legs 	Use of overgrip (knuckles up to balance bar across shoulders). Keep head up and back flat and squat until the thighs are parallel to the floor.

(continued)

TABLE 7.3 Examples of exercises commonly used in isotonic programs *(continued)*

Name	Area developed	Description
2. Bench press 	Chest, arms and shoulders 	Lying facing up on bench, hold bar with overgrip (palms forward) and with hands slightly wider than shoulders. Push bar up and then lower until it touches the chest.
3. Barbell curls 	Arms (biceps) 	With arms shoulder width apart, hold bar at thigh height, palms facing out. Lift bar to shoulders and return in a smooth continuous movement, keeping the back straight.
4. Calf raise 	Calf muscles 	With bar across shoulders, place balls of feet on a board, keeping heels off the ground. Keeping the body erect, rise on toes as high as possible and lower until heels touch the floor.
5. Upright rowing 	Upper arms and shoulders 	Using an overgrip (knuckles on top and away) hold bar in front of body with hands 5 centimetres apart. Lift the bar to chin height keeping elbows higher than bar and then return.
6. Sit-ups 	Abdominal 	Hold weight on the chest. Lie with hips flexed. Sit up with curling action, taking shoulders as far off the ground as possible, then return to floor.
7. Lateral arm raise 	Shoulders 	Grasp dumbbells with palms facing towards body and arms at side. Keeping the body straight, raise arm to shoulder height. Elbows remain locked throughout. Gradually return dumbbells to starting position (lower arm).
8. Leg curl 	Hamstrings 	With body lying face-down on a bench, lock heels under rollers. Grasp front of bench and bring heels over until rollers touch back of thighs.

9. Back raise 	Lower back 	Lie across a bench with heels hooked under roller. Place hands behind head and bend forward until trunk is at right angles to legs. Raise body to straight position.
10. Seated barbell twist 	Back and lower trunk 	Sit on bench with a bar across shoulders and hands well spread. Twist body so that the bar turns at least 180°.
11. Pull-overs 	Chest and shoulders 	Lie on bench holding a bar with arms extended and hands slightly wider than shoulder width. Lower weight over head and then bring it on an arc to rest on thighs. Repeat.

7.2.5 Skill and tactical development

Skill and tactical development is essential for improving movement execution and mastering advanced techniques in sports. Effective coaching plays a key role, with a focus on proper analysis, feedback and suitable drills. Observation, along with tools like demonstrations and videos, helps identify strengths and areas for improvement. While each player may have their own technique due to individual differences, corrections are necessary to refine skills and enhance performance.

In basketball, skill development might focus on breaking down a lay-up into subroutines, such as catching the ball, landing on the correct foot, and driving towards the basket. These subroutines are practiced individually before being incorporated into continuous lay-up drills. Similarly, in tennis or golf, players may have slight variations in their techniques based on their height, weight or mechanics. Coaches should focus on improving fundamentals, addressing individual needs, and increasing performance under pressure while enhancing communication and thinking skills through drills.

Once players are warmed up and conditioned, coaches need to spend the majority of the remaining time on skills and tactics for the specific sport. These need to specifically target:

- improvement in the fundamentals of the game
- individual needs in specific areas — for example, ball handling
- performance under gradually increasing pressure
- provision of enjoyment through competitive situations
- an increase in knowledge of the game
- development of cognitive or thinking abilities
- development of communication via skills practices.

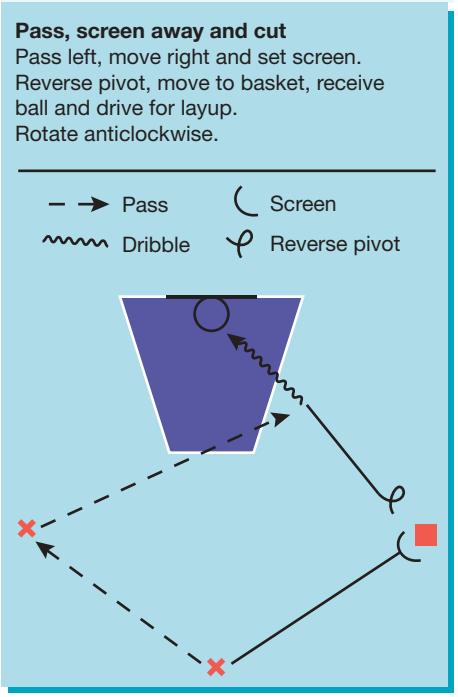
skill and tactical development involves improving specific abilities required for a sport and enhancing strategies to outmanoeuvre opponents, often through practice, analysis and applying game situations

Drills

Players learn physical skills and tactics through repetition of movements in what are called skills practices or drills. The players need to develop a mental picture of the skill through demonstration/video and be made aware of the important points in learning the skill (teaching points). During a drills practice, the player focuses on executing the selected skill as correctly as possible. There will be errors in the initial stages but, with practice, feedback and refinement, the player will gradually improve.

It is important to have a variety of drills for teaching a particular skill or tactic. Skills taught repeatedly under the same conditions and using the same situations do not challenge players and lead to loss of interest and motivation. An example of a basketball drill is shown in figure 7.16. Drills can be varied by changing the complexity of the activity, concentrating on one or more skills, using a real game or small-sided games and by changing group organisation (for example, individual, pair, grid work).

FIGURE 7.16 A drill commonly used in basketball



Modified games

These are fun games often organised on smaller modified areas of play, but requiring the use of the same skills as the real game. These games can be used to focus on particular skills and provide the opportunity for players to apply newly learned techniques. Minor games add fun and enjoyment to a training session. Examples include end ball and corner ball for basketball and netball. Small games are an important part of skill training because they mimic the major game but have fewer players — for example, three-on-three basketball or five-a-side hockey. They are played under game conditions and provide the opportunity for all players to be involved continuously. Small-sided games cater for skill development, fitness, decision-making and tactical development opportunities. Small games can also be used to impose certain conditions (conditional games) on the play in order to practise a particular tactic or skill; it might require, for example, that all shots at the basket must be jump shots.

FIGURE 7.17 Modifed games can help build skills and fitness.

Games for specific outcomes

Games are an effective way to target specific outcomes in sports, allowing athletes to focus on particular skills or strategies. These outcomes might include improving defensive skills, attacking abilities, creating space, using support, exploiting opposition weaknesses, or enhancing decision-making and tactical development. By isolating and practising key components of a sport, players gain opportunities for concentrated skill execution and decision-making in scenarios that closely mimic actual game situations.

This approach is similiar to extracting and refining a small part of the overall game. For example, repetitive practice under competitive conditions might involve passing into the circle in netball or positioning for a corner in hockey. These drills, performed with or without opposition — such as a three-on-one drill — focus on skill improvement, tactical understanding and decision-making.

An example in basketball could involve a two-on-one half-court game. Here, two offensive players work against one defender. The offensive players must decide how to draw the defender away and create a scoring opportunity by passing to a teammate in a better position. Conversely, the defensive player focuses on using positioning, anticipation and skill to prevent a basket despite the numerical disadvantage. These tailored small games are invaluable for honing skills and developing strategies in preparation for full-game scenarios.

DEPTH STUDY IDEA

1. Conduct research into how HIIT training can improve physical fitness in a sport or event of your choice.
2. Machines or free weights. You are training a sprinter. Research what type of strength training method would be most appropriate and why? You could use the **Machines vs free weights** weblink in the Resources panel to assist you in your appraisal.

EXAM TIP

Designing a training session for a particular sport

An exam question focusing on the creation of a training session should consider the fitness components necessary for performance in this sport and how they can be enhanced in the training sessions. For example, *in the sport of basketball it is important to include skill sessions that enhance agility (court movement) and support leg power (rebounds). These fitness components can direct the integration of specific aerobic, anaerobic, strength and flexibility training and training methods of the relevant sport.*

Training methods should be explained to illustrate how they operate in a training session to enhance specific sporting performance. For example, *in basketball a combination of aerobic and anaerobic training in the form of fartlek and plyometric training can be used to enhance speed and power in the goal circle to support rebounding and the ability to make a fast break up the court.* It is important to give practical examples of how this can be applied to the training program. For example, agility sprints, leg power circuit course (squat jumps, jumping lunges, stair climbing, etc.).

7.2 ACTIVITIES

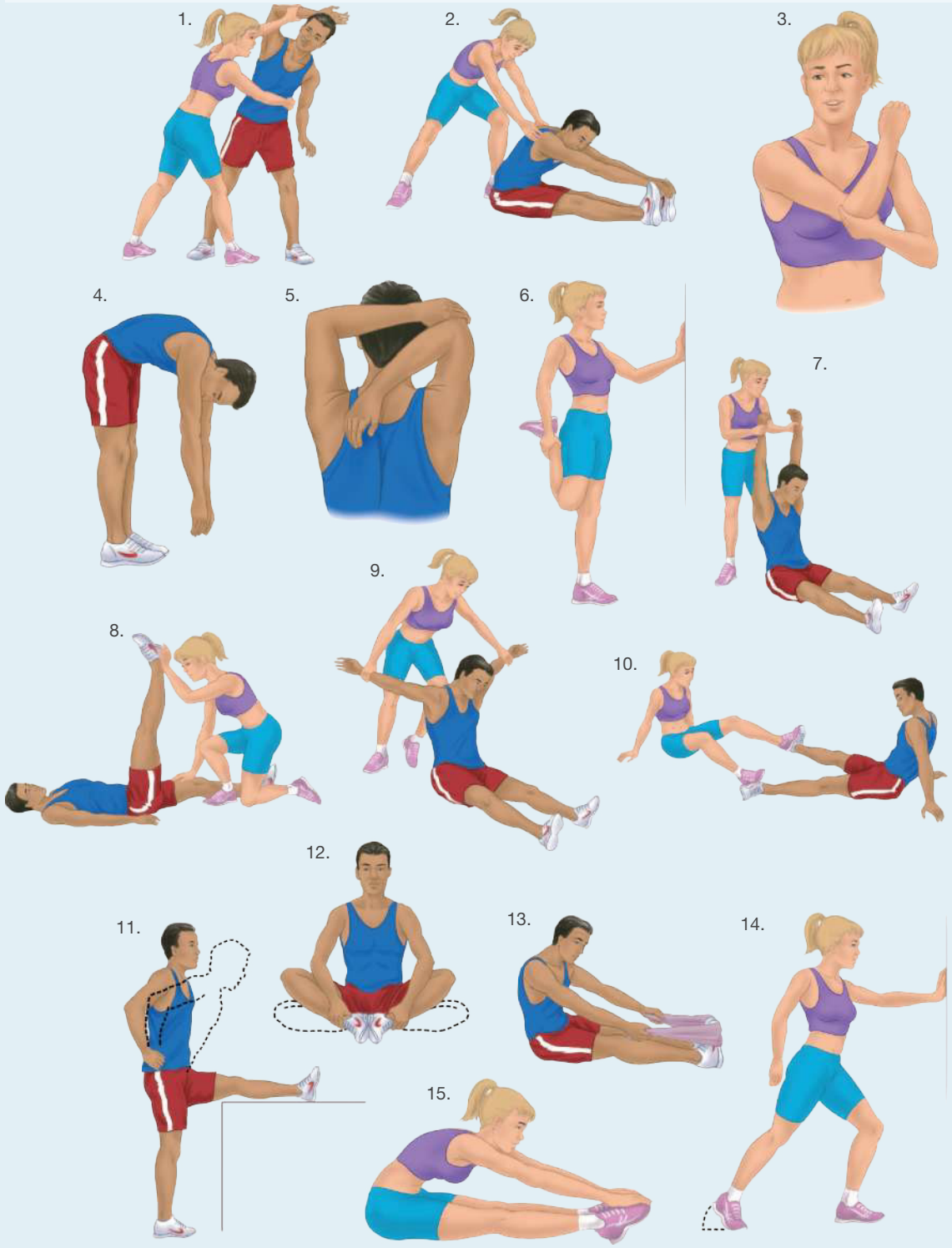
Designing and trialling a circuit

1. As a class or in small groups, design a circuit to improve aerobic capacity. Include at least ten activities and ensure that the activities address different muscle groups.
   a. Make a card for each activity in your circuit that names (and perhaps illustrates) what is to be done at each station.
   b. On each card, indicate the number of repetitions of the movement that is required before progression to the next activity.
   c. Perform your circuit as quickly as possible and record the time taken.
   d. Reflect on how circuits can be versatile and tailored to different sports. Share your ideas with the class.

Categorising different forms of stretching

2. From figure 7.18, choose five exercises that are static stretches and five that are PNF stretches.
- **a.** In pairs, perform your exercises.
- **b.** Briefly describe your exercises and say why each fits the specified category.

FIGURE 7.18 Flexibility exercises



Training types and methods for different sports

3. **a.** Draw an enlarged copy of the following table in your workbook together with the list of sports/activities.
   b. For each sport, identify the training type/method that would most enhance performance in that sport.
   c. Use the final column to justify your choice by indicating why you prefer that type/method of training and how it would affect your performance.

Sport	Training type and method	Justification
Basketball		
Triathlon		
Soccer		
High jump		
Surfing		
100 m hurdles		
Rugby League		

on Resources

Weblink Machines vs free weights

7.2 Exercises

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7.2 Quick quiz on | **7.2 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
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Revise your knowledge

1. What is the main difference between HIIT and SIT?
2. Outline which sports benefit most from fartlek training.
3. Describe the type of exercises commonly used in plyometric training.
4. Why is ballistic stretching potentially harmful?
5. Outline why body weight exercises are suitable for beginners.

Apply your knowledge

6. Design a HIIT workout for basketball players. What exercises would you include?
7. Explain how resistance training with a parachute benefits sprinters.
8. How can drills be adapted to ensure players remain engaged and challenged during skill development?
9. Compare the difference between static and dynamic stretching.
10. Discuss how strength training exercises using free weights contribute to an athlete's performance in rugby league.

7.2 Exam questions

Question 1 (3 marks)
Explain how flexibility can improve athletic performance.

Question 2 (4 marks)
Explain how fartlek training benefits midfielders in soccer.

Question 3 (4 marks)
Evaluate the effectiveness of SIT for improving anaerobic capacity.

Question 4 (5 marks)
Explain the benefits and drawbacks of using body weight exercises for strength training in athletes.

Question 5 (6 marks)
To what extent do small-sided games benefit skill development and tactical training?

7.3 Principles of training

Syllabus: Evaluate the application of the principles of training to both aerobic and strength training

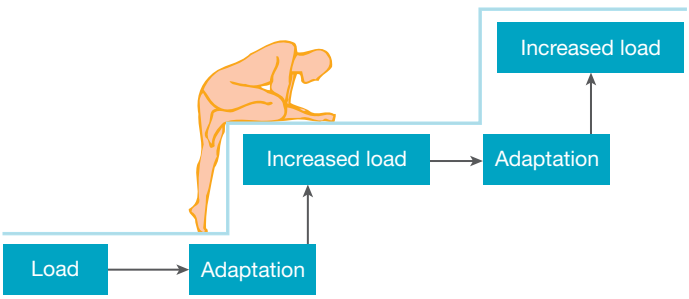
Including:
- progressive overload
- training thresholds
- reversibility
- specificity
- variety
- warm-up and cool-down

Athletes train by repeating the movements needed for their sport because it helps them perform better. However, the effectiveness of their training depends on understanding its benefits. To train effectively, certain important principles must be followed, whether the goal is to improve aerobic fitness or strength. If these principles are ignored or not followed, the effort put into training won't yield the desired results.

7.3.1 Progressive overload

Progressive overload is crucial in both aerobic and strength training for sustained improvement in performance. By systematically increasing the demands placed on the body, it stimulates necessary adaptations, which are vital to prevent performance plateaus. The application of this principle varies between aerobic and strength training, but it remains essential in both for continual progress.

FIGURE 7.19 The overload principle requires a gradual increase in load for benefits to be realised.



In aerobic training, progressive overload can be effectively applied through various strategies, such as increasing the duration, intensity or frequency of exercise. For example, a cyclist might start with 30-minute sessions at a moderate pace three times a week. Gradually extending these sessions to 45 minutes or an hour, or increasing the frequency from three to five times per week, ensures the cardiovascular system is consistently challenged, thus fostering endurance improvements. Another way to progressively overload the aerobic system is by integrating hill training or interval training, which introduces varying intensities to push the body's limits. For instance, a runner incorporating hills or sprints into their routine encourages better oxygen utilisation and endurance. It is important that overload is implemented progressively for long-term adaptations to occur. For example, increasing the load by no more than 10 per cent each week is recommended.

FIGURE 7.20 Progressive overload means increasing the duration, intensity or frequency of exercise to challenge the body.

In strength training, progressive overload can be implemented by incrementally increasing the resistance, repetitions or sets. For instance, a person might bench press 50 kg for three sets of eight repetitions. After a minimum of two weeks, gradually increasing the weight to 55 kg or adding additional sets ensures muscles are continually strained beyond their current capacity, leading to hypertrophy and strength gains. It is essential that there is a gradual increase in load, as abrupt changes could lead to overtraining or injury, negating the benefits. Other effective techniques include decreasing rest time between sets or incorporating more complex exercises, such as progressing from body weight squats to barbell squats.

Overall, the strategic application of progressive overload ensures that the body is consistently challenged, promoting continual improvement in both aerobic and strength performance. Proper planning and incremental increases in workload are crucial to avoid overtraining and injury while maximising the benefits of each training session.

FIGURE 7.21 An appropriate training load must be applied for adaptations to be maximised.

7.3.2 Reversibility

The principle of reversibility highlights that the positive adaptations gained through training are not permanent and will diminish when the training stimulus is removed. This detraining effect applies to both aerobic and strength training programs and can occur due to various reasons such as injury or illness, off-season breaks, or a deliberate reduction in training intensity or frequency.

FIGURE 7.22 Injury can result in loss of training adaptions

For example, in relation to aerobic training, a long-distance runner who stops training for several weeks will notice a decline in their VO_2 max, the maximal oxygen uptake. The heart becomes less efficient at pumping blood, and the muscles' ability to extract and use oxygen decreases. To prevent this, cross-training methods such as swimming or cycling can be employed during injury to maintain cardiovascular fitness.

In strength training, muscle strength can decline more rapidly than aerobic endurance. For example, a weightlifter who ceases regular lifting will experience muscle atrophy, where muscle fibres decrease in size due to the lack of resistance stimuli. This results in a noticeable reduction in strength and power output and can occur as quickly as three weeks after stopping training.

In general, if big gains have been made during training, for both aerobic or strength training, greater losses will follow when training stops because there is more to lose. To mitigate the effects of reversibility, maintaining a baseline level of training is crucial. For aerobic fitness, this might mean engaging in moderate-intensity exercises at least three times a week, ensuring the heart and muscles remain conditioned. For strength training, incorporating light resistance exercises or body weight training during downtime can help preserve muscle mass and strength to some extent.

7.3.3 Specificity

The principle of specificity is important for optimising performance improvements in both aerobic and strength training. It emphasises that the most effective adaptations occur when training closely mirrors the movements, energy systems and muscle groups used in the sport or activity.

FIGURE 7.23 Soccer players need specific training that develops both aerobic and anaerobic capacity.

In aerobic training, specificity dictates that the method of training should match the energy demands of the sport. For instance, a marathon runner benefits from continuous aerobic training, which involves long-duration, steady-state activity that predominantly uses the aerobic energy system and recruits slow twitch muscle fibres. This method enhances cardiovascular efficiency, crucial for sustained performance over long distances. In contrast, a soccer midfielder, who requires both aerobic and anaerobic capacity due to the intermittent nature of the game, should focus on fartlek training. This type of aerobic training alternates between high-intensity bursts and lower-intensity recovery periods, simulating the varying intensities experienced during a soccer match and drawing on both fast and slow twitch muscle fibres.

Specificity in aerobic training ensures that the adaptations are tailored to the athlete's needs, thereby improving performance in the specific context of their sport.

In strength training, the specificity principle involves selecting the appropriate training methods to develop the required strength characteristics. For a rugby player, free weights are most beneficial as they allow for compound movements that build overall power, strength and stability, which are essential for tackling and scrummaging. Exercises like deadlifts, squats and bench presses provide the necessary overload to stimulate muscle hypertrophy and enhance functional strength. On the other hand, gymnasts benefit more from body weight exercises like push-ups, pull-ups and dips. These exercises are highly specific to the sport, focusing on relative strength, balance and control, which are crucial for performing various gymnastics movements. Choosing the right method of strength training based on the sport's demands ensures that the adaptations are functional and directly transferable to performance.

Furthermore, specificity extends to the training of particular fitness components. A netball centre, for example, requires agility, reaction time and coordination. Training drills such as agility ladder exercises or reaction-based activities mimic the rapid directional changes and quick decision-making necessary in a game, thereby enhancing these specific skills. Specificity not only improves physical performance but also refines the motor patterns critical for success in specific sports. Without specifically training the correct energy system, training may give generalised improvements that do not necessarily lead to enhanced performance in the targeted sport as the required intensity might not have been achieved throughout the training.

7.3.4 Variety

Using the same drills and routines to develop fitness components in every training session is not productive, as it can become boring. It is important to use different techniques to keep athletes challenged and engaged. For example, a footballer doesn't need to practice passing, tackling and tactics every session. General endurance, strength and power can be developed using a variety of techniques such as swimming, plyometrics and resistance programs. Mental wellbeing is also crucial to maximise effort in physical training.

Some examples of the application of the variety principle are given in table 7.4.

TABLE 7.4 Application of the variety principle

Aerobic training	
Mode	Aerobic training can be diversified by alternating between activities such as swimming, running, cycling, rowing and hiking. Each model uses different muscle groups and provides unique cardiovascular challenges. For example, swimming not only improves aerobic capacity but also enhances joint flexibility and reduces the impact on the joints, making it suitable for injury recovery or low-impact training days.
Method	Different method, such as continuous, fartlek, circuit or interval. For example, incorporating interval sessions with varying intensity levels and durations can add variety and also enhance different energy systems.
Environment	Training in different environments, such as trails, treadmills or indoor tracks, can introduce new challenges. Running on a trail, for example, requires more balance and coordination due to uneven terrain, while indoor tracks can be used for controlled interval workouts.
Strength training	
Equipment	Strength training can be varied by using different types of equipment. Free weights (like dumbbells and barbells), fixed machines, elastics and body weight exercises each offer distinct benefits and can be rotated within a training program. For example, a chest workout might include bench presses with a barbell one day and push-ups or chest flies with dumbbells on another.

(continued)

TABLE 7.4 Application of the variety principle *(continued)*

Strength training	
Muscle contractions	Alternating between isometric exercises (holding a position, like a plank) and isotonic exercises (moving through a range of motion, like bicep curls) can target muscles in different ways. Isometric exercises help build static strength and endurance, while isotonic exercises are great for building muscle size and strength through dynamic movement.
Session type	Incorporating different session types such as supersets, drop sets, pyramids and circuit training can enhance the variety within a strength workout. A superset, for instance, involves performing two exercises back-to-back without rest, which can increase workout intensity and save time.

7.3.5 Training thresholds

Training thresholds refer to the specific points of intensity during exercise that, when surpassed, lead to significant physiological adaptations, propelling an individual to a new level of fitness. These thresholds are crucial in both aerobic and strength training, as they define the minimum and optimal intensities needed to achieve fitness gains.

To enhance physical condition, it is essential to train at an intensity that stimulates the body to adapt. This point is known as the training threshold. For aerobic fitness, this is referred to as the **aerobic threshold**, the lowest level at which exercise yields improvements in cardiorespiratory efficiency. Aerobic thresholds are closely tied to work intensity, often measured using heart rate. The maximal heart rate (MHR) is estimated by subtracting a person's age from 220. For example, a 20-year-old would have an MHR of 200 beats per minute. The aerobic threshold, usually around 70 per cent of MHR, represents the intensity level necessary for aerobic improvements — roughly a moderately paced jog for most individuals between 16 and 20 years old.

When working above the aerobic threshold but below the anaerobic threshold, athletes operate in the **aerobic training zone**, where steady-state exercise leads to significant improvements in aerobic capacity. Training closer to the **anaerobic threshold** maximises cardiovascular efficiency and enhances the ability to tolerate lactic acid build-up, delaying fatigue and improving endurance performance. The exercise intensities for the aerobic threshold (training threshold) and anaerobic thresholds are shown in figure 7.24.

For instance, a marathon runner who regularly trains near the anaerobic threshold can increase their lactate threshold, allowing them to sustain higher speeds for longer periods. Similarly, a soccer midfielder might use fartlek training to simulate game conditions, alternating between high and moderate intensities, thereby enhancing both aerobic capacity and anaerobic tolerance.

In strength training, pushing the upper limits of resistance ensures progressive overload, stimulating muscle hypertrophy and muscular endurance, which are essential for strength gains. Strength training thresholds are defined by the resistance or load used, determining the focus on either **absolute strength** or **strength endurance**. Absolute strength gains occur when working with high resistance and low repetitions (1–6 reps), targeting maximal strength by engaging more motor units and muscle fibres. Training near a 1-repetition maximum (1RM) is common for developing maximal strength, as seen in powerlifters.

Conversely, strength endurance training utilises lower resistance with higher repetitions (15–20 reps), focusing on the muscle's ability to sustain prolonged activity. Working at the upper threshold, for example, lifting a weight that becomes challenging beyond 20 repetitions, ensures specific adaptations, optimising performance for various athletic goals.

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).

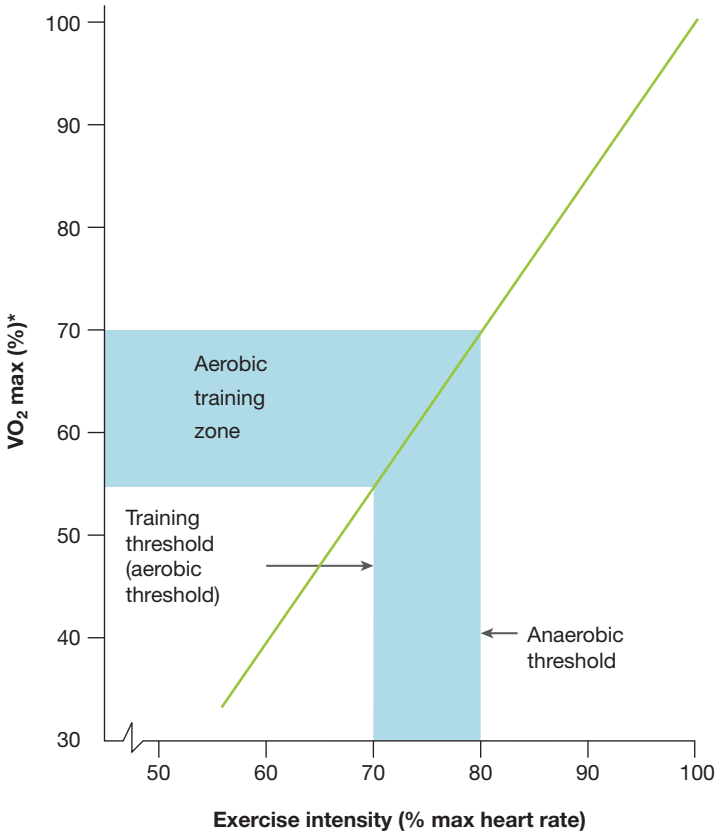
aerobic training zone a level of intensity that causes the heart rate to be high enough to cause significant training gains

anaerobic threshold a level of intensity in physical activity where the accumulation of lactic acid in the blood increases very quickly

absolute strength working with high resistance and low repetitions (1–6 reps)

strength endurance working with low resistance and high repetitions (15–20 reps)

FIGURE 7.24 Working between the training (aerobic) and anaerobic thresholds is necessary for fitness gains to be realised.



* VO_2 max (%) = percentage maximal volume of O_2 that can be consumed in one minute

Source: Adapted, with permission, from B.J. Sharkey and S.E. Gaskill, 2007, *Fitness & Health*, 6th ed. Champaign, IL: Human Kinetics, p. 101, Fig. 6.1.

7.3 PRACTICAL ACTIVITY 1

Aerobic training threshold test

Activity:

Conduct a 20-minute steady-state jog to estimate the students' aerobic training thresholds.

Instructions:

a. Begin with a 5-minute warm-up, including light jogging and dynamic stretches.
b. Students will jog continuously for 20 minutes at a pace they believe is close to their aerobic threshold.
c. During the jog, students should periodically check their heart rate using heart rate monitors/watches or manually at their wrist/neck.
d. After the jog, they will record their average heart rate during the exercise and compare it to their estimated 70–85 per cent of maximal heart rate (MHR).

Calculating MHR:

Maximal heart rate (MHR) = 220 – age.

Aerobic threshold range = 70–85 per cent of MHR.

Questions

1. What was your average heart rate during the 20-minute jog, and how does it compare to your calculated aerobic threshold range?
2. Did you feel you maintained a steady-state pace throughout the jog? If not, what adjustments might you need to make in future sessions?
3. How did your body respond during the jog (e.g. breathing rate, perceived exertion)?
4. Based on your heart rate data and perceived exertion, do you think you were training within your aerobic zone? Why or why not?

7.3.6 Warm-up and cool-down

Each training session requires three essential components — warm-up, training (or conditioning) and cool-down. A session that lacks one or more of these components may contribute to injuries or fail to achieve the desired results.

The purpose of the warm-up is to:

- *reduce the risk of injury* or soreness by increasing joint mobility and muscle stretch
- *increase body temperature* and enzyme activity to promote faster and more powerful muscle contractions
- *mentally prepare* the athlete for training
- *stimulate* the cardiorespiratory system.

The warm-up should follow a set procedure involving:

- *general aerobic activity* (gross motor) such as jogging to raise body temperature
- *specific flexibility exercises* to increase the range of motion of joints and to prevent muscle tears
- *callisthenics*, such as push-ups, star jumps and sit-ups to increase blood flow to the working muscles
- *skill rehearsal* — that is, performing movements or skills that will be repeated in the game (for example, sidesteps, swerves, dribbling or passing the ball).

An effective warm-up for both aerobic and strength training sessions includes 5–10 minutes of light cardiovascular activity, such as jogging or cycling, to gradually elevate the heart rate and increase blood flow to the muscles. This common component prepares the body for the demands of the upcoming workout and helps reduce the risk of injury. For aerobic training, this is often followed by dynamic stretching exercises like leg swings and arm circles to loosen joints and prepare the body for sustained cardiovascular activity. In contrast, a strength training warm-up often includes movement-specific drills, such as body weight squats or light-weight sets of the planned exercises, to activate the muscles and improve the range of motion, preparing them for the intensity of resistance work.

FIGURE 7.25 Warm-ups are essential before any training session.

An effective cool-down for both aerobic and strength training sessions helps to gradually lower the heart rate, prevent blood from pooling in the extremities and reduces the risk of dizziness or fainting. For aerobic training, a cool-down typically involves 5–10 minutes of low-intensity aerobic activity, such as slow jogging or walking, followed by static stretching to improve flexibility and promote muscle relaxation. It also helps to disperse and metabolise lactic acid concentration, as well as replenishing the body's energy stores. In strength training, the cool-down also includes low-intensity cardio to lower heart rate, followed by static stretching or foam rolling to focus on muscle recovery and flexibility, particularly for the muscles that were heavily used during the session. The cool-down's primary goal is to minimise muscle stiffness and soreness that may result from a strenuous training session which helps optimise recovery.

A cool-down is an essential component of aerobic and strength programs.

on Resources

Weblink The importance of a warm-up and cool-down

DEPTH STUDY IDEA

Design a 12-week training program for an athlete of your choice that incorporates the principles of training.

7.3 ACTIVITIES

Investigation of training programs

1. Investigate two different training programs — for example, one that relates to sprinting and one that relates to a game, cycling or rowing. Suggest the type of activities that would be included in the program and describe how the principles of overload and specificity could be applied.

Training and performance

2. Copy and complete the web diagram in figure 7.26 to analyse the following critical question: 'How can the principles of training improve performance?'

FIGURE 7.26 Principles of training and their effect on performance

Applying the principles of training

3. Draw an enlarged copy of the following table in your workbook, leaving plenty of space in the blank sections. The principles of training are listed in the centre of the table. Use the columns either side to describe how each principle can be applied to aerobic and resistance training. Use examples to clarify your points.

Aerobic training	Principles of training	Resistance training
	Progressive overload	
	Specificity	
	Reversibility	
	Variety	
	Training thresholds	
	Warm-up/cool-down	

7.3 Exercises

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7.3 Quick quiz on

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Revise your knowledge

1. What is progressive overload and why is it important for aerobic training and strength training?
2. How is the aerobic threshold defined?
3. Describe what happens when training ceases, according to the principle of reversibility.
4. Explain the role of specificity in training.
5. Outline why a warm-up is important before exercise.

Apply your knowledge

6. Explain how you could apply the principle of progressive overload to an aerobic training program for a beginner runner.
7. Discuss how training thresholds can be used to optimise strength training.
8. How would you apply the principle of reversibility to maintain aerobic fitness during an off-season for a cyclist?
9. A footballer is starting to lose motivation and enjoyment in their training. How can the principle of variety be applied to their program to address this?
10. Create an effective warm-up and cool-down for a sport of your choice.

7.3 Exam questions

Question 1 (3 marks)
Outline the different ways in which progressive overload can be applied to strength training.

Question 2 (4 marks)
Analyse the principle of reversibility in the context of strength training.

Question 3 (5 marks)
Assess the impact of training above the aerobic threshold but below the anaerobic threshold in improving aerobic fitness.

Question 4 (5 marks)
Explain how variety in training methods benefit both aerobic and strength training programs. Use examples to support your response.

Question 5 (8 marks)
To what extent do the principles of training improve performance?

7.4 Training principles, physiological adaptations and improved performance

Syllabus: Examine the relationship between the principles of training, physiological adaptations and improved performance

Including:

- heart rate
- stroke volume and cardiac output
- oxygen uptake and lung capacity
- haemoglobin level
- muscle hypertrophy
- fast/slow twitch muscle fibres

Following the principles of training is essential for bringing about physiological adaptations and improved performance. In response to training, the body makes adaptations or adjustments to the level of stress imposed on it. These adaptations allow it to function more comfortably at existing levels of stress and respond more efficiently to new levels of stress.

The time taken before improvements are noticed varies from one individual to another and depends upon the biological systems affected. Although progressive improvements will be seen throughout a training program, it usually takes about 12 weeks to see the entire benefits. Training will cause adaptations to the heart rate, stroke volume, cardiac output, oxygen uptake, lung capacity, haemoglobin levels, muscle size and fast/slow twitch muscle fibres. By following the principles of training consistently, athletes can make sure their training is effective, leading to sustained physiological improvements and optimal performance outcomes.

7.4.1 Heart rate

Heart rate measurement at rest and during exercise is a reliable indicator of how hard the heart is working. A trained athlete typically has a lower resting heart rate compared to an untrained individual due to the efficiency of their cardiovascular system and a higher stroke volume. This adaptation results from progressive overload, which involves gradually increasing the intensity, duration or frequency of training. By progressively challenging the cardiovascular system, the heart becomes stronger and more efficient, pumping more blood with each beat. For example, a sedentary person with a resting heart rate of 72 bpm can expect it to reduce by about one bpm each week for the first few months of training. After 10 weeks of endurance training, their resting heart rate might decrease from 72 to about 60 bpm. Over time, highly conditioned endurance athletes can have resting heart rates below 40 bpm, and some even drop below 30 bpm.

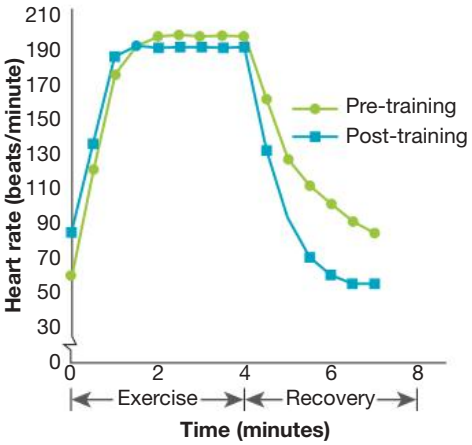
The principle of training thresholds is also critical to improving heart rate adaptation. These thresholds refer to specific intensity levels, such as the aerobic and anaerobic thresholds, that must be surpassed to trigger significant cardiovascular adaptations. By training at or near these thresholds, athletes push the heart to function at its maximum capacity, leading to a more efficient cardiovascular system. For instance, a runner who gradually increases their running distance or pace to work near their aerobic threshold will see improvements in their heart's ability to pump blood and manage oxygen consumption, resulting in a lower resting heart rate and quicker recovery after exercise.

Additionally, the principle of specificity plays a significant role in heart rate adaptation. Training must closely match the demands of the sport or activity for the most effective cardiovascular improvements. For example, a cyclist who regularly trains at varying intensities will experience specific heart rate adaptations that enhance

cycling performance, such as improved efficiency at high intensities and faster recovery during sprints. This also supports the recruitment of fast or slow twitch fibres.

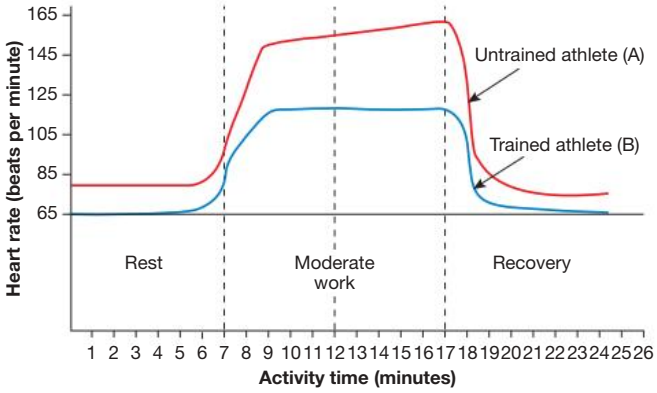
Figures 7.27 and 7.28 illustrate the benefits of a training program on heart rate, particularly showing the differences between trained and untrained individuals during maximal exercise and recovery periods. As athletes incorporate progressive overload, work at appropriate training thresholds, and ensure specificity in their training, the cardiovascular system becomes more efficient. This results in a lower resting heart rate, improved heart rate control during exercise, and better overall performance during sport.

FIGURE 7.27 The effect of training on heart rate



Source: Adapted, with permission, from J.H. Wilmore and D.L. Costill, 2004, *Physiology of Sport and Exercise*, 3rd ed. Champaign, IL: Human Kinetics, p. 281, Fig. 9.7.

FIGURE 7.28 Heart rate responses before, during and after exercise for a trained athlete and an untrained athlete



7.4.2 Stroke volume and cardiac output

Stroke volume (SV) refers to the amount of blood ejected by the left ventricle of the heart during a contraction and is typically measured in mL per beat. A significant increase in stroke volume is one of the key adaptations resulting from aerobic training. As athletes engage in regular training, the heart becomes more efficient, and the left ventricle fills more completely during diastole (the relaxation phase), allowing the heart to pump more blood with each beat. This adaptation leads to a greater stroke volume at maximal exercise.

Training also increases blood plasma volume, which can rise by up to half a litre after just eight days of endurance training. The increased plasma volume results in a greater amount of blood available to fill the ventricle, leading to enhanced ventricular stretch and greater elastic recoil. This allows the heart to pump with greater force, improving stroke volume. The principle of progressive overload is essential for stimulating these adaptations. By continuously challenging the cardiovascular system, progressive overload allows the heart to adapt and function more efficiently, thereby increasing stroke volume over time.

Cardiac output (CO) is the volume of blood the heart pumps per minute and is worked out by multiplying stroke volume by heart rate.

$$\text{Cardiac output} = \text{stroke volume} \times \text{heart rate}$$

stroke volume the amount of blood ejected by the left ventricle of the heart during a contraction. It is measured in mL/beat.

cardiac output the amount of blood pumped by the heart per minute

While maximal heart rate may not significantly increase with training, cardiac output improves through a marked increase in stroke volume. For untrained individuals, cardiac output may range from 15 to 20 litres per minute. In trained athletes, this can increase to 20 to 25 litres per minute, and in highly trained endurance athletes, it may rise as high as 40 litres per minute. The higher cardiac output in trained athletes is mainly the result of a significant increase in stroke volume, rather than an increase in heart rate. This enhanced cardiac

output allows athletes to deliver more oxygenated blood to working muscles during exercise, improving endurance and overall performance.

FIGURE 7.29 Stroke volume is significantly improved by training. As HR increases, the SV change in untrained athletes is negligible whereas trained athletes experience a considerable benefit.

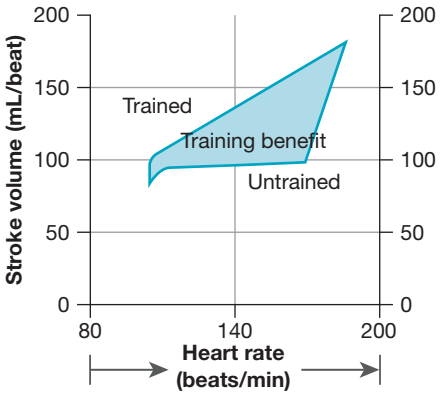
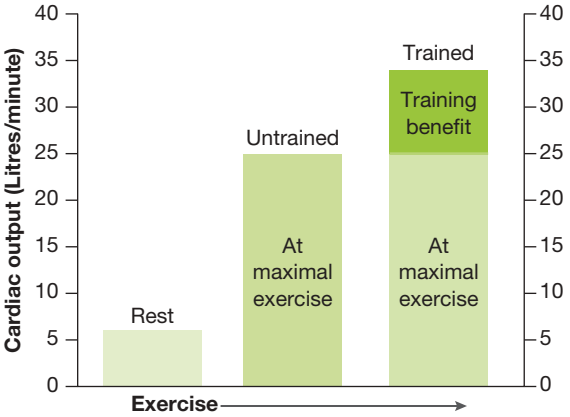


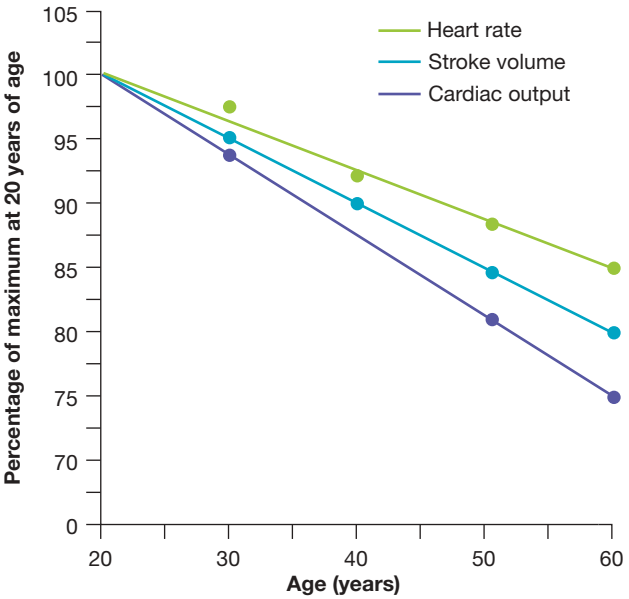
FIGURE 7.30 While cardiac output is much the same for trained and untrained athletes at rest, at maximal exercise the trained athlete has the advantage of much more oxygen being available courtesy of significantly higher cardiac output.



The principle of specificity ensures that training adaptations are tailored to the specific demands of a sport. For example, endurance runners will experience a greater increase in stroke volume, enabling them to sustain higher intensities for longer periods. Through consistent training that adheres to the principle of specificity, athletes can achieve targeted cardiovascular adaptations that improve their performance in their chosen sport.

The principle of warm-up and cool-down also plays a vital role in enhancing stroke volume and cardiac output. A proper warm-up gradually increases blood flow and prepares the cardiovascular system for more intense physical activity, while a cool-down allows the body to return to its resting state more effectively, aiding in recovery and preventing excessive strain on the heart. These activities help to maintain the efficiency of the cardiovascular system, contributing to ongoing improvements in stroke volume and cardiac output.

FIGURE 7.31 The effects of ageing on maximal values for cardiac output, stroke volume and heart rate.



Source: Adapted, with permission, from J.H. Wilmore and D.L. Costill, 1999, *Physiology of Sport and Exercise*, 2nd ed. Champaign, IL: Human Kinetics, p. 554, Fig. 17.7.

Reversibility, another important principle, highlights that the benefits gained from training will diminish if the training stimulus is removed or reduced. If an athlete stops training or significantly decreases the intensity of their workouts, after 2–3 weeks stroke volume and cardiac output will gradually return to pre-training levels. This shows the importance of maintaining regular training sessions to maintain cardiovascular adaptations and continue improving performance over time.

7.4.3 Oxygen uptake and lung capacity

Oxygen uptake (VO_2) is one of the most significant improvements resulting from aerobic training. At rest, the body consumes only small amounts of oxygen, but during exercise, the **mitochondria** in muscle cells use more oxygen to provide energy. Maximal oxygen uptake (VO_2 max) is the best indicator of cardiorespiratory endurance, as it shows the maximal amount of oxygen the muscles can absorb and use during intense activity. VO_2 max can be measured through laboratory tests like bicycle ergometry or field tests such as the 12-minute run or the multistage fitness test.

oxygen uptake the ability of the working muscles to use the oxygen being delivered

mitochondria cell organelles that produce energy (ATP) through cellular respiration and have their own DNA

lung capacity the amount of air that the lungs can hold

Improving VO_2 max is crucial for endurance athletes as it enhances the body's ability to deliver oxygen to working muscles. A high VO_2 max indicates a superior oxygen delivery system and contributes significantly to outstanding endurance performance. The principle of progressive overload is key in this adaptation. By gradually increasing the intensity, duration and frequency of training, athletes stress their cardiovascular and respiratory systems, stimulating physiological adaptations that improve VO_2 max. For instance, a sedentary person who applies the FITT (Frequency, Intensity, Time and Type) formula consistently over six months can expect a 15–20 per cent improvement in VO_2 max. This is generally accompanied by a 35–42 mL/kg/min increase in VO_2 max, reflecting an improvement in aerobic capacity.

Increases in VO_2 max result from several interrelated physiological adaptations. One such adaptation is the increase in the number and size of mitochondria in the muscle cell, which use the oxygen to produce energy. These adaptations align with the principle of specificity, as the training program needs to target aerobic capacity to enhance VO_2 max. For example, a long-distance swimmer focusing on aerobic endurance will see significant gains in mitochondrial function and oxygen usage, improving their VO_2 max and overall performance. By tailoring the training to the specific demands of the sport, athletes can ensure that their cardiovascular and respiratory systems develop in a way that enhances their performance in their chosen sport.

Furthermore, training thresholds play an important role in improving VO_2 max. Athletes need to train at an intensity that is high enough to challenge the body's ability to transport and use oxygen. This intensity falls within the aerobic zone, typically 60–85 per cent of an athlete's maximum heart rate. Consistently training within this threshold helps improve oxygen uptake by increasing the efficiency of the cardiovascular and respiratory systems.

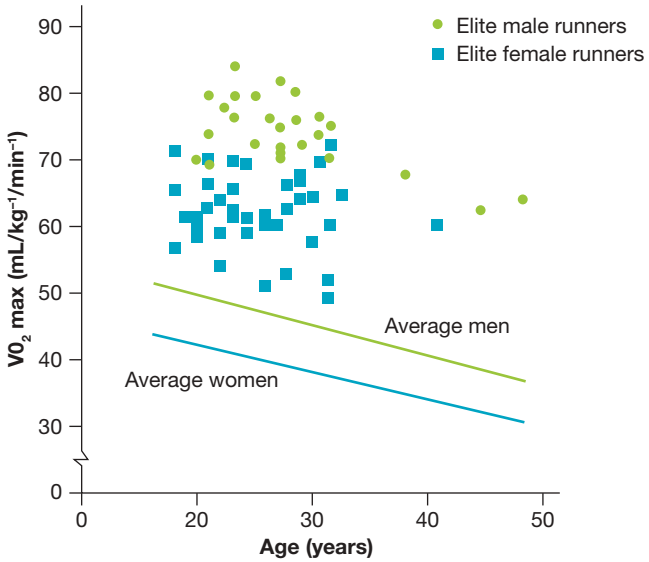
FIGURE 7.32 An athlete undertaking a treadmill test for maximal oxygen uptake.

Source: © Rees Buck / www.reesbuck.com

In terms of **lung capacity**, the amount of air the lungs can hold plays a critical role in how efficiently oxygen is absorbed during exercise. While total lung capacity remains relatively unchanged with training, there are small but important improvements in certain lung volumes. Vital capacity, which refers to the amount of air that can be expelled after maximal inspiration, can increase slightly with training, while residual volume, the amount of air left in the lungs after exhalation, typically decreases. Training also causes tidal volume (the amount of air breathed in and out during normal respiration) to increase at maximal exercise intensities, allowing the athlete to take in more oxygen during high-demand periods.

The principle of variety also plays a role in improving oxygen uptake and lung capacity. Incorporating a variety of aerobic activities, such as running, cycling, swimming and rowing, helps to stimulate different muscle groups and challenges the cardiovascular system in different ways. This can lead to a more balanced improvement in VO_2 max and lung function, as each activity stresses the heart and lungs in unique ways, promoting overall aerobic capacity.

FIGURE 7.33 Male and female elite athletes have significantly higher maximal oxygen uptake values than average individuals.

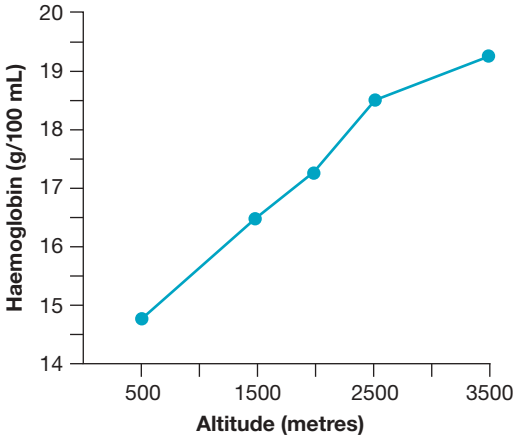


Source: Adapted, with permission, from J.H. Wilmore and D.L. Costill, 2004, *Physiology of Sport and Exercise*, 3rd ed. Champaign, IL: Human Kinetics, p. 577, Fig. 18.6.

7.4.4 Haemoglobin level

Haemoglobin, contained in red blood cells, plays a critical role in oxygen transport throughout the body. Each red blood cell contains approximately 250 million haemoglobin molecules, all capable of carrying large amounts of oxygen. The average male has about 14.3 grams of haemoglobin per 100 mL of blood, while females have slightly lower levels of around 13.9 grams per 100 mL. The lower haemoglobin levels in women contribute to lower VO_2 max values and, consequently, endurance performance.

FIGURE 7.34 The effect of altitude on haemoglobin levels in males.



Source: Adapted, with permission, from J.H. Wilmore and D.L. Costill, 2004, *Physiology of Sport and Exercise*, 3rd ed. Champaign, IL: Human Kinetics, p. 347, Fig. 11.4.

The majority of oxygen in the body is carried by haemoglobin, while only a small amount is dissolved in plasma. Without sufficient haemoglobin, the body would need an extraordinarily large volume of blood to transport enough oxygen to sustain basic functions, let alone during exercise. The ability to transport and use oxygen efficiently is crucial for athletic performance, particularly in endurance sports.

Training significantly increases haemoglobin levels, which enhances the body's oxygen-carrying capacity. This adaptation is achieved through consistent and structured aerobic training, using the principles of progressive overload and specificity which ensures that the body is gradually exposed to greater stress, resulting in an increase in haemoglobin production over time. For example, an athlete might increase the duration of their runs or the intensity of their interval training sessions, thereby stimulating the production of red blood cells and enhancing haemoglobin levels.

Training at high altitudes is another method used to increase haemoglobin levels. At higher altitudes, the body is exposed to lower oxygen levels, which triggers the production of **erythropoietin (EPO)**, a hormone that stimulates red

haemoglobin the substance in blood that binds to oxygen and transports it around the body

erythropoietin (EPO) a hormone produced mainly by the kidneys that stimulates red blood cell production in the bone marrow

blood cell production. This is an application of specificity, where the training environment closely mimics the conditions an athlete will face in competition. The famous success of Kenyan endurance runners, particularly in middle- and long-distance events, is partially attributed to their ability to train in high-altitude environments, where the reduced oxygen levels lead to a natural increase in red blood cell and haemoglobin production.

The increase in haemoglobin levels that occurs with endurance training is generally about 20 per cent, raising the total amount of haemoglobin in the blood from about 800 grams to around 1000 grams per 100 mL. This increase is largely due to an increase in blood plasma (and consequently, blood volume) and a rise in the number of red blood cells. However, it is important to note that although the total amount of haemoglobin increases, its concentration may decrease due to the rise in plasma volume. Endurance athletes often have 'thinner' blood in terms of haemoglobin concentration, but they possess a greater overall blood volume, which enables them to transport more oxygen to muscles during prolonged activity.

The principle of training thresholds plays a key role in this adaptation. For haemoglobin levels to increase, training must reach a sufficient intensity and volume to challenge the cardiovascular system and stimulate the production of red blood cells. Athletes must consistently train at a moderate to high intensity within the aerobic zone to promote these adaptations. Over time, the body becomes more efficient at oxygenating muscles, allowing athletes to maintain high performance during extended efforts.

While endurance training can significantly improve haemoglobin levels, it is crucial to also consider the principle of reversibility. If an athlete reduces or stops training, haemoglobin levels will gradually decline. This is a natural process, as the body no longer requires the same capacity for oxygen transport, resulting in a decrease in red blood cell count and haemoglobin concentration. Therefore, consistent training is necessary to maintain the benefits of increased haemoglobin levels.

7.4.5 Muscle hypertrophy

Muscle hypertrophy refers to the increase in muscle size due to growth in muscle fibres and the enlargement of cross-sectional muscle area. This process is essential for athletes who need to increase strength, power and muscle endurance for various sports.

Training, particularly strength training, leads to hypertrophy by stimulating muscle fibres, causing them to grow larger and stronger. For hypertrophy to occur, muscles must be challenged beyond their normal capacity, which is achieved through the principle of progressive overload. This involves gradually increasing the intensity of the workout, either by increasing resistance, the number of repetitions or the training volume. Over time, this consistent overload causes structural changes in the muscle, including an increase in the actin and myosin filaments, myofibrils and connective tissues that support muscle contraction.

The specificity principle ensures that the training is tailored to target the muscle groups that are most relevant for an athlete's performance. For example, a sprinter may focus on lower body resistance training to enhance leg strength and power, while a swimmer would likely focus on upper body strength.

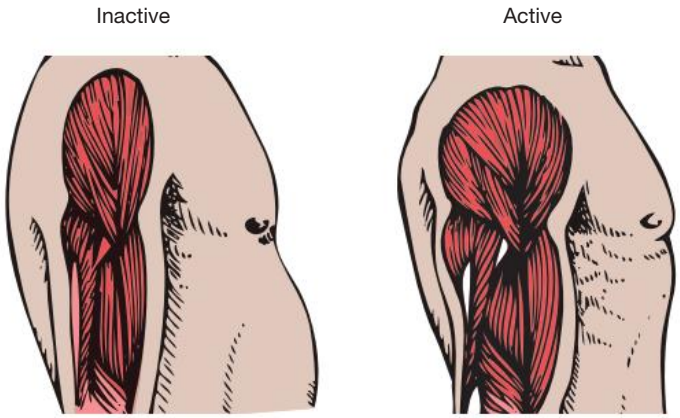
To maximise the effectiveness of strength training, athletes must train within specific training thresholds that challenge their muscles enough to stimulate growth. Low repetitions with high resistance tend to be most effective for stimulating hypertrophy. For example, a weightlifter performing high-intensity lifts at low reps will effectively promote muscle growth in key areas.

Regularity of training is vital, as consistent effort over time promotes hypertrophy. If an athlete's training is irregular or if there are long periods without training, muscular atrophy (the wasting or decrease in muscle size) can occur. Regular training sessions are necessary for muscle fibres to adapt, grow and become stronger and to avoid reversibility.

Variety in training helps prevent the body from adapting to the same stimuli. By changing the exercises, the volume or the intensity, athletes can ensure continued muscle development. For instance, a change from machine-based to free-weight exercises or varying rep ranges (e.g. 6–8 reps v. 10–12 reps) can keep muscles challenged and progressing.

Moreover, a warm-up and cool-down are crucial for optimising muscle hypertrophy. A warm-up increases blood flow to muscles and prepares them for the intensity of the workout and reduces the risk of injury. The cool-down helps remove waste products from muscles, aids in recovery and enhances flexibility, which supports the maintenance of muscle growth.

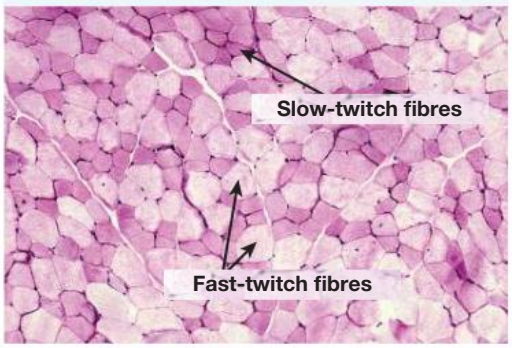
FIGURE 7.35 Training, particularly resistance training, causes growth in the size of muscle known as hypertrophy.



7.4.6 Fast/slow twitch muscle fibres

Muscle fibres are essential in determining an athlete's performance across various sports. There are two primary types of muscle fibres: slow twitch (ST) and fast twitch (FT).

FIGURE 7.36 Cross-section of skeletal muscle fibre



Slow twitch muscle fibres are mainly used during aerobic endurance activities such as long-distance running, cycling and swimming. These fibres contract slowly, are fatigue-resistant and are efficient at using oxygen to generate energy (ATP). This helps them sustain activity over extended periods. Aerobic training, which focuses on sustained moderate-intensity activity, leads to several key adaptations in these fibres. For example, progressive overload is essential for improving endurance performance, as increasing the duration or intensity of activities like jogging or swimming gradually stresses slow twitch fibres, prompting them to adapt. This results in improved mitochondrial function as the number and size of mitochondria increase, therefore enhancing the muscle's ability to utilise oxygen for ATP production. Additionally, capillary density increases, which improves the delivery of oxygen and nutrients to muscle fibres, thus enhancing overall muscle efficiency. **Myoglobin** content also increases, allowing muscles to store more oxygen for use during prolonged exertion. These adaptations result in a more efficient aerobic system, allowing athletes to maintain higher intensities for longer periods without fatigue.

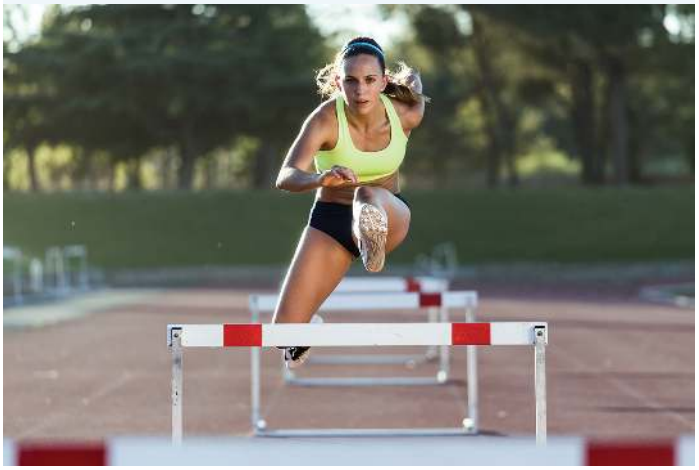
Endurance training also leads to an increase in oxidative enzymes that facilitate more efficient energy production and muscle hypertrophy, where slow twitch fibres experience some growth to handle prolonged activity better. These adaptations highlight the importance of specificity, as endurance athletes must target slow twitch fibres through activities that challenge the aerobic system. Warm-up and cool-down are also crucial here — warming up helps to prepare muscles for the demands of sustained exercise and increases circulation, while the cool-down facilitates recovery by helping to clear metabolic waste and reduce muscle stiffness.

slow twitch muscle fibres contract slowly and for long periods of time. They are recruited for endurance-type activities such as marathons.

myoglobin a protein found in muscle cells that stores and transports oxygen, helping to supply oxygen to muscles during physical activity

In contrast, **fast twitch muscle fibres** are used during anaerobic, high-intensity activities such as sprinting, weightlifting and explosive movements. They contract quickly and generate high amounts of power but fatigue rapidly. These fibres are particularly well-suited for short bursts of maximal effort, relying on anaerobic energy systems for fuel. To enhance the performance of fast twitch fibres, athletes must use progressive overload in anaerobic activities, such as sprints or resistance training. Increasing the intensity of these efforts forces the fast twitch fibres to adapt, resulting in greater muscle strength, power and efficiency. Fast twitch fibres also undergo adaptations like hypertrophy, where muscle size increases to allow for greater power production, and glycolytic enzyme activity, which improves the efficiency of energy production through anaerobic pathways. Additionally, anaerobic training increases lactic acid tolerance, allowing the athlete to perform high-intensity efforts for longer before fatigue sets in.

FIGURE 7.37 Fast twitch muscle fibres are recruited for power and explosive movements.



fast twitch muscle fibres reach peak tension quickly and are recruited for power and explosive movements such as throwing and lifting

For athletes aiming to improve fast twitch muscle performance, specificity dictates that explosive activities like plyometrics, sprint intervals and heavy resistance training should form the core of their routine. These exercises directly target the fast twitch fibres, stimulating the adaptations necessary for improved power output. In addition, regular warm-up and cool-down routines are important to prepare muscles for high-intensity efforts and to help in recovery by promoting blood flow and reducing lactic acid build-up. The variety in training — by combining different types of resistance and high-intensity interval training (HIIT) — keeps the muscles challenged, encouraging further adaptation and preventing training plateaus.

CASE STUDY

Aerobic training and its physiological adaptations

Background

Emma is a 28-year-old amateur runner who has recently decided to start training for a half-marathon. Having led a sedentary lifestyle until now, she is determined to improve her cardiovascular fitness and endurance. Emma begins her training with a focus on aerobic exercises, such as long-distance running, cycling and swimming. Her goal is to increase her ability to sustain longer runs without experiencing fatigue and to improve her overall cardiovascular health. To ensure steady improvement, she plans to gradually increase the intensity, frequency and duration of her workouts over the next 12 weeks.

Emma's aerobic training program includes:

- Running: 3–4 sessions per week, with an increase in weekly distance.
- Cycling: 1–2 times per week for cross-training and to reduce the risk of overuse injuries.
- Swimming: 1 session per week for variety and to engage different muscle groups.

She tracks her resting heart rate, perceived exertion and running times to monitor progress and to ensure that she's adhering to the principles of aerobic training, specifically focusing on progressive overload, specificity and variety.

Expected physiological adaptations

As Emma continues with her aerobic training, she can expect to see significant physiological changes that improve her cardiovascular system and muscle endurance. These adaptations will help her perform at a higher level during long-distance runs and sustain activity over extended periods. Key physiological changes she may experience include:

1. Reduced resting heart rate: Over time, Emma's heart will become more efficient at pumping blood, leading to a reduction in her resting heart rate. This is because her heart will pump more blood per beat, thanks to an increase in stroke volume.
2. Increased stroke volume: As Emma's heart becomes stronger, the left ventricle will fill more completely during each heartbeat, enabling it to pump more blood with each contraction. This adaptation allows Emma to deliver more oxygen-rich blood to her muscles with each beat.
3. Improved cardiac output: By increasing her stroke volume, Emma will experience a corresponding increase in cardiac output during exercise. This is essential for providing the working muscles with more oxygen during her runs.
4. Enhanced oxygen uptake (VO_2max): Emma's ability to take in and use oxygen during exercise will improve, allowing her to sustain higher intensities for longer periods. This will be reflected in a higher VO_2 max, which is a key indicator of aerobic fitness.
5. Improved muscle endurance: Through consistent aerobic training, Emma's muscle fibres — particularly the slow twitch fibres — will become more efficient, allowing her to maintain a steady pace for longer periods without fatigue.

Detailed progression and monitoring

Week 1–4: Initial adaptation phase

In the first few weeks of her training, Emma focuses on building a foundation of aerobic fitness. She starts with relatively low-intensity runs, aiming for 30–40 minutes per session at a pace where she can still maintain a conversation (around 60–70 per cent of her maximum heart rate). She also incorporates cycling and swimming to introduce variety and reduce the risk of injury.

Key adaptations:

- Heart rate: Emma notices that her heart rate is slightly elevated at first, but she gradually becomes more comfortable during each session.
- Recovery: Emma takes longer to recover after each run, but by the end of the first month, she feels that her heart rate returns to normal more quickly after training.

Week 5–8: Progressive overload

As Emma's cardiovascular system adapts, she begins increasing the intensity of her runs. She extends her running sessions by 5–10 minutes each week and gradually increases her pace. She adds one session per week where she runs at a slightly higher intensity for short intervals (e.g. 4 minutes at a faster pace followed by 2 minutes of easy jogging or walking).

Key adaptations:

- Stroke volume: Emma notices she is able to maintain a faster pace with less effort, and her heart rate is lower during exercise compared to the beginning of the program.
- VO_2max: Through consistent aerobic training, her VO_2 max improves, allowing her to sustain a higher intensity for longer.
- Recovery: Emma's recovery time decreases, and her muscles feel less fatigued after each run.

Week 9–12: Refinement phase

By the final weeks of her training, Emma's aerobic capacity has significantly improved. She now runs longer distances (up to 15 km per session) at a moderate pace, with one session per week where she incorporates hill sprints or tempo runs. Emma feels much stronger and more capable of maintaining a steady pace throughout the run.

Key adaptations:

- Heart rate and cardiac output: Emma's resting heart rate has dropped significantly, and during runs she can maintain higher intensities with lower heart rates. Her cardiac output has increased, improving the delivery of oxygen to her muscles.
- Endurance: Emma is now able to run for longer periods without feeling overly fatigued. Her muscle endurance has greatly improved due to the increase in slow twitch fibre efficiency.

Questions

1. How does progressive overload apply to Emma's aerobic training program?
2. Why does Emma's resting heart rate decrease as her training progresses?
3. What role do VO_2 max and stroke volume play in Emma's aerobic training?
4. How does increased muscle endurance improve Emma's performance in long runs?
5. What potential benefits did Emma experience as a result of increasing the intensity of her training into the anaerobic zone?

DEPTH STUDY IDEAS

1. Research various athletes' heart sizes and account for the differences in relation to aerobic training and the physiological adaptations.
2. Investigate, through case studies, the effects of altitude training on haemoglobin levels and its implications for performance.

EXAM TIP

Examine the relationship between the principles of training, physiological adaptations and improved performance

An exam question addressing this question is likely to be heavily weighted (high mark value) as there is a lot to consider. When addressing a question such as this, it is critical to show a clear relationship as to how the principles of training support the physiological adaptations to improve performance. It is important to show syllabus knowledge by listing the six principles of training (overload, specificity, variety, reversibility, training thresholds and warm-up and cool-down), although it is good to focus on 2–4 principles depending on the mark weighting. (Overload is invariably the strongest principle to discuss that is responsible for multiple adaptations.)

Show HOW the principle of training allows for at least three adaptations explaining why/how and then consider how sporting performance is enhanced. For example, *when the principle of progressive overload is applied an athlete's stroke volume is enhanced as the additional stress placed on the heart enhances the strength of the cardiac muscle to ensure the left ventricle contracts more forcefully allowing a greater supply of oxygen-rich blood to exit the heart per contraction. This allows the athlete to have a greater capacity to perform aerobically for longer periods due to an improved supply of oxygen to the working muscles*.

7.4 ACTIVITIES

Maximal oxygen uptake

1. The tests of aerobic power mentioned earlier can be performed in school situations because they require little equipment. However, there can be some variation in results, even with the same subjects performing the same tests on successive occasions.

   Investigate how maximal oxygen uptake is calculated using direct measurement. The **VO_2 max test** weblink in the Resources panel may assist.

   Why would the results be more accurate?

Summarising physiological responses and adaptations

2. Copy and complete the diagram in figure 7.38 to create an overview of the physiological adaptations in response to aerobic training (refer to this subtopic).

FIGURE 7.38 Physiological adaptations

on Resources

Weblink VO_2 max test

7.4 Exercises

learnon

7.4 Quick quiz on | **7.4 Exercise**

Learning pathways

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

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Revise your knowledge

1. How does training affect stroke volume and cardiac output?
2. What is the role of haemoglobin in athletic performance?
3. Describe how muscle hypertrophy occurs.
4. What are the differences between slow twitch and fast twitch muscle fibres?
5. What adaptations take place in the following areas as a result of training?
   - a. Heart rate
   - b. Stroke volume
   - c. Cardiac output
   - d. Oxygen uptake (VO_2 max)
   - e. Lung capacity
   - f. Haemoglobin level
   - g. Muscle hypertrophy
   - h. Fast/slow twitch fibres

Apply your knowledge

6. How does progressive overload lead to improvements in heart rate?
7. What role does specificity play in improving stroke volume and cardiac output?
8. Explain how training at high altitudes can impact haemoglobin levels.
9. Why is warm-up and cool-down important for improving stroke volume?
10. How does the principle of variety support oxygen uptake and lung capacity?

7.4 Exam questions

Question 1 (3 marks)

Describe the physiological changes that occur in the heart due to progressive overload.

Question 2 (4 marks)

Explain the importance of training thresholds for improving VO_2 max.

Question 3 (4 marks)

Assess the significance of specificity in improving VO_2 max for endurance athletes.

Question 4 (6 marks)

To what extent does reversibility impact cardiovascular adaptations after stopping training?

Question 5 (8 marks)

Source: *HSC 2019, PDHPE Exam, Section I, Part B, Q.27*

An athlete is participating in a 12-week aerobic training program. **Analyse** how progressive overload and training thresholds can result in physiological adaptations for the athlete.

7.5 Sample exam question response

Question

Evaluate the importance of incorporating three principles of training for a weightlifter. **(8 marks)**

Criteria	Marks
• Provides well-informed judgements of the importance of incorporating three principles of training for weightlifting • Demonstrates extensive knowledge and understanding of the principles of training • Provides relevant and detailed examples	8
• Provides sound judgements of the importance of incorporating three principles of training for weightlifting • Demonstrates sound knowledge and understanding of the principles of training • Provides relevant examples	6–7
• Provides characteristics and features of the importance of incorporating three principles of training for weightlifting • Provides examples	4–5
• Demonstrates a basic understanding of the principles of training • Provides example/s	2–3
• Provides some relevant information about three principles of training/weightlifting	1

Sample response

Breaking down the question

Evaluate the importance of incorporating three principles of training for a weightlifter.

Identify the action word/s: Evaluate — Make a judgement based on criteria; determine the value of

Sylabus terminology: principles of training

Examples: Weightlifting (strength training)

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 is this paragraph 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

Incorporating the principles of training for a weightlifter is crucial for optimising performance, preventing injury and achieving specific strength-related goals.[1]

Progressive overload is fundamental for muscle growth and strength improvement in weightlifting.[1] By incrementally increasing the resistance, repetitions or sets, the muscles are continually challenged, leading to muscle hypertrophy and strength gains.[2] For instance, a weightlifter may start with a clean and jerk of 100 kg for three sets of three repetitions. After a few weeks, they gradually increase the weight to 110 kg to ensure the muscles adapt to the higher load, promoting further strength development. They will continue to progressively increase the weight at approximately 10 per cent every two weeks in order to allow the body to adapt and gains to be achieved.[3] Without progressive overload, the lifter would likely experience performance plateaus.[4]

Training thresholds in weightlifting refer to the specific intensities required to achieve strength gains.[1] Working near the maximal threshold, such as lifting weights close to the lifter's 1-repetition maximum (1RM), is essential for developing maximal strength. The weightlifter will focus on high weight and low repetitions as this is what is specifically required in order to build absolute strength.[2] For example, performing deadlifts at 90 per cent of 1RM for three sets of three[3] repetitions engages more motor units and muscle fibres, and ensures that the weightlifter is working in the correct training zone and fosters significant strength adaptations.[4]

Specificity in weightlifting means tailoring the training to mimic the movements and demands of the sport.[1] For example, performing Olympic lifts such as the snatch and clean and jerk with barbells directly enhances the skills and strength required for competition. Similarly, focusing on compound movements like squats and deadlifts builds the overall power and stability needed for successful lifts. Ensuring that these movements are regularly practised in training also reduces the likelihood of injuries because the body is building strength not only in the muscles but also the joints that help stabilise and maintain form throughout the movement, both of which are crucial in strength training.[3] This targeted approach ensures that the training adaptations are directly transferable to the weightlifting performance.[4]

Introducing variety in weightlifting prevents overuse injuries and maintains motivation.[2] For instance, alternating between different types of equipment, such as free weights and fixed machines,[3] can challenge muscles in various ways and prevent boredom.[4] Additionally, varying session types with supersets, drop sets or pyramids[3] can keep the training engaging and stimulate muscle growth through different pathways.[2]

Incorporating the principles of training, such as progressive overload, training thresholds and specificity, is essential for weightlifters. These principles ensure continuous strength development, prevent injuries, maintain motivation and enhance recovery, ultimately contributing to peak performance in weightlifting.[4]

7.6 Review

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7.6.1 Topic summary

7.2 Types of training and training methods

- 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 five types of training are anaerobic training, aerobic training, flexibility training, strength training, and skill and tactical development.
- Anaerobic training includes High Intensity Interval Training (HIIT) and Sprint Interval Training (SIT) that are effective anaerobic methods that improve explosive power, speed and anaerobic capacity, making them ideal for sports requiring short, intense bursts of effort.
- Aerobic training includes continuous, fartlek, aerobic interval and circuit training methods that enhance cardiovascular endurance and stamina. This is crucial for sports involving prolonged, steady efforts, such as long-distance running, cycling and swimming.
- Flexibility training uses various stretching methods to improve muscle and joint range of motion.
- Static stretching, common in sports like tennis, helps enhance flexibility and prevent injury.
- Ballistic stretching, suitable for advanced athletes like gymnasts, increases muscle responsiveness.
- PNF combines stretching with isometric contractions for rehabilitation and flexibility improvement.
- Dynamic stretching, seen in football, prepares muscles for activity through controlled, sport-specific movements.
- Strength training builds muscle strength through resistance using methods like free weights, machines, elastic forces or body weight, and serves purposes such as improving power, endurance and injury recovery.
- Skill and tactical development enhances athletes' technique and strategy through effective coaching, drills and modified games. In basketball, drills focus on isolated skills like ball handling, while small-sided games simulate real game conditions to develop decision-making and tactical awareness and to prepare players for competitive scenarios.

7.3 Principles of training

- The principles of training include progressive overload, training thresholds, reversibility, specificity, variety, and warm up and cool down. They are essential for continuous improvement in aerobic and strength training, ensuring the body adapts and progresses.
- Progressive overload systematically increases training demands, promoting continuous adaptation. By gradually enhancing duration, intensity, resistance or repetitions, athletes prevent plateaus and foster endurance and strength gains while avoiding overtraining or injury.
- Training thresholds are intensity levels that drive significant adaptations. In aerobic and strength training, working near these thresholds, such as through steady-state exercise or increasing resistance, improves cardiovascular efficiency, endurance and muscle strength.
- Reversibility highlights the loss of fitness gains without regular training. Maintaining baseline activity, like moderate cardio or light resistance exercises, helps mitigate declines in cardiovascular efficiency and muscle strength.
- Specificity ensures training closely mirrors sport-specific demands. Tailoring exercises to match the movements and energy systems of a particular sport optimises performance by promoting relevant adaptations.

- Variety prevents monotony and enhances training effectiveness. Alternating aerobic activities or varying strength equipment and session types keeps workouts stimulating, reduces burnout and encourages comprehensive fitness development.
- A proper warm-up, involving light cardio and dynamic stretches, prepares the body for exercise, while a cool-down with low-intensity exercises and static stretching aids in recovery and reduces injury risk.

7.4 Training principles, physiological adaptations and improved performance

- Regular training that follows the principles of training causes physiological adaptations and improved performance across various systems. These adaptations allow the body to handle greater stress and perform at higher intensities over time.
- Heart rate: A trained athlete experiences a lower resting heart rate due to improved cardiovascular efficiency, which results from progressive overload and training at specific intensity thresholds. This allows for quicker recovery and better performance during exercise.
- Stroke volume and cardiac output: Regular endurance training increases stroke volume by enhancing the heart's ability to fill and pump more blood with each beat. This leads to improved cardiac output, allowing athletes to deliver more oxygenated blood to muscles, which is essential for endurance performance.
- Oxygen uptake and lung capacity: Training improves oxygen uptake (VO_2 max) by enhancing the cardiovascular and respiratory systems. Regular endurance training increases mitochondrial function and oxygen transport, which improves endurance. Lung capacity may also improve, allowing for better oxygen intake during exercise.
- Haemoglobin: Endurance training raises haemoglobin levels which improves oxygen transport throughout the body. High-altitude training further stimulates haemoglobin production, which boosts oxygen delivery to muscles during prolonged efforts.
- Muscle hypertrophy: Strength training leads to muscle hypertrophy, or increased muscle size, through progressive overload. The challenge of lifting heavier weights or performing more reps leads to muscle fibre growth, and enhanced strength and power for specific sports.
- Fast/slow twitch muscle fibres: Endurance training enhances slow twitch muscle fibres, and improves aerobic capacity and endurance. Anaerobic training, on the other hand, improves fast twitch muscle fibres and increases power and strength for short, high-intensity activities.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Title: The principles of training in action for different athletes, same team

Time: 10 hours

Task description: Comparative investigation and analysis of two players in distinct positions and their training programs. Present as an infographic with a written or verbal evaluation.

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents Topic 7 summary (doc-43062)
Key terms glossary (doc-43063)
Revision quiz (doc-43064)

Interactivity Missing word interactive quiz (int-9364)

7.6 Exercises

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7.6 Revision quiz on | 7.6 Exam questions

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7.6 Exam questions

Section I

Question 1 (1 mark)

What is a key characteristic of Sprint Interval Training (SIT)?

A. Long, moderate-intensity exercise
B. Work periods performed at 80%–95% of MHR
C. Maximum effort with extended recovery
D. Alternating speed and terrain changes

Question 2 (1 mark)

Which of the following is an example of a small-sided game used in skill development?

A. Full-court basketball
B. Double tennis
C. Marathon running
D. Five-a-side hockey

Question 3 (1 mark)

What is the aerobic threshold range typically expressed as?

A. 60% to 75% of MHR
B. 70% to 85% of MHR
C. 50% to 65% of MHR
D. 80% to 95% of MHR

Question 4 (1 mark)

What is the primary purpose of progressive overload in strength training?

A. To increase resistance, repetitions or sets
B. To allow more rest between sets
C. To maintain the same weight and repetitions
D. To reduce training intensity over time

Question 5 (1 mark)

What does VO_2 max measure?

A. The maximum power output during exercise
B. The maximum oxygen uptake during exercise
C. The maximum heart rate during exercise
D. The efficiency of muscle contractions

Section II

Question 6 (3 marks)

Outline the purpose of plyometric training.

Question 7 (3 marks)

Describe what happens when training ceases according to the principle of reversibility.

Question 8 (4 marks)

What is the significance of training thresholds in aerobic fitness and how are they calculated?

Question 9 (5 marks)

Source: *HSC 2021, PDHPE Exam, Section I, Part B, Q.24*

Describe how specificity and progressive overload can be applied to a strength training program in order to improve an athlete's performance. Provide examples to support your answer.

Question 10 (5 marks)

Source: *HSC 2020, PDHPE Exam, Section I, Part B, Q.24*

Explain how TWO flexibility training methods can improve the performance of an athlete in ONE sport. Provide examples to support your answer.

Question 11 (6 marks)

Evaluate the impact of high-altitude training on haemoglobin levels and performance.

Question 12 (7 marks)

Source: *HSC 2022, PDHPE Exam, Section I, Part B, Q.21*

a. Outline ONE anaerobic training method that is appropriate for an athlete who is competing in a high intensity, short duration event. Provide an example to support your answer. **(3 marks)**

b. Describe the effects of regular anaerobic training on an athlete's performance. Provide an example to support your answer. **(4 marks)**

Question 13 (7 marks)

Examine how modified games can help athletes improve their tactical understanding of the sport.

Question 14 (8 marks)

Source: *HSC 2023, PDHPE Exam, Section I, Part B, Q.27*

Analyse the relationship between ONE physiological adaptation and improved performance. Provide examples to support your answer.

Section III

Question 15 (12 marks)

Analyse how the principles of warm-up and cool-down, training thresholds, progressive overload and specificity in the provided six-week training program can prepare an individual for an 6 km fun run.

Week	Warm-up	Aerobic session	Target heart rate	Cool-down	Frequency
1	5–10 mins light jogging, dynamic stretches	20-minute steady-state run at 70% MHR	70% of MHR	5–10 mins slow jogging, static stretches	3 times a week
2	5–10 mins light jogging, dynamic stretches	25-minute steady-state run at 70–75% MHR	70–75% of MHR	5-10 mins slow jogging, static stretches	3 times a week
3	5–10 mins light jogging, dynamic stretches	30-minute steady-state run at 75% MHR	75% of MHR	5–10 mins slow jogging, static stretches	3 times a week
4	5–10 mins light jogging, dynamic stretches	30-minute run with 2 minutes at 80% MHR intervals every 10 minutes	75–80% of MHR	5–10 mins slow jogging, static stretches	3 times a week
5	5–10 mins light jogging, dynamic stretches	35-minute steady-state run at 75–80% MHR	75–80% of MHR	5–10 mins slow jogging, static stretches	4 times a week
6	5–10 mins light jogging, dynamic stretches	40-minute steady-state run at 80–85% MHR with 2-minute intervals at 85% MHR every 10 minutes	80–85% of MHR	5–10 mins slow jogging, static stretches	4 times a week

8 Training for individual and group sports

LEARNING SEQUENCE

8.1 Overview 327
8.2 Designing a training session 328
8.3 Yearly training programs 334
8.4 Psychological strategies 344
8.5 How strategies and tactics are applied 353
8.6 Sample exam question response 358
8.7 Review 360

8.1 Overview

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Key inquiry question

How does training differ for individual and group sports?

Syllabus

	Syllabus content	Subtopic
○	■ Compare aspects that need to be considered when designing a training session for individual and group sports **Including:** • health and safety considerations • overview/aim of the session (goal specific) • warm-up and cool-down • skill instruction and practice • conditioning • strategies and tactics • athlete reflection and/or coach evaluation	**8.2**
○	■ Compare a yearly training program for an individual and a group sport **Including:** • phases of competition: pre-season, in-season and off-season • sub-phases • peaking and tapering • sport-specific attributes: fitness components, skill requirements	**8.3**
○	■ Investigate how individual and group sports apply psychological strategies, optimising arousal and management of stress and anxiety, to improve participation and performance	**8.4**
○	■ Discuss the factors that influence how strategies and tactics are applied to individual and group sports **Example(s):** Environmental conditions. Group strengths and weaknesses.	**8.5**

Outcomes

- investigates factors that impact movement and performance HM-12-04
- analyses individual and group training programs to improve performance HM-12-05
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

8.2 Designing a training session

Syllabus: Compare aspects that need to be considered when designing a training session for individual and group sports

Including:
- health and safety considerations
- overview/aim of the session (goal specific)
- warm-up and cool-down
- skill instruction and practice
- conditioning
- strategies and tactics
- athlete reflection and/or coach evaluation

When designing a training session there are factors to consider to make sure the session is effective. While many principles will be the same, there are some differences between approaches for individual and group sports.

8.2.1 Health and safety considerations

Health and safety considerations are important to include when designing a training session for individual and group sports. Some key considerations include:

- *injury prevention*. Both individual and group sports players need to prevent injury through an adequate warm-up/cool-down. Individual and group sporting athletes need to ensure they warm up appropriately; for example, a 5–10-minute jog, dynamic stretching and calisthenics. Athletes must also have correct technique while training; for example, good form while strength training.
- *protective equipment*. Essential protective equipment, such as mouthguards, helmets, face guards, padding, wetsuits and gloves, need to be worn during both training and games.
- *general equipment*. Bats, clubs, javelins, poles for pole vault, padding on goal posts and all general equipment must be checked regularly to ensure the safety of both individual and group athletes. Cracked, worn or suspect equipment needs to be repaired or discarded.
- *rules for safety*. Appropriate supervision and rules must be in place during training. For example, ensuring opposed training games in a sport like rugby league are refereed appropriately to promote the safety of athletes, including stopping play if there is high contact in a tackle.
- *apparel*. Clothing such as shorts, tops, jumpers and ski suits needs to be comfortable while providing protection and allowing freedom of movement and airflow. Footwear must be supportive and protective. Poor footwear contributes to blisters, calluses and even structural deformities.
- *environmental hazards*. Depending on the sport, sunglasses, sunscreens, protective suits, hats and caps may be needed to protect the body from potentially damaging ultraviolet rays.
- *illnesses*. The risk of illnesses such as colds and influenza can be minimised through use of safe health practices and awareness of modes of viral transfer.

8.2.2 Overview/aim of the session (goal specific)

At the beginning of a training session and particularly where teams are involved, it is common for coaches to provide a brief overview of what will be expected during the session. This ensures that the intentions of the coach and expectations of players, whether an individual athlete or a group sporting situation, are focused in the right direction. It also has the advantage of making sure specific issues can be addressed. Some of these may include:

- recording attendance
- assessment of injuries
- discussion of previous performance
- an outline of specific goals.

FIGURE 8.1 A session overview provides an opportunity to outline goals and make clear the immediate performance objectives.

8.2.3 Warm-up and cool-down

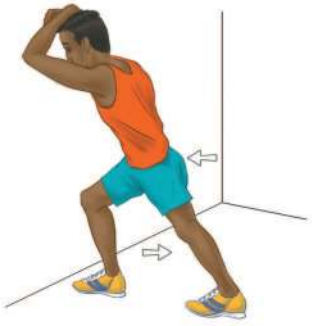
For both individual and group sports, an effective warm-up consists of the following phases.

- *Phase 1: general body warm-up until the body begins to sweat*. Some suggested activities are jogging, cycling or skipping for 5–10 minutes to elevate heart rate and help prepare athletes for the training session ahead.
- *Phase 2: stretching*. This is important in making sure the required muscle groups are effectively warmed up to prevent injury. In addition, stretching promotes blood circulation, increases muscle relaxation and improves performance. Stretching exercises need to be safe and should include dynamic stretching as a part of a warm-up; for example, leg swings gradually increasing range of motion, walking lunges or shoulder circumduction.
- *Phase 3: callisthenics*. These are general body exercises, such as push-ups, sit ups and abdominal crunches, that involve large muscle groups (see figure 8.3). These exercises should be specific to the game or activity; that is, they should work the muscle groups used in the game or activity. For this reason, the exercises should not be exhausting.

FIGURE 8.2 Some general stretching exercises appropriate for warm-ups

Lateral flexion stretch — one side then the other; push pelvis across as you bend.

Hip flexor stretch — keep back straight, tuck bottom under, lunge forward on front leg.



Gastrocnemius stretch — keep your knee straight and heel on ground, and face feet forward.

Shoulder rotator stretch — use towel, pull it up with upper arm and then down with lower one.

Source: Adapted from Sports Medicine Australia.

FIGURE 8.3 Callisthenics such as (a) abdominal crunches and (b) push-ups help strengthen muscle and prepare it for use.

(a)

Sit-up

(b)

Push-up

FIGURE 8.4 During skill rehearsal, players practise many of the moves required in the game.

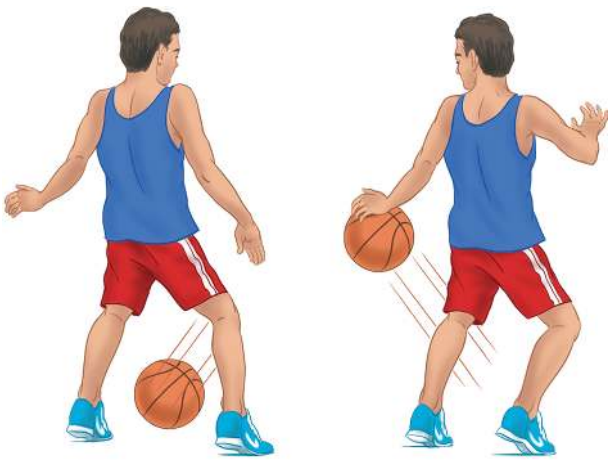


FIGURE 8.5 Effective instruction requires prior knowledge and good communication skills.

- *Phase 4: Skill rehearsal*. In this phase, the athlete performs some routines required later in the game or sport. Players in team games (group sports) such as soccer and basketball participate in patterns (e.g. dribbling in basketball) that increase agility and replicate movements required in the game. There is an emphasis on maintaining the body temperature established through previous physical work.

Cool-down should focus on helping return the body to its pre-exercise state. For example a 5–10-minute jog, followed by static stretching; for example, seated hamstring stretch held for 15–30 seconds to help rid the body of lactic acid. In team sports a cool-down can also provide a good social opportunity for teammates to bond.

8.2.4 Skill instruction and practice

Instruction at a training session refers to delivery of a body of knowledge by a coach (or coaches and trainers) to the players. Good instruction requires prior organisation and effective communication skills. All coaching sessions need to be well planned, provide guidance on how to perform the fundamental skills, and should allow these to be practised in related drills and movements. Skill instruction and practice should be:

- *brief* — it is important that instruction is concise and factual to allow maximal practice time
- *well timed* — use words when their impact will be greatest
- *specific* — instruction needs to be specific to the skill, game and situation; it should not be general
- *constructive* — focus on the positive points for improvement, not on how poorly the skill is being performed

- *clear* — there should be no misunderstanding about the information communicated by the coach. Questions should be encouraged if the message is not understood
- *informative* — all instruction should relate specifically to information that the players need to know
- *demonstrable* — effective instruction is supported by visual aids such as demonstrations to provide clear pictures of skills and techniques.

This part of a training session should take up the majority of the session. For example, in a one-hour training session this component could make up 40 minutes of the session. It is important to note that what takes place will differ for individual and group sports. This is outlined in table 8.1

TABLE 8.1 Example of skill instruction and practice: individual and group sport

Individual sport — 3000 m runner	Group sport — basketball team
Aerobic interval training working on: • pacing • relaxing shoulders • holding form while controlling breathing.	A wide range of drills; e.g.: • lay-ups • three-man weaves • three-on-three small-sided games • defensive shell drill • shooting drills.

8.2.5 Conditioning

Conditioning, also known as fitness training, is an integral part of every training session. Most sports have a short fitness session immediately following the warm-up. Supplementary fitness in the form of circuits, interval training, continuous training and callisthenics may also take place after skill instruction and practice. Conditioning may differ in individual and group or team sports but it is worth noting that many effective drills within the main component of the training session's 'skill instruction and practice' will incorporate conditioning so this may not be required in every session. It could be particularly useful for training sessions taking place during pre-season or early on in a season to assist game or competition readiness.

FIGURE 8.6 Conditioning is an integral part of every training session.

Coaches need to be aware of the element of fatigue in skill learning. While fitness can be addressed in some skill-learning situations, it is important not to fatigue players unduly, as concentration and interest will suffer. It is particularly important to make regular fitness testing part of the fitness program in order to provide feedback and to be a source of motivation.

8.2.6 Strategies and tactics

Strategies and tactics are also important in designing a training session. A strategy is the overall method used to achieve a goal and tactics are about how you implement the strategy and gain an advantage over the opposition. Effective strategic and tactical development requires each individual to know their role within the strategy.

This takes practice and experience and coaches play a key role in implementing strategy and tactics. When designing a training session the amount of time spent on strategies and tactics will depend on:

- how effective athletes have been in prior performance
- the age and/or skill level of the individual/team
- potential weaknesses or areas to exploit in an opposing team or individual
- a coach's ability to be versatile.

Strategy and tactics will differ for individual athletes compared to those in group or team sports. For example, an individual 800 m runner may have a race tactic to sit and kick at the end of the race, avoid running wide around bends and trying to overtake on the straights. This will be quite different to a basketball team who may choose to double team (when two players guard one player) a strong player from the opposing team as soon as they take their first dribble.

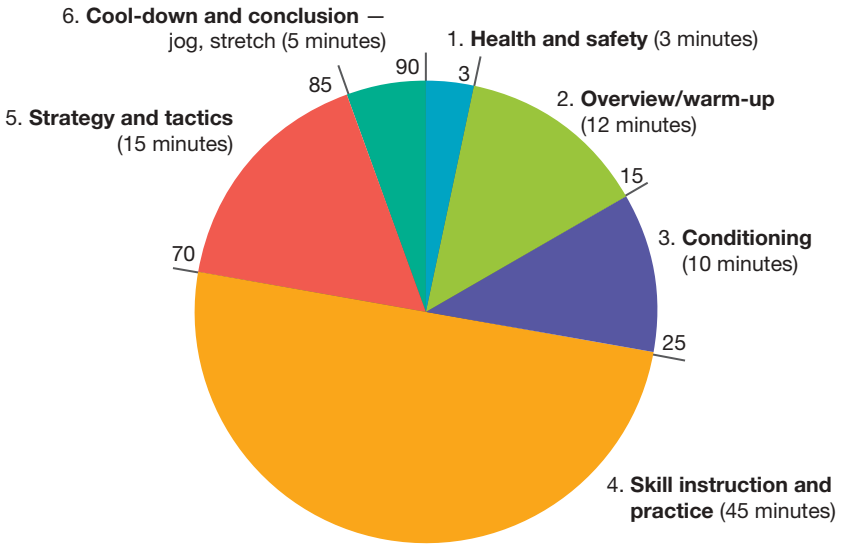
8.2.7 Athlete reflection and/or coach evaluation

Athlete reflection and/or coach evaluation is an important and professional way to end a training session. An evaluation is an appraisal of performance after the training session. It is normally carried out during and after the cool-down and involves coaches and players reporting on the value of the session. An evaluation should address performance outcomes; that is, it should address the performance goals for the session (e.g. learning the serve in tennis) and how well the goals were achieved. Evaluation also needs to address behavioural outcomes such as punctuality. Athletes should be encouraged to share reflections and express opinions on issues that may have come up from the training session. For example, players may suggest a drill was complex and needs to be broken down into elements or perhaps spending more time on defensive drills due to a high number of goals being scored during a training game.

Evaluation of the coaching session is followed by a brief reminder of the date, time and venue of the next fixture and training session and a recheck of player availability. Individuals with specific problems, such as taping requirements, should see the coach and make special arrangements. It is important that training sessions finish at the arranged time.

The final step following the session is an evaluation by the coach as a preparation for future sessions. This could include an analysis of the fitness testing and skills testing results and a review of the game performance. The time allocation to the various elements of a training session is illustrated in figure 8.7.

FIGURE 8.7 Time allocation in a 90-minute training session



Source: © Australian Sports Commission, from FS Pyke, *Better Coaching: Advanced Coaches Manual* Australian Sports Commission, 1991 p. 249.

DEPTH STUDY IDEA

Practical comparison of strategies and tactics

1. Design and conduct a training session for both an individual and a group sport. Compare:
   - How health and safety considerations differ (e.g. equipment, space, injury risks).
   - Adjustments in strategies and tactics for individual focus versus group dynamics.
   - Athlete reflections and coach evaluations post-session.
2. Use participant surveys or performance measures to evaluate the effectiveness of each training session.
3. Use video recording or observation checklists to capture how well participants understand and apply strategies and tactics.
4. Collect feedback from participants about the clarity, relevance and impact of the strategic focus.
5. Compare the challenges and benefits of incorporating strategies and tactics into training sessions for individual and group sports.
6. Create a written report or multimodal presentation summarising how strategies and tactics influence the training process and outcomes in individual versus group sports.

8.2 ACTIVITIES

Designing a training session

In pairs, design a training session for a sport of your choice. One person in the pair should develop a training session for an individual sport and the other should choose a group sport. Include time allocation for the different elements plus warm-up and cool-down activities, skills practice, strategies and information relating to other training session elements. Compare your session with your partner and consider the differences in designing a training session for an individual and a group sport. As a class, choose one of the training session plans and conduct it with the class. Evaluate the session by considering the following questions.

1. Did the activities match the abilities of the group?
2. What was the reaction of the group?
3. How could the session be modified or improved?
4. Was the time allocated to each element of the training session realistic/effective?

Structuring training sessions

Briefly examine different methods of structuring training sessions. You may wish to use the **Training sessions** weblink in the Resources panel or research others. Write a brief report on your findings.

on Resources

Weblink Training sessions

8.2 Exercises

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8.2 Quick quiz on | **8.2 Exercise**

Learning pathways

LEVEL 1	LEVEL 2	LEVEL 3
1, 3, 4, 10	2, 5, 6, 8	7, 9, 11

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Revise your knowledge

1. Identify three health and safety considerations when designing a training session for a netball team.
2. Outline how strategies and tactics can be used in a training session for a basketball coach.

3. Why might it be important to include an athlete reflection at the end of a training session?
4. How long should skill instruction and practice go for in a training session?
5. What is similar about an individual athlete and a group sport athlete when it comes to providing an overview/aim of session?

Apply your knowledge

6. When planning a training session for a group sport, what health and safety measures would you implement to prevent injuries? Provide examples of specific precautions and outline their importance.
7. You are designing a training session with the goal of improving a soccer team's attacking skills. What objectives could you introduce to a training session and how could these be communicated?
8. Describe a warm-up routine suitable for a basketball team before a high-intensity practice.
9. For an individual athlete in tennis, how would you structure the skill instruction and practice element of a training session to focus on improving their serving technique?
10. Why is conditioning important for an AFL player?
11. After a training session, explain the benefit of a netball team reflecting on their performance.

8.2 Exam questions

Question 1 (3 marks)
Outline the relevance of conditioning when designing a training session.

Question 2 (4 marks)
Describe the importance of warm-up and cool-down for athletes training for both individual and group sports.

Question 3 (4 marks)
Explain how warm-up and cool-down can help prevent injury.

Question 4 (5 marks)
Discuss how training differs for individual and group sports in relation to strategies and tactics.

Question 5 (8 marks)
Compare aspects that need to be considered when designing a training session for individual and group sports.

8.3 Yearly training programs

Syllabus: Compare a yearly training program for an individual and a group sport

Including:
- phases of competition: pre-season, in-season and off-season
- sub-phases
- peaking and tapering
- sport-specific attributes: fitness components, skill requirements

A yearly training program is often referred to as a periodisation chart or yearly plan. A yearly training program will differ in some ways for an individual and a group sport (see figure 8.8).

Effective planning requires the training year be divided into manageable sections. The training year needs to be thoughtfully constructed and well formulated if it is to be of benefit. If programs are not fully planned and monitored, progress is difficult to measure. If planning does not include adequate rest, athletes are at risk of injury and overtraining.

The nature of a yearly training program will vary according to the sport, activity, number and frequency of games/competitions, age, experience and the characteristics of the particular sport. For example, a yearly training program for team sports such as basketball and football (soccer) will be different to planning for individual sports such as athletics or swimming because the team sports may have weekly games whereas the individual athlete or swimmer will likely have less frequent competitions each year.

Often governing sporting bodies dictate competition dates and so a coach's yearly training program needs to be planned around these dates, ensuring athletes can peak (perform their best) at the right time.

FIGURE 8.8 Sample yearly training programs for individual and group sports

Yearly training program sample individual – marathon runner											
Pre-season				In-season						Off-season	
General prep		Specific prep		Competition						Transition	
Dec	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov
					Sydney half mara				Sydney mara		
4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	1 × week complete rest	Start base work Variety + rehab + target improvement

Yearly training program sample team – NRL											
Pre-season				In-season						Off-season	
General prep		Specific prep		Competition						Transition	
December–January		February		March–September						October–November	
4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	4 × micro cycles	1 × week complete rest	Variety + rehab + target improvement

*Note: Microcycle = weekly plan, see section 8.3.2

8.3.1 Phases of competition

There are three distinct phases of competition: pre-season, in-season and off-season. Each of these phases has specific demands in terms of goals, needs, and training and performance requirements.

Pre-season (preparation phase)

This phase might last from six to 12 weeks or longer, depending on the type of competition. It requires a high volume of training at moderate levels of intensity. The training needs to target the appropriate energy system/s. Often, training sessions are longer in an effort to increase stamina together with mental aspects, such as increasing drive and commitment. The basic aims of the pre-season phase are to:

- develop fitness components required for the season ahead; for example, aerobic, strength and flexibility
- develop technique
- improve performance biomechanics
- introduce strategies and familiarise players with them particularly towards the end of the pre-season
- teach appropriate mental skills.

These aims are best achieved through programs that focus on endurance, strength and skill in a variety of environments. Examples of commonly used methods include:

- continuous training
- fartlek training
- interval training
- circuits
- resistance work
- speed development.

FIGURE 8.9 Developing fitness is a major aim of pre-season training.

Important fitness components such as speed, strength and flexibility need to receive specific attention. Towards the end of the pre-season phase, physical condition and quality of skill performance (e.g. technique, biomechanics and strategies) should have reached the targeted level.

In-season (competition phase)

The competition phase varies in duration, depending on the sport. During this phase, maintaining fitness developed in the pre-season phase is continued. However, a general increase in intensity is matched by a corresponding decrease in volume. In other words, less time is spent on continuous repetitive work, but the effort put into training escalates. The aim during this period is to:

- maintain stamina
- practise and improve tactics and strategies
- perfect skill execution
- gain competitive experience
- continue work on developing appropriate mental skills.

FIGURE 8.10 The in-season phase is characterised by an increase in intensity together with emphasis on technique, strategies and tactics.

This is best achieved through:

- supplementary work on required fitness components, including strength, power, agility, flexibility and speed
- use of highly specific skills practices (drills)
- continuation of conditioning training
- use of small games, grids and resistance work to increase intensity and provide relief (variety).

The principle of specificity needs to be applied more rigidly during the competition phase. The gradual increase in intensity should be matched by focus on activities that relate directly to competition requirements. Specificity needs also to be applied to the mix of volume and intensity. For instance, in power sports requiring explosive actions such as sprinting and high jump, some volume is sacrificed at the expense of increased intensity. However, in endurance activities such as cross-country running and triathlons, the volume remains steady.

The number of training sessions required varies in accordance with the type of activity. This relates to the athlete's ability to *load* (train) and *unload* (regenerate). Excessive emphasis on work without ample time for

restoration leads to development of a state known as *overtraining*. The competitive phase has many periods in which volume and intensity are manipulated to provide the greatest gain. However, it is important that the athlete peaks for each competition and particularly for major events within the season.

Off-season (transition phase)

This phase is one of physical and mental recovery from training and competition. It provides time for general refreshment, allowing both mental and physical abilities to recuperate. It is sometimes thought that off-season training means absence of all activity. This is incorrect, as a complete lay-off leads to a loss of the immense gains made during training and makes the pre-season preparation more difficult and protracted.

The off-season phase is characterised by:

- one week of total rest
- remaining weeks consisting of active rest, with training sessions being reduced to a couple of times per week and a corresponding reduction in both volume and intensity
- a change in environment, such as outdoors to indoors or use of swimming for runners and cyclists
- diet modification to reflect the decreased workload
- maintenance of strength and flexibility
- work on weaknesses, such as injuries, or perhaps on specific technical skills.

The off-season phase is important for refreshing the athlete. Although it is generally a short period lasting a month or so, it provides the opportunity to restore mental and physical energy and prevent the onset of staleness in the coming competitive season. A plan for development and maintenance of strength, endurance and speed is illustrated in figure 8.11.

FIGURE 8.11 The development of specific attributes during the phases of competition

	PRE-SEASON		IN-SEASON		OFF-SEASON
	General preparatory	Specific preparatory	Pre-competitive	Main competitions	Transition
Strength	Anatomical adaptation	Maximum strength	Conversion: • power • muscular endurance • or both	Maintenance	Regeneration
Endurance	Aerobic endurance	Develop the foundation of specific endurance	Specific endurance		Aerobic endurance
Speed	Aerobic and anaerobic endurance	Develop the foundation of speed	Specific speed, agility and reaction time		

Source: TO Bompa, *Theory and Methodology of Training*, 3rd edn, Kendall Hunt, 1994, Dubuque, Iowa, p. 251.

8.3.2 Subphases

Preparation for competition can be divided into manageable blocks called **macrocycles** and **microcycles**. Macrocycles are long-term planning frameworks and may represent an entire planning program, sometimes called an annual plan. The macrocycle includes the available preparation time before a major competition and identifies all lead up competitions and major events along the way. The macrocycle plan provides an overview of what is to happen in terms of long-term training and preparation. While noting competition dates, it also references training specifics such as volume and intensity over a period of time and maintenance or increase of fitness components such as strength and endurance. An example of a macrocycle is shown in table 8.2.

macrocycles are long-term planning periods or overviews

microcycles are short training cycles containing specific details and usually cover a period of about 7–10 days

TABLE 8.2 Example of a macrocycle

	January	February	March	April	May	June	July	August	September	October	Nov–Dec
Cycle	Pre-season	General	Specific		Competition						Transition
Competition			6 1	2	6 6	3 6	6	4	6 6	5	
Strength	Introduce	Volume		Intensity	Maintain						
Speed	None	Introduce		Volume	Intensity			Maintain			
Flexibility	Introduce	Develop		Maintain							
Endurance	Introduce	Volume		Intensity	Maintain						
Technique	Introduce	Develop		Maintain							
Plyometrics	None	Introduce	Develop	Maintain	None			Maintain			
Psychology	Introduce	Develop	Monitor								
Evaluation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Key	1	2	3	4	5	6
	School	Zone	Regional	State	National	Other

While macrocycles represent an overview, more specific detail is contained in mesocycles and microcycles. Mesocycles are periods of 4–8 weeks, while microcycles are much shorter, usually 7–10 days. This allows for detailed planning and specific objectives to be achieved. The microcycle includes detailed information about frequency of training, intensity, duration and volume together with skills, activities, resistance training, plyometrics and specific session organisation. Table 8.3 is an example of a microcycle.

TABLE 8.3 An example of a microcycle

Day	Date	AM Session	PM Session
Monday	9/3	Strength training	Warm-up, Circuit, Skill development, Technique, Cool-down
Tuesday	10/3	Plyometrics	Warm-up, Long interval, Technique, Cool-down
Wednesday	11/3	Strength training	Warm-up, Speed/short interval, Skill development, Cool-down
Thursday	12/3	Pilates	Warm-up, Circuit, Technique, Cool-down
Friday	13/3	Strength training	Warm-up, Skill development, Speed drills, Cool-down
Saturday	14/3	Competition	
Sunday	15/3	Rest	Rest

Objectives	To maintain strength, speed and power. Continue to develop technique through specific exercises. Maintain and develop core strength, flexibility and cardiorespiratory fitness.
Warm-up	Detail exercises for duration, repetitions and recovery. Example: legs, shoulders, abdominals, 10 minutes, 10–15 repetitions, 1 minute recovery.
Cool-down	Detail exercises and duration. Example: light jog (5 minutes), stretching (10 minutes).
Strength	Detail each session for sets, repetitions, resistance, speed, rest between sets and recovery. Example: biceps curl, 60% of 1 RM, 2 sets × 15 reps, moderate speed, 3-minute rests between sets.
Endurance	Detail activities to maintain cardiorespiratory endurance. Example: circuit training × 2, long interval training × 2.
Speed and agility	Detail activities to maintain speed. Example: short interval × 2, agility sprints, grid work.

(continued)

(continued)

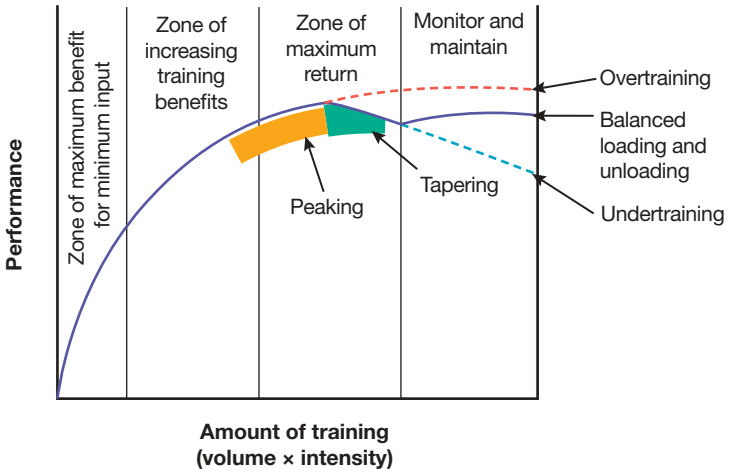
Flexibility	Detail exercises to maintain flexibility and improve core stability. Example: core session at fitness centre, general stretching program, Pilates.
Technique	Detail how to continue development on technique improvement. Example: focus on biomechanics and good form, organise session with guest coach to examine technique, video aspects of technique.
Plyometrics	Detail each session for sets, repetitions, recovery. Example: jumps, reactive drop jumps, speed hops, alternate leg bounding — 2 sets × 10 reps with 3-minute rest.
Psychology	Detail and be alert for signs of overtraining. Example: lack of motivation, tiredness. Discuss motivation strategies with athletes.

8.3.3 Peaking and tapering

Peaking

Peaking is the phase of training in which performance is optimised to meet the demands of a race, competition or series. To arrive at a point at which an athlete peaks usually involves months of preparation, gradual increases in volume and intensity of training and a short **tapering** period just prior to performance (see figure 8.12). Tapering is the period immediately before competition when the volume and intensity of training is reduced. For example, a marathon runner trains for six to 12 months, and this involves periods of base building (no speed work), sharpening (which requires specific endurance), speed work and finally a tapering phase approaching the peak. Another example is a Super Netball team who would benefit from achieving multiple peaks during the season to qualify for finals. A smaller taper; for example, a one day rest before a game, may help athletes freshen up and achieve optimal performance each week. The training program needs to be organised so that physical and mental functioning is optimised at the right time. The peaking period is actually a temporary state ideally timed with performance or race day. When this occurs, a number of physiological indicators are apparent, including:

FIGURE 8.12 Peaking happens when you see the benefits of using the right volume and intensity of training.



- a state of excellent health
- heightened rate of recovery from training
- body systems, particularly the circulatory, respiratory, muscular and energy systems, tuned for optimal functioning
- adjustments to technical and tactical preparation completed
- superior neuromuscular coordination.

During the peaking phase the athlete experiences a number of social and psychological indicators including:

- heightened self-confidence and motivation
- a state of mental alertness and readiness for action.

Tapering

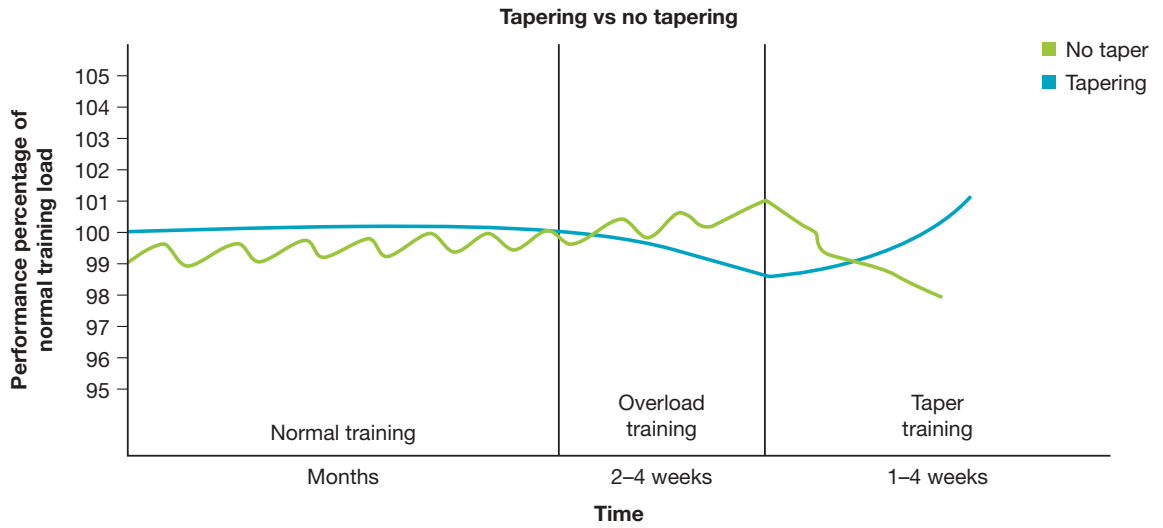
Concentrated training with increasing volume and intensity reduces strength and subsequently impacts on performance. A tapering period is fundamental for allowing tissue to rebuild and for the full replacement of energy stores.

peaking the phase of training in which performance is optimised to meet the demands of a race, competition or series

tapering a period immediately before competition when the volume and intensity of training is reduced

The aim of tapering is to remove built-up fatigue which has developed over a long period of training, to refresh the athlete and ultimately to boost performance. Probably the most difficult psychological barrier faced in a taper is convincing athletes and coaches to do less training and trust that it will help.

FIGURE 8.13 The benefits of tapering for elite athletes far outweigh the consequences of not tapering at all.



Source: Tri-Hard Endurance Sports Coaching.

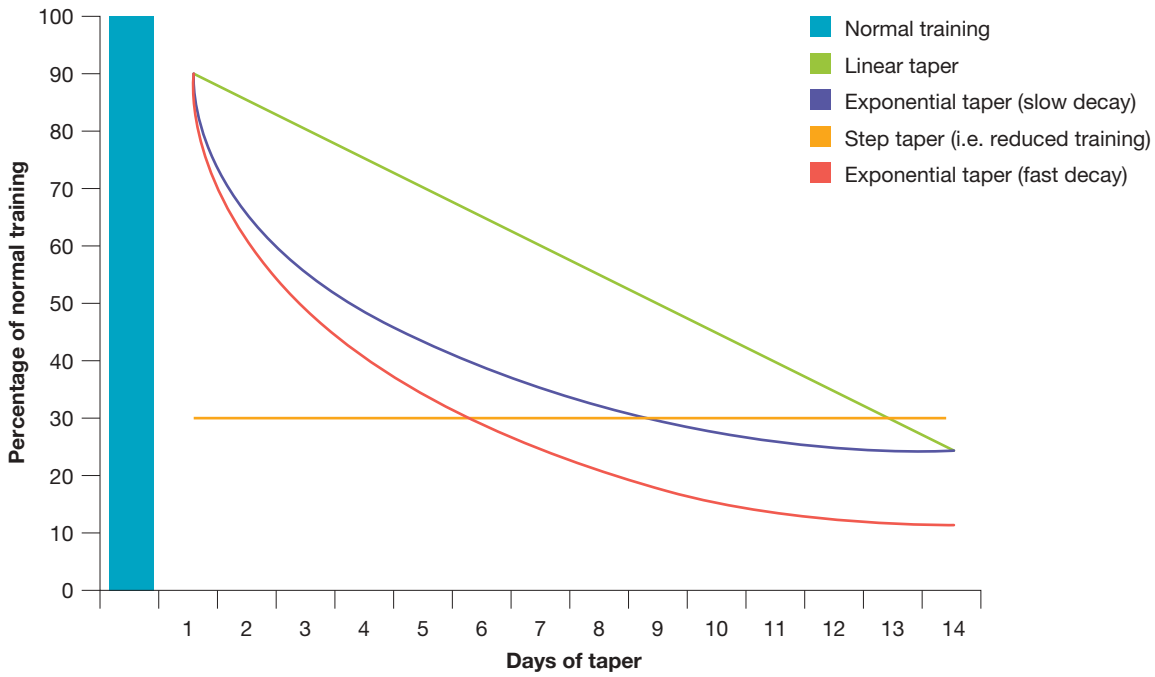
In a taper, the amount of training is reduced, but the intensity stays the same or even increases. Endurance athletes might taper for weeks, while those in strength or speed sports might only need 3–5 days, depending on the event. This is because aerobic training causes different physiological and metabolic adaptations to those enhanced by anaerobic training. Capillary and mitochondrial density, red blood cell volume, haemoglobin capacity, hormone production and ability to use fat as fuel are all progressively established benefits of endurance work and, in accordance with the reversibility principle, will decline only slowly. In contrast, anaerobic adaptations have more to do with enzyme production, lactate tolerance and motor control, the reversal of which will be more rapid. Regardless of how it is achieved, the goals of tapering are the same — loss of fatigue without the negative effects of detraining.

There are four different ways athletes taper, all of which reduce volume dramatically.

- The *step taper* involves a 33 per cent reduction in training volume in the first week followed by a further 33 per cent reduction in the second week.
- The *linear taper* reduces volume and intensity gradually over the designated time period.
- The *exponential, slow decay taper* has a greater reduction in training load at the beginning of the taper, gradually levelling off at 40–50 per cent.
- The *exponential, fast decay taper* has a greater reduction in training at the beginning, with the training load reduced to 20–30 per cent.

The type of taper used generally depends on the training load. In the case of endurance events, long distances such as marathons require a two-week taper whereas shorter distances such as 5 km runs require only a one-week taper. The best results for athletes involved in resistance programs, such as weightlifting, are achieved using the step taper while exponential decay tapering seems to work best for endurance athletes. It is worth noting many team sports will simply use a rest day as a mini-taper prior to a game to ensure they are fresh for the game. Due to the regular/frequent nature of games, some of the above taper methods may not be practical due to a need for teams to perform at or near their peak each week for the entire season in order to make finals. This is a key point of difference between an individual athlete and a group sport athlete.

FIGURE 8.14 The four major types of taper



Tapering plans are different for each sport and athlete. To taper, athletes reduce frequency (about 20 per cent), distance, time per training session and the number of sessions per week. Intensity is maintained or even increased. Athletes might gain some weight during this time because their muscles will store more glycogen and water. The key is to trust the process and let the body recover from training fatigue.

8.3.4 Sport specific attributes (fitness components, skill requirements)

Subphases provide an opportunity to target specific areas that need further development. For example, one athlete in a group may need additional work on skill while another may benefit more from improved fitness. There are many areas that could be the subject of specific examination and additional work, including testing, monitoring, evaluation, specialisation, loading, unloading, volume, intensity or whatever is required depending on the individual's needs. Sport-specific attributes are integral to planning a yearly training program, to make sure athletes are improving in the right areas.

An attribute that is key to performance is fitness. Fitness components need to be considered closely throughout the yearly plan and are particularly relevant towards the end of the pre-season.

This is because once the general fitness of an athlete has improved, they can start to target more specific fitness elements required for their sports.

For example, a 400 m sprinter will likely do a high volume of running, strength work and flexibility training as part of their general preparation during the pre-season. However, these fitness components will not fully prepare the athlete for the demands of racing during the in-season.

Sport-specific attributes can be improved safely towards the end of the pre-season because a base level of fitness has been built. For example, strength training can be converted into power needed to explode out of the blocks. Aerobic base work can complement the lactic speed-work needed to improve performance.

In group sports, the specific attributes needed to improve can vary between athletes within a team. This is an important consideration when planning training for a year. For example, a football goalkeeper will have different demands to a centre midfielder and this differentiation can be reflected in their training plans. For example, the midfielder may be required to further build their aerobic fitness during the end of the pre-season while a goalkeeper may be required to focus on skill development.

EXAM TIP

The design of a training session

In an exam question addressing the design of a training session, you need to recognise the seven aspects from the syllabus (health and safety considerations, overview/aim of the session, warm-up and cool-down, skill instruction and practice, conditioning, strategies and tactics and athlete reflection and/or coach evaluation).

Depending on the mark value and the nature of the question, add depth and detail to a smaller selection of factors. This can be done by using an example of an individual sport such as tennis and comparing to a group activity such as soccer. Think about the similarities and differences of these training elements due to the unique nature of the activity. One key difference in the design between an individual and a team sport is the team-oriented focus in training and the integration of team work. For example, *Skill instruction combined with strategies and tactics would include working with the team and positional play. This is somewhat different to an individual sport where you are focusing on addressing personal weaknesses and capitalising on strengths.*

Include mention of the value of feedback and post-competition analysis (self/coach) to determine training focus moving forward. Comparison is key in these exam questions.

DEPTH STUDY IDEA

1. Interview coaches/trainers of both an individual and group sport about their approaches to pre-season, in-season and off-season training. Compare their methodologies. Present your findings as a multimodal presentation.
2. Simulation: Students act as 'coaches' to design a training program tailored to a specific athlete or team, considering factors like injury prevention, recovery and sport-specific goals.

8.3 ACTIVITIES

Understanding yearly training plans

Working in groups, discuss the following questions about figure 8.8 Sample yearly training programs for individual and group sports.

a. What is a key difference in relation to tapering for the marathon runner compared to the NRL player?
b. What is the difference between the general preparation phase of the pre-season and the specific preparation phase of the pre-season?
c. What are some key considerations for the in-season?

Develop a periodisation chart

Working in pairs, choose an individual or team sport. Design a periodisation chart suitable for your chosen sport. You can refer to figure 8.8 to assist you in your planning. Use the digital document **Example yearly training programs** as a template.

on Resources

Digital document Example yearly training programs (doc-43113)

8.3 Exercises

learnon

8.3 Quick quiz on | **8.3 Exercise**

Learning pathways

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

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Revise your knowledge

1. Identify three phases of competition.
2. Outline how tapering complements peaking.
3. Why might it be important to include sport-specific attributes towards the end of the pre-season?
4. What is the difference between a macrocycle and a microcycle?
5. What are two differences between yearly training programs for individual and group sport athletes and coaches?

Apply your knowledge

6. You are a coach designing a 12-week pre-season for a group sport. What would be some important considerations? Provide examples that relate to both general preparation and specific preparation.
7. You are designing an in-season microcycle for a 100 m sprinter that you are coaching with a focus on improving their start in races. What is an example of a 7-day microcycle for this athlete to assist their progress?
8. Imagine you are an athlete heading into the off-season. What are three things you might do to help yourself next season?
9. For an individual athlete in swimming, how would sport-specific attributes of fitness and skill help improve performance?
10. After two major international races, it becomes clear that a marathon runner's yearly training program was not very effective. Explain how this information could assist a coach in developing a future annual training plan.

8.3 Exam questions

Question 1 (3 marks)

Why might the pre-season requirements be different for individuals within a group sport?

Question 2 (4 marks)

Outline how subphases can help coaches prepare an individual athlete for performance.

Question 3 (4 marks)

Describe the process of tapering.

Question 4 (6 marks)

Compare sport-specific attributes for an athlete in an individual sport and a group sport.

Question 5 (12 marks)

Source: *HSC 2019, PDHPE Exam, Section II, Q.31b*

A periodisation chart is being developed for an athlete in a particular sport. **Analyse** why the athlete's fitness and skill-specific requirements change during each phase of competition.

8.4 Psychological strategies

Syllabus: Investigate how individual and group sports apply psychological strategies, optimising arousal and management of stress and anxiety, to improve participation and performance

Research suggests that there is great potential to improve performance through mental training and goal setting. Better understanding of specific psychological influences, particularly optimising arousal, managing stress and anxiety management is important and can help improve participation and performance.

FIGURE 8.15 Psychology has an impact on performance.

The way an athlete thinks prior to and during performance can significantly impact performance or even their willingness to participate. For example, consider the athletes in figure 8.15. If one athlete is telling themselves they can't win and is experiencing stress as a result of fatigue and pressure they have put on themselves, this will negatively impact performance. If the other athlete is able to remain focused and think positively about their efforts, visualising success instead of failure, this can have a positive impact on their focus and ultimately participation and performance.

First, we need to know what anxiety, stress and arousal are to know how psychological strategies can work to improve participation and performance.

8.4.1 Anxiety

Anxiety is predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening. It is a complex emotion identified by various levels of agitation. It is caused by reaction to a threat or perceived threat that generates a 'fight or flight' response.

Athletes may suffer from either 'trait' or 'state' anxiety.

Trait anxiety

Trait anxiety refers to a general level of stress that is characteristic of each individual. It is shown in how we respond to daily situations, especially new or worrying ones. For example, an individual who feels physically sick and vomits prior to every sports match would have a personality *trait* of being highly anxious and this could negatively affect their performance and enjoyment of the sport.

anxiety uneasy emotional state that may be brought on by an actual or perceived threat to the safety and wellbeing of the individual

State anxiety

State anxiety is more specific. This type of anxiety is characterised by a *state* of heightened emotions that develop in response to fear or danger. For example, if an individual feels physically sick and vomits prior to a grand final, it might be due to the extra stress of the important game, not their overall personality. In extreme cases, state anxiety can cause physical and mental paralysis, making it hard to perform tasks that are usually easy in practice. Examples include missing easy shots in basketball, failing goal attempts in soccer, or 'breaking' in important swimming and athletics races.

8.4.2 Stress

Stress is the non-specific response of the body to a demand placed on it. It is a normal part of everyday life. However, it is also very relevant to sport performance situations. It can be felt by participants in all sports, but particularly individual sports such as tennis and diving where there may be a feeling of isolation and exposure. Stress causes a unique body reaction with which we are all familiar, particularly in times of crisis. We feel stress building within us, produced by *adrenaline* (a stimulant hormone), which readies the body for action. It is characterised by:

- *increased blood supply* to skeletal muscles
- *more oxygen* to the lungs
- *increased glucose production* to provide extra fuel
- *increased sweat production* to cool the body
- *tightened muscles* to prepare the body for action.

Stress can also be experienced in group sport settings, as many athletes may place a higher level of stress on performing well, not wanting to let their teammates down. For example, a dancer performing as part of a group dance routine may experience a heightened level of stress prior to performance, if they feel as though they are not as good as the other dancers in the routine.

Factors that produce stress are called *stressors*.

In practice and competitive sporting environments, they can develop from:

- *personal pressure* — individual pressure felt by the desire to win, achieve or fulfil goals
- *competition pressure* — pressure from opponents on the field of play
- *social pressure* — pressure from coaches, parents, peers and others who are looked up to by the athlete
- *physical pressure* — the pressure of having to perform skills under the demands of competition.

Many researchers believe that coping effectively with stress has a lot to do with an individual's perception. Traits such as positive expectations and confidence are important in managing anxiety that might come up in different situations. This is not to say that the athlete will not experience anxiety. However, qualities such as self-assurance and self-belief can help them see anxiety as something that can help rather than hurt their performance. Successful athletes do not deny the existence of anxiety, commonly called 'butterflies', but are skilled at managing it effectively.

Athletes, indeed anyone, can further learn to cope with stress by using strategies such as:

- practising relaxation techniques
- developing concentration skills that require focusing on the immediate task rather than on the perceived reaction to it
- developing confidence
- planning strategies to cope with the situation.

stress physiological or psychological influence that produces a state of tension in a person

8.4.3 Arousal

Arousal is a specific level of anxiety and can be experienced prior to and during a performance. It is different from anxiety. While anxiety is mainly a psychological state, arousal is essentially a physiological process. Arousal is a necessary part of sports performance, although its level can either help or hinder the execution of specific skills or task components. Ideally, individual and group athletes would like to be able to achieve 'optimal arousal' which is the ideal level of physiological readiness to perform well. It is important to note that this differs between sports and even between individual athletes.

The individual performs a skill most successfully when the level of arousal is optimal for that particular task and that individual. A runner in a 100 m sprint, for example, may complete a time far worse than expected. This could be partly because of a low level of arousal, perhaps resulting from distraction, disinterest or a depressed level of motivation. The other extreme is a state of over-arousal, whereby and athlete is unable to perform the required movements with precision because they are excessively tense and unable to concentrate. Levels of arousal vary considerably between individuals. Generally, athletes who have a high tendency towards anxiety require less arousal than those who have a low tendency towards anxiety.

Both over-arousal and under-arousal contribute to adverse performance. The role of the coach and athlete is to ensure the level of arousal is optimal for each performance. All athletes respond to different stimuli to raise or lower their levels of arousal. Some can achieve optimal arousal by thinking about what they need to do in the game or activity. Others may require input from a coach, parent or peers. This suggests that arousal has drive properties — that is, the manipulation of factors that affect anxiety, such as motivation, can increase or decrease arousal.

arousal a specific level of anxiety and can be experienced prior to and during a performance

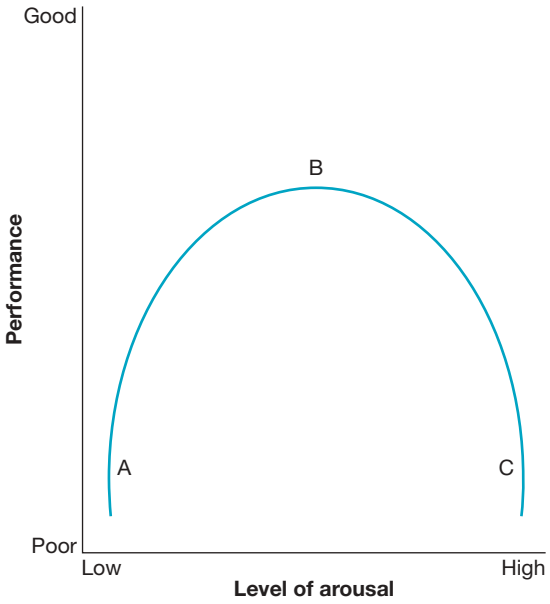
inverted U hypothesis a theory that suggests that performance improves with increasing arousal to a point beyond which performance will deteriorate

Optimal arousal

The **inverted U hypothesis** shown in figure 8.16 shows the connection between arousal and performance. It suggests there is an optimal level of arousal for any performance. If an individual's level of arousal is at A on the curve, then they would be considered to be under-aroused for that activity. Performance may suffer from such factors as lack of motivation, disinterest, poor concentration and the inability to cope with distractions.

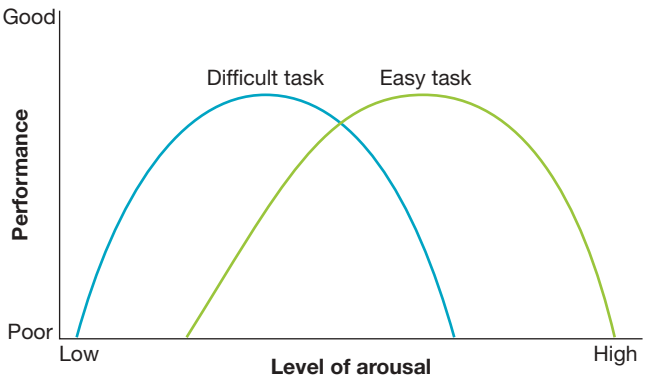
As an athlete's interest heightens, they move into the arousal zone and attain an optimal level of arousal at the peak of the curve (B). This is shown by a balance between level of motivation and ability to control muscular tension, which could be increasing as a result of the desire to perform well. Levels of arousal in the C area of the curve are excessive. If an individual's level of arousal is in this area, then their feelings would be characterised by anxiousness and apprehension, reflecting their excessive concern about the performance. This leads to increased muscular tension and possible mental confusion as the individual tries to process messages during skill execution, resulting in a poorer performance.

FIGURE 8.16 The inverted U hypothesis shows the relationship between arousal and performance.



The optimal level of arousal varies from one skill to the next. Generally, when difficult tasks involving few muscle groups are involved — for example, archery and putting in golf — levels of arousal need not be high to be optimal. However, many other activities that may be easier to execute or that involve large body movements — for example, running and weightlifting — require an increase in the level of arousal for performance to be optimal (see figure 8.17).

FIGURE 8.17 Higher levels of arousal are necessary for optimal performance in easy tasks.



Optimal arousal levels for a given task vary between athletes, and largely depend on the individual's personality and factors that include:

- *self-expectation* — how the individual expects to perform
- *expectation by others* — how a person thinks others, such as their coach or parents, expect them to perform
- *experience* — affects how the individual handles the increased pressure at higher levels of competition
- *financial pressures* — whether the individual's livelihood depends on their performance
- *the level of competition* — whether the individual is playing a round or a final
- *the degree of difficulty* — with higher levels of arousal generally being associated with more difficult tasks.

There are a number of effective psychological strategies that can be used to help optimise arousal and manage stress and anxiety leading to improved performance. These include:

- concentration/attention skills (manage stress and anxiety)
- mental rehearsal/visualisation (manage stress and anxiety and optimise arousal)
- relaxation techniques (manage stress and anxiety)
- goal setting (optimise arousal).

8.4.4 Concentration/attention skills (focusing)

Sport psychologists generally agree that the key to success among elite sportspeople is **concentration**, or the ability to focus on the task at hand. To understand concentration we need to distinguish between doing and thinking about doing. Total focus can contribute to over-arousal. When an individual focuses on the task or activity, their thoughts relate more to execution.

FIGURE 8.18 Some sports, such as diving, require intense concentration while sustained concentration is essential in sports such as triathlons.

Concentration can be improved through training that emphasises the *process* rather than the *outcome*. When an individual focuses on the process, they give attention to technique and try to understand why, for example, the shot missed the target. Focusing on the outcome places importance on the result — the success or otherwise of the shot.

The ability to widen and narrow attention skills can be developed through training. Some coaches require athletes to develop lists that embrace their thoughts at particular stages of the game/performance.

concentration is the ability to link movement and awareness to the extent that the individual can focus on doing, rather than on thinking about doing

The type of concentration required varies from one sport to another.

- Intense concentration is required in individual sports such as high jump, gymnastics or diving.
- Intervals of high concentration interspersed with periods of less intense concentration predominate in most team games such as touch football, netball and softball.
- At the extreme is sustained concentration, as might be required in triathlons, marathon running and high-level tennis matches.

8.4.5 Mental rehearsal/visualisation

Mental rehearsal is the technique of picturing the performance or skill before executing it. It is sometimes called visualisation or mental imagery. Mental rehearsal is a commonly used technique in many forms of physical activity. Individual athletes in sports such as weightlifting, gymnastics and high jump frequently use it. Group sports athletes, such as netball or basketball players, can also benefit from it by imagining successful plays or shots.

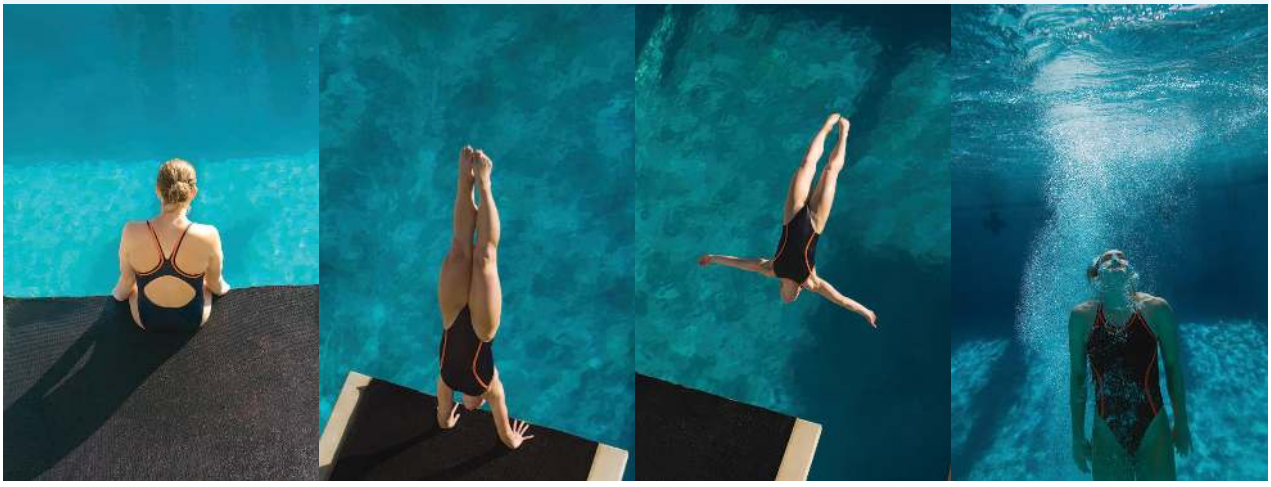
Mental rehearsal helps athletes become familiar with movements and improve concentration. It provides extra practice, especially when physical training isn't possible due to bad weather, illness or injury. However, it can be hard for coaches to control what athletes visualise.

Both individual and team sports can use mental rehearsal to manage stress and anxiety and enhance performance.

The importance of mental rehearsal to improving performance is that it:

- can help the body to achieve optimal arousal
- provides a clear idea of what has to be done
- heightens concentration
- narrows thoughts to the task, thereby decreasing anxiety.

FIGURE 8.19 Effective mental rehearsal requires concentration and clear images.



However, to be totally effective, mental rehearsal requires:

- vivid, realistic pictures at performance speed in the mind
- at least one and possibly more rehearsals
- a narrowing of thoughts to exclude distractions
- a sense of 'experiencing' — seeing colours, hearing sounds, feeling the movement and noticing the crowd
- seeing a successful performance — to visualise failure is to experience failure
- practice, so the process can be 'turned on' when required.

mental rehearsal is the technique of picturing the performance or skill before executing it

8.4.6 Relaxation techniques

While optimal arousal is desirable for good performance, over-arousal will reduce even the best efforts. **Relaxation techniques** may assist both individual and group sport athletes in control of arousal.

FIGURE 8.20 Relaxation involves both physical and mental techniques.

Without the use of relaxation techniques, an athlete may be unable to reproduce in competition what has been learned in training because other factors interfere with their concentration. For example, an individual athlete experiencing high levels of stress and anxiety prior to a major race may benefit from listening to some calming music to reduce anxiety and prevent over-arousal. Similarly, a group sport may have a team relaxation session leading into a grand final to help calm the athletes down to avoid over-arousal. For example, a hockey team may do meditation together leading into a big match to help the team remain calm.

Techniques commonly used by athletes include:

- *progressive muscular relaxation* — involves relaxing muscle groups using special exercises (a good technique if arousal is excessive)
- *mental relaxation* — involves relaxing the body through controlled breathing, relaxing the mind and gaining a 'floating' feeling
- *self-hypnosis* — involves using the power of suggestion to have the mind accept a particular level of anxiety in a specific situation
- *mental rehearsal* — involves concentrating on rehearsing the performance of the task rather than on how you feel about it
- *meditation* — involves narrowing one's thoughts using simple repetitive images and sounds
- *centred breathing* — involves controlling breathing to release tension before a performance.

It is important that each athlete finds the relaxation technique that suits them personally. Some may respond best to physical techniques such as progressive muscular relaxation, while others will benefit from a technique with a mental focus, such as yoga.

8.4.7 Goal setting

Goals are targets that we direct our efforts towards. Setting **goals** is important to improve both individual and group sport preparation. By giving athletes the responsibility to set their own goals, they are more likely to seriously attempt to fulfil them. Goals provide athletes with a reason to persevere with training over extended periods. They provide focus, give direction, and help people to achieve their aspirations.

Goals may be short or long term. Short-term goals are the most important because they serve as checkmarks by which other goals can be measured. The approach to achieving short-term goals should not be inflexible and it shouldn't be of concern if one or a number of goals are not achieved. Personal circumstances or injury may interfere with the goal's timeframe. In this case, discussion and renegotiation are preferable rather than reinforcing feelings of failure and disappointment.

relaxation techniques are a series of techniques that seek to control the body's response to stress

goals are targets that we direct our efforts towards. They can relate to either performance or behaviour.

The types of goal that are important to athletes are:

- *Short-term goals.* These are goals that can be achieved in a limited period of time. An example for an individual sport might be 'I will complete at least three endurance training sessions this week'. For a group sport or team sport it might be 'I want to try to make the A team at rugby trials next week'. Short-term goals are stepping stones to achieving long-term goals.
- *Long-term goals*. These goals can be achieved only over a long period of time; for example, the individual athlete with the aerobic short-term goal may have the long-term goal of wanting to complete the City2Surf. The rugby player who is part of a group sport may have the long-term goal of his A team making the grand final.

FIGURE 8.21 Goals provide direction and act as benchmarks of achievement.

Ultimately, both short-term and long-term goals can be helpful for individual and group sport athletes in keeping them focused and helping them work towards a concrete and attainable outcome. Short-term goals can help athletes decrease anxiety because they are able to focus on their own performance; for example, achieving a personal best instead of being concerned about their result. This is particularly true in individual sports. For example, a 800 m runner may be thrilled to run a personal best time, despite finishing below where they had hoped in a race. Goals can also be vital to supporting optimal arousal, as short-term goals can encourage consistency of effort in training which can help athletes feel as 'ready' as possible for an event. For example, an NRL team who has undergone a difficult 12-week pre-season may feel less anxious about their round 1 game due to the short-term goals achieved.

Some coaches may encourage goal setting to improve performance but also track success along the way. An effective way to do this is using the SMART criteria. This means you need to:

- ensure goals are *specific* to the individual athlete/group sport
- *measurable* to ensure success can be observed and celebrated
- *achievable* and within reach
- *relevant* to the athlete/sport
- *time-bound* so there is a clear correlation to the sporting season.

FIGURE 8.22 SMART goals can motivate athletes and optimise arousal

For example, a female athlete specialising in the 800 m might set a goal to run it in 1 minute and 59 seconds. This goal would be effective if it follows the SMART criteria:

- **Specific**: the goal is clear (1 minute and 59 seconds)
- **Measurable**: the time can be tracked
- **Achievable**: if her previous best is 2 minutes and 1 second, this goal is realistic
- **Relevant**: as an 800 m runner, this goal is directly related to her sport
- **Time-bound**: she aims to achieve it by the end of the track and field season.

Coaches can help athletes set SMART goals to improve performance and build confidence.

EXAM TIP

Applying psychological strategies

The syllabus dot point is: Investigate how individual and group sports apply psychological strategies, optimising arousal and management of stress and anxiety to improve participation and performance. An exam question is likely to investigate part or segments of this focus question. For example, a question might ask: Investigate how individual and groups sports can optimise arousal OR investigate how individual and groups sports can manage stress or anxiety.

Both these questions still require a discussion of the psychological strategies that SHOW stress management. It is important to apply the strategies to a scenario so that strategies are applied, and examples are evident. You need to understand that the choice of psychological strategy is linked to the level of arousal (low levels require concentration/attention skills vs high levels of arousal requiring specific relaxation techniques and mental rehearsal). And make sure you provide a group or individual sporting example. Include some practical tips and strategies about how to implement the techniques. For example, *Mental rehearsal can be more successful for a diver if the mental picture is vivid and realistically paced with performance speed in the mind to encourage smooth entry into the water vs a water polo player who may find the pace of the ball hard to visualise as it is externally paced by other teammates. However instead the team as a whole might benefit by focusing on visualising effective goal-shooting technique which will support accuracy*.

Take note that feeling some form of stress or anxiety, if controlled, can support motivation and physical readiness to enhance participation but regulation and management can be advantageous to improve performance (hence the introduction of the strategies).

8.4 ACTIVITIES

1. Recall a time when you experienced stress, anxiety or over-arousal before or during sport or PE. Consider how the application of a psychological strategy may have helped you.

Practical activity

2. Practical application — as a class complete two activities from the list below and discuss if you think it would be effective in reducing anxiety, stress or over-arousal.
   - Listening to calm music
   - Goal-setting activity
   - Meditation activity
   - Centred breathing

CASE STUDY 1

How Nick Haynes overcame his anxiety to embrace footy again

'I remember the prelim, still feeling like I still need another stepping-stone to get over this [anxiety] and meditation was a thing that I just latched on to straightaway, and it benefited me straightaway to be able to be present,' Haynes said.

1. Based on the above quote, identify the psychological strategy used by Nick which he found very helpful.

Read the full article, using the weblink in the Resources panel.

2. What other strategies did Nick use to help his anxiety?
3. Consider some of Nick's sources of stress and whether other athletes may share similar experiences.

Resources

Weblink How Nick Haynes overcame his anxiety to embrace footy again

DEPTH STUDY IDEA

Investigate an elite individual and/or group sport athlete who uses/used a mindfulness coach/sports psychologist.

Some individual and group sport athletes to consider:

- Michael Jordan (Basketball)
- Ash Barty (Tennis)
- New Zealand All Blacks (Rugby).

8.4 Exercises

learnon

8.4 Quick quiz on | **8.4 Exercise**

Learning pathways

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

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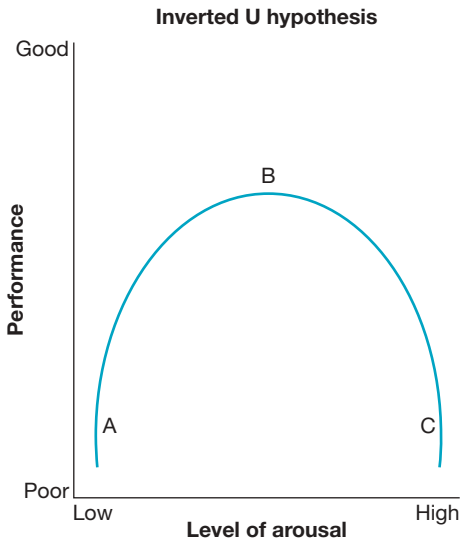
Revise your knowledge

1. Outline how anxiety can affect sports performance.
2. Identify three strategies athletes could learn to help them cope with stress.
3. Describe how mental rehearsal/visualisation is an effective psychological strategy to manage stress and anxiety.
4. Outline one effective relaxation technique that could be used to manage anxiety and improve performance.
5. Compare how an individual athlete and a group sport athlete use short-term goals to improve participation and performance.

Apply your knowledge

6. You often experience *state anxiety* before big games and your AFLW grand final is approaching. Explain two strategies you could use to manage the state anxiety. Provide examples.
7. You are designing a relaxation session for a national rugby 7s team the day before they play for a gold medal. Describe two relaxation techniques you plan to include.
8. Investigate how the inverted U hypothesis for arousal could be applied to both an individual athlete and a group sport team.
9. Explain how a rugby player who is lining up the ball to kick a goal to win the match could use concentration/attention skills to manage anxiety.
10. Why might coaches use SMART goals to improve performance?



8.4 Exam questions

Question 1 (3 marks)
Outline how optimal arousal can work to improve performance.

Question 2 (4 marks)
Describe how relaxation techniques could be used effectively in group sports to reduce stress.

Question 3 (4 marks)
Explain what is necessary for mental rehearsal/visualisation to be effective in helping improve performance.

Question 4 (5 marks)
Evaluate the role concentration/attention skills have in supporting individual and group sport athletes who experience anxiety.

Question 5 (8 marks)
Explore how a tennis player and a netball team apply psychological strategies to manage stress and anxiety, leading to improved participation and performance.

8.5 How strategies and tactics are applied

Syllabus: Discuss the factors that influence how strategies and tactics are applied to individual and group sports

8.5.1 Strategic and tactical development

Several factors influence how strategies and tactics are applied to individual and group sports. These include environmental conditions as well as group strengths and weaknesses. These factors can significantly impact the effectiveness of strategies and tactics. To understand how strategies and tactics can be applied in both individual and group sports, it is essential to closely examine these concepts.

A strategy is the overall method used to achieve a goal and tactics are about gaining an advantage over the opposition. Effective strategic and tactical development requires each individual player to know their role within the strategy. Ultimately, strategy and tactics work together to help coaches and athletes form plans to achieve success.

Coaches need to be able to adapt their plans and strategies based on a range of factors. Some of these may include the opponent, environmental factors and group strengths and weaknesses. It is important for athletes to be prepared and aware of a range of strategies and tactics to effectively gain an advantage in different situations. This applies to both individual and group sports.

FIGURE 8.23 The games-centred approach focuses on the development of tactical skills within an open environment.

A highly effective way coaches do this includes replicating performance-like situations in training. When athletes are exposed to performance-like pressure, they are able to test the integrity of strategies and tactics.

Game sense or a games-centred approach can help athletes and coaches develop and practise strategies and tactics in training. This is particularly key in group sports and commonly used through:

- small-sided games; for example, 3 vs 3 (simulate game pressure)
- overload situation; for example, 4 vs 3 (learning to capitalise with an extra player)
- underload situation; for example, 3 vs 2 (learning to cope when down a player)
- friendly games/matches (against other teams to test effectiveness of strategies).

Tactical development is built on problem solving so it is important that athletes have a chance to solve problems in training situations. This can help gain an advantage in a game. The players shown in figure 8.24 are an example of a team that would have executed their strategy and tactics to gain an advantage over the opposition.

FIGURE 8.24 Successful strategy and tactics creates overlap.

Good strategies have inbuilt *options* so that if a plan is derailed, there is always an alternative. Strategies involve planning and practice and might need to change according to the opposition.

The implementation of strategy and tactics can differ for individual and group sport athletes. If we take the example of a 100 m sprinter and a football (soccer) player, the different options available can be seen. For example, a 100 m sprinter may choose to work on starts practice, driving out of the blocks to assist their strategy/tactic of getting a good start and immediately putting opposing sprinters under pressure in a race. In a football team, they are more likely to focus on team strategy and tactics. For example, a focus on working on defensive shape and formation such as pressing up together as a team to apply pressure. This differs to an individual's strategy and tactics because it requires teamwork and timing from all players. Effective strategic and tactical development requires each individual player to know their role within the strategy.

FIGURE 8.25 A 100 m sprinter and football player use different strategies and tactics.

8.5.2 Environmental conditions

Environmental conditions can impact strategies and tactics for both individual and group sport athletes. Some environmental conditions, such as excessively high or low temperatures, humidity, wind or rain may force some strategical and tactical changes.

Both individual and group sport athletes want to avoid serious impacts of climatic conditions such as hypothermia (low body temperature) and hyperthermia (high body temperature). Hypothermia is a condition characterised by body heat loss that far exceeds body heat gain, resulting in subnormal body temperature. Hyperthermia is excessively high body temperature that is usually experienced in hot, humid conditions in which evaporation is unable to take place.

However, besides these serious impacts which negatively affect individual or group athletes, there are a range of more common environmental conditions that can impact strategies and tactics such as wind, rain and heat.

For example, a cyclist may change their strategy and tactics if it *rains* to take corners a little slower than initially planned to avoid slipping and crashing, causing injury and negatively impacting performance. This is also true for group sports such as NRL where a coach may change strategies and tactics if it is raining by minimising the number of passes thrown and simplifying attack to prevent making errors due to a slippery ball. These examples show how environmental conditions such as rain can influence strategies and tactics.

Individual athletes such as a 1500 m runner may also change tactics depending on conditions such as *wind*. If it is a windy day, many runners may avoid running at the front and employ a 'sit and kick' strategy so they do not experience the added fatigue of being a windbreak for the athletes behind them. Similarly, group sport athletes such as AFL players may choose less risky shorter kicks to teammates as windy conditions make it harder to catch a mark. These examples show how wind could influence strategies and tactics.

Coaches also shift strategies and tactics if environmental conditions are *hot*. For example, a singles tennis player may decide that a good way to gain an advantage over their opponent is to make them run around the court. They could employ a tactic of playing shots sideline to sideline and using drop shots, with a strategy and tactic of fatiguing their opponent to gain an advantage later in the match. This strategy could be particularly helpful if the athlete is very fit, as it would be in their best interest to keep rallies longer and create fatigue. Similar strategies and tactics can be used in group sports if it is hot, such as making 'maintaining possession' a key strategy and minimising errors, forcing the opposing team to play lots of defence which may drain them of their energy, thereby providing an advantage or competitive edge towards the end of the game. This is seen in a football or hockey group sport setting.

8.5.3 Group strengths and weaknesses

When planning strategies and tactics, it is important to consider the strengths and weaknesses of the group. This is especially true for team sports. For example, in netball, having tall players can be a strength for making lob passes, especially if the opposing team is shorter. However, tall players might be less agile, which can be a weakness. Tactically, these group strengths and weaknesses need to be considered, particularly by coaches.

In contact sports such as rugby, physical strength can be a key advantage. A coach might focus on using the team's power to dominate play and have a tactic of keeping the ball tight and playing through the forwards using their strength and power to get over the advantage line. Conversely, a team with fast and fit players might use speed and endurance to outmanoeuvre and fatigue opponents.

Good coaches reflect on their team's weaknesses and anticipate how opponents might exploit them. For instance, a rugby coach might work on improving the team's aerobic fitness if it is a known weakness. Similarly, an individual athlete such as a gymnast might practice on their weakest apparatus to ensure a well-rounded performance.

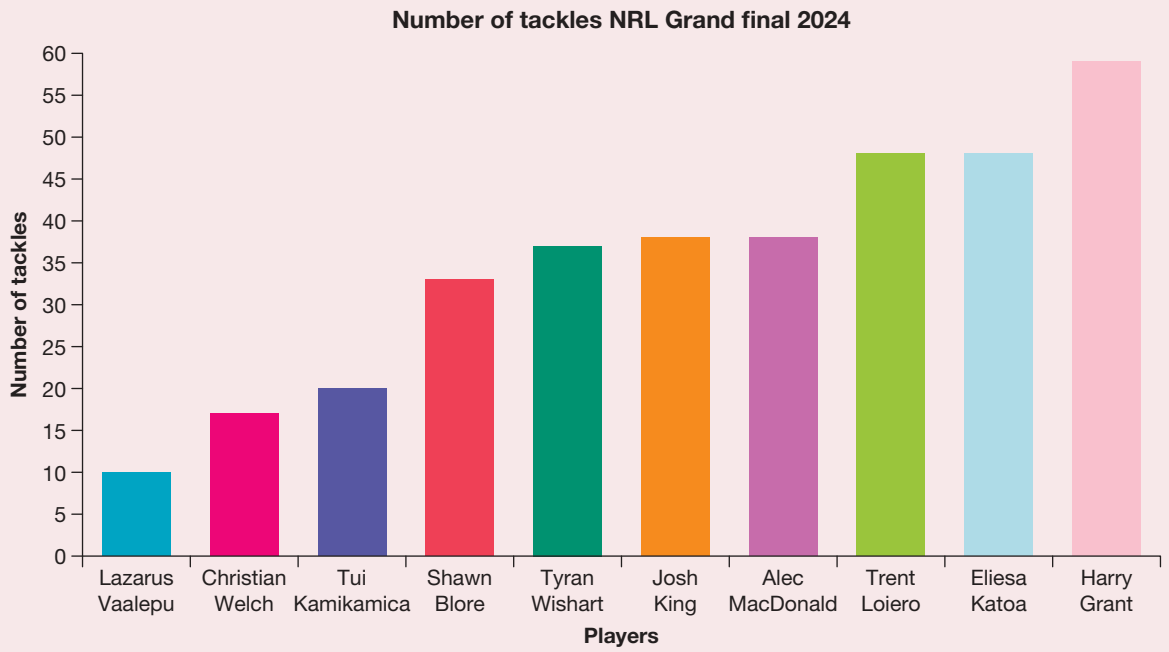
In individual sports, you do not need to consider group strengths and weaknesses. One benefit of being in an individual sport is the ability to focus purely on your own performance and the elements you can improve.

CASE STUDY 2

2024 NRL Grand Final

Use the image below to answer the following questions.

How the Penrith Panthers ran Melbourne's forwards ragged



1. Why might Penrith have tried to force Harry Grant and Eliesa Katoa into making the most tackles?
2. Was this a successful strategy or tactic?

8.5 PRACTICAL ACTIVITY 1

Team strategy

Lesson 1 Preparation

Lesson 2 Practical participation and video review

As a class, choose a team sport you will participate in (e.g. football, netball, hockey, basketball) and split the class into small teams. Each group needs to write down a team strategy prior to playing the sport. It is important they have a clear strategy/tactic that they hope to implement in the chosen team sport.

With permission, the game will be filmed and then reviewed as part of Lesson 2.

Teams will play for approximately ten minutes and then the footage will be reviewed in class. Each group will then be asked to answer the following questions based on the vision:

1. Identify your team's strategy and tactics and decide if they worked.
2. Give yourself a score between 1–5 (5 being the best) in terms of how you think you executed the strategy/tactics.
3. What would you/your team change next time?
4. Evaluate your own performance in relation to attack and defence, off the ball work and strategies and tactics.

DEPTH STUDY IDEA

Game analysis: Analyse recorded games of an individual sport (e.g. swimming) and a group sport (e.g. volleyball) to identify how strategies are adapted to environmental conditions or team dynamic.

Format of task: Written report with video analysis and annotated screenshots.

8.5 Exercises

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8.5 Quick quiz on | **8.5 Exercise**

Learning pathways

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

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Revise your knowledge

1. Outline strategies and tactics.
2. Explain how environmental conditions can influence strategies and tactics for an individual sport.
3. How might a coach's knowledge of group strengths and weaknesses inform strategies and tactics?
4. How does a games-centred approach to training support the development of strategy and tactics?
5. Compare strategies and tactics for individual and group sports. Provide examples.

Apply your knowledge

6. Imagine you are a basketball coach of an elite team, and you have been watching game vision of the opposing team you will be playing next weekend. You notice that they shoot a lot of 3-point shots but struggle with mid-range shooting. What strategies and tactics would you use?
7. You are running in a 3000 m race and you usually race from the front and push the pace, but your coach tells you it is very windy. What strategies and tactics could you employ to counter the environmental conditions?
8. Imagine you are coach of a basketball team and the opposing team are all taller. What strategies or tactics could you utilise?
9. Imaging it is pouring rain and you are the coach of a rugby team. What strategies or tactics would you suggest?
10. Provide a range of ways tactics can be learnt through training situations.

8.5 Exam questions

Question 1 (3 marks)

Source: *HSC 2023, PDHPE Exam, Section I, Part B, Q.23a*

Outline TWO benefits of developing tactics for use in team sports.

Question 2 (3 marks)

Outline how strategy and tactics could positively influence sports performance.

Question 3 (4 marks)

Explain how two environmental conditions could lead to a change in strategy and tactics.

Question 4 (6 marks)

Compare how group strengths and weaknesses would influence strategies and tactics in TWO sports.

Question 5 (8 marks)

Discuss the factors that influence how strategies and tactics are applied to individual and group sports.

8.6 Sample exam question response

Question

Discuss TWO environmental conditions that influence strategies and tactics for an individual AND a group sport. **(5 marks)**

Criteria	Marks
• Provides a detailed discussion for and/or against how TWO environmental conditions would influence strategies and tactics for both an individual and a group sport. • Provides detailed and relevant examples	5
• Provides a sound discussion of how TWO environmental conditions would influence strategies and tactics for both an individual and a group sport. • Provides relevant examples.	4
• Describes how TWO environmental conditions would influence a sport OR strategies and tactics with reference to two sports generally.	3
• Outlines environmental conditions and/or strategies and tactics used in sport	2
• Identifies some relevant information about environmental conditions, strategies and tactics or individual and group sports.	1

Sample response

Breaking down the question

Discuss TWO environmental conditions that influence strategies and tactics for an individual AND a group sport.

Identify the action word/s: Discuss: Identify issues and provide points for and/or against.

Syllabus terminology: strategies and tactics, individual and group sport, environmental conditions

Mark allocation: 5 marks — according to HSC past papers, questions worth 5 marks require answers that include 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

Humidity and wind are two environmental conditions that would pose issues for a 1500 m runner and a football player. These conditions would influence strategies and tactics, meaning coaches would need to adjust their plans to be successful.[1]

A 1500 m race is highly tactical and often involves a clear race strategy.[1] A strategy is an overall method used to achieve a goal and a tactic is about gaining an advantage and the two work together closely to help athletes achieve success. This is true for a 1500 m runner who will have a plan for their race. Humidity and wind are two environmental conditions that could influence race strategies and tactics.[2] For example, a 1500 m runner who likes to run at the front usually may devise a new plan to sit in the pack and not break the wind for the competitors behind them, particularly when the humidity will cause fatigue.[3] Hence, adjusting their strategy and tactics to conserve energy would prove helpful for the individual athlete (1500 m runner) given the environmental conditions.[4]

A football player, who is part of a group sport (as there are 11 players on the pitch), would also be impacted by humidity and wind.[1] This is because the humidity will likely increase fatigue for the players on the field (bar the goalkeeper) and the wind would impact the flight of the ball. For these reasons, coaches and team members may choose to revise their strategies and tactics leading into the game.[2] For example, a coach may strongly encourage the players to keep the ball on the ground when crossing the ball into the box. This would form part of the overall method used to achieve success as a team by minimising inaccurate balls into the penalty area. Another example of how strategies and tactics might be modified to suit the conditions could be earlier substitutions, in anticipation of reduced performance from players due to the humidity and wind. A negative strategic outcome of environmental conditions could be a soccer team captain selecting to run with the wind in the first half to gain an advantage in the first half, but having fatigue set in and the team struggling to defend against the wind in the second half.[3] Therefore, both wind and humidity are environmental conditions that would influence strategies and tactics for a group sport like football.[4]

As has been discussed, both an individual and group sport strategies and tactics would be impacted by environmental conditions.[4]

8.7 Review

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8.7.1 Topic summary

8.2 Designing a training session

- When designing a training session for individual and group sports, you must think about health and safety considerations to avoid injury and ensure athlete safety.
- The overview/aim of the session (goal specific) is important for both individual and group sports to help provide a guide for athletes and assist in developing a level of focus.
- Warm-up and cool-down are important for both individual and group sports athletes. The primary aim of a warm-up is to prepare the body physically and mentally for the session ahead. The primary aim of a cool-down is to assist recovery and help future performance.
- Skill instruction and practice element of a training session usually takes up the majority of the training session and includes a range of known skills and drills and some new activities.
- Conditioning needs to be sport specific to individual and/or group sport athletes. Specificity is the key, and this can happen immediately after the warm-up but should not take away from the quality of the rest of a training session.
- Strategy is the overall method used to achieve a goal and tactics are about gaining an advantage over the opposition. They need to be used in a training session in order for individual or group athletes to be able to gain an advantage in a game.
- Athlete reflection and/or coach evaluation helps inform future training and provide valuable feedback.

8.3 Yearly training programs

- The three phases of competition include pre-season (preparing for the season ahead), in-season (the competition phase of a yearly training program) and the off-season phase (a chance to recover physically and mentally and incorporate some variety).
- Macrocycles are long-term planning frameworks; for example, a yearly plan.
- Microcycles are shorter-term training blocks; for example, 3–10 days with more specific training details.
- A taper is a period of reduced volume and often comes before an athlete intends to peak for competition.
- Peaking refers to optimal performance and is a major focus for athletes when designing a training plan.
- Sport-specific attributes (fitness components, skill requirements) are important to include towards the end of the pre-season, following the general preparation phase of training. This is because, prior to the competition season starting, athletes need to be ready to perform with a high level of fitness and skill.

8.4 Psychological strategies

- Individual and group athletes can experience anxiety.
- Anxiety is predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening.
- State anxiety is situational; for example, occurring during a high-stress event such as a grand final. Trait anxiety is like a personality trait.
- Arousal is a physiological state of readiness that is often closely impacted by anxiety.
- Stress is the non-specific response of the body to a demand placed on it. It is a normal part of everyday life, but it can negatively impact athletes.
- Concentration and attention skills involve taking control of the mind and, with clarity, focusing on what's important.

- Mental rehearsal/visualisation, or picturing a successful performance vividly, can help build confidence and reduce stress and anxiety.
- Relaxation techniques are a series of techniques that seek to control the body's response to stress.
- Goal setting can help athletes focus attention on a goal, instead of the things that may go wrong. Short-term and long-term goals can help improve participation and performance.

8.5 How strategies and tactics are applied

- A strategy is the overall method used to achieve a goal and tactics are about gaining an advantage over the opposition.
- Some environmental conditions, such as excessively high or low temperatures, humidity, wind or rain may impact strategies and tactics in both individual and group sports.
- A coach's knowledge of group strengths and weaknesses can help inform strategies and tactics both within their own team and in terms of knowing areas to target in an opposing team.
- The games-centred approach or game-sense style of training is popular as it focuses on the development of tactical skills within an open environment.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: Investigation — Inside the mind of a winner — sharing winning psychological strategies with amateur athletes

Time: 5 hours

Task description: Choose an elite athlete or team and investigate the psychological strategies they use before, during and following competition to improve participation and performance. Apply this understanding of psychological strategies for pre, during and post-performance to provide evidence-informed advice to an amateur athlete in the same sport.

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents Topic 8 summary (doc-43065)
Key terms glossary (doc-43066)
Revision quiz (doc-43067)

Interactivity Missing word interactive quiz (int-9365)

8.7 Exercises

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8.7 Revision Quiz on | 8.7 Exam questions

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8.7 Exam questions

Section I

Question 1 (1 mark)

Source: *HSC 2018, PDHPE Exam, Section I, Part A, Q.20*

A coach uses strategic development to enhance a team's performance. Strategic development focuses on:

A. adopting the opponent's game plan.
B. allowing players to make spontaneous decisions.
C. encouraging players to be creative.
D. utilising strengths and targeting the opponent's weaknesses.

Question 2 (1 mark)

Which of the following are examples of an *individual* and *group sport*?

A. Netball, Softball
B. 1500 m athletic race, Basketball
C. 1500 m swim, High jump
D. Football goalkeeper, Netball

Question 3 (1 mark)

An athlete who feels physically sick prior to every sports match could be experiencing:

A. Under arousal
B. Trait anxiety
C. State anxiety
D. Optimum arousal

Question 4 (1 mark)

A swimmer sets a goal to beat their time in the 50 m freestyle next time they race.

This is an example of a

A. short-term goal.
B. long-term goal.
C. behavioural goal.
D. performance anxiety.

Section II

Question 5 (3 marks)

Picturing a successful performance vividly can help build confidence and reduce stress and anxiety. **Outline** this concept and provide an example of how it can be applied in a sports context.

Question 6 (2 marks)

Outline the pre-season and in-season phases of competition.

Question 7 (3 marks)

Outline what a microcycle is and how long it lasts.

Question 8 (3 marks)

How long should a marathon runner take to taper prior to a major race?

Question 9 (3 marks)

Outline ONE health and safety consideration when designing a training program for an individual sport.

Question 10 (4 marks)

How could arousal affect performance in an individual sport?

Question 11 (4 marks)

Explain why a cool-down would be valuable for both an individual and group sport athlete.

Question 12 (4 marks)

Describe how environmental conditions may impact strategy and tactics.

Question 13 (6 marks)

Compare anxiety and arousal in terms of effects on performance.

Question 14 (5 marks)

Explain how sport-specific attributes could differ for individual and group sport athletes.

Section III

Question 15 (12 marks)

Analyse TWO aspects that need to be considered when designing a training session for a group sport.

9 The impact of sleep, nutrition and supplements on movement and performance

LEARNING SEQUENCE

9.1 Overview 365
9.2 Dietary requirements and fluid intake 366
9.3 Sleep, nutrition and hydration 378
9.4 Supplements, micronutrients, protein, caffeine and creatine products 391
9.5 Sample exam question response 401
9.6 Review 403

9.1 Overview

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Key inquiry question

What impact does sleep, nutrition and supplementation have on movement and performance?

Syllabus

	Syllabus content	Subtopic
○	■ Using research, analyse the dietary requirements, pre, during and post performance needed and fluid intake requirements of athletes from different sports	**9.2**
○	■ Explain how sleep, nutrition and hydration can be used to reduce fatigue and positively influence movement and injury prevention **Including:** • guidelines • planning • routines • monitoring	**9.3**
○	■ Discuss the use of supplements, micronutrients, protein, caffeine and creatine products for improved performance	**9.4**

Outcomes

- investigates factors that impact movement and performance HM-12-04
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem-solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

on Resources

Digital documents Topic 9 summary (doc-43068)
Key terms glossary (doc-43069)
Revision quiz (doc-43070)

9.2 Dietary requirements and fluid intake

Syllabus: Using research, analyse the dietary requirements, pre, during and post performance needed and fluid intake requirements of athletes from different sports

9.2.1 Dietary requirements of athletes

For athletes to achieve improved performance, they need to think about the dietary requirements specific to their sport. If athletes are not eating the right foods, it will be difficult for them to physically improve and perform at their best. This is because food provides energy, with the best sources of energy coming from carbohydrates. If athletes' intake of carbohydrates are too low, they will lack the energy needed to be able to train and sustain performance in competition.

Different sports will require different energy intakes depending on the predominant energy system. For example, a marathon runner's predominant energy system is the aerobic energy system requiring carbohydrates as the main source of fuel. A marathon runner's dietary intake of carbohydrates will be higher to meet the needs of the aerobic energy system compared to a sprinter relying on the ATP/PCr energy system.

FIGURE 9.1 Dietary requirements are essential for all athletes.

Athletes should always eat enough **macronutrients** and **micronutrients** suitable for their sport and training requirements.

Macronutrients are the main nutrients in the foods we eat and are the main fuel sources for the energy systems. Macronutrients include carbohydrates, protein and fats.

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 and minerals.

As a general rule, an athlete's diet should consist of:

- 45–65 per cent carbohydrates
- 15–25 per cent protein
- 20–35 per cent fat.

Depending on the specific sport, dietary requirements may differ to meet the demands of that sport. For example, endurance athletes may need to increase their carbohydrate intake to sustain their energy needs. Athletes such as weightlifters completing a lot of strength training will need to increase their protein intake.

Micronutrients are 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. They are also known as vitamins and minerals. Examples of vitamins include vitamin B12 and vitamin C and examples of minerals include iron and calcium.

Training programs designed to improve performance must be supported by dietary requirements. This involves many factors such as what specific macronutrients and micronutrients to eat and drink, being aware of the most appropriate time for energy intake and having recovery strategies in place to regain expended energy. While nutritional balance is essential for optimal physical performance, carbohydrates are one of the most important macronutrients for all athletes.

Carbohydrates

Carbohydrates are the most versatile fuel source available to supply energy for ATP resynthesis. How many carbohydrates are needed will vary depending on the duration, frequency and intensity of the training and sporting performance. If athletes don't consume enough carbohydrates to meet their energy needs, this can result in an increase in fatigue, reduced training ability and low performance during competition. It's important for athletes to seek advice from a sports dietician to work out the right amount of carbohydrates for their sporting requirements.

Endurance athletes will consume a combination of low **glycaemic index (GI)** carbohydrates (these release energy at a slower rate in the body) and high GI carbohydrates (these release energy at a faster rate in the body). Foods with low GI include grainy bread, lentils, oats and foods with a high GI include potatoes, white bread and white rice.

carbohydrates the most versatile fuel source available to supply energy for ATP resynthesis

glycaemic index is a ranking system for carbohydrates based on how they affect blood sugar level

CASE STUDY 1

Athletes looking for a competitive edge may find it within their gut microbiome

By ***Christopher Damman, Associate Professor of Gastroenterology, School of Medicine, University of Washington***

23 July 2024

When milliseconds can mean the difference between silver and gold, endurance athletes in sports like marathon running, cycling, rowing and swimming optimise every aspect of their physiology for a competitive edge.

Many of these efforts result in enhancing the performance of mitochondria, the tiny but mighty energy-generating powerhouses within your cells …

But there is another aspect of endurance training that may have largely been overlooked by athletes and trainers – the role of the gut microbiome in optimizing your mitochondrial health and fitness.

…

The gut microbiome, a hidden factory of highly collaborative microorganisms in your intestines, ensures that your metabolism, immune system and brain run smoothly. Some researchers liken it to another organ that senses nutritional inputs, manufactures signaling molecules and prepares your body to respond appropriately.

Research has shown that endurance athletes have different gut microbiomes compared with the general population. Their microbiome's composition and function, like increased production of a short-chain fatty acid called butyrate, are associated with increased VO_2 max, a fitness benchmark that measures your ability to consume oxygen during intense exercise. One organism in particular, *Veillonella* is found in some elite runners and may help raise lactate threshold, a fitness metric closely linked to mitochondrial function and how long an athlete is able to sustain intense effort.

Mitochondria are more than just the powerhouses of the cell

A healthy microbiome communicates with the mitochondria, the tiny structures within your cells that convert calories into the raw cellular energy required for muscle contraction and other essential functions. It does this by transforming undigested food components of a healthy diet – like fiber, polyunsaturated fats and polyphenols – into molecules that increase the number and health of your mitochondria.

Some of these metabolites – butyrate, conjugated linoleic acid and urolithin A among them – have been shown to specifically improve muscle strength and endurance. Combining exercise with diets high in fiber, polyphenols – a chemical compound from plants – and healthy fats may thus augment mitochondrial fitness and improve exercise performance.

…

Performance-enhancing microbes

... a diet rich in foods that positively affect your microbiome — beans, nuts, seeds, whole grains, fruits and vegetables — during the recovery phase of training can help most people prevent the adverse effects of high-intensity exercise and optimize performance.

… Research has shown that specific strains of probiotic bacteria can improve barrier function, reduce systemic inflammation and potentially enhance athletic performance by mitigating the side effects of high-intensity exercise. An alternative approach is to increase consumption of fermented foods, such as yogurt and pickled vegetables, which can increase microbiome diversity and decrease systemic inflammation.

Foods with probiotics, such as yogurt, can be beneficial to your microbiome.

In some cases, healthy foods might also be complemented by directly providing the body the key metabolites that microbes produce. Research shows that these metabolites – also called postbiotics or exercise mimetics – enhance muscle strength and exercise performance. Some postbiotics also function as prebiotics that fuel the growth of healthy microbes and help restore a damaged microbiome.

…

Source: Damman, C. (2024), 'Athletes looking for a competitive edge may find it within their gut microbiome'. *The Conversation*, 23 July, https://theconversation.com/athletes-looking-for-a-competitive-edge-may-find-it-within-their-gut-microbiome-234979.

Case study questions

1. What are gut microbiome?
2. Why do endurance athletes have different gut microbiomes?
3. What are the effects of healthy gut microbiome for endurance athletes?
4. What are examples of foods that support healthy gut microbiome?

9.2.2 Pre-performance

Food consumed before activity is useful only if digested and its energy and nutrients are available where they are needed in the body.

Most athletes feel comfortable having a normal meal three to four hours prior to competition. As the time period to competition becomes shorter, food intake should be in the form of snacks and liquid preparations. Solid foods can still be consumed up to two hours prior to competition, while carbohydrate solution drinks are preferred in the 30 minutes prior to the event. The reason for this is to avoid any digestive upset prior to competition. Having a carbohydrate solution drink not only provides energy but also hydration.

FIGURE 9.2 A bowl of cereal with fruit can be an effective meal for pre-performance.

In general, athletes should ensure that their pre-performance meal or snack is rich in carbohydrates to fuel energy stores, low in fibre, easy to digest and not a new food. Examples may include:

- cereal with fruit and yoghurt
- crumpets with banana and honey
- small bowl of pasta with tomato-based sauce
- smoothie.

Pre-performance meals are essential to optimal performance. If the athlete does not fuel and hydrate properly, performance can suffer and result in the following:

- earlier onset of fatigue
- reduced speed, especially during repeat efforts
- reduced endurance
- poor concentration and decision making
- skill errors
- gut upset
- suboptimal body composition.

Carbohydrates

Carbohydrates are broken down and stored as **glycogen**. Glucose released from the stored glycogen in the liver will be oxidised to create **adenosine triphosphate (ATP)** for muscular contraction. This process is known as **glycolysis** (the process of using glycogen or glucose as fuel). Endurance athletes in particular will need higher intakes of carbohydrates due to the long duration of their training and performances. Carbohydrates are beneficial, particularly for endurance athletes, as they will fuel the body for long periods at moderate to high intensity. Examples of carbohydrates for athletes include wholegrain breads, quinoa, pasta, oats, sweet potato, brown rice and wholegrain cereals.

glycogen the storage form of glucose and is used for fuel when blood glucose levels decline

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

glycolysis the process of using glycogen or glucose as fuel

Fats

Fats are the most concentrated form of energy for ATP resynthesis and are particularly important for endurance athletes. Fats should make up 20–35 per cent or 0.5–1.5 g per kg of body weight of an endurance athlete's diet. Fats are stored as triglycerides which is similar to glycogen and supplements energy production. Fats also help maintain nerve cells which is important for continual muscle contractions. Fat can fuel athletes for long periods of time but only at a low intensity. Many endurance athletes will utilise fat stores for energy once carbohydrate stores have been utilised. Fat sources may include avocados, oily fish, olives, plant-based oils, nuts and seeds.

FIGURE 9.3 Fats are important for athletes.

Protein

Protein is an essential component of a balanced diet. Protein allows for muscle growth and repair, fights disease, helps chemical reactions and transports materials. Protein is used for muscle repair for all athletes, particularly weightlifters. Athletes have higher protein needs due to the need for muscle repair after training and competition. Athletes should consume 1.2–1.7 g per kg of body weight approximately; however, this will depend on the individual and their sport. Endurance athletes also require high levels of protein as events over two hours will start to lead to micro tears in the muscles and protein is needed to aid muscle repair. Protein along with carbohydrates, can assist in greater glycogen resynthesis as protein can stimulate glucose uptake in skeletal muscle tissue making the intake of carbohydrate and protein post-performance beneficial for athletes.

FIGURE 9.4 Eggs are a good source of protein.

Creatine

When the glycolytic system runs out of creatine phosphate, for ATP to be replenished, glucose is required. Athletes in sports relying on this energy system need carbohydrates to sustain performance.

For example, using the ATP-PCr system for a 100 m sprint requires a fuel source of **phosphocreatine (PCr)**. ATP and creatine phosphate combine to produce energy. ATP is used and then resynthesised using creatine phosphate to create more ATP.

fats the most concentrated form of energy for ATP resynthesis

protein an essential component of a balanced diet. Protein allows for muscle growth and repair, fights disease, helps chemical reactions and transports materials.

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

If athletes do not consume enough creatine phosphate in their diet, then supplements may be needed. Additionally, supplements are often needed for high intensity sports such as sprinting and weightlifting. Creatine is found in meat, fish and poultry. Increasing the amount of meat, fish and poultry can assist performance for these athletes.

TABLE 9.1 The Australian Institute of Sport guidelines for eating before performances

Time before performance	Examples of foods
3–4 hours	This is the time frame to have a meal. Aim to mix your protein with some carbohydrate and fruit or vegetables; e.g. baked beans on toast, cereal and milk, a bread roll with a banana, or pasta or rice with vegetables and a low-fat sauce.
1–2 hours	Now is the time for a snack. Stick to fruit or a small amount of carbohydrates; e.g. a fruit smoothie, yogurt, banana, pear, orange or cereal bar.
Less than 1 hour	Avoid anything that is too heavy with a lot of protein, fat or fibre. You need sugar and some carbohydrate to fuel your body, so try a sports drink, lollies, cordial or sports bar with less than 15 grams of protein.

Carbohydrate loading

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.

FIGURE 9.5 Carbohydrates are an essential fuel source for all athletes.

Endurance sports will benefit from carbohydrate loading as carbohydrates are the main fuel source for the aerobic energy system. The carbohydrates are broken down into glucose and with carbohydrate loading, excess glucose is stored in muscle and the liver as glycogen. When needed, the body will break down the glycogen stores to glucose which will be transported to the muscles and converted to energy.

Proper carbohydrate loading increases muscle and liver glycogen, thus boosting endurance and improving performance by about 2–3 per cent. This makes it an effective key pre-competition strategy for triathlons, marathons, cycling and endurance swimming.

Tapering

Reducing training for 2–4 days before a competition helps maximise glycogen stores. To make carbohydrate loading effective, athletes must taper their training before the event. Tapering means reducing the training load which includes the intensity, frequency and duration of training. If they continue high-intensity training, glycogen stores will be depleted, making carbohydrate loading ineffective.

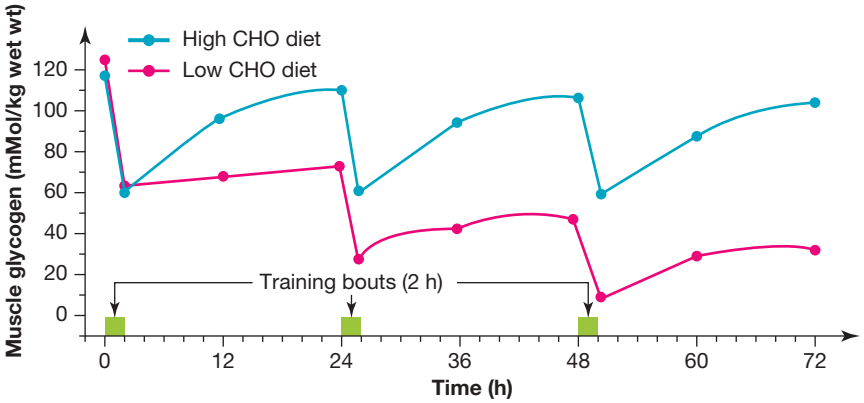
During endurance events, glycogen stores can drop to very low levels, reducing power output and perhaps skill. Starting with high muscle glycogen can delay this fatigue. Carbohydrate loading increases muscle glycogen by 50–100 per cent above normal resting values. This can potentially enhance endurance by 20 per cent or, in fixed distance events, an improved race time of 2–3 per cent. It may also help maintain skill and movement patterns in long team games.

carbohydrate loading the manipulation of training and nutrition prior to endurance events to maximise muscle glycogen (carbohydrate) stores

Carbohydrate loading strategies have evolved significantly over the last 30 years. Recent evidence shows that well-trained athletes can achieve optimal muscle glycogen levels by combining exercise tapering with a high carbohydrate intake (7–12 g per kg of body weight). In most cases, 36–72 hours will be required to fully carbohydrate load.

Carbohydrate loading for endurance events has the benefit of delaying the point at which the muscles being repeatedly used run out of fuel. The effects of high muscle glycogen content as a result of carbohydrate loading compared to the effects of low glycogen content as a result of low carbohydrate intake can be seen in figure 9.6.

FIGURE 9.6 High carbohydrate diets have a positive effect on muscle glycogen levels and the benefits can last well into endurance events.



Carbohydrate loading for endurance and ultra-endurance events

For endurance events, the athlete needs to aim for a daily carbohydrate intake of 7–12 g per kg body mass over the period of loading.

For example, an athlete weighing 65 kg might aim for a daily carbohydrate intake ranging from 455 g to 780 g. The following meal plan provides a guide to such targets.

TABLE 9.2 Carbohydrate loading for endurance and ultra-endurance events

Timing	Food item and carbohydrate content
Breakfast	2 cups wholegrain cereal 50 g 1 cup skim milk 15 g 2 large wholegrain pieces of toast 40 g 1 tablespoon jam or peanut butter 14 g 1 glass juice 25 g
Snack	1 serve protein powder drink 44 g 1 cup skim milk 15 g
Lunch	2 wholegrain rolls with salad 60 g 1 banana 20 g 1 tub low-fat yoghurt 26 g
Snack	1 sports bar 42 g 600 ml sports drink 36 g
Dinner	3 cups cooked wholemeal pasta with tomato-based sauce 120 g 1 slice bread 15 g
Snack	250 g tinned fruit 35 g 3 scoops low-fat ice cream 30 g
Approximate carbohydrate total	587 g

Source: © Australian Sports Commission, from *Current Concepts in Sports Nutrition* by Dr Louise Burke et al., p. 20, found via www.ausport.gov.au.

9.2.3 During performance

Training or sports performance lasting longer than 60 minutes will require an intake of carbohydrates to replenish blood glucose levels and delay fatigue. Current recommendations suggest 30 g to 60 g of carbohydrate and should consist of high GI carbohydrates such as lollies, sports gels and bananas for a faster breakdown of glycogen and release of glucose into the bloodstream and to working muscles.

FIGURE 9.7 Sports drinks are good sources of hydration for athletes.

Endurance events, particularly in hot and possibly humid conditions, can have a significant impact on the body's fuel and fluid supplies. In these events, the need for carbohydrate and **electrolyte** replacement depends on a number of factors including intensity, duration, humidity, clothing type and individual sweat rates. Electrolytes are salts and minerals, such as sodium, potassium, calcium and magnesium, that are important for many body functions such as chemical breakdown and nerve conduction. Electrolytes can be lost through perspiration during exercise and cause symptoms such as fatigue, headaches, muscle cramps, nausea, tingling in extremities and confusion.

electrolytes salts and minerals, such as sodium, potassium, calcium and magnesium, that are important for many body functions such as chemical breakdown and nerve conduction. Electrolytes can be lost through perspiration during exercise.

Dietary considerations during performances aim to conserve muscle glycogen and maintain blood glucose levels and electrolytes.

Some dietary considerations during performance may include:

- Carbohydrate supplementation is needed to avoid glycogen depletion. At exercise intensities above 75 per cent of aerobic capacity, liquid carbohydrate feeding (sports drinks) can delay glycogen depletion by up to 30 minutes.
- Glycogen supplementation is not needed for low-intensity, short-duration exercise such as sprinting.
- Adequate hydration by regular fluid intake must be maintained. Athletes should have a fluid replacement plan that matches their body's requirements and the exercise duration and intensity. It is suggested that 200–300 mL of fluid, preferably in the form of a sports drink, be taken every 15–20 minutes during exercise. Sports drinks contain liquid carbohydrates and can both hydrate and energise.
- When planning hydration requirements, it is important to understand the environmental factors and typical sweat losses for athletes. For example, hotter conditions are going to increase sweat rate, requiring a higher intake of fluids to maintain hydration.
- Not all sports will require snacks during performance; for example, sprinting. However, if back-to-back heats are required, a carbohydrate mouth rinse may be suggested. Using a carbohydrate mouth-rinse may boost performance without needing to eat any carbohydrates. This is great for short, intense events where eating is not easy or comfortable.

9.2.4 Post-performance

Post-performance dietary requirements aim to return the body to its pre-event state as quickly as possible, enabling full training to resume in preparation for the next phase of competition.

This is best achieved through **proactive recovery**, which emphasises immediate refuelling and rehydration which continues until a pre-event state is obtained. This means that refuelling and rehydrating begins immediately and continues for 8–12 hours following the performance. This enables optimisation of body repair and regeneration processes.

Post-performance dietary requirements will depend on the type of sport, intensity, duration and individual preferences of the athlete.

The aim of post-performance dietary intake is to:

- replenish glycogen stores
- replace lost fluids
- promote muscle recovery, repair and growth
- assist in increasing performance
- support immune function.

If a post-performance diet is not followed, the athlete may experience:

- increased fatigue
- reduced performance during training or competition
- increased muscle soreness and fatigue
- lack of training gains.

proactive recovery emphasises immediate refuelling and rehydration that continues until a pre-event state is obtained

In general, foods should be rich in carbohydrates to replenish muscle fuel stores, contain lean protein for muscle repair and include a source of fluid and electrolytes to rehydrate effectively.

According to Sports Dieticians Australia, post-performance meal suggestions for athletes may include:

- bowl of muesli with yoghurt and berries
- lean chicken and salad roll
- fresh fruit salad with Greek yoghurt
- spaghetti with lean beef bolognaise sauce
- chicken burrito with salad and cheese
- small tin of tuna on crackers and a banana.

FIGURE 9.8 Spaghetti can be an optimal source of carbohydrates to refuel after competition.

9.2.5 Fluid intake requirements

Athletes competing in competitions or events should drink adequate fluid in the days beforehand, particularly for an endurance event such as a marathon or triathlon. This increases the body's weight, especially if glycogen has been increased in the diet (because each gram of glycogen stores 2.6 grams of water with it). Many coaches now monitor the weight levels of athletes before endurance events to ensure adequate pre-event hydration suited to the individual athlete. As a general rule, 500–600 mL of fluid should be consumed in the 2–3 hour period prior to endurance performance and 250–300 mL in the last quarter-hour.

FIGURE 9.9 There are a variety of sports drinks to suit performance requirements.

The amount and timing of fluid intake depends on each individual's needs and the rules and regulations of the sport. For example, some recommendations include:

- begin exercise well-hydrated to reduce the risk of dehydration
- aim for pale, yellow urine as a sign of good hydration
- avoid drinking too much fluid before and during exercise to prevent frequent urination and stomach issues
- after exercising, replace 125–150 per cent of the fluids lost through sweat and urine over the next 4–6 hours
- drink fluids with salty recovery snacks (e.g. cereal, bread, Vegemite, milk) to help your body rehydrate effectively.

9.2.6 Dietary requirements of different sports

While all athletes require the essential macronutrients and micronutrients for daily training, rest and recovery; there are some key differences when it comes to pre-performance, during performance and post-performance dietary requirements in different sports. Table 9.3 compares two different sports and their dietary requirements.

TABLE 9.3 Dietary requirements for different sports

Sport	Pre-performance	During performance	Post-performance

AFL	• Small increase in carbohydrates in the 24 hours prior to competition; e.g. adding a banana at breakfast.
	• Last meal 3–4 hours before competition focusing on carbohydrates.
	• Meal ideas may include:
	  • muesli/banana/yoghurt
	  • sandwich with ham/salad
	  • chicken and vegetable stirfry with rice.
	• A light high GI carbohydrate snack to top up glycogen stores 1–2 hours before competition. Examples include:
	  • smoothie
	  • muesli bar and fruit
	  • low-fat fruit muffin.
		• During the game, players can top up their glucose levels which can be done via sports drinks or gels. In longer breaks, fruit or crackers could be consumed. These should be high GI for a fast release of glucose to working muscles.
		• Fluid intake is also important, consisting of water and sports drinks.
			• In the 30-min post-performance, athletes should aim to consume snacks to aid recovery. This should include a high GI, protein snack. Examples may include:
			  • flavoured milk
			  • protein shake.

Triathlon	• Pre-event meals should be consumed 1–2 hours prior to competition. Meals should include low GI carbohydrates, including:
	  • cereal
	  • porridge
	  • toast
	  • sandwiches.
	• A small high GI snack such as a banana can be consumed 30 min before performance to further boost glycogen stores.
		• For events lasting 40–75 mins, only small amounts of carbohydrate are needed. This can be achieved with an intake of 20–30 g of carbohydrate per hour or via carbohydrate mouth rinse (see below).
		• For events from 75–180 mins in duration, intake of 30–60 g of carbohydrate per hour is recommended.
		• Triathlons lasting longer than an hour will require carbohydrate intake. These carbohydrates should be high GI for fast release of glucose.
		• Examples may include:
		  • sports gels
		  • sports drinks
		  • bananas
		  • sports bars.
			• Carbohydrate stores are important to replenish for optimal recovery along with protein for muscle repair. Examples of meals may include:
			• fruit smoothies or milkshakes
			• long-life liquid meal replacement tetras
			• eggs or beans on toast
			• sandwich/wrap/roll filled with meat and salad
			• cereal or porridge with nuts and yoghurt.

Source: Adapted from https://www.sportsdietitians.com.au/factsheets/food-for-your-sport.

DEPTH STUDY IDEA

Invite an elite athlete to your school. It could be an ex-student who trains regularly and enters higher-level competitions. Ask them questions about their training regime, dietary requirements, and pre-event, during event and post-event strategies and practices. Make notes and summarise your findings.

9.2 ACTIVITIES

Dietary requirements of different sports

1. Draw an enlarged copy of the following table into your workbook. Use the weblink **Food for your sport** in the Resources panel.
   Choose three sports that are different in their dietary requirements and performance needs. Choices may include sports such as marathons, sprinting, discus throwing and basketball. Use the table to compare the pre-, during and post-performance dietary requirements for athletes competing in these events.

	Pre-performance	During performance	Post-performance
Sport 1			
Sport 2			
Sport 3			

Sports confectionary

2. Use the **Sports Confectionary** weblink in the Resources panel to research the benefits of sports confectionary for endurance athletes.

Performance diet plan

3. Research a sport of your choice. Prepare a fact sheet of a diet plan including pre-performance, during performance and post-performance requirements. Include some sample recipes.

Class discussion

4. 'Why is it more beneficial to consume foods rich in macronutrients and micronutrients instead of taking supplements?'

Carbohydrate loading

5. Prepare a report discussing the benefits and limitations of carbohydrate loading. Use research to support your report.

on Resources

Weblinks Sports Confectionary
Food for your sport

9.2 Exercises

learnon

9.2 Quick quiz on | **9.2 Exercise**

Learning pathways

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

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Revise your knowledge

1. Identify examples of foods an athlete could consume for each of the following:
   a. carbohydrates
   b. protein
   c. fats
2. What is carbohydrate loading?
3. Describe proactive recovery and explain how it can help performance.
4. What are some recommendations for fluid intake for athletes?
5. Identify the basic differences between a pre-event and post-event dietary intake for endurance athletes.

Apply your knowledge

6. For a sport of your choice, explain the effects on performance of not meeting dietary requirements.
7. Why is carbohydrate loading recommended for endurance athletes, and how is it best achieved? What role does tapering play in this process?
8. Compare the dietary requirements of athletes in TWO sports that use different energy systems.
9. Explain the effect on recovery and performance if an athlete has inadequate post-performance food and fluid intake.
10. Many high-performance athletes will seek dietary advice from a sports dietician. Discuss the benefits of this for the athlete's performance.

9.2 Exam questions

Question 1 (3 marks)
Outline the importance of carbohydrates for endurance events.

Question 2 (5 marks)
Discuss why carbohydrate loading could improve performance for a triathlete.

Question 3 (6 marks)
Compare the dietary requirements of athletes in two different sports. Provide relevant examples.

Question 4 (8 marks)
Explain the importance of hydration for athletes. Provide examples.

Question 5 (8 marks)
Analyse the dietary requirements (pre, during and post-performance) of athletes from different sports.

9.3 Sleep, nutrition and hydration

Syllabus: Explain how sleep, nutrition and hydration can be used to reduce fatigue and positively influence movement and injury prevention

Including:
- guidelines
- planning
- routines
- monitoring

Sleep, nutrition and hydration are all essential elements for athletes that assist in reducing fatigue while also positively influencing movement and injury prevention.

FIGURE 9.10 For improved performance, athletes require optimal sleep, nutrition and hydration.

9.3.1 Sleep

For both athletes and non-athletes, sleep is essential for overall health and wellbeing. Sleep plays a key role in reducing fatigue, positively influencing movement and preventing injuries.

FIGURE 9.11 Sleep is essential in reducing fatigue.

Most athletes will experience **fatigue** at some point during training and competition. Fatigue is an extreme feeling of tiredness along with a lack of energy that can interfere with the body's ability to sustain movement. Fatigue can result from:
- a lack of sleep and rest
- increases in the amount or intensity of training
- stress
- a lack of macronutrients and micronutrients, in particular carbohydrates and iron.

One of the key strategies athletes can use to reduce fatigue is getting enough high-quality sleep. Due to demands of training and competition, athletes should aim for 8–10 hours of sleep per night to allow for optimal rest and recovery.

fatigue an extreme feeling of tiredness along with a lack of energy that can interfere with the body's ability to sustain movement

Sleep allows for the growth and repair of muscles and tissues. During deep sleep, the body secretes growth hormone which is essential for muscle repair and growth. Growth hormone stimulates protein synthesis, which is the process by which the body builds new proteins to repair and grow muscle tissue and is significantly increased during sleep. When athletes are in a state of deep sleep, it enhances their body's ability to produce ATP which is essential in providing energy for their performance.

To help reduce fatigue, some strategies for adequate quantity and quality of sleep include:

- going to bed and waking up at the same time each day
- aiming for 8–10 hours of sleep per night and more if training increases
- taking naps (20–30 mins) if needed during the day after training
- optimising the sleep environment (dark room, eye masks, cool temperature, quietness, comfortable bedding)
- creating a before bed routine, such as doing stretches, meditating, having a warm bath and performing breathing exercises which can help prepare the body for sleep and rest
- limiting stimulants and alcohol as these will interfere with sleep
- avoiding screens as the blue light can suppress melatonin production
- avoiding eating large meals before bed
- consuming a light snack if needed that contains tryptophan (yoghurt, bananas).

Sleep can also help in positively influencing movement when training and during competition.

Sleep can enhance movement in the following ways:

- increased speed for sprinters
- increased accuracy
- increased reaction time
- increased ability to learn new skills and make decisions
- decreased risk of injury
- decreased risk for illness
- slower to exhaustion, which is helpful for endurance athletes and for all athletes to optimise training.

Studies reported by the Sleep Foundation have shown that sleep positively affects athletic movement and performance.

- Basketball players sleeping 10 hours per night could run faster during sprints and improved their shooting by at least 9 per cent for free throws and three-point shots.
- Male and female swimmers sleeping 10 hours per night had faster reaction times off the blocks, faster turns and kick strokes increased.
- Male and female tennis players who had 9 hours of sleep a night increased the accuracy of serves from 36 per cent to 42 per cent.
- Overall, players also had improved physical and mental wellbeing along with a decrease in daytime fatigue.

Additionally, sleep helps prevent injuries in athletes by allowing time for muscle repair and growth, which helps athletes recover from training. Sleep helps repair tissues, including muscles, tendons and ligaments, thereby reducing the risk of injuries caused by fatigue and overuse, such as stress fractures, strains, sprains and tendonitis.

Adequate sleep restores the nervous system which helps improve reaction time, reducing the likelihood of accidents, poor technique or collisions, especially in team sports such as soccer, AFL, hockey, netball and basketball.

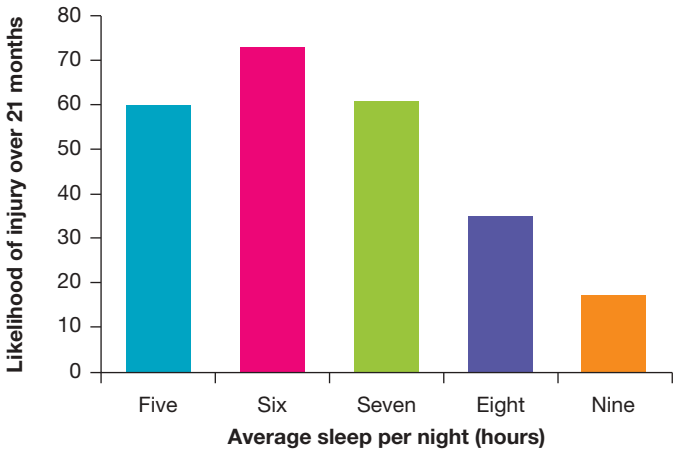
FIGURE 9.12 Getting enough sleep can improve your sporting performance.

Sleep also helps regulate cortisol levels. Elevated cortisol levels can interfere with recovery and increase inflammation which makes the body more susceptible to injury.

Additionally, sleep enhances focus, concentration, motivation and mood. Well-rested athletes are also more likely to follow injury prevention strategies such as warming up, stretching and staying hydrated.

Figure 9.13 shows the likelihood of injury based on hours of sleep per night.

FIGURE 9.13 Likelihood of injury based on hours of sleep per night.



Source: Based on graph taken from Journal of Pediatric Orthopedics, 34(2) Chronic Lack of Sleep is Associated with Increased Sports Injuries in Adolescent Athletes, p 129-133, content reviewed in 2025.

Overall, sleep is essential in reducing fatigue, positively influencing movement and preventing injuries.

CASE STUDY 2

Some Australian Open matches run extremely late. How would that impact player sleep and recovery?

By ***Nicholas Saner, Post-doctoral researcher in sleep science, Victoria University and Olivia Knowles, High Performance Manager, Hawthorn FC, and Researcher, Deakin University***

24 January 2024

For many Australians, January is synonymous with late nights spent watching the Australian Open tennis tournament. These night matches are a great spectacle, and many players consider the prime time slot on centre court as a privilege and reward for their hard work.

An early highlight of this year's tournament was the men's third seed Daniil Medvedev playing out a five-set thriller against unseeded Emil Ruusuvuori, with the match finishing at nearly 4 am. Less than 48 hours later, Medvedev followed this up by winning his next round match.

In Medvedev's post-match interview, he discussed recovery and preparation strategies after the previous late-night finish. This included ice baths, medical treatment and physio work before finally going to bed at around 7 am, managing to get five hours of sleep.

Similarly, the first round match for women's number two seed, Aryna Sabalenka, didn't start until almost midnight.

As sleep scientists, we know limited and disrupted sleep opportunities can impact the body. So what do these late nights and lack of sleep mean for players' recovery and performance?

Why a lack of sleep is bad for your muscles

The function of sleep is still not well understood, despite us spending close to a third of our life asleep. While we do know that sleeping less than six hours a night is linked to the increased risk of several chronic diseases, there is still much to investigate.

Several recent studies we've worked on have demonstrated the importance of sleep for optimal muscle function. For example, one night of sleep deprivation (pulling an 'all-nighter') or repeated nights of short sleep actually impair the muscles' ability to make new proteins, which is essential for repair and recovery.

Furthermore, other recent research suggests that a period of sleep loss (five nights, with four hours of sleep each night) can reduce mitochondrial function within your muscles. Mitochondria are known as the 'powerhouses of the cell' and are responsible for producing the energy needed to exercise – and win a tennis match.

Therefore, the lack of sleep tennis players experience after such late-night finishes may well impact their recovery and subsequent performance.

Sleep loss directly affects athletic performance

It is well accepted that sleep loss negatively impacts cognitive function and decision making. While the data is not definitive, there are also several studies that show sleep loss impacts athletic performance.

A recent study in healthy young women accustomed to resistance exercise found that when they performed their weights session after several nights of restricted sleep, the quality and volume of their performance was reduced. The effort it took to complete the session increased, too.

Losing sleep is also detrimental to anaerobic power and skill execution – both of which are critical for Australian Open hopefuls. One study found a decline in tennis serving accuracy with only five hours of sleep, while another found a decline in maximal power output.

Exercise can help you sleep – but it depends

It is a widely held belief that exercise improves sleep. However, falling asleep shortly after completing an adrenaline-fuelled, high-intensity tennis match is not always easy.

Indeed, a recent study investigated the impact of high-intensity exercise on sleep quality. When the high-intensity exercise was performed in the early afternoon, deep sleep was improved. But when participants exercised shortly before bed, their sleep quality diminished.

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Can players prepare to handle late-night matches?

Some players have voiced their concerns regarding late-night matches. But other players suggest it's just part of the game. So what can a player do to prepare for the sleep disruption?

Professional athletes have a number of strategies available. For example, napping has myriad benefits for both cognitive function and physical performance.

A popular supplement, caffeine, has consistently been shown to improve physical performance and alertness. While endurance exercise has shown the largest performance benefits from caffeine, small to moderate improvements have been shown in muscle strength, sprinting, jumping and throwing performance.

However, caffeine can be detrimental to subsequent sleep. While athletes preparing for late matches might have an evening caffeine hit, the average Australian should avoid drinking coffee after 3 pm.

Increasing sleep duration in the week leading up to late-night matches can also help. Studies have shown that sleep extension increases tennis serving and basketball free throw accuracy almost 10%. Increasing sleep duration could really be the difference between hitting a winner or an unforced error.

Source: Saner, N. & Knowles, O. (2024), 'Some Australian Open matches run extremely late. How would that impact player sleep and recovery?'. *The Conversation*, 24 January, https://theconversation.com/some-australian-open-matches-run-extremely-late-how-would-that-impact-player-sleep-and-recovery-221591.

Case study questions

1. How do late-night matches affect the sleep patterns and overall recovery of professional tennis players?
2. What strategies can athletes use to mitigate the negative impact of disrupted sleep after late matches?

9.3.2 Nutrition

Nutrition is essential for athletes in managing fatigue and positively influencing movement and injury prevention. Insufficient intake of macronutrients (carbohydrates, protein and fats) can lead to fatigue.

Insufficient carbohydrates can lead to low glycogen stores, leading to fatigue, lack of energy to train, poor movement and subsequently predispose the athlete to injuries. For example, an NRL player with an insufficient carbohydrate intake will lack adequate glycogen stores for training. If fatigue sets in during training, poor movement in a tackle could result in injury.

FIGURE 9.14 Athletes need to meet the energy demands of their sport to avoid injury.

Athletes frequently encounter challenges in meeting the energy demands of their respective sports. Elevated training loads require increased caloric intake, yet many athletes, particularly females, fail to consume adequate quantities of carbohydrates. The need to maintain a specific body weight, as seen in sports such as wrestling, judo, boxing, taekwondo and gymnastics, may restrict energy intake despite the ongoing high training volumes, resulting in fatigue. For instance, gymnasts may experience an increased risk of injury due to muscle fatigue, which arises from insufficient glucose availability for ATP production, ultimately impairing muscle contraction.

Insufficient iron intake can also lead to fatigue, particularly in female athletes due to menstruation and children and adolescent athletes going through muscle growth and development. Iron is a crucial component of haemoglobin, the protein in red blood cells responsible for carrying oxygen from the lungs to tissues and muscles. When iron deficiency occurs, the body's ability to transport oxygen to muscle tissues is compromised, which significantly limits aerobic capacity and endurance. As a result, muscles do not receive sufficient oxygen during physical activity, leading to early onset fatigue and reduced performance. It is important for athletes to consume red meat or alternative iron sources such as mushrooms, dark leafy green vegetables, nuts and seeds to meet their recommended iron intake.

Nutrition impacts sleep quality. High-fat and high-sugar foods, low-tryptophan foods, low-fibre diets, alcohol and caffeine consumption can lead to poor sleep quality as these foods are harder to digest. Symptoms may include bloating and indigestion which can impact sleep. For better sleep, foods such as milk, cheese, eggs, bread, beans, cherries and oily fish may help. Excessive caffeine intake can interfere with sleep, causing chronic tiredness and fatigue. One of the reasons for this is that caffeine stimulates the central nervous system, increasing the production of neurotransmitters like dopamine and norepinephrine. These chemicals are involved in wakefulness and alertness, leading to increased energy and focus making it harder to sleep.

Athletes should ensure their diets are rich in calcium and vitamin D to strengthen bones and reduce the risk of stress injuries and fractures. Recommended foods include milk, cheese, yogurt, eggs and oily fish. Supplements may also be beneficial if dietary intake is too low.

Healthy fats reduce inflammation, produce energy, and keep ligaments and tendons flexible, easing movement. Fats help reduce fatigue in endurance athletes by supplementing energy production. Stored as triglycerides, fats serve as a fuel source similar to glycogen. Good sources of healthy fats include avocados, nuts, seeds, olive oil and oily fish.

Protein is essential for muscle repair as well as helping to build more muscle, making them stronger, which is important for the prevention of injury. A lack of protein can also contribute to fatigue and lack of energy. Animal sources include lean meats, poultry, eggs, seafood, dairy products and whey protein powders. Plant-based sources include beans, peas, nuts and seeds, legumes and plant-based protein powders.

FIGURE 9.15 Healthy fats are essential for athletes to reduce fatigue, positively influence movement and prevent injury.

CASE STUDY 3

Running on empty: female athletes health and performance at risk from not eating enough

By ***James McKendry, Postdoctoral Research Fellow in exercise physiology, muscle protein metabolism and aging, McMaster University and Mikkel Oxfeldt, PhD Fellow, Department of Public Health, Aarhus University***

15 August 2023

For athletes and highly physically active individuals, a well-planned and executed nutrition and exercise training regimen are critical to maximizing training and pursuing peak performance.

Many people are aware that habitually consuming more calories than is expended can lead to weight gain. It also increases the risk of developing obesity and other metabolic health concerns such as Type 2 diabetes.

However, female athletes and highly active women are at an increased risk of quite the opposite problem; that is, not eating enough.

When energy intake is reduced by too much for too long, or not increased to match the demands of their training, the consequences for exercise performance, muscles and health can potentially be severe.

Low energy availability

Food provides our bodies with energy to carry out basic bodily processes, such as regulating metabolism and promoting cell repair and growth from exercise training.

When the energy consumed from food becomes insufficient to meet the demands of high physical activity levels in athletes, a state of imbalance occurs called low energy availability. Low energy availability is the underlying cause of the sporting phenomenon known as relative energy deficiency in sport (RED-S).

RED-S refers to a syndrome where several physiological functions outside the context of exercise are impaired. These include metabolic rate, menstrual function and bone health.

While it varies considerably between sports, it is estimated that 25 to 60 per cent of athletic women, consciously or unconsciously, may be in a state of low energy availability.

There are a whole host of reasons why one may be in a state of low energy availability. Mental health issues such as an eating disorder, a desire to achieve a particular body image due to social media pressures, or taking part in weight-sensitive or aesthetic sporting events such as combat sports or gymnastics all increase the risk of low energy availability.

However, it can be extremely difficult to establish the true prevalence of low energy availability or RED-S for several reasons: the symptoms can be subtle, we often rely on self-reported assessments and athletes may wish to hide its presence for sociocultural reasons. There is also no widely established biomarker to screen for RED-S.

Health and performance concerns

In an energy crisis, the body will prepare for a period of starvation — entering 'survival mode' — by trying to preserve as much energy as possible by reducing the most energy-consuming processes.

Low energy availability can disrupt hormones and metabolism in as little as five days. If this persists, long-term energy deprivation can lead to more severe health issues such as menstrual cycle irregularities, impaired bone health and increased risk of injury.

We are a team of muscle physiologists — from Canada and Denmark — who study nutrition and female physiology. We recently conducted a study to understand how low energy availability impacts the muscles and metabolism of female athletes.

We put 30 young, healthy female athletes through an intense exercise training program designed to increase muscle mass and strength, and improve cardiovascular fitness. At the same time, and with their prior informed consent, we controlled their dietary intake and reduced the energy they consumed to around half of what is considered optimal.

In this study, we showed that reducing the energy available for the body for just 10 days impairs the muscle-building response during intense exercise training. It also led to a rapid loss of lean mass, reduced resting metabolic rate (the number of calories burned at rest) and altered thyroid hormones.

We know that protein intake is essential to maximize gains in muscle mass with exercise training. One may think that if the women involved in the study were exercising intensely and consuming enough protein, they would be protected against muscle loss during this energy crisis.

Unfortunately, this was not the case. The negative consequences of low energy availability occurred despite consuming protein at about 2.2 grams per kilogram of lean body mass per day — about twice the recommended daily allowance.

As little as 10 days of low energy availability can have grim consequences for muscle.

Source: McKendry, J. & Oxfeldt, M. (2023), 'Running on empty: female athletes health and performance at risk from not eating enough'. *The Conversation*, 15 August, https://theconversation.com/running-on-empty-female-athletes-health-and-performance-at-risk-from-not-eating-enough-210113.

Case study questions

1. What is RED-S syndrome?
2. Why are female athletes more susceptible to RED-S syndrome?
3. Discuss the effects of RED-S syndrome on performance.
4. Identify some food sources that will best equip the energy needs of female athletes.

9.3.3 Hydration

Hydration involves supplying sufficient water to the body's cells and is essential for athletes to avoid dehydration. **Dehydration** is an excessive loss of water. Symptoms can include headaches, fatigue, dizziness, muscle cramps, weakness, confusion and slow reaction times. Dehydration can also affect sleep by causing the mouth and nasal passages to become dry, increasing the likelihood of snoring.

For athletes, dehydration can lead to an increase in body temperature and heart rate, leading to fatigue. Movement is affected as motor control, decision-making and concentration may be affected.

FIGURE 9.16 Hydration is essential for athletes in reducing fatigue, positively influencing movement and preventing injury.

Deydration can also cause a decreased volume of blood, which means the amount of blood pumped decreases, so muscles don't receive enough oxygen and the athlete starts to fatigue, their movement becomes slower and injuries may occur due to poor technique.

When the body is well hydrated, there is efficient circulation of nutrients and oxygen to muscles, thus helping sustain energy levels. This assists with mental alertness as dehydration can impact cognitive function, leading to lack of concentration and focus. If sports drinks are consumed, electrolyte balance is maintained which prevents muscle cramps and fatigue. Hydration also regulates body temperature, cardiovascular function and energy production which all assist in reducing fatigue.

Hydration helps to positively influence movement as it helps lubricate joints (synovial fluid relies on water to maintain optimal lubrication levels). This assists smoother, comfortable movements and fewer injuries. Adequate hydration also helps maintain muscle and tissue elasticity as dehydrated muscles and tissues become more prone to tears and strains due to lack of elasticity.

Hydration also helps flush toxins and waste products from tissues, and aids in faster recovery and reducing overuse injuries. Adequate hydration helps regulate body temperature, which is essential in preventing heat exhaustion and heatstroke.

hydration involves supplying sufficient water to the body's cells

dehydration an excessive loss of water

The following guidelines and recommendations should be followed by athletes to help reduce fatigue, positively influence movement and prevent injury.

- *Hydrate before, during and after physical activity*. Thirst is not a good indicator of the body's need for fluid; by that time, dehydration has already started to take effect.
- *Drink every 15–20 minutes while running*. A typical runner loses about 0.5 to 1.5 litres of water per hour during a moderate run and this can increase to 1 L to 2.5 L per hour in hot and humid conditions.
- *Drink water or low-carbohydrate concentration sports drinks*. Cool plain water or sports drinks that have 4–8 per cent carbohydrate concentration are recommended. Concentrations higher than 8 per cent are not recommended because they slow the body's absorption rates.
- *Ensure that you have trained properly and acclimatised to race conditions*. Trained and acclimatised athletes are able to control their body temperature more effectively than those who are untrained and who have failed to acclimatise.
- *Wear clothing that 'breathes'*. Light 'airy' clothing promotes heat loss through convection and evaporation.
- *Avoid activity in times of high temperature and high humidity*. Exercise is considered safe when the temperature is below 30 °C and the relative humidity is below 90 per cent.

- *Do not run if suffering from fever*. The core body temperature is already elevated during fever, and physical activity increases the body temperature and endangers the athlete's life.
- *Learn to recognise the symptoms of heat stress*. The symptoms are chilling, unsteadiness, dry skin, loss of focus and profuse sweating.

FIGURE 9.17 Athletes should maintain hydration throughout training and competition.

9.3.4 How sleep, nutrition and hydration can reduce fatigue, positively influence movement and prevent injury

To improve performance, athletes should follow sleep, nutrition, and hydration guidelines specific to their sport. Planning is crucial to ensure these guidelines are met alongside training. Establishing routines helps athletes consistently meet their sleep, nutrition and hydration needs.

Athletes should systematically track key factors such as sleep, nutrition and hydration using tools like diaries, logbooks, mobile applications and monitoring devices. By assessing both the quantity and quality of sleep, as well as daily nutritional and hydration intake, athletes can collaborate with qualified professionals, such as accredited sports dietitians, to identify potential factors influencing performance. This monitoring process allows for the evaluation of whether any adjustments are necessary to optimise performance and address any contributing issues.

TABLE 9.4 An example of guidelines, planning, routines and monitoring strategies for athletes

	Guidelines	Planning	Routines	Monitoring
Sleep	8–10 hours of sleep as a guide. May be more during intense training. Deep sleep and REM sleep are important for optimal recovery and cognitive functioning.	Schedule naps (20–30 mins). Late games; e.g. NRL players, tennis players, which can impact sleep patterns. Travel Scheduling of events; e.g. back-to-back matches.	Consistent schedule of sleep and wake-up time. Pre-sleep routine of relaxation, stretching, deep breathing. Avoid screens 1 hour before bedtime.	Sleep monitors Athletes should log training performance, fatigue levels, and recovery status for better understanding of how sleep, nutrition, and hydration affect overall performance.

Nutrition	Minimise caffeine intake before bed. Ensure a balance of macronutrients: 45–65% carbohydrates, 15–25% protein and 20–35% fat. 3–4 meals per day with snacks to keep glycogen stores optimised for energy maintenance and recovery. Ensure meals rich in carbohydrates and protein before and after training to replenish glycogen stores and repair muscles.	Athletes should plan and prepare their meals the day before to ensure their daily energy intake is from sources providing optimal nutrition for their energy and performance needs. Athletes may work with a nutritionist and dietician to ensure they are receiving the amounts of macronutrients and micronutrients their body needs to optimise movement, reduce fatigue and limit injuries.	Planning their diet and meal plans along with their training and competition planning will assist in optimising nutrient intake. For example, having a routine of scheduled meals and snacks before and after training and performance will assist in optimising intake of macronutrients to maximise energy levels and minimise fatigue.	Athletes can work with a nutritionist and dietician. Use apps to track nutrient intake. Keep track of energy levels, endurance and recovery times.
Hydration	The general recommendation for athletes is 3.7 litres/day for men and 2.7 litres/day for women, but this varies with training intensity and climate. It's important that athletes hydrate pre-performance, during performance and post-performance. For endurance events, sports drinks will be beneficial in replenishing glycogen stores and hydration levels for energy and to optimise movement and minimise fatigue.	Athletes should plan their drink breaks throughout the day, which may mean an increase in water intake depending on the weather. For example, more water will be required in hot conditions. For endurance athletes, planning to consume sports drinks containing carbohydrates and electrolytes is important.	Drink 400–600 mL of water 2–3 hours before exercise and 200–300 mL 30 minutes before starting. Have a pre-performance, during performance and post-performance hydration routine with the type of fluid; e.g. water or sports drinks, and amount needed.	Athletes can monitor fluid intake using water bottles, measuring and monitoring fluid intake by ml/L. Hydration apps to log water intake and set reminders. Sweat rate monitoring. Athletes will weigh before and after training or performance which will help estimate fluid loss. Urine colour. The lighter the colour, the more hydrated the athlete is and the darker the colour indicates dehydration.

The following is an example of a how an athlete may plan for sleep, nutrition and hydration in a day.

Morning

- 6.00 am wake up and drink 500 mL of water. Drink 500 mL of water to rehydrate the body after sleep. A pinch of sea salt or a squeeze of lemon can be added for electrolytes and to stimulate digestion.
- 7.00 am breakfast (should include essential macronutrients; for example, oats with berries, boiled eggs with spinach and avocado on wholegrain toast)
- 8.00 am training (specific to sport)
- 9.30 am post-training snack (protein and carbohydrates such as a protein shake with whey protein (about 20–25 g of protein) and a banana [natural carbohydrates to replenish glycogen stores]) and rehydrate with 250–300 mL of water or an electrolyte drink

Afternoon

- 12.00 pm lunch (May include grilled chicken breast [protein] with a side of quinoa [carbohydrates] and a mixed salad with olive oil and balsamic vinegar [healthy fats]. A side of steamed broccoli or roasted sweet potatoes for additional fibre and micronutrients.)
- 1.30 pm light nap (20–30 minutes which can help improve cognitive function and energy levels for the rest of the day)
- 3.00 pm snack (such as Greek yogurt [protein] with a handful of mixed nuts [healthy fats] and a drizzle of honey [natural sugars] to top up glycogen stores for afternoon training)
- 4.00 pm training (specific to sport or the training session could be a lighter activity, such as a 45-minute yoga session, swimming, or a moderate-intensity cycling workout)
- 5.30 pm post-training snack + rehydrate (500 mL of water or an electrolyte drink if needed. A snack including some protein and carbohydrates, for example a protein shake and a banana to replenish glycogen stores and support muscle recovery.)

Evening

- 7.00 pm dinner (for example, grilled chicken, sweet potato, vegetables and avocado for muscle recovery and repair)
- 8.30 pm relaxation activity for sleep and rest (for example, deep breathing, meditation or yoga)
- 9.30 pm sleep, aiming for 7–9 hours for physical and mental recovery

FIGURE 9.18 Athletes need to plan pre- and post-training snacks throughout their day.

DEPTH STUDY IDEA

Review the sleep, nutritional and hydration needs of a Tour de France cyclist.

Prepare content in the form of an online sports magazine or podcast.

Information should effectively explain how sleep, nutrition and hydration can be used to reduce fatigue, positively influence movement and injury prevention for this endurance event.

EXAM TIP

Analyse the pre, during and post-performance needs of the athlete

It is important to make a clear distinction between the timing, volume and choice of nutrition to best support performance in an exam question. Address this in regard to the energy needs of the athlete (based on the predominately used energy system), the choice of macro/micro nutrients, examples of food sources and the impacts on performance.

For example, *a cyclist in the Tour de France would need to have ongoing carbohydrate intake during the race to replenish glycogen stores. This will help in reducing fatigue as a result of depleted glycogen stores. During the race the cyclist could consume energy bars or carbohydrate gels that are easy to consume at roughly the rate of 80 g to 120 g per hour of carbohydrates and intake 500 mL to a litre of electrolyte-based water every hour. This will allow the cyclist to utilise glycogen and maintain hydration for aerobic and anaerobic glycolysis during this long event to sustain energy to major muscle groups.*

It is important to show a clear relationship between the intensity and duration of the sport, and how this affects the energy needed. Link this to the appropriate fuel sources to enhance performance, and consider the timing of consumption (particularly relevant to pre and during nutrition). A common mistake is to ignore the importance of rehydrating and considering fluid intake which is a critical factor as hydrating adequately with water and electrolyte drinks assists in reducing muscle cramping and increasing blood volume.

9.3 ACTIVITIES

Swimmer's routine

1. Use the weblink **Swimmers routine** in the Resources panel to watch an example of a swimmers routine (heats in the morning and finals in the evening). Discuss the routine in terms of pre-, during and post-performance dietary needs.

Sleep for athletes

2. Use the **Sleep** weblink in the Resources panel to answer the following questions.
   - **a.** In general, how much sleep is needed for athletes?
   - **b.** What factors may contribute to poor sleep for athletes?
   - **c.** Discuss the benefits of napping for athletes.
   - **d.** Outline some sleep recommendations for athletes.

Sleep diary

3. Keep a diary for one week, tracking your sleep duration and quality of sleep.

   Include the following:
   - Guidelines for your age group
   - Planning of the week to factor in sleep and wake up times
   - Routines (factor in a before bed sleep routine; e.g. stretches, bath, meditation, no screens)
   - Monitor: Write a reflection about how you feel each morning and continue to update the diary during the day based on your energy levels and fatigue, mood, focus during class andmovement during sport/exercise).

   At the end of the week, submit your diary and write a reflection to explain how sleep impacted your fatigue and movement during the week.

Meal planning

4. Work in pairs to use the **Food for sport** weblinks in the Resources panel to select a sport. Prepare a daily or weekly meal plan for an athlete in the chosen sport. The following should be addressed:
   - **a.** Meals and snacks (include details of the meal and providing a brief explanation why the selected food/s and timing of the meal has been chosen for the athlete).
   - **b.** Hydration (include type of fluid and provide a brief explanation for the fluid, amount and timing).
   - **c.** Include sleep, training and competition.
   - **d.** Justify your selection of dietary requirements for your chosen sport. For example, how do they support performance for the chosen sport?

on Resources

Weblinks Swimmers routine
Sleep
Food for sport (3 options)

9.3 Exercises

learnon

9.3 Quick quiz on | **9.3 Exercise**

Learning pathways

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

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Revise your knowledge

1. What are some benefits of proper nutrition for athletes?
2. What is the number of hours of sleep an athlete should aim for each night?
3. Provide examples of strategies athletes can use for improved quality of sleep.
4. Explain the impacts of dehydration on sporting performance.
5. Provide some examples of hydration guidelines for athletes.

Apply your knowledge

6. Discuss some of the reasons why athletes may not be meeting the energy demands for their sport.
7. Explain how hydration can:
   a. reduce fatigue
   b. positively influence movement
   c. prevent injury.
8. What sleep-related considerations should a tennis player keep in mind during a Grand Slam tournament?
9. Explain how fats and protein can positively influence movement and reduce injury. Provide a sporting example to show your understanding.
10. Scenario:
    Joe is a talented athlete who has been playing hockey for five years. He has excellent reaction time, speed and the ability to make quick decisions and communicate with his team. Over the last few months, Joe's performance has begun to deteriorate with slower reaction time, lack of speed and lack of focus during games. In his last game, while dribbling with the ball towards the goal, he became dizzy and tripped over, falling to the ground and sustaining an ankle strain.
    After reading the scenario, consider the following factors:
    Nutrition: *Joe has recently become a vegetarian*
    Sleep: *5–6 hours of sleep per night due to his studying commitments*
    Hydration: *He has only been drinking when thirsty*
    a. Explain how Joe's nutrition, sleep and hydration may have impacted his energy, movement and the injury sustained in the last game.
    b. Provide recommendations for Joe that he can implement for his nutrition, sleep and hydration and how each can assist in positively influencing his movement, reducing fatigue and preventing injuries.

9.3 Exam questions

Question 1 (3 marks)
Describe symptoms of fatigue on performance.

Question 2 (5 marks)
Outline strategies that athletes may adopt to counteract the effects of dehydration during endurance events.

Question 3 (5 marks)
Discuss how carbohydrates can reduce fatigue for endurance athletes.

Question 4 (6 marks)
Explain how nutrition can help prevent injuries in athletes.

Question 5 (8 marks)
Explain how the quality and duration of sleep can affect an athlete's fatigue levels in relation to movement efficiency and risk of injury

9.4 Supplements, micronutrients, protein, caffeine and creatine products

Syllabus: Discuss the use of supplements, micronutrients, protein, caffeine and creatine products for improved performance

9.4.1 Supplements

supplements products designed to give the body nutrients that might be missing from the diet to meet dietary requirements

Sports foods and supplements can play an important role in an athlete's diet. **Supplements** are products designed to give the body nutrients that might be missing from the diet to meet dietary requirements.

While most athletes will be able to meet their dietary requirements by consuming a range of whole foods, many high-performance athletes with demanding training and competition schedules will require the intake of supplements. Popular supplements include micronutrients (vitamin B12, calcium and iron), protein, caffeine and creatine products.

Performance-enhancing supplements as identified by the AIS Sports Supplement Framework include:

- caffeine
- sodium bicarbonate
- ß-Alanine
- creatine
- dietary nitrate/beetroot juice
- glycerol.

FIGURE 9.19 Athletes often use supplements to enhance performance.

The above supplements should be discussed with an accredited sports dietitian to ensure they meet the athlete's needs.

Supplements may help athletes receive the nutrients their body needs, particularly in the following situations:

- athletes are deficient in a particular nutrient; for example, protein or iron
- female athletes may take iron supplements to increase iron levels due to losses during menstruation
- travelling for competition where food availability may be limited
- to improve sleep quality if needed
- when athletes can't consume enough food for their nutrient needs; for example, protein
- if athletes have food allergies or intolerances to certain foods; for example, dairy or gluten
- dietary preferences; for example, vegetarian or vegan diets may require iron, protein or creatine supplements.

Choosing the right supplements

Athletes need to be aware of possible side effects of consuming too much of a particular supplement.

For example, consuming too much protein can cause symptoms such as dehydration, fatigue, headaches and nausea. It's important to make informed choices in consultation with an accredited sports dietitian and to consider questions such as:

- Will the supplement be effective and/or enhance performance?
- What other ingredients are in the product? (Many supplements may be combined in the form of powders and sports bars.)
- What's the right dosage of the supplement?
- Are there any potential side effects?
- Is the supplement regulated and trustworthy?

FIGURE 9.20 Many athletes will receive enough nutrients to meet their daily needs from a balanced diet.

Athletes also have to adhere to the doping regulations issued by the Australian Sports Anti-Doping Authority (ASADA) and the World Anti-Doping Agency (WADA). Athletes need to ensure supplements consumed adhere to doping regulations and don't contain a banned substance.

Athletes can look at the **ABCD Classification system** on the AIS Sports Supplement Framework. This system sorts sports foods and supplements into four groups based on scientific proof and other factors so it is possible to see if a product is safe, allowed and helps improve sports performance.

9.4.2 Micronutrients

Micronutrients include chemical elements that are required in small amounts for healthy growth and life of cells. These are referred to in our diet as **vitamins** and **minerals**.

The most common micronutrients required by athletes include vitamin B12, iron and calcium. Athletes will often use a multivitamin for a range of vitamins and minerals.

Vitamin B12

Vitamin B12 is a micronutrient that assists in producing red blood cells that transport oxygen to working muscles. Vitamin B12 is especially important for endurance athletes.

Food sources include protein foods such as lean red meat, poultry, eggs, fish, legumes, lentils, nuts and seeds.

Vitamin B12 supplements may improve performance by increasing oxygen supply to muscles as a result of red blood cell development. They may also improve muscle function and increase performance and recovery times as vitamin B12 can assist with the production of the proteins needed for muscle repair.

It's important to note that if an athlete's diet is adequate in vitamin B12, then supplementation isn't required and will provide little benefit as excess vitamin B12 will be excreted.

High doses of vitamin B12 can result in headache, nausea, vomiting and diarrhoea.

vitamins inorganic compounds that are essential to maintaining bodily functions

minerals inorganic substances found in the body that are necessary for the body to function adequately

vitamin B12 a micronutrient that assists in producing red blood cells to transport oxygen to working muscles

Magnesium

Magnesium is a mineral that is essential for healthy muscles, nerves, bones and blood sugar levels. Magnesium plays an important role in muscle contraction, supports energy production and promotes muscle recovery. It can also assist in reducing muscle cramps. Most athletes should meet their recommended magnesium intake from a whole-food diet, such as green leafy vegetables, legumes, nuts and seeds, and wholegrains.

If an athlete requires supplements, they need to ensure they are aware of possible side effects which may include hypotension, muscle weakness, respiratory fatigue and apnoea.

Iron

Iron is a mineral and an essential micronutrient for athletes. Iron is needed to make haemoglobin which is found in red blood cells responsible for carrying oxygen around the body and to working muscles. Depleted haemoglobin levels affect performance because the muscle cells are deprived of oxygen, which is needed to break down the nutrients and produce energy.

FIGURE 9.21 Lean meats, broccoli, eggs, mushrooms, nuts and seeds are all good sources of iron.

The body stores and uses iron but cannot make it and so athletes need to consume foods containing iron. The recommended daily intake of iron for adults is 8 mg per day for males and 18 mg per day for females.

There are two types of iron, haem iron and non-haem iron. Haem iron is easily absorbed and is present in foods such as lean meat, poultry, seafood and organ meats. Non-haem iron is harder for the body to absorb and is found in plant-based sources such as iron fortified cereals, nuts/seeds, dried fruit, legumes, dark leafy green vegetables, mushrooms and tofu.

Symptoms of low iron levels or iron deficiency (anaemia) include fatigue, pale skin, reduced capacity to train and more susceptibility to illness.

Athletes more susceptible to **anaemia** include female athletes due to menstruation, adolescents, endurance and high-impact sports athletes and those consuming a vegetarian or vegan diet.

It's important for athletes to seek advice from a sports nutritionist and dietician. If supplements are needed, care must be taken as some oral iron supplements can cause nausea and constipation. The advice is for supplements to be taken every second day to reduce those symptoms.

Calcium

Calcium is a mineral which is important for strong bones. Calcium plays an important role in muscle contraction, maintaining a regular heartbeat and nerve impulse conduction. Calcium also helps the heart muscles pump and transmits signals to the nerves for muscle contraction. The Australian recommended dietary intakes (RDI) for calcium for 19–50-year-old males and females is 1000 mg/day. Higher intake of calcium is needed for adolescent athletes due to bone growth and development.

Good sources of calcium include reduced-fat dairy products such as cheese, milk and yoghurt, tofu, fortified nut milks, soy milk, canned salmon with bones, fortified breads and cereals, milo, egg, baby spinach, almonds and broccoli.

magnesium a mineral that is essential for healthy muscles, nerves, bones and blood sugar levels

iron a mineral naturally present in many foods and contributes to producing haemoglobin, responsible for carrying oxygen to working muscles

anaemia a condition where the body lacks enough red blood cells or hemoglobin to carry oxygen to the body's tissues

calcium a mineral found naturally in many foods, particularly dairy products, and it is essential for bone growth

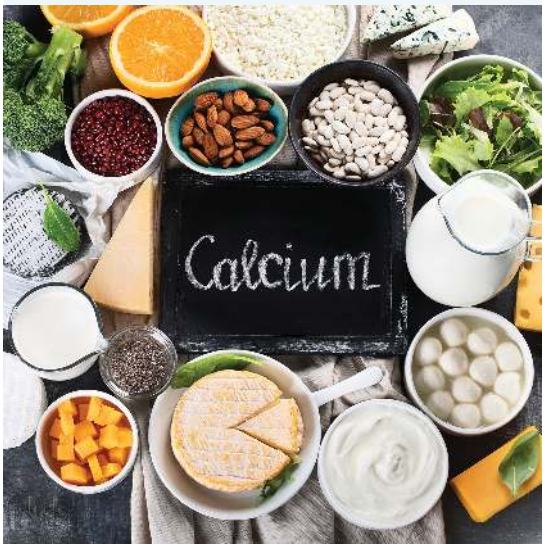
Athletes with low calcium levels are predisposed to weakened bones and an increased risk of fractures. Calcium deficiency can include symptoms of frequent muscle cramps as calcium assists muscle contraction. Other symptoms may include brittle fingernails, stress fractures, irregular heart beat and tingling in arms and legs.

Athletes at risk of calcium deficiency include:

- athletes with inadequate intake of dairy products
- athletes on a vegan diet with limited calcium-fortified foods
- athletes with conditions involving malabsorption of calcium
- female athletes due to amenorrhoea.

If athletes are deficient in calcium, an oral supplement can be taken based on the advice of an accredited sports dietician. Consultation regarding food sources and supplements will determine if an athlete is meeting calcium RDI. Too much calcium can cause gastrointestinal issues such as bloating, constipation and kidney stones. Excess calcium absorbed by the body is secreted in urine.

FIGURE 9.22 Calcium requirements can be met through consuming foods such as dairy products, almond milk and almonds.



Multivitamins

Multivitamins are supplements containing a variety of essential vitamins and minerals which are important for energy metabolism, cell growth and repair, and nerve and muscle function. A lack of vitamins and minerals due to inadequate intake of energy or a particular food source can lead to tissue deficiency.

If an athlete eats a balanced diet and consumes a variety of foods containing micronutrients, they will not require the addition of a multivitamin unless there is a deficiency.

Athletes may take a multivitamin supplement if they are on an energy restricted diet to manage weight for performances, or if they have significant food intolerances or a heavy training schedule, which may limit the regular intake of meals.

An intake of micronutrients that is too high can cause side effects such as constipation, diarrhoea or nausea.

9.4.3 Protein

Protein supplements are popular with weightlifters, bodybuilders and strength athletes. These supplements can be natural or synthetic and come in powder, liquid or solid forms. Many athletes believe protein supplements help build muscle, with higher intake increasing muscle size.

Protein supports exercise adaptations and muscle recovery and repair. Athletes need 1.2–1.6 g of protein per kg of body mass. Most athletes get enough protein from a balanced diet that meets their energy needs. Foods high in protein include lean meats, poultry, seafood, low-fat dairy products, eggs, nuts/seeds tofu and legumes. Many athletes will consume extra protein if required from protein shakes, bars and powders.

FIGURE 9.23 Many athletes take protein supplements to build muscle.

Heavy training loads and resistance training will require increased protein requirements for muscle repair, muscle growth and strength development.

Athletes who may benefit from protein supplements include:

- athletes needing extra protein if food sources are low; for example, vegetarian or vegan diets
- when fast intake of protein is needed after a heavy resistance workout
- those needing an alternative to a meal; for example, consuming a liquid protein shake is easier and more convenient than a steak
- those needing to meet weight requirements but protect muscle mass, such as boxing, wrestling or gymnastics.

Considerations for protein supplements include:

- many protein supplements such as powders and bars contain other ingredients which may be a doping risk
- may not have the same 'feeling full' impact as a meal
- may be lacking in nutrients present in food
- the impact on performance from not meeting protein needs.

CASE STUDY 4

Running gels and protein powders can be convenient boosts for athletes — but be sure to read the label

By ***Emma Beckett, Senior Lecturer, University of Newcastle and Patrice Jones, Post-doctoral Research Fellow, Institute for Health & Sport, Victoria University***

13 April 2023

What is in sports gels?

Sports gels (also known as energy gels) are essentially carbohydrate supplements. They contain simple sugars like maltodextrin, fructose, and glucose. These sugars don't need much digestion to be absorbed and used as energy. Sugars are the easiest form of energy for our bodies to use.

During long periods of exercise, our stored sources of energy get depleted. Our blood sugar drops and we use the glycogen stored in our muscles. So during long bouts of exercise, athletes like long-distance cyclists and runners as well as players in extended length 'stop and start' type sports, such as soccer need to replace these stores.

The research into the benefit of carbohydrate supplementation during exercise isn't new. It dates back as far back as the 1924 Boston Marathon.

The gel forms are a bit more modern, taking off in the 1980s and 1990s. For some people and sports, they have replaced the sweet drinks used previously. Gels have the advantage of being a more concentrated form than a drink, which means less to carry and less to ingest for the same carbohydrate kick.

What about protein powders?

Protein powders are exactly what the name suggests. They are typically casein or whey (proteins found in milk) but can come in plant-based forms too.

Protein won't give you the quick energy boost that sugars do, even though protein and carbohydrates have the same energy value (meaning gram for gram they have the same amount of calories).

This is because proteins are more complicated for the body to break down and use. But protein is not just important for energy. It provides important building blocks for most of our body's structures, including our muscles. This is why protein powders are popular with weight lifters and other power-based athletes.

But can food do the same thing?

Plenty of foods are rich in carbohydrates and proteins. Honey, dried fruits, bananas and even those half-time orange wedges are all potential carbohydrate sources for athletes.

Consuming carbohydrates in these forms has been shown to have the same benefits as gels during exercise.

For protein, milk, eggs and meats are all great sources.

Food sources also have the added benefit of being complex, which means they have other good things in them in addition to the macros, including vitamins and minerals, and bioactive compounds which promote good health.

Foods that are whole (unprocessed) or minimally processed are the most cost-effective means to obtain a mix of nutrients needed for rest and recovery after exercise, as well as during. They might taste a bit better too.

Why supplement then?

But, the supplements do have some benefits. They are highly concentrated, meaning you can get a lot in quickly, with less to carry and less chance of feeling overly full.

So they are but are generally considered by athletes as more convenient and are also linked to less gut discomfort (like cramps and diarrhoea).

The processed and packaged nature also means you know exactly what and how much you are getting, which might be important for some athletes to keep track of.

Any downsides of macro supplements?

Macro supplements can be expensive, and they can use a lot of packaging. The huge variety of products on the market also means products could contain lots of other ingredients (for better and for worse). Some sports gels contain stimulants like caffeine or preservatives like salts. Some protein powders contain added sugar.

And like all supplements, they are not without their risks.

Highly concentrated sports gels can cause stomach upsets and excessive protein supplementation can damage other organs, such as the kidneys.

Macro supplements can also make dehydration worse because the body will need to shift water to deal with these concentrated products.

Blocks and chews and bars can be even more concentrated, but have a more complex composition.

The science is also a bit sexist

The vast majority of studies on sports gels have used males, and the same benefits may not be seen in females. This is due to sex differences between males and females in how readily carbohydrates are used as energy, with females oxidising more fat and less carbohydrate, compared to males, during endurance exercise.

Ultimately, whether or not supplements or foods are the right choice for you during sports and exercise is going to come down to your preferences, budget, needs and the length and intensity of your exercise or sport.

For casual, short or low intensity sporting pursuits, supplements might be overkill, but for activities of high intensity or long duration, they can have benefits.

Source: Beckett, E. & Jones, P. (2023), 'Running gels and protein powders can be convenient boosts for athletes – but be sure to read the label'. *The Conversation*, 13 April, https://theconversation.com/running-gels-and-protein-powders-can-be-convenient-boosts-for-athletes-but-be-sure-to-read-the-label-200730.

Case study questions

1. What are the advantages of sports gels for athletes?
2. What foods could be consumed to deliver the same effect as sports gels?
3. When would sports gels be used by athletes?
4. What are the disadvantages of sports gels and protein powders?
5. Why are food sources suggested to be better alternatives to sports gels and protein powders?

9.4.4 Caffeine

Caffeine is a naturally occurring stimulant from leaves, nuts and seeds of plants. Caffeine is widely consumed, and is found in coffee, tea, cola, chocolate and energy drinks. Many athletes will also take supplements and sports products containing caffeine to help improve performance.

FIGURE 9.24 Caffeine can promote 'glycogen sparing'.

The main benefit of caffeine for performance is the increase in alertness, reduced perception of fatigue and reduced perception of effort. These effects would be of benefit to endurance athletes, team sports and high intensity sports.

It is important for athletes to consider the side effects which may result in a decline in performance. For example, increased heart rate, impaired fine motor control, anxiety and over-arousal, and gastrointestinal upset. Sleep may also be affected with athletes' duration and/or quality of sleep impacted leading to fatigue during training and competition.

Caffeine has **ergogenic aid** properties, which means that it improves performance by assisting specific metabolic processes. The most favourable evidence supporting ergogenic aid properties of caffeine relates to endurance sports such as marathon running. In the case of endurance performance, it is the ability of caffeine to mobilise fat stores in the body and convert them into free fatty acids that is important. Working muscles oxidise free fatty acids, making them a usable source of energy. It is believed that caffeine promotes 'glycogen sparing', a process whereby fat is metabolised early, sparing finite reserves of glycogen and subsequently prolonging the point at which exhaustion will occur. Research suggests that glycogen sparing is most significant in the first 15 minutes of sustained endurance activity, where it is reported that glycogen consumption can be decreased by as much as 50 per cent under normal circumstances.

caffeine a naturally occurring stimulant from leaves, nuts and seeds of plants

ergogenic aid a substance or practice that improves or is believed to improve physical performance

creatine a naturally occurring compound found in skeletal muscle. It is in the muscle that creatine is converted to creatine phosphate and thereafter assists in the resynthesis of ATP.

9.4.5 Creatine products

Creatine is a naturally occurring compound found in skeletal muscle. It is in this muscle that creatine is converted to creatine phosphate and thereafter assists in the resynthesis of ATP. Creatine is therefore important in making energy available to sustain short-duration explosive activity such as weightlifting and sprinting. Because creatine cannot be stored in the body, the idea of supplementation is supported by many athletes, particularly those who are involved in mainly anaerobic programs.

FIGURE 9.25 Creatine supplements are often in the form of powders that dissolve in water which helps with meeting creatine requirements and hydration.

The benefits of increasing creatine intake include a decrease in fatigue and improved performance in high-intensity, short-duration events such as sprinting and weightlifting. This is due to the increase in ATP in muscles, producing more energy for explosive movements.

Creatine assists in muscle hypertrophy, as well as a faster recovery by reducing muscle inflammation and damage. Cognitive benefits include faster processing and decision making, which is helpful for athletes in team-based sports who need to make quick decisions such as where to pass the ball.

Athletes who may benefit from creatine supplements include resistance athletes wanting to increase lean muscle mass, athletes in sports of high intensity and short duration such as sprinters and athletic field events, and athletes in team-based sports with intermittent periods of high intensity and recovery.

Creatine food sources include red meat, poultry, fish, dairy products, tofu, quinoa, lentils, chickpeas, pumpkin seeds, spinach and almonds.

Athletes should be aware of potential side effects of creatine supplements which may include weight gain, muscle cramps, strains and tears.

Creatine supplements are in the form of powders, tablets and gummies and are taken orally.

DEPTH STUDY IDEA

1. Visit the **Australian Sports Commission** weblink in the Resources panel. Investigate one of the following performance supplements.
   - Sodium Bicarbonate
   - β-Alanine
   - Dietary Nitrate/Beetroot Juice
   - Glycerol
2. As a sports marketer, you are promoting a performance-enhancing supplement. Choose the supplement you would like to focus on.
   Write a report including the following:
   - What is it?
   - How and when do athletes use it?
   - What sports would benefit most from the supplement?
   - Are there any concerns or considerations?
3. Create an advertisement for a sports product (this may include a powder, gel or sports bar) that could be marketed to athletes. Prepare a pitch and presentation to showcase the product.

EXAM TIP

Discuss the use of supplements, micronutrients, protein, caffeine and creatine products for improved performance

An exam question is likely to target the advantages and disadvantages *or* question the need for some of these macro and micronutrients. It is important that you know clear examples and recognise *how* they impact performance. Critical analysis is encouraged to determine this, but you will need to make clear and supported judgements of their value and necessity.

For example: *Vitamin B12 can support the energy demands of a long-distance athlete as it supports the production of red blood cells which promote transportation oxygen to working muscles. While this is beneficial in meeting the energy demands of a long distance race, an overconsumption of this vitamin can result in headaches, nausea, vomiting and diarrhoea which severely hinders performance. So, it is important to monitor diet and regulate quantities of this vitamin.*

When responding to a question of this nature, consider the impacts of a balanced diet and the specific dietary demands of the athlete and the sport to address how it can enhance performance.

9.4 ACTIVITIES

Supplements in sport

1. Visit the **Nutrition and Supplements in Sport** weblink in the Resources panel to watch a video from Sport Integrity Australia and answer the following questions.
   a. What are some of the reasons athletes take supplements?
   b. What can athletes do to make informed decisions about whether to take supplements?
2. Use the **Fact Sheets: AIS Sports Supplement Framework** weblink in the Resources panel to further investigate the use of supplements for athletes.

Cases for and against using supplementation

3. Complete the table below by analysing evidence for and against supplementation to improve performance. The **Supplementation** weblink in the Resources panel may assist you in developing your arguments.

The case FOR supplementation	The case AGAINST supplementation

Debate: Supplements vs. Whole Foods

4. Divide the class into teams. One team argues for the use of supplements and the other for whole foods. Each team needs to present evidence and counterarguments on the effectiveness, possible side effects, suited sports and considerations.

Creatine

5. Use the **Creatine** weblink in the Resources panel to discuss the benefits of creatine supplements for athletes.

Marketing of supplements

6. Research the advertising techniques used by supplement companies. To assist your research, visit popular supplement stores via their online websites. Information to gather includes:
   - Endorsements by athletes, product claims and other marketing strategies.
   - Assessing the accuracy of the claims based on your knowledge and understanding of supplement use for athletes.

   Work in pairs to prepare an infographic to present the information you gathered.

on Resources

Weblinks ABCD Classification system
Nutrition and Supplements in Sport
Fact Sheets: AIS Sports Supplement Framework
Supplementation
Creatine

9.4 Exercises

learnon

9.4 Quick quiz on | 9.4 Exercise

Learning pathways

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

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Revise your knowledge

1. What are the most common micronutrients to be consumed as supplements by athletes?
2. Why would athletes choose to consume caffeine to enhance performance in a 100 m sprint?
3. In which activity would creatine supplementation be most likely to enhance an athlete's performance?
4. Identify reasons for caffeine supplements in endurance events.
5. Describe the effects of protein on performance for a gymnast.

Apply your knowledge

6. Explain the role caffeine plays in improving performance for endurance athletes.
7. Discuss the statement 'Creatine supplementation is a waste of money'.
8. Discuss the benefits of consuming a whole-food diet rather than relying on supplements.
9. Explain why athletes should use caution when deciding to use supplements.
10. Scenario: *Alex is a 20-year-old sprinter who competes at a national level. Recently, Alex has been looking at ways to improve her performance, in particular speed and recovery time. Her coach advises her to include supplements in her diet. Alex starts using protein supplements and a pre-workout drink to increase energy levels before training.*
    A couple of weeks later, Alex starts to feel more fatigued than usual. She's not sure if it's related to the supplements. Alex decides to meet with an accredited sports dietician.
    a. What nutrient/s could Alex be deficient in?
    b. How could Alex change her diet and use supplements to improve her performance?

9.4 Exam questions

Question 1 (3 marks)
Source: *HSC 2021, PDHPE Exam, Section I, Part B, Q.22*

Why would an athlete competing in a long jump event consider using creatine supplementation to improve performance?

Question 2 (3 marks)
Explain why a soccer player may consider using micronutrient supplements to improve their performance.

Question 3 (4 marks)
Explain the importance of iron for endurance athletes.

Question 4 (5 marks)
Source: *HSC 2023, PDHPE Exam, Section I, Part B, Q.24*

Discuss the effects of TWO supplements used by athletes to alter their performance.

Question 5 (8 marks)
Discuss the use of supplements for improved performance.

9.5 Sample exam question response

Question

Explain how athletes can use sleep to reduce fatigue, positively influence movement and prevent injury. **(8 marks)**

Criteria

Criteria	Marks
• Provides a comprehensive explanation of how sleep can be used to reduce fatigue and positively influence movement and injury prevention. • Provides relevant and detailed examples	8
• Provides a sound explanation of how sleep can be used to reduce fatigue and positively influence movement and injury prevention. • Provides relevant examples	6–7
• Describes how sleep can be used to reduce fatigue and positively influence movement and injury prevention. • Provides example(s)	4–5
• Demonstrates a basic understanding of sleep, reducing fatigue OR positive influence on movement and injury prevention.	2–3
• Provides some relevant information	1

Sample response

Breaking down the question

Explain how athletes can use sleep to reduce fatigue and positively influence movement and prevent injury.

Identify the action word/s: Explain — relate cause and effect; make the relationships between things evident; provide reasons why and/or how

Syllabus terminology: sleep to reduce fatigue and positively influence movement and prevent injury

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/stated topic sentence/what is this paragraph 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

Sleep is an essential factor that needs to be considered for athletes. Its important for overall health and wellbeing as well as helping to improve performance. Sleep has a direct impact in reducing fatigue, positively influencing movement and preventing injury.

Fatigue is an extreme feeling of tiredness along with a lack of energy that can interfere with the body's ability to sustain movement. It is increased when an athlete's muscles and nerves have not fully recovered from training, which is helped by adequate sleep.[1] It is essential that athletes achieve quantity and quality sleep to assist in reducing fatigue. Due to the demands of training and competition, athletes should aim for 8–10 hours of sleep per night.[2] Sleep helps reduce fatigue because sleep allows the body to rest and recover. In particular, this is the time when muscles and tissues grow and repair. For example, when a runner is in a state of deep sleep, it enhances the body's ability to produce ATP which is essential in providing energy for an athlete's performance.[3] As the runner has increased ATP stores and muscle rest from this deep sleep they will have less fatigue, more energy and improved endurance the following day.[4]

Sleep positively influences movement by improving cognitive function, which enhances decision-making and reaction time during performance.[1] When an athlete is well-rested, their coordination and motor skills are sharper, leading to better muscle control and quicker responses to stimuli.[2] This is essential in sports such as gymnastics and diving where performances are judged on the quality and execution of movement. Poor sleep, on the other hand, impairs movement by slowing reaction times and diminishing coordination which can lead to poor performance, particularly in team sports such as soccer and hockey where quick passes are needed to help score a goal.[3]

In terms of injury prevention, sleep is essential.[1] Sleep helps prevent injury in athletes as it is the time for muscle repair and growth which helps athletes recover from training. Sleep increases the repair of tissues, including muscles, tendons and ligaments reducing the likelihood of injuries[2] caused by fatigue and overuse such as stress fractures, strains, sprains and tendonitis. When athletes are not fatigued, this can increase reaction time, making them less prone to accidents, poor technique or collisions, particularly in team sports such as soccer, AFL, hockey, netball and basketball.[3]

Overall, sleep is essential for athletes to help reduce fatigue, positively influence movement and prevent injuries.[4]

9.6 Review

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9.6.1 Topic summary

9.2 Dietary requirements and fluid intake

- Athletes need to follow dietary guidelines specific to their sport to improve performance.
- Athletes should always eat enough macronutrients and micronutrients suitable for their sport and training requirements.
- Carbohydrate needs vary depending on the duration, frequency and intensity of the training and sporting performance.
- Food consumed prior to activity is useful only if digested and its energy and nutrients made available to where they are required in the body.
- Pre-performance meals are essential to optimal performance.
- Carbohydrates are required by all athletes to be broken down and stored as glycogen.
- Fats are stored as triglycerides, similar to glycogen, and help to produce energy.
- Protein is used for muscle repair for all athletes, particularly weightlifters. Athletes have higher protein needs due to the need for muscle repair after training and competition.
- Carbohydrate loading for endurance events has the benefit of delaying the point at which the muscles being repeatedly used run out of fuel.
- Endurance events, particularly in hot and possibly humid conditions, can have a significant impact on the body's fuel and fluid supplies. In these events, the need for carbohydrate and electrolyte replacement depends on a number of factors including intensity, duration, humidity, clothing type and individual sweat rates.
- Post-performance nutrition aims to quickly restore the body to its pre-event state, allowing full training to resume.
- Fluid intake should be tailored to individual needs and the sport's rules.
- While all athletes need essential nutrients for daily training, rest, and recovery, there are key differences in dietary needs before, during and after performance.

9.3 Sleep, nutrition and hydration

- Sleep is essential for everyone's health and wellbeing. It helps reduce fatigue, improve movement and prevent injuries.
- Addressing fatigue with sleep is important, but individual needs vary.
- Sleep improves movement during training and competition.
- For athletes, sleep allows time for muscle repair and growth, aiding recovery from training.
- Nutrition is essential for athletes in managing fatigue and positively influencing movement and injury prevention.
- Not eating enough carbohydrates can lead to low glycogen stores, causing fatigue, low energy, poor movement and a higher risk of injuries.
- Insufficient iron intake can also lead to fatigue, particularly in female athletes and young athletes.
- Protein is vital for muscle repair and growth, which helps prevent injuries.
- Hydration is essential for athletes to avoid dehydration.

- Hydrate before, during and after physical activity. Thirst is not a good indicator of the body's need for fluid; by that time, dehydration has already started to take effect.
- For improved performance, athletes need to ensure they follow guidelines for sleep, nutrition and hydration specific for their sport.

9.4 Supplements, micronutrients, protein, caffeine and creatine products

- Sports foods and supplements can play an important role in an athlete's diet.
- While most athletes will be able to meet their dietary requirements by consuming a range of whole foods, many high-performance athletes with demanding training and competition schedules may require the intake of supplements.
- Popular supplements include micronutrients (vitamin B12, calcium and iron), protein, caffeine and creatine products.
- Athletes need to be aware of possible side effects of consuming too much of a particular supplement.
- It is important to make informed choices in consultation with an accredited sports dietitian.
- The most common micronutrients required by athletes include vitamin B12, iron and calcium. Athletes will often use a multivitamin for range of vitamins and minerals.
- Vitamin B12 is a micronutrient that assists in producing red blood cells to transport oxygen to working muscles. Vitamin B12 is especially important for endurance athletes.
- Iron is needed to make haemoglobin which is found in red blood cells that are responsible for carrying oxygen around the body and to working muscles.
- Calcium plays an important role in muscle contraction, maintaining a regular heartbeat and nerve impulse conduction.
- Multivitamins are supplements containing a variety of essential vitamins and minerals which are important for energy metabolism, cell growth and repair, nerve and muscle function.
- Many athletes believe that protein supplements are important because of their muscle building qualities, with higher intake positively affecting muscle size.
- The main benefit of caffeine for performance is the increase in alertness, reduced perception of fatigue and reduced perception of effort.
- The benefits of increasing creatine intake include a decrease in fatigue and improved performance in high-intensity, short-duration events such as sprinting and weightlifting.

on Resources

Digital documents Topic 9 summary (doc-43068)
Key terms glossary (doc-43069)
Revision quiz (doc-43070)

Interactivity Missing word interactive quiz (int-9366)

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Title: Serving up game day nutrition

Time: 8 hours

Task description: Design and prepare a pre, during and post-performance meal for an individual or team sport. (Can be done in groups of 2-3.)

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

9.6 Exercises

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9.6 Revision quiz on | 9.6 Exam questions

9.6 Exam questions

Section I

Question 1 (1 mark)

Which supplement could assist an athlete suffering from anaemia?

A. Vitamin C
B. Iron
C. Calcium
D. Magnesium

Question 2 (1 mark)

Which activity would creatine supplementation be most likely to enhance an athlete's performance?

A. Long-distance running
B. Sprinting
C. Yoga
D. Swimming

Question 3 (1 mark)

An athlete is competing in an endurance event. What is the best nutritional intake for this athlete three hours prior to this event?

A. High-fat meal
B. High-protein meal
C. High-carbohydrate meal
D. No meal

Question 4 (1 mark)

Why is an adequate intake of protein important in an athlete's diet?

A. For hydration
B. For energy
C. For muscle repair and growth
D. For vitamin absorption

Section II

Question 5 (3 marks)

Why would athletes choose to consume caffeine to enhance performance in a high-intensity activity of short duration?

Question 6 (3 marks)

Outline the importance of carbohydrate intake during an endurance event.

Question 7 (4 marks)

Explain how dehydration can be used to positively influence movement in an event.

Question 8 (5 marks)

Compare the post-performance dietary requirements of athletes in TWO different sports.

Question 9 (5 marks)

Explain how planning AND monitoring can influence the use of hydration to reduce fatigue in athletes.

Question 10 (6 marks)

Discuss the importance of sleep for the prevention of fatigue and injury.

Question 11 (6 marks)

Explain how caffeine can have a positive effect on endurance performance.

Question 12 (8 marks)

Discuss the effectiveness and potential side effects of creatine supplementation in enhancing athletic performance.

Question 13 (8 marks)

Discuss the importance of sleep, nutrition and hydration in reducing the risk of overuse injuries for athletes in high-impact sports such as soccer and gymnastics.

Question 14 (12 marks)

Analyse the dietary requirements (pre, during and post-performance) and fluid requirements of athletes from two different sports.

Section III

Question 15 (12 marks)

Refer to the two meal plans below that are for an endurance athlete.

Meal Plan A	Meal Plan B
Pre-performance meal (2–3 hours) • Quinoa, grilled chicken breast, steamed vegetables, olive oil dressing • Water (500–600 mL) • 1 banana Snack (30 minutes) • Up & Go chocolate flavoured drink • 300 mL water During performance • Water and sports drink 200–300 mL every 15–20 mins • Energy gel Post-performance (30 minutes) • Protein shake • Banana • Sports drink 250 mL • Water 500 mL Meal (1 hour after) • Spaghetti bolognaise • Water and sports drink	Pre-performance meal (2–3 hours) • Fast-food burger with fries and a cola Snack (30 minutes) • Chocolate bar and chips • Water 100 mL During performance • Water 300–600 mL per hour • Orange slices Post-performance (30 minutes) • Water 500 mL • Lollies • Doughnut Meal (1 hour after) • Pizza • Cola

Analyse both meals and their suitability in meeting the dietary requirements for an endurance athlete.

10 How individuals train for sustained movement and performance

LEARNING SEQUENCE

10.1 Overview 409
10.2 How biomechanics can develop efficient movements 411
10.3 Recovery strategies for sustained movement and performance 419
10.4 The role technology can play to improve performance 425
10.5 The management and prevention of sporting injuries 433
10.6 The impact of drug use 448
10.7 Sample exam question response 456
10.8 Review 458

10.1 Overview

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Key inquiry question

How do individuals train for sustained movement and performance?

Syllabus

	Syllabus content	Subtopic
○	■ Explain how biomechanics can be used to develop efficient movements for sustained movement and improved performance **Example(s):** Physical activity. Sport-specific movements. Functional movements.	**10.2**
○	■ Justify recovery strategies used for sustained movement and performance **Including:** • physiological, including cool-down, hydrotherapy • psychological, including relaxation	**10.3**
○	■ Examine the role technology can play to improve performance **Including:** • training innovations • equipment advances • recording and monitoring training and performance	**10.4**
○	■ Explain the management and prevention of sporting injuries **Including:** • classification of sports injuries, including direct and indirect, soft and hard tissue or overuse • assessment of injuries, including the Talk, Observe, Touch, Active movement, Passive movement, Skill (TOTAPS) test • management of injuries • rehabilitation procedures, including progressive mobilisation, graduated exercise, training, use of heat and cold • return-to-play policy and procedures, including application to different sports, responsibility	**10.5**
○	■ Discuss the impact of drug use on injury management and improving performance **Including:** • health implications • ethical considerations • drug testing	**10.6**

Outcomes

- investigates factors that impact movement and performance HM-12-04
- Analysis: critically analyses the relationships and implications of health and movement concepts HM-12-06
- Communication: communicates health and movement concepts using modes appropriate to a range of audiences and contexts HM-12-07
- Creative thinking: generates and assesses new ideas that are meaningful and relevant to health and movement contexts HM-12-08
- Problem solving: proposes and evaluates solutions to complex health and movement issues HM-12-09
- Research: analyses a range of sources to make conclusions and judgements about health and movement concepts HM-12-10

on Resources

Digital documents Topic 10 summary (doc-43071)
Key terms glossary (doc-43072)
Revision quiz (doc-43073)

10.2 How biomechanics can develop efficient movements

Syllabus: Explain how biomechanics can be used to develop efficient movements for sustained movement and improved performance

10.2.1 Biomechanics for sustained movement and improved performance

Biomechanics is the study of human movement, specifically looking at how and why we move. It is a science that investigates the forces acting on the body (**kinetics**) and the movements of the body (**kinematics**). By using the fundamental principles of physics to study how people move, biomechanists can describe and measure these movements and understand why they happen. In sports, biomechanics is used to closely examine movements to reduce injury risks and improve performance. Biomechanics involves how the muscles, bones, tendons and ligaments work together to produce movement. Biomechanics can help improve movement by analysing technique during different movements to identify ways to optimise force, balance and stability. Correct technique leads to efficient movement, allowing for sustained movement and improved performance. For example, changing the body's angle or adjusting technique in freestyle swimming can result in more efficient propulsion, greater endurance, less fatigue and overall better performance. Biomechanics can enhance movement and performance across a variety of areas, including physical activity, sport-specific movements and functional movements.

FIGURE 10.1 Biomechanics can assist athletes to improve their performance.

Biomechanical analysis explores how the athlete moves their body. Movements are explored in detail, problems identified and ways of making movement and technique more biomechanically efficient recommended. Biomechanical analysis aims to make execution of any movement more skillful, efficient and safe, allowing for sustained movement and improved performance. The **biomechanical principles** referred to include motion, balance and stability, fluid mechanics (drag) and force.

biomechanics is a science concerned with forces and the effect of these forces on and within the human body

kinetics forces acting on the body

kinematics movements of the body

biomechanical principles involve the mechanics of movement and the forces that cause it. Understanding biomechanics helps minimise injury risks, shorten rehabilitation time, improve sports performance, and promote mastery in sports.

10.2.2 Physical activity

Physical activity is any movement involving repeated contraction of the muscles, moving the body and increasing heart rate along with breathing rate. It's a broad term that includes playing sport, exercise and fitness activities such as Pilates and yoga, everyday activities such as walking, doing household chores and gardening as well as many other forms of active recreation.

Biomechanics can help improve technique in physical activity which helps to sustain movement and improve performance. For example, understanding force and gait can help runners avoid excessive impact on joints, minimising the risk of injury. This allows runners to be able to run for longer periods of time without being in pain due to poor technique and injury.

physical activity body movement that is produced by a contraction of skeletal muscle and that increases energy expenditure

In physical activity, the biomechanical principles of **balance** and **stability** are important for sustained movement. In achieving balance and stability, posture and core strength play an important role in keeping the body balanced and stable during physical activity in a variety of activities such as hiking, yoga and Pilates. For example, in Pilates, balance and stability help sustain controlled movement and proper form. During an exercise such as the 'V-sit', the individual lifts their torso and legs off the ground to form a V shape. During this movement, they must engage their core muscles to maintain stability during the movement. If the individual loses balance, they will lose the position and disrupt the flow and effectiveness of the exercise. Stability in the core allows for smooth, controlled motions, while balance ensures proper alignment and helps prevent injury.

Applying the biomechanical principles of balance and stability can help reduce energy expenditure and reduce fatigue, meaning movement can be sustained for longer. Other examples of how the biomechanical principles can be applied to physical activity can be seen below.

balance the ability to maintain equilibrium while either stationary or moving

stability the ability of a body or object to maintain balance and resist movements to ensure control during dynamic or static activities

linear motion when the body travels in one direction

reactive force when one body or object exerts force on another and the second object exerts an equal reaction force on the object

drag the force that opposes the forward motion of a body or object reducing its speed or velocity

Biomechanics and recreational running

Recreational running applies the principle of **linear motion** where the body travels in one direction. To sustain movement in running, the individual should adopt the following techniques:

- look ahead and relax the shoulders to minimise tension in the shoulders and neck, which can lead to muscular fatigue
- relax hands to avoid tension moving from hands to arms, shoulders and neck
- bend arms at 90 degrees by the sides
- keep posture upright, back straight and shoulders level. Ensure the shoulders aren't forward which can tighten the chest and restrict breathing
- rotate arms from the shoulder joint and avoid crossing arms over the chest
- reduce the force applied to the ground which can lead to fatigue — if more force is applied, the **reactive force** from the ground to the runner will be greater
- run lightly and land softly on your feet to reduce energy expenditure.

FIGURE 10.2 Knowledge of biomechanics can help improve running technique.

See the **Usain Bolt and Biomechanics** weblink the the Resources panel for more information.

Biomechanics and recreational swimming

Recreational swimming is another popular physical activity with many individuals swimming for leisure at a pool or a beach. Applying biomechanics to improve technique can lead to sustained movement and improved performance in swimming. **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. If a swimmer can improve technique, drag can be minimised, leading to less resistance and a reduction in energy expenditure resulting in sustained movement.

FIGURE 10.3 Swimming technique is important to sustain movement.

Tips for reducing drag include:

- keep a streamlined position and keep the abdominal muscles engaged with hips lifted — the higher the hips are and the closer the legs are to the surface there will be less drag, resulting in less energy expenditure and sustained movement
- keep arms and legs close to the centre of the body, reducing the joint angle of the shoulder and hip joints
- tight kick with legs close together, toes pointed to reduce splash
- turn the head to the side and not too far out of the water when you breathe
- keep the hands in a *sculling* (slightly cupped) position, which acts to 'catch' the water and push it past the swimmer.

Through reducing drag, the swimmer will move through the water at a faster rate, which will enhance their performance and minimise fatigue.

10.2.3 Sport-specific movements

Sport-specific movements include movements applied to a specific sport, such as bowling a cricket ball, kicking the ball in soccer, serving in tennis, striking the hockey ball and performing a somersault in gymnastics.

Biomechanics plays an important role in sustaining movement and improving performance in sport-specific movements. It can help identify poor movement which may increase the risk of injury, increase energy expenditure and fatigue as well as decrease performance.

Appropriate technique is crucial for maintaining performance, as it enhances speed, accuracy and power. A professional tennis player may execute close to 150 serves per match making sustained movement important. This also applies to the strokes, such as forehand and backhand, for which sustained movement is crucial during long matches and rallies. Working with a sports biomechanist to correct technique can improve performance of strokes and serves, and help sustain movement throughout a match.

FIGURE 10.4 Biomechanics can help improve a tennis serve for improved performance.

The following is an example of applying biomechanics to a tennis serve:

- Developing more **force** in a tennis serve. The more forceful the muscular contraction, the more **momentum** will be generated, and a more forceful serve will occur.
- Shifting the weight from the back foot to the front foot can transfer forces and generate momentum. This momentum will help apply energy to the serve. This will reduce strain which can lead to injury and fatigue.
- The serve involves a phase of shoulder and trunk rotation. Biomechanics helps refine the timing and **speed** of this rotation for maximum **velocity**.
- Pushing off the ground (internal force applied to the ground) through the legs and the ground provides an external force that pushes up through the legs.

Other sport-specific movements may include:

- applying angular motion for a gymnast rotating around a high bar which will enable multiple rotations
- correcting a tumble turn in swimming can allow for a more forceful push from the wall, enabling increased **acceleration** and speed
- swimmers on the blocks reduce their base of support (placing their feet closer together) and move their centre of gravity forward to improve their acceleration

force the push or pull acting on a body or object

momentum the quantity of motion that a body or object possesses

speed the ability to perform body movements quickly

velocity the rate of positional change of an object

acceleration the rate at which velocity changes in a given amount of time

- for rowing, the drive and recovery phases should use correct technique, by applying force through the legs by concentric and eccentric contractions for more powerful and efficient drive phases
- effectively catching the ball in cricket can decrease muscle fatigue allowing for more sustained movement and decreasing the risk of injury. It also increases the chance of catching the ball, leading to improved performance.

EXAM TIP

Using biomechanics to develop efficient movements

If an exam question asks you to explain how biomechanics (specifically the biomechanical principles) can be applied to improve sports-specific performance, you will need to show a good understanding of the nature and the key principles of movement efficiency. These principles include:

- motion
- balance and stability
- fluid mechanics (drag)
- force.

Apply these principles to a sport which you are familiar with, so that you can describe how these principles relate to different aspects of the game or even to positional play.

For example, *in a game of netball, balance and stability are critical to most players as they change direction and are agile in moving up and down the court. This is achieved by bending the knees (lowering the centre of gravity) and redirecting weight to push off the ground (reactive force) to change direction. Attacking players will use linear motion and run with their hands in front to reduce drag and to help receive the ball, and they attempt to use acceleration (changes in speed) to move in front of their defenders. Defenders often distribute their weight with legs more than shoulder length apart (knees bent) to promote stability (wider base of support) which also allows them to change direction and be ready to intercept the ball as they use reactionary forces from the ground to leap and gain height to take possession of the ball.*

CASE STUDY 1

The best techniques for being a cricket fast bowler, according to science

By ***Paul Felton, Senior Lecturer in Biomechanics in the School of Science and Technology, Nottingham Trent University***

2 November 2023

The best techniques for being a cricket fast bowler, according to science

Twenty years ago, Shoaib Akhtar became the first person recorded to bowl at 100 mph (161 km per hour) during the 2003 One-Day International Men's World Cup match for Pakistan against England. There was an expectation afterwards that this feat would become a regular occurrence.

…

However, despite continuing improvement in the athletic ability of fast bowlers, the magical three-figure barrier has only been surpassed since by Brett Lee and Shaun Tait – and not for over ten years.

Has cricket fast bowling's top speed stalled? …

The performance of cricket fast bowlers almost entirely depends on two factors. The first is the amount of momentum developed in the run-up and maintained before the front foot contacts the floor. The second is the technique employed to generate and transfer momentum within the body during the bowling phase between the front foot contacting the floor and the release of the ball from the bowler's hand.

…

To understand why the top speed has stalled, it is important to consider how all the factors influencing human movement patterns affect the technique of fast bowlers.

…

Explosive activation

Elite males complete the bowling phase in approximately 100 milliseconds. This is similar to the time required to explosively activate a single muscle. This limits the ability of bowlers to develop additional momentum using their muscles in the bowling phase and neutralises the effect of strength increases on ball speed.

This explains why maximising momentum generated during the run-up is preferred over generating muscular momentum during the bowling phase. It also explains why fast bowling top speeds have not increased despite recent advances in fast bowlers' athletic abilities.

Interestingly, research on women fast bowlers has highlighted that bowlers who generate less momentum during the run-up and therefore have more time available to generate additional muscular momentum, adopt a movement pattern more akin to throwing. In this approach, the momentum generated in the run-up is added to via the use of large rotational torso muscles within the bowling phase.

…

A potential mechanism to increase the time available to develop more momentum from muscles would be to increase the range of motion that joints move through during the bowling phase.

Joint 'hypermobility'

Recent research has highlighted that, on average, elite fast bowlers with an increased range of motion in the hip and shoulder had greater ball release speeds. It was also suggested that the bowlers' techniques were probably influenced by their range of motion during their early learning years.

In addition, elbow hyperextension – where the joint travels beyond a straight position – has been shown to increase the speed of ball release by up to 5% during the bowling phase. A common misconception, however, is that taller bowlers will bowl faster due to the benefit associated with increased limb length.

Unfortunately, as limbs get longer, they get more difficult to rotate. As muscular strength does not scale equally with limb length this becomes a disadvantage. Thus, an optimal height for fast bowlers probably exists, though we don't know what it is.

Source: Felton, P. (2023), 'The best techniques for being a cricket fast bowler, according to science'. *The Conversation*, 2 November, https://theconversation.com/the-best-techniques-for-being-a-cricket-fast-bowler-according-to-science-216589.

Case study questions

1. What are the two factors that the performance of a fast bowler depends on?
2. Why is it preferred for momentum to be maximised in the run-up?

10.2.4 Functional movements

Functional movements mimic activities in everyday life. These can include actions such as walking, lifting, climbing stairs, bending, reaching, carrying bags, squatting and pushing/pulling. Biomechanics is evident every time a movement occurs. For example, typing at a computer involves coordination, timing and movement of the hands and fingers involving intricate biomechanical movements.

Joint protection and alignment is important; for example, learning to lift a heavy box with correct technique can help protect the spine and reduce stress on knees and hips, allowing for repeated movement. Strengthening muscles and improving joint stability can assist in walking and carrying heavy items.

When lifting, applying biomechanical principles can include:

- bending at the hip joint
- keeping your back straight and contracting the leg muscles to apply more force, therefore maximising power
- ensuring a wider base of support with feet slightly wider than hips

functional movements mimic activities in everyday life

- lowering your centre of gravity and keeping the line of gravity in the centre of the base of support for greater stability
- keeping the back safe
- when standing, engaging the abdominal and leg muscles.

This will help reduce injury and lead to improved lifting technique so the individual can sustain movement for longer.

CrossFit is an example of functional movement because it mimics real-life, multi-joint movements which engage multiple muscle groups. CrossFit includes functional movements such as squats, deadlifts and kettlebell swings which focus on developing strength, mobility and coordination in movements used in daily activities. Focusing on biomechanics, CrossFit can help improve strength, motor control, balance and overall movement efficiency, leading to sustained movement and improved performance in both sport and daily tasks.

FIGURE 10.5 Biomechanics can be applied to functional movements such as lifting boxes or climbing stairs.

Climbing stairs is a common functional movement that many individuals complete each day. Strength in the leg muscles and gluteus maximus will assist in sustaining movement for longer periods of time. To allow for more efficient movement when climbing stairs, the following actions should be performed.

- Keeping the back upright to avoid forces generated through the quadriceps transferring through the torso. Keeping shins upright to reduce stress in the knee joint.
- Contracting the quadriceps, hamstrings and gluteus maximus can generate more power.
- Avoiding leaning forward.
- Placing the entire foot on the step to apply and transfer more force to the ground.
- Keeping knees soft by slightly bending help absorb force and reduce injury.

Biomechanical principles can not only be applied to sport but to functional movements individuals participate in every day. It is essential that correct technique is applied to allow for efficient movement, help sustain movement and improve performance.

DEPTH STUDY IDEA

Choose a skill/activity from either category below:

- physical activity (e.g. walking)
- sport-specific movements (e.g. running)
- functional movements (e.g. squatting).

Create a fitness circuit incorporating drills and resistance-based exercises targeting the chosen skill/activity. Justify how the drills and exercises will help an individual develop efficient movement for sustained movement and improved performance in the selected skill/activity.

10.2 PRACTICAL ACTIVITY

Analysis of walking technique

Perform this activity in pairs.

1. Record each other walking in slow motion with poor technique; for example, poor posture, lack of muscular contraction, head looking down, arms hanging by side, increased gait.
2. Record each other walking in slow motion, with correct technique. Focus on foot placement, knee alignment and hip movement.
3. Analyse the different phases of the gait cycle (heel strike, mid-stance and toe-off) and identify key muscle groups used.
4. After watching the recordings of each walk, explain which walking style was the most effective for sustained movement.

10.2 ACTIVITIES

Analysing biomechanical skills in sport

1. Watch the **Perfect your tennis serve in 5 steps** and **Perfect your return of serve in 3 steps** via the weblinks in the Resources panel and then discuss the biomechanical principles that can be applied to improving a tennis serve and return of serve.

Wearable technology

2. Choose a wearable technology such as Fitbits, smartwatches or apps that track movement patterns; for example, Runkeeper or Strava.
   a. Engage in a physical activity of your choice (e.g. running, cycling, playing a sport) while wearing the technology or using the app.
   b. Record your movement patterns and performance metrics during the activity.
   c. Review the data collected by the technology.
   d. Look for key metrics such as speed, distance, heart rate and movement patterns.
   e. Assess your performance and technique based on the data.

Injury and biomechanics

3. a. Visit the **Sports Injuries by Sports Medicine Australia** weblink in the Resources panel to gain an understanding of some common sports injuries.
   b. In groups, choose three common sports injuries. Using your understanding of biomechanics, analyse the injuries to determine how a lack of efficient movement may contribute to the injuries.
   c. Watch demonstrations on proper techniques for various sports and exercises to prevent injuries.
   d. Participate in exercises designed to promote injury prevention, such as strength training, flexibility exercises and proper warm-up routines.

on Resources

Weblinks Perfect your tennis serve in 5 steps
Perfect your return of serve in 3 steps
Sports Injuries by Sports Medicine Australia

10.2 Exercises

learnon

10.2 Quick quiz on | 10.2 Exercise

Learning pathways

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

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Revise your knowledge

1. Define the term 'biomechanics'.
2. What are biomechanical principles?
3. Why is the study of biomechanics important for improving performance?
4. Identify examples of functional movements.
5. For each category below, identify examples of activities that require sustained movement.
   a. Physical activity
   b. Sport-specific movements
   c. Functional movement

Apply your knowledge

6. Outline the effect of drag on the performance of a swimmer and a cyclist.
7. How can biomechanics be used to improve performance in CrossFit?
8. For a sport of your choice, identify the skills that may require the application of biomechanics for improved performance.
9. Provide some guidelines to support a fast-paced cricket bowler from excessive fatigue and injury.
10. Discuss the benefits of applying biomechanics to the following:
    a. physical activity
    b. sports-specific movements
    c. functional movement.

10.2 Exam questions

Question 1 (3 marks)
Outline the biomechanical principles that can be applied to climbing stairs.

Question 2 (3 marks)
Describe correct freestyle swimming technique for improved performance.

Question 3 (4 marks)
Explain how an understanding of biomechanics can help an athlete improve their running efficiency.

Question 4 (5 marks)
Explain how biomechanics can be applied to swimming to sustain movement.

Question 5 (6 marks)
Discuss the benefits of applying the principles of balance and stability in yoga for sustained movement.

10.3 Recovery strategies for sustained movement and performance

Syllabus: Justify recovery strategies used for sustained movement and performance

Including:

- physiological, including cool-down, hydrotherapy
- psychological, including relaxation

Recovery is essential for athletes as it allows the quick return to a normal physical and psychological state. Effective recovery can lead to sustained movement and performance in subsequent training sessions and performances.

Recovery strategies can be categorised as physiological or psychological. Elite athletes use a range of strategies designed to enable them to resume full training in the shortest possible time.

10.3.1 Physiological strategies

Physiological recovery refers to the process by which an athlete's body returns to a state of normal functioning after physical exertion. It involves the recovery of physiological processes such as energy stores, muscle repair, hydration and the removal of metabolic waste products such as lactic acid. Physiological recovery is essential to allow the body to repair, reduce the risk of injury and improve performance.

Athletes can achieve physiological recovery through cool-down and hydrotherapy.

Cool-down

The purpose of a cool-down following exercise is to gradually reduce heart rate and metabolism to the pre-exercise state. In doing this, a number of other elevated physiological processes, such as ventilation rate, blood distribution and adrenaline levels, gradually return to normal.

Vigorous or sustained exercise that is not concluded with a cool-down may result in blood pooling, causing dizziness. A proper cool-down also assists in the removal of waste products including lactic acid, which contributes to muscle stiffness and soreness. It may also assist in preventing muscle spasms, cramps and possibly assist in preventing delayed onset muscle soreness (DOMS).

FIGURE 10.6 Stretching assists in lengthening, relaxing and realigning of muscle fibres.

While the cool-down needs to be active, it should also be gradual. An effective cool-down should consist of 5–10 minutes of walking/jogging/slow swimming, with the aim of slowly returning the body to pre-exercise temperature. Static stretching is also important. Muscle fibres involved in exercise tend to shorten and may lose alignment as a result of aggressive movements. Static stretching assists in lengthening, relaxing and realigning muscle fibres, making the normal range of movement easier to accomplish.

Additional reasons why stretching is essential in cool-downs for recovery include:

- Stretching helps maintain muscle length and flexibility, reducing the chance of tightness which may impact future performances.
- It promotes muscle relaxation through the activation of the parasympathetic nervous system which promotes a state of calm and recovery.
- Stretching increases blood flow to muscles, which aids in the delivery of oxygen and nutrients. This helps remove waste products like lactic acid that accumulate during exercise, speeding up the recovery process.
- By improving flexibility and promoting muscle relaxation, stretching can help reduce the risk of injuries in future workouts or physical activities.
- Regular stretching during cool-downs can gradually improve flexibility, allowing for a greater range of motion in future exercises or activities, which is particularly beneficial for athletes.
- Stretching provides a moment of relaxation and mindfulness, helping to reduce mental stress. It can help ease any tension built up during intense workouts, fostering a sense of physical and mental recovery.

Hydrotherapy

Hydrotherapy involves the use of water to relax, soothe pain and assist metabolic recovery. Water provides support for movements, and eliminates jarring and straining movements that are associated with land drills and field exercises. Typical hydrotherapy methods involve use of contrast baths, cold water immersion (ice baths), warm water immersion, aquatic therapy (water-based rehabilitation), whirlpool therapy (hydrotherapy pools), saltwater immersion, hydrotherapy treadmills and underwater massage therapy.

With hydrotherapy, active exercise can be incorporated through use of gravity-assisted movements such as jumping. Swimming, assisted flotation exercises and even movements such as sprinting, jogging and combat exercise can be performed in a gravity-assisted environment, lessening the risk of injury. Sports centres with heated swimming pools are ideal for hydrotherapy sessions. In some cases, hydrotherapy can be used in conjunction with **cryotherapy** (use of cold) techniques to help accelerate blood flow.

Three popular hydrotherapy techniques used with elite athletes are:

- warm water immersion (WWI)
- cold water immersion (CWI)
- contrast water therapy (CWT).

Warm water immersion causes vasodilation (widening) of blood vessels in the body's extremities. As the temperature of the body's surface area increases, blood flows more freely to the limbs, lowering blood pressure and enhancing the removal of waste. It also promotes the transport of nutrients and oxygen to muscles to aid repair and reduce inflammation. While WWI can promote relaxation and help with stiff joints, it doesn't provide the same level of muscle recovery as CWI. If an athlete wants to reduce muscle soreness and increase recovery, CWI is the best option.

Cold water immersion (CWI) uses ice-baths, plunge pools and cold-water therapy. Immersion in cold water (usually about 10–15 °C) for 10–15 minutes causes blood flow to the extremities to be reduced. This occurs due to decreased heart rate and **vasoconstriction** of the blood vessels in response to the sudden drop in temperature. The temperature-induced reduction in blood flow to damaged tissues reduces oedemas and inflammation which is particularly important if there is soft tissue damage such as a sprain or strain. The cold water also leads to decreased nerve conduction speeds and a reduced perception of pain. CWI has proven to be an effective method for enhancing recovery, particularly reducing Delayed Onset Muscle Soreness (DOMS).

hydrotherapy the use of water to relax, soothe pain and assist metabolic recovery

cryotherapy the use of cooling to treat injury or quicken recovery from performances, particularly those that involve collisions and/or sustained intensity

vasoconstriction a decrease in blood vessel size, causing less blood to be supplied to the area that is serviced by that blood vessel

It's important to note that temperatures that are too cold (below 10 °C) may counteract some of the positive effects of CWI. If the temperature is too cold, it increases vasoconstriction which reduces heart rate and peripheral blood flow to preserve core temperature. This increases central metabolism which increases waste products and decreases energy stores as the body tries to keep warm which decreases effective recovery.

Therefore, it is thought that contrast water therapy is best for recovery which is when WWI is alternated with CWI. Here, the athlete moves between pools or showers that are either warm or cold. This practice enhances the cycle of blood vessel dilation/constriction thereby increasing blood mobility through the tissues. This causes a more rapid dispersal of waste, reduces muscle soreness and promotes a faster recovery.

FIGURE 10.7 CWI uses ice baths where the athlete immerses themselves in cold water at approx. 10–15 °C.

It's important to note that hydrotherapy should not be used when the athlete has an injury that is hot, red and inflamed. All swelling needs to be controlled before athletes use hot water immersion.

10.3.2 Psychological strategies

Psychological strategies are essential for athletes' recovery. Psychological strategies reduce stress and anxiety which can occur post-performance. Cortisol (a hormone produced by the adrenal glands that helps to regulate the body's response to stress) levels are reduced aiding relaxation and helping to improve focus. Psychological strategies can enhance sleep quality which is essential for recovery as discussed in topic 9.

Relaxation

Relaxation is an important psychological recovery strategy and may require considerable experimentation to find the most rewarding method.

Relaxation techniques target both the body and the mind. Following hard training and demanding performances, athletes may experience symptoms of low concentration, lack of motivation and increased levels of anxiety. The use of psychological strategies represents an important phase in emotional and possibly spiritual recovery.

Additionally, a body that holds mental or physical tension is not able to sleep and experience full recovery. Adequate sleep is still regarded as probably the most important recovery strategy, although too much sleep can be detrimental, contributing to feelings of sluggishness and lethargy.

The following effects demonstrate why psychological recovery strategies, such as relaxation, are essential for athletes:

- Stress reduction — athletes often face increased stress from competition and training. Relaxation can help reduce stress by calming the body and mind.
- Improved focus — relaxation improves concentration, helping athletes stay focused during performance and reducing distractions.
- Prevent burnout — athletes often push themselves to their physical and mental limits, which can lead to burnout. Consistent use of relaxation methods can help balance physical exertion with psychological recovery, preventing the negative impacts of overtraining.
- Faster recovery — relaxation techniques like deep breathing help relax muscles and improve circulation, speeding up physical recovery and reducing fatigue.

The choice of relaxation method(s) is quite individual and involves experimentation to establish which technique works best.

Some examples of effective relaxation techniques used by athletes include:

- Deep breathing exercises — involves slow, deep breaths to activate the parasympathetic nervous system to promote relaxation. This technique can also improve oxygen flow to muscles, aiding recovery. Athletes will often use this technique before, during and after competition as a strategy to help performance and assist in recovery.
- Progressive muscle relaxation (PMR) — involves tensing and relaxing the muscles from head to toe. The technique helps athletes become aware of areas of tension or muscle tightness and is effective in releasing them.
- Meditation — assists in managing the mental and emotional effects of intense training and competition by promoting relaxation and helping to regulate the stress response. Mindfulness meditation, in particular, enhances the athlete's ability to concentrate, stay in the present and maintain focus during training and competition. Regular meditation can improve sleep quality by calming the mind. Additionally, meditation can help athletes develop emotional resilience, making it easier to manage frustration, anger or disappointment during competitions. Meditation can also foster a greater awareness of the body, which can improve movement and performance, while also helping to prevent injuries.

FIGURE 10.8 Guided meditation can help athletes reduce stress and promote recovery after training and competition.

Other psychological techniques that may be used by athletes after performance to assist in recovery and enhance mental resilience include mental rehearsal, yoga, listening to calming music, aromatherapy and journaling.

It may take time to discover the best strategies to suit the individual athlete; however, the benefits are evident to promote not only psychological but also physiological recovery.

CASE STUDY 2

Taking breaks from competing is key to athletics resilience — a sports psychologist explains

By ***Sahen Gupta, Lecturer in Applied Sport & Exercise Psychology, University of Portsmouth***

24 July 2024

Increasingly, high-profile athletes are making a point of taking a break from competing. Some have done so specifically for mental health reasons, such as Simone Biles, Naomi Osaka and Michael Phelps. Others for combination of physical and mental reasons, such as Roger Federer, Lewis Hamilton, Virat Kohli, Emma Raducanu and Rafael Nadal.

Some fans support this decision, while others denounce it. But taking a break is an important part of recovery.

Recovery is what happens when you take a break from competing. Taking a break enables physical recovery, such as muscle repair, energy replenishment, inflammation reduction, hydration and adequate sleep. It also enables mental recovery, for example, by reducing cognitive load, reducing stress hormones, improving emotional regulation and supporting neuroplasticity (the brain's ability to change and adapt with experience) and psychological detachment.

My research has shown that taking a break and spending quality time away from their sport – for example, enjoying time with family or friends – is crucial for athletes to develop resilience.

Athletes face many adversities in their careers. During this time, they develop 'resilience resources' to form a kind of filter that reduces the effect of the adversity.

My research has shown that these resources include how athletes think of adversity ('is this a challenge or a threat for me?'), emotional regulation (their coping strategies to manage emotional upheaval), accessing social support (using support from coaches, partners and friends), sense of meaning (the significance of the sport to them) and mastery (how they isolate the things within their control).

The stronger these resilience resources, the less the athlete is hit with the full force of adversity. Sometimes, though, these resources get depleted. It is important to disengage from the public eye, take a break and replenish them. The strongest athletes know that great prowess is only possible when managed alongside adequate rest.

Source: Gupta, S. (2024), 'Taking breaks from competing is key to athletics resilience — a sports psychologist explains'. *The Conversation*, 24 July, https://theconversation.com/taking-breaks-from-competing-is-key-to-athletic-resilience-a-sports-psychologist-explains-234416.

Case study questions

1. Identify athletes who have taken a break from competing.
2. Outline the benefits of taking a break from competing.

EXAM TIP

Justify recovery strategies used for sustained movement and performance

When responding to an exam question regarding recovery strategies, it is important to describe how the strategy impacts the body to allow for sustained movement and performance.

- Describe the recovery strategy with relevant examples.
- Explain how the strategy supports the athlete psychologically (feel relaxed, confident and focused) and physiologically (aid muscle tissue and blood flow to promote recovery).
- Consider whether there are any limitations to the strategy by showing the for and against of the strategy's impact.
- Make a judgement on the degree to which the strategy allows for sustained movement and performance.

In an exam question addressing recovery strategies, it is beneficial to mention all the strategies from the syllabus including physiological and psychological strategies and then deep dive into two or three key strategies depending on the number of marks and the verb used in the question (i.e. mention physiological including cool-down and hydrotherapy as well as psychological, including relaxation).

For example: *A well conducted cool-down provides strong support for the body to return to its pre-exercise state by allowing the heart rate to gradually slow which supports blood distribution returning to essential organs, controls ventilation and regulates hormonal balance. This is particularly relevant to competitive long-distance runners/swimmers who need to reduce core body temperature and support oxygen redistribution within the body after an extended period of exercise. This will allow the athlete to experience minimal post-exercise stiffness and feel confident that the body can cope with a quick return to exercise. While a cool-down can discard any metabolic waste products to eliminate the presence of lactic acid pooling in the muscles, there is evidence to show that a poorly conducted cool-down can lead to extra muscle damage; for example, in the case of a running cool-down that is at a higher intensity. This reinforces the value of a lower impact, reduced intensity cool-down to more effectively support muscle tissue recovery to enhance future performance.*

DEPTH STUDY IDEA

Examine how psychological recovery strategies can affect mental recovery and performance.

1. Choose a psychological recovery strategy such as progressive muscle relaxation (PMR), deep breathing exercises, mindfulness, visualisation/mental imagery, meditation, yoga or listening to music.
2. Participate in a training session.
3. Perform the recovery strategy after the training session and record the physiological and psychological effects.
4. Conduct the study over 1–2 weeks, recording the impact on movement and performance during the sessions and post-sessions.
5. Write a report using the findings to justify the use of psychological strategies for sustained movement and improved performance.

10.3 ACTIVITIES

Recovery for sustained movement and performance

1. Research an athlete and their recovery strategies. For each strategy discuss how these contribute to sustained movement and performance.

Practice a psychological strategy

2. a. In pairs, choose a psychological strategy (e.g. relaxation strategies such as progressive muscle relaxation, deep breathing exercises, mindfulness, visualisation/mental imagery, meditation, yoga or listening to music).
   b. Person A will perform a physical activity; for example, 100 m sprint. After completing the physical activity, person A implements the chosen psychological strategy to aid recovery (e.g. practice deep breathing for 5 minutes).
   c. Person A then assesses their performance or how they feel post-activity using a simple scale (e.g. rate energy level, mood or perceived recovery on a scale of 1–10).
   d. Person B will then do the same.
   e. Share your experiences and results with each other.
   f. Discuss the effectiveness of the psychological strategy and any differences in performance or feelings.

Sports psychologist

3. Contact a sports psychologist and discuss the best recovery strategies for athletes in two different sports. Prepare some questions prior to the interview and summarise the key findings.

Class debate

4. 'Which recovery strategy is best for sustained movement and performance?'
   Team A: Physiological strategies
   Team B: Psychological strategies

Recovery strategies

5. Watch the video **Top 10 recovery strategies** using the weblink in the Resources panel to deepen your understanding of recovery strategies for athletes.

on Resources

Weblink Top 10 recovery strategies

10.3 Exercises

learnon

10.3 Quick quiz on | **10.3 Exercise**

Learning pathways

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

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Revise your knowledge

1. What is the purpose of a cool-down?
2. Provide examples of suitable cool-down activities for a sport of your choice.
3. Describe static stretching and provide an example.

4. Outline hydrotherapy recovery strategies.
5. Outline the benefits of relaxation for an athlete's performance.

Apply your knowledge

6. For a sport of your choice, explain the role of cool-down in maintaining sustained movement and performance. Provide examples of activities that are included in a cool-down.
7. An athlete has completed a high-intensity training session. As a coach, outline a recovery strategy plan for the next 24 hours to optimise their performance for a competition the following day.
8. How does hydrotherapy such as ice baths or contrast baths help reduce muscle soreness and inflammation?
9. Justify the importance of cool-down exercises, such as gentle stretching, in assisting in the prevention of injury and the support of long-term performance.
10. Explain how relaxation techniques, such as deep breathing or meditation, contribute to mental and physical recovery for athletes.

10.3 Exam questions

Question 1 (2 marks)
Identify two physiological recovery techniques.

Question 2 (3 marks)
Outline the effects of cold-water immersion for recovery.

Question 3 (5 marks)
Compare the physiological effects of cold-water immersion versus warm-water immersion.

Question 4 (6 marks)
Discuss how physiological recovery strategies can contribute to improved performance.

Question 5 (8 marks)
Evaluate a range of recovery strategies for sustained movement and performance.

10.4 The role technology can play to improve performance

Syllabus: Examine the role technology can play to improve performance

Including:
- training innovations
- equipment advances
- recording and monitoring training and performance

Athletes want to improve performance by becoming stronger, faster, jumping higher or throwing further. Achieving these performance goals often requires intense training, dedication and focus on technique, but technology can also play a significant role in enhancing athletic performance.

Modern technology offers **equipment advances** that provide athletes with the ability to track their progress, monitor their physical condition and fine-tune their techniques. For example, wearable devices like fitness trackers and smartwatches can measure heart rate and distance, helping athletes optimise their training routines. Motion analysis technology and high-speed cameras can be used to assess and correct form, improving efficiency and preventing injuries.

equipment advances improvements in sports gear, tools or technology to improve performance and safety

Additionally, equipment innovations, such as lightweight materials for sports gear or customised footwear, can lead to improvements in performance. Virtual reality (VR) and **augmented** reality (AR) can be used for mental training by helping athletes visualise performance scenarios and rehearse under pressure without the physical strain. Nutritional technologies, including apps and devices that monitor hydration and food intake, also support recovery and endurance.

Artificial intelligence (AI) and machine learning algorithms are being applied to analyse vast amounts of data, identifying patterns that can inform coaching strategies and personalise training regimens.

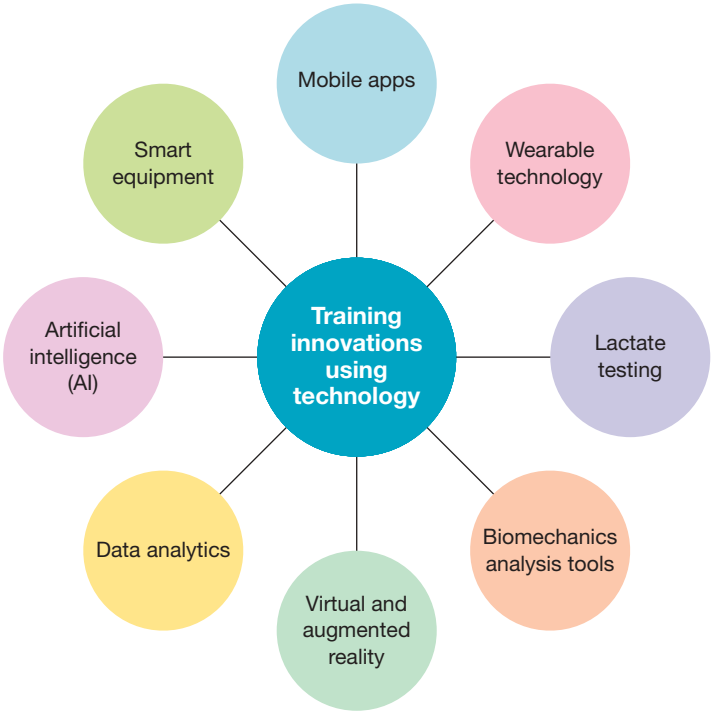
augmented increased to enhance the size, extent or value of something. For instance, augmented feedback might include visual or auditory stimuli from a coach or spectators that provide additional information to the athlete.

training innovations new or improved techniques, programs or technologies used to enhance an athlete's performance

10.4.1 Training innovations

Training innovations involve new approaches, techniques or methods to help athletes improve performance. For athletes, training innovations can provide the competitive edge they are looking for. Innovation can lead to more effective training sessions and improved recovery and performance.

FIGURE 10.9 Examples of training innovations using technology.



Lactate testing

Lactate testing aims to measure the concentration of lactate in the body during exercise. Lactate increases when the body's demand for energy passes the rate in which oxygen can be delivered to muscles. The body breaks down glucose for energy leading to lactate being produced as the by-product. Lactate can also convert to glucose through a process called gluconeogenesis taking place in the liver. This is part of the Cori Cycle which helps maintain blood glucose levels during intense exercise. During anaerobic exercise (e.g. sprinting), muscles produce lactate due to lack of oxygen. Lactate is transported in the bloodstream to the liver. Lactate is converted back to pyruvate which enters the gluoneogenic pathway to synthesise gluocse. A series of enzymatic steps reverse glyocolysis, leading to the production of glucose.

Lactate testing involves athletes running or cycling, adjusting the intensity and testing blood lactate levels at different points. Blood samples are taken from the fingertip or earlobe to test lactate concentration. Lactate testing can help athletes and coaches customise a training plan to focus on particular intensities to improve their performance. Rising lactate thresholds can help athletes perform at higher intensities without fatiguing as quickly.

Virtual reality

Virtual reality (VR) provides simulated training environments where athletes can train in virtual settings to help replicate competition. For example, soccer players may use it to practise tactics. Skiers and surfers may use it when they cannot access the snow or ocean.

FIGURE 10.10 Virtual reality can be used in basketball to stimulate a virtual court and hoop to practise shooting.

Augmented reality (AR)

Augmented reality (AR) provides athletes with immersive, real-time feedback and data-driven insights. Through AR, athletes can visualise game scenarios, refine techniques and enhance their decision-making abilities without the need for physical training. For example, AR systems can project virtual opponents, ideal movements, or specific performance metrics directly into the athlete's field of view, allowing them to practice under realistic conditions. This technology helps athletes to engage in high-quality training sessions, reduce the risk of injury and accelerate skill development. Additionally, AR can be used to simulate complex game situations, offering coaches and players a deeper understanding of strategy and tactics, all while increasing engagement and motivation.

Smart resistance machines

Smart resistance machines adjust resistance based on the athlete's strength, providing a more personalised training experience. For example, some machines provide resistance that will vary depending on the athlete's level of exertion. If the athlete applies more force, the resistance increases which provides feedback for the athlete to optimise their strength training and performance outcomes. Smart cardio machines also provide personalised workouts, track progress and display data such as speed, duration, heart rate and kilojoules burned.

FIGURE 10.11 Smart cardio machines can help athletes personalise their workouts.

Biomechanics analysis tools

Biomechanics analysis tools use motion capture systems and 3D movement analysis. High-speed cameras and sensors can capture movement patterns to improve technique. Sports such as golf, tennis and baseball use this technology in training to help improve technique. 3D movement analysis can identify small mechanical adjustments such as changing the grip when holding a tennis racquet which could improve performance.

Altitude simulation chambers

Altitude simulation chambers simulate high-altitude conditions to enhance athlete's endurance and overall performance. Athletes train in chambers which have lower levels of oxygen to help promote the production of red blood cells. Athletes such as endurance runners and cyclists will use the chambers to improve their VO_2 max and oxygen efficiency.

If athletes are unable to access an altitude simulation chamber, they may use an altitude training mask which provides adjustable resistances during inspiration with a set resistance on expiration to help stimulate high-altitude training. The mask restricts oxygen flow limiting the amount of air entering the mask and lungs.

FIGURE 10.12 A hyperbaric chamber can be used for altitude training.

For more information, access the **Elevation Training Mask Science** weblink in the Resources panel.

Other technologies

Digital platforms and mobile apps can provide personalised training programs for individuals wanting to improve performance. Examples of apps providing personalised training programs include Trainerize, MyFitnessPal, TrueCoach, Strava, Nike Training Club and Fitbod.

Brain training using technology can monitor athletes' brains to help them achieve optimal mental states such as optimal arousal levels. There are headsets which the athletes wear that deliver electrical stimulation to the brain's motor cortex, aiming to increase focus, learn skills faster and improve muscle memory.

10.4.2 Equipment advances

Technology can help improve performance through advances in equipment.

Advances in materials are improving performance, making equipment more comfortable, lightweight and more streamlined. For example, 3D printing technology can customise athletic equipment by creating equipment specifically for their body shape and movement pattern. Equipment may include footwear, helmets or mouthguards.

Smart equipment uses technology to improve performance when training. Smart balls and racquets are embedded with sensors to help develop power and accuracy, thereby developing techniques for the athlete which they can adjust when training.

Examples of equipment advances in tennis include:

- smart racquets which have integrated sensors, providing real-time data on the player's strokes, serves and overall contact with the ball allowing for more accurate adjustments to technique and improved performance
- footwear that is more lightweight, enhancing support and agility, allowing players to move more quickly across the court while also supporting the foot and ankle during slides returning serves
- ball machines using apps that control drill patterns, speed and spin to suit the player's training needs

- clothing and accessories designed for improved temperature regulation, such as cooling wristbands, that help players maintain performance in hot weather
- some tennis courts are now embedded with sensors that capture data such as ball speed, spin and placement. These systems provide real-time analytics to both players and coaches, helping to improve performance.

FIGURE 10.13 Advancements in footwear technology have led to the creation of shoes with enhanced comfort, performance and durability. Smart shoes are also becoming more common, incorporating sensors and AI to track activity and improve personal fitness.

Other sporting examples of equipment advances using technology include:

- Netballs — netball balls have evolved with technological advancements to improve grip, handling and durability. Modern netball balls often feature advanced rubber compounds and textured surfaces that provide better control, even in wet or humid conditions. These balls are designed to maintain their shape and performance over time, with enhanced durability to withstand intense play.
- Football helmets — advances in football helmet design for NFL have incorporated materials like expanded polypropylene and liquid foam, along with improved padding systems, to better absorb impact and reduce the risk of concussions. Some helmets also include sensors that monitor the force and location of hits to alert teams about potential head injuries.
- Cycling bikes — in cycling, technological advancements such as aerodynamic carbon fibre frames and integrated electronic shifting systems have greatly improved performance. Electronic shifting allows for precise, fast gear changes, while lighter, more aerodynamic frames reduce drag, improving speed and efficiency during races.
- Running shoes — technological advancements in running shoe design have led to innovations like foam cushioning systems, which provide superior energy return and shock absorption. Additionally, shoes now feature adaptive uppers made from breathable, lightweight materials like knitted meshes, and some models include carbon fibre plates in the midsole to enhance propulsion and efficiency, especially for long-distance runners. These technologies are designed to improve performance, comfort and injury prevention.
- Track surfaces — advances in synthetic materials, like polyurethane and rubberised composites, have led to the creation of tracks that provide better grip, cushioning and energy return. This allows athletes to run faster and reduces the risk of injury.

Assistive technology devices

Equipment advances in assistive technology can significantly enhance the athletic experience for athletes with disability, especially in terms of performance, independence and overall participation. Using technology can assist athletes with disability to overcome barriers related to mobility and sensory limitations. For example, wheelchair technology and audible balls.

Wheelchair technology

There has been equipment advances in wheelchair design for athletes. For example, lightweight wheelchairs are essential for athletes with mobility impairments, offering enhanced performance, ease of movement and independence. Use of lightweight materials to reduce the weight of the wheelchair allow athletes to move freely and faster, improving their performance. Technology in wheel design; for example, lightweight tyres, enhances manoeuvrability and speed, ensuring athletes have an optimal performance experience. Powered wheelchairs can assist in maintaining speed, especially during long races or events requiring sustained movement.

Audible balls

Equipment advances have also been made in ball design for athletes with visual impairments. For example, audible balls allow athletes to locate the ball by sound. Using advanced sound technology, audible balls can produce consistent, clear and directional sounds. This helps athletes track the ball's movement during a game, improving their ability to intercept or engage with it. In addition to sound, some balls can incorporate vibration or haptic feedback that provides an additional sensory cue, allowing athletes to feel when the ball is close or in play.

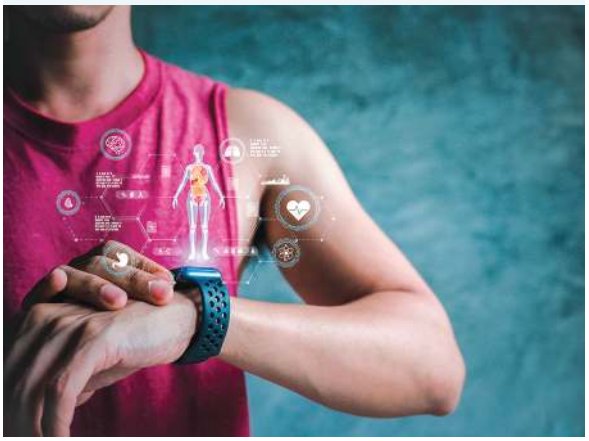
10.4.3 Recording and monitoring training and performance

Technology plays an important role in recording and monitoring training and performance.

Examples include wearable devices, smart clothing and biometric sensors, video analysis, force plate and pressure sensors, data analysis apps, GPS (Global Positioning System), sensor-enabled shoes and Artificial Intelligence (AI).

For example, wearable devices that include heart rate monitors and smart clothing that provides feedback in training about heart rate, breathing rate, muscle contractions and body temperature can help optimise performance.

FIGURE 10.14 Technology advancements in wearable technology such as smartwatches provide instant feedback for athletes.



Sensor technology in shoes can help monitor and improve aspects of an athlete's performance, especially in running, football and tennis. These shoes contain sensors like accelerometers, gyroscopes, pressure sensors and sometimes even temperature sensors. Sensors track the athlete's gait, stride length and foot strike pattern, providing insights into running technique. This data can then be used to help runners correct their technique to improve speed and avoid injury. With embedded sensors, the shoes can provide real-time feedback through a connected smartphone app, allowing athletes to adjust their movements or technique instantly.

GPS is used in wearable devices such as smartwatches, smartphones and athletic trackers which can provide location data to record and monitor performance. This technology can provide a range of insights into player performance, health and tactical development. Recording data on movement, speed, distance and intensity, GPS technology helps to optimise athlete's performance, manage workload and improve team strategies and tactics which all contribute to overall performance.

GPS trackers are excellent for monitoring the distance travelled during activities like running, cycling or walking. Additionally, they can help calculate the speed of an athlete. Apps like Strava allow athletes to upload their routes and compare times or performance with others. In sports such as soccer and rugby, GPS technology can track movement and distance which assists in monitoring the players' fitness levels over the course of a game or training session. GPS technology can also help detect early signs of fatigue and risk of injury so coaches can use the data to make informed decisions on player rotation, recovery and rest.

Other examples include:

- Smart swim goggles can track and display distance, time, splits, stroke and pace in real time. The visual feedback for swimmers assists them in adjusting their technique to improve overall performance.
- Force platforms are used by sprinters and weightlifters which can measure force, power and balance, helping athletes improve strength, stability and power.
- Pressure mapping systems placed in footwear can measure foot strike patterns and pressure distribution that aids in gait analysis and helps improve performance and decrease the risk of injury.
- Apps such as Strava, TrainingPeaks and MyFitnessPal help athletes monitor and record their training. Analysing data from these apps can help identify strengths and weaknesses to determine areas for improvement.
- Performance analysis software such as Dartfish allows coaches to annotate video, compare performance and highlight areas for improvement.

Artificial Intelligence

Artificial Intelligence (AI) is being used in sport to create more efficient and personalised training programs for athletes. AI can track data on athletes' performance, providing information about training adaptations and areas for improvement. AI algorithms can tailor training programs based on athlete's progress, recovery rate and goals.

Some examples include:

- PlayerMaker which uses AI-driven sensors to monitor players' performance during training. It can track the distance covered, speed, acceleration and fatigue levels.
- Statcast which is an automated tool designed to analyse player movements and athletes abilities in Major League Baseball.
- TacticAI is an AI assistant for football. This technology can assist in predicting player movement.
- Hudl can assist coaches to examine games by focusing on tactics, movements and outcomes.

DEPTH STUDY IDEA

Choose a sport and examine how wearable technology can play a role in improving athletic performance.

- Access a variety of wearable technologies; for example, fitness trackers, heart rate monitors or GPS devices.
- Participate in a training session using the monitors.
- Record data and use the data to write a report on how wearable technology can be used to optimise training sessions, prevent injury and over exertion, make adjustments to movement and improve overall performance.

10.4 ACTIVITIES

Training innovations

1. Choose a training innovation and research the following:
   a. How does the technology work?
   b. Is it effective?
   c. What sports would it be best suited for?
   Present your research to the class.
2. Research advancements in technology for training and performance using the **Tonal Smart Gym** and **Adidas Future Craft** weblinks in the Resources panel.
3. Create a timeline showing the evolution of a piece of sports equipment such as running shoes. Highlight the key advancements and the effects on performance.

Debate

4. Debate the following question: 'Should there be limits on technological advancements in sport?' Use the weblink **Are running shoes getting too good?** in the Resources panel to assist with your response.

Technology and sport

5. Listen to the following reports from ABC Radio using the weblinks in the Resources panel: **Technology is revolutionising sport performance** and **How technology is key to the future of sports**.
   Write a report to summarise your findings.

AI in sport

6. Read the article at the weblink **Can AI improve football teams success from corner kicks?** in the Resources panel. Discuss the benefits of AI in improving athletes' performance.

on Resources

Weblinks
Using AI to Enhance Athletic Capabilities
Tonal-Smart Gym
Adidas Future Craft
Can AI improve football teams success from corner kicks?
Elevation Training Mask Science
Are running shoes getting too good?
Technology is revolutionising sport performance
How technology is the key to the future of sports

10.4 Exercises

learnon

10.4 Quick quiz on | **10.4 Exercise**

Learning pathways

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

Revise your knowledge

1. Describe training innovations.
2. Identify examples of technology for the following categories:
   a. training innovations
   b. equipment advances
   c. recording and monitoring of training and performance.
3. Outline the benefits of Artificial Intelligence (AI) for training.
4. Outline the effects of altitude simulation chambers.
5. What are the benefits of wearable technology on performance?

Apply your knowledge

6. Investigate an area in which technology has made a significant difference to performance. Outline how the changes work to improve performance and suggest future developments in this area.
7. Describe one advancement in sports equipment and its impact on performance.
8. How do wearable fitness trackers contribute to improving performance?
9. Explain how virtual reality (VR) can be used as a training tool for athletes.
10. Choose a piece of sports equipment and compare the technological advancements to the traditional forms of the equipment. How have these developments assisted in improving performance?

10.4 Exam questions

Question 1 (2 marks)
Identify two training innovations.

Question 2 (2 marks)
Outline two equipment advances.

Question 3 (4 marks)
Use examples to **describe** how technology is being used to improve performance.

Question 4 (6 marks)
Explain why recording and monitoring of training is important for athletes.

Question 5 (8 marks)
To what extent can technology improve performance? Provide examples.

10.5 The management and prevention of sporting injuries

Syllabus: Explain the management and prevention of sporting injuries

Including:
- classification of sports injuries, including direct and indirect, soft and hard tissue or overuse
- assessment of injuries, including the Talk, Observe, Touch, Active movement, Passive movement, Skill (TOTAPS) test
- management of injuries
- rehabilitation procedures, including progressive mobilisation, graduated exercise, training, use of heat and cold
- return-to-play policy and procedures, including application to different sports, responsibility

10.5.1 Classification of sports injuries

Sports injuries are usually classified according to their cause. The most common classification is to identify injuries as *direct*, *indirect*, *soft tissue*, *hard tissue* and *overuse* injuries.

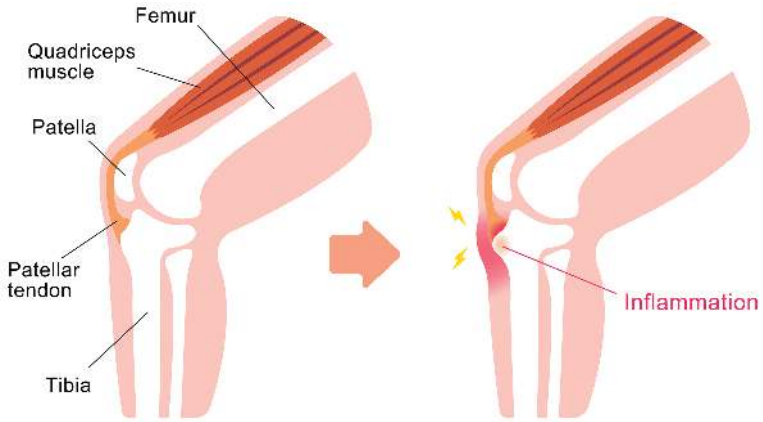
FIGURE 10.15 For improved performance, management and prevention of sporting injuries is essential.

Direct and indirect injuries

Some injuries are caused by direct forces generated from outside the body. **Direct injuries** result in fractures, dislocations, sprains and bruises. A shoulder dislocation caused by a tackle in football or a broken bone caused as a result of a collision between netball players are examples of direct injuries.

In contrast to direct injuries, **indirect injuries** are caused by an intrinsic force; that is, a force within the body. These injuries often result from inadequate warm-up, sudden or excessive movements, or incorrect execution of a skill. They occur when too much strain is placed on muscles, tendons and ligaments, leading to irritationor damage. Examples include a sprinter tearing a hamstring during a race or a volleyball player stretching knee ligaments during a spike for the ball. Osgood-Schlatter Disease is a common cause of knee pain in adolescents as they go through growth spurts. Children and adolescents participating in sports that involve running and jumping are at increased risk of developing the disease as these activities place stress on the patellar tendon and tibia. Symptoms may include pain and swelling with treatment focusing on reducing pain and swelling.

FIGURE 10.16 Osgood-Schlatter Disease showing inflammation in the patellar tendon.



Soft and hard tissue injuries

Soft tissue injuries include damage to muscles, tendons, ligaments, fascia, nerves, fibrous tissue, blood vessels and synovial membranes. These are the most common types of injuries in sport. A **sprain** is an injury to the ligaments and capsule joint of the body and a **strain** is an injury to the muscles or tendons.

Hard tissue injuries cause damage to bones and teeth. They are often more serious than soft tissue injuries. Examples include dislodging a tooth and fracturing a bone, with **fractures** being the most common in sport. Due to their structural role, injured hard tissue must be carefully examined and treated.

Overuse injuries result from intense or excessive use of joints or body areas. They are caused by repetitive, low-impact exercise such as jogging or stepping. These injuries cause pain and inflammation around the injury site. Common overuse injuries include anterior shin splints (an irritation to the front portion of the shinbone), tendonitis (irritation of tendons; e.g. in the Achilles tendon in the heel) and Osgood-Schlatter Disease in children and adolescents.

Overuse can also lead to **stress fractures**, which are small, incomplete bone fractures from repeated impact, usually on hard surfaces. Local swelling and tenderness may indicate a stress fracture. Initial treatment should use the RICER method, but prolonged rest may be necessary for full recovery.

direct injuries caused by an external force applied to the body, such as a collision with a person or object

indirect injuries caused by an intrinsic force;that is, a force within the body

soft tissue injuries injuries to all tissue other than bones and teeth

sprains arise from the stretching or tearing of a ligament

strains occur when a muscle or tendon is stretched or torn

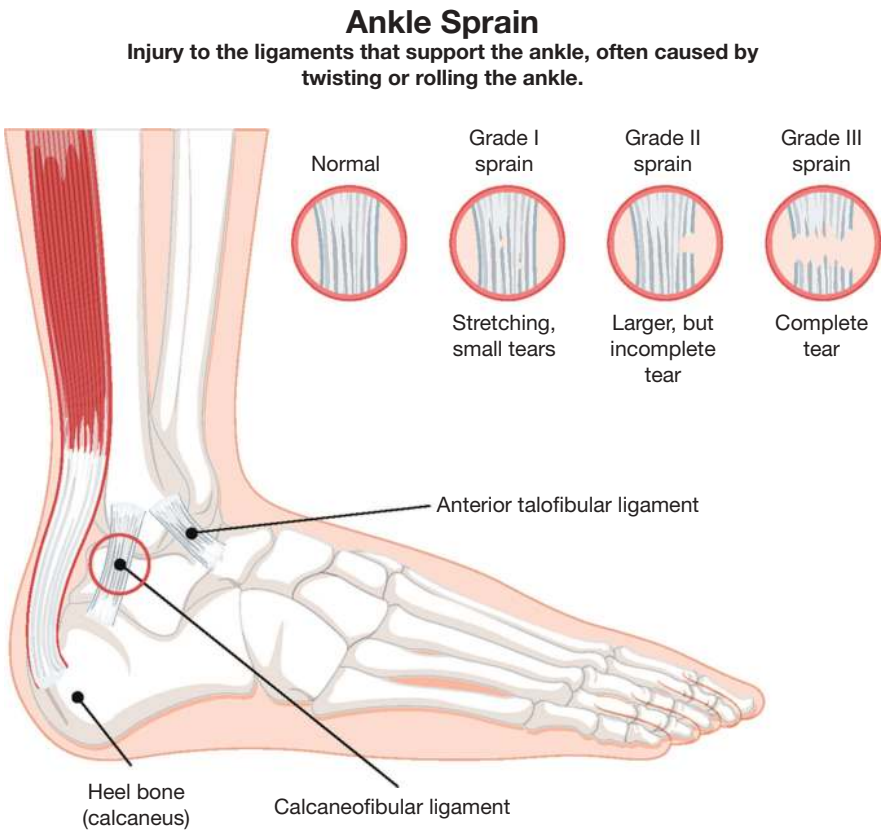
hard tissue injuries injuries that cause damage to bones and teeth

fracture a break in a bone

overuse injuries caused by overuse of specific body regions over long periods of time

stress fractures small incomplete bone fractures caused by repeated pounding, usually on hard surfaces

FIGURE 10.17 Ankle sprains are a common sporting injury affecting the ligaments.



10.5.2 Assessment of injuries: the TOTAPS test

Assessment of injuries

TOTAPS is an acronym that stands for:

- Talk
- Observe
- Touch
- Active movement
- Passive movement
- Skills test.

It is used to assess the extent of injury to a player and to determine whether or not the injured person can return to the field. If the player can complete all tasks required, they should be allowed to return to play.

However, if the player is unable to complete any one of the requirements, the player should be allowed to return to the field only after assessment from a qualified medical practitioner.

hard tissue injuries injuries that cause damage to bones and teeth

fracture a break in a bone

overuse injuries caused by overuse of specific body regions over long periods of time

stress fractures small incomplete bone fractures caused by repeated pounding, usually on hard surfaces

TOTAPS

To complete the TOTAPS regime, follow the steps outlined in table 10.1.

Assessment can be stopped at any stage if damage is apparent; for example, if the player feels pain. In the case of minor injuries, it is often possible to continue play. However, should there be a risk of further damage through continued play, it is recommended to remove the player from the game.

TABLE 10.1 TOTAPS steps

Step	Action
Talk	Talk to the player to find out exactly what happened. This provides valuable information about the nature of the injury.
Observe	Look at the injury and see if there are any obvious signs of swelling or deformity. The easiest way to assess if an area is swollen is to compare both sides of the body.
Touch	Gently feel the injury for any sign of deformity or swelling and try to pinpoint the area of pain.
Active movement	Ask the player to perform a range of joint movements such as flexion, extension and rotation. If these can be done without pain, then further assessment can proceed.
Passive movement	The assessor physically mobilises the joint (flexion, extension, rotation) using a range of movements aimed at identifying painful areas and any instability in the joint.
Skills test	In this phase, the player is asked to perform a skill that is required during the game — for example, a sidestep. If the player is able to perform to the satisfaction of the assessor, then the player can return to the game.

10.5.3 Management of injuries

Soft tissue injuries

Management of soft tissue injuries requires application of the RICER principle. RICER is an acronym that stands for *rest*, *ice*, *compression*, *elevation* and *referral.*

The RICER method, which is explained fully in table 10.2, ensures that the injury heals correctly and in the shortest period of time. If RICER is not used, the injury takes longer to repair and the athlete expieriences less strength and flexibility.

TABLE 10.2 RICER steps

Step	Action
Rest	Avoid movement to reduce blood flow to the injured site.
Ice	Apply a cold pack for 20 minutes every 2 hours to reduce pain, swelling and bleeding. Place the cold pack wrapped in a towel to avoid it touching the skin.
Compression	Apply a compression bandage to reduce swelling and bleeding. Ensure the bandage isn't too tight.
Elevation	Elevate the injury to reduce bleeding and swelling. This could be done by placing a pillow under the area, such as the ankle, for comfort and support.
Referral	Refer the individual to a qualified professional such as a doctor for diagnosis, care and treatment.

It is important to note that while ice is used to help reduce inflammation and pain in the early stages of soft tissue injury, prolonged use can act as a barrier to recovery. Prolonged use of ice can lead to a reduction of blood flow, resulting in nerve damage.

The No HARM protocol should also be applied, which includes no heat, no alcohol, no running or activity and no massage. This will ensure decreased bleeding and swelling to the soft tissue injury.

FIGURE 10.18 Ice is an important step in the RICER management of soft tissue injuries.

Hard tissue injuries

The two most common hard tissue injuries are fractures and dislocations.

Fractures

There are two broad classifications of fractures — simple and compound. In simple (closed) fractures, the bone breaks but remains underneath the skin. In compound (open) fractures, the bone breaks and protrudes through the skin.

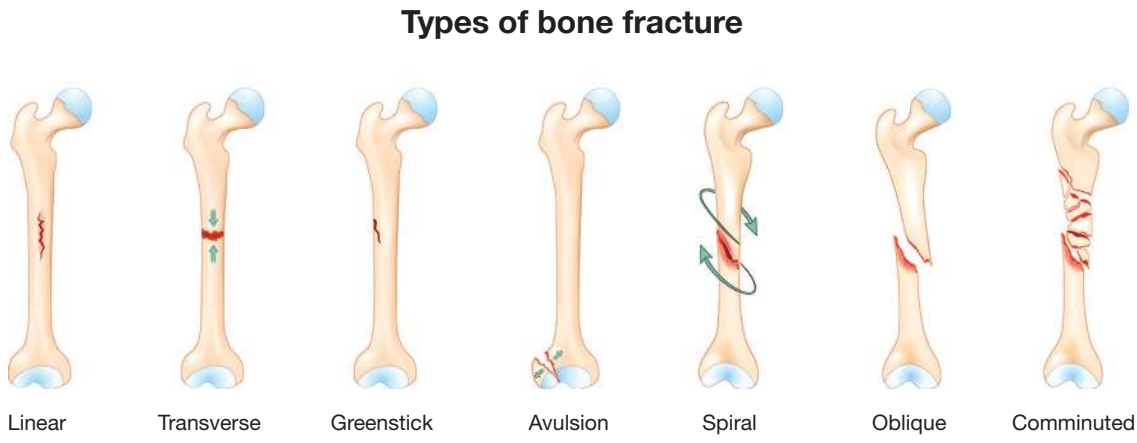
Management of fractures requires:

- use of DRSABCD
- controlling bleeding
- treating shock
- use of a splint and bandage to **immobilise** (restrict movement of) the area
- immediate medical assistance.

Most suspected fracture type injuries require medical attention. Generally, medical attention is required if:

- there is obvious deformity
- there is uncontrolled bleeding
- the casualty is unable to complete the TOTAPS regime.

FIGURE 10.19 Different types of fractures.



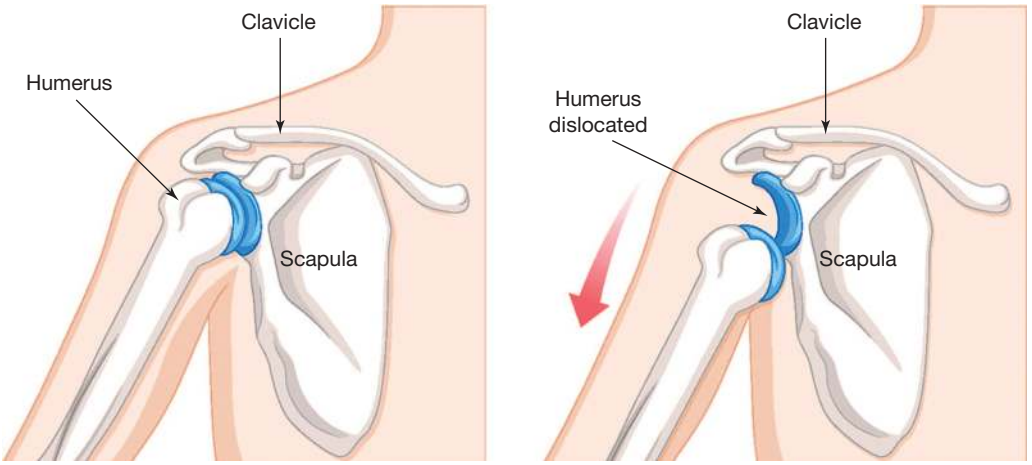
Dislocations

A **dislocation** occurs when a bone is displaced from its joint. This causes pain and visible deformity. Although the bone is not damaged, the ligaments are stretched or ruptured. The bone stays out of the joint until it is physically reinserted. Only a qualified practitioner should reposition a dislocation to avoid further damage.

immobilise restricting movement in the injured area by using splints and bandages

dislocation the displacement of a bone at a joint

FIGURE 10.20 A shoulder dislocation is the displacement of the humerus from the scapula.



The common signs and symptoms of dislocation are:

- deformity and swelling
- pain and tenderness
- loss of function.

Finger dislocations occur most often in contact sports. If the finger is dislocated, it usually looks as if it is out of its normal position. Management requires:

- securing with a splint to fully immobilise the injury
- ice, elevation and support using a bandage
- immediate medical attention.

When treating a dislocation, follow these guidelines:

- never attempt to relocate the displaced bone as this might increase the damage
- seek medical attention.

Sometimes a bone might momentarily 'pop out' and quickly return to place. This is called a *subluxation*. Although it stretches the ligaments, it may not cause additional damage at the time. However, the joint will be vulnerable and require rehabilitation and, possibly, surgery.

rehabilitation the process of restoring the athlete to the pre-injury level of physical fitness

10.5.4 Rehabilitation procedures

Rehabilitation is the process of restoring the athlete to the pre-injury level of physical fitness. It involves mobilisation, stretching, conditioning, taping, training and testing. A proper rehabilitation plan must be followed through all stages, ensuring the injury is fully healed before returning to competition. Recovery time varies, but full recuperation is essential, especially if immobilisation was needed or if the injury has recurred.

FIGURE 10.21 Taping is a technique that can help support an injury by minimising the range of motion.

Progressive mobilisation

After using the RICER method, it is important to restore movement to the injury as soon as possible. This is called progressive mobilisation and involves gradually increasing the range of motion until the

injured part is fully functional. The athlete must avoid aggravating the injury during rehabilitation to prevent extending the healing period. A sprinter returning from an ankle sprain may start early rehabilitation by improving range of motion and strength through exercises such as using a resistance band to move the ankle inward and outward.

FIGURE 10.22 Stretching with a theraband can help in the early stages of rehabilitation following a soft-tissue injury.

Graduated exercise

Graduated exercise involves:

- stretching
- conditioning
- achieving total body fitness.

It is important that the program of exercises is individualised for each athlete. Even if two athletes have ankle sprains, their healing processes may differ. Physiological and metabolic differences, along with the effectiveness of specific exercises, will affect the healing rate and progression.

Stretching

Stretching the injured area is crucial to prevent scarring, which can shorten the muscle and increase the risk of further injury. The best form of stretching is proprioceptive neuromuscular facilitation (PNF) stretching. This technique combines stretching and isometric contractions to improve flexibility and range of motion.

FIGURE 10.23 PNF stretching combines stretching and isometric contractions to increase flexibility and range of motion. Resistance bands are effective in this stretching method.

Examples of PNF stretches may include:

- *hamstring* — Lying on your back with one leg raised in the air and the other extended on the floor. A partner will hold the raised leg. Push against the partners hand by contracting your hamstring for 5–10 seconds. Relax the hamstring and let the partner gently apply force pushing your leg back towards you, increasing the stretch. If a partner is not available, a resistance band or towel can be used.
- *gastrocnemius stretch* — Stand facing a wall with legs in a lunge position. One leg is extended back keeping the heel on the ground and the other leg is slightly bent with the knee facing the wall. Press against the wall with both hands, contracting the gastrocnemius in the back leg for 5–10 seconds, then relax and sink further into the stretch to further stretch the gastrocnemius.

Conditioning

Conditioning is important for athletes in a rehabilitation program as it assists in regaining strength, endurance and flexibility.

Conditioning implies a build-up in fitness as a result of adaptations to gradual increases in physical stress. An effective conditioning program uses the overload principle, which means placing a greater than normal load on the body. Following the principle of progression is also important, as it ensures the optimal amount of overload for each individual over the best time period. Periods of rest and recovery are followed by gradually increasing periods of work. When used correctly, the principle of progression ensures that conditioning is pain-free in the injured area.

The principle of specificity is also important. The conditioning regime should target general cardiorespiratory fitness and increase strength, power and local muscular endurance around the injured area.

FIGURE 10.24 Muscular condition assists athletes to strengthen areas of weakness along with total body fitness during rehabilitation.

Total body fitness

Total body fitness means regaining the mental and physical fitness level the athlete had before the injury. The training program must progressively and gradually overload the muscle groups and energy systems to regain the necessary adaptations before returning to competition. In rehabilitation, these adaptations include

- hypertrophy (increased size) of the muscles
- strengthening of tendons and ligaments
- increased capillarisation and subsequent blood flow to the injured area
- increased elasticity of fibres
- increased joint mobility
- absence of all pain
- full confidence in knowing that the injured area can handle sport-specific stress
- fully restored balance and coordination.

Training

With total body fitness achieved, full training can resume. Here the athlete is expected to participate in the full training program in a pain-free environment. This involves participating in warm-up, conditioning, drills, skills development exercises, tactics and cool-down.

FIGURE 10.25 Various drills in controlled environments such as gyms will be performed during a rehabilitation program.

Use of heat and cold

When to use heat and/or cold on injuries has always been controversial. Generally, cold can be applied for anything up to four days following injury and may be required at times following that to reduce inflammation. Heat is not generally used for two or three days after injury, depending on the injury type and extent of damage.

Cold applications

Commonly used cold applications include:

- *ice massage*, where ice is rubbed gently over the injury for up to 15 minutes at a time
- *cold water immersion*, where the injured area is placed in a container of iced water for short periods of time. Ice baths may also be used for larger areas and whole body recovery
- *cold sprays or gels* are topical solutions that when applied to the skin provide a cooling sensation.

Heat applications

Thermotherapy is the application of heat in various forms to the injury. When internal bleeding has stopped (about 48 hours after the injury), heat may be used to:

- increase elasticity to the new fibres during the stretching process
- reduce pain
- reduce stiffness
- increase blood flow
- reduce inflammation.

Heat energy is transmitted through radiation, convection and conduction. It may be applied using superficial techniques such as heat packs, or penetrating therapies such as ultrasound. Commonly used methods for heat application include:

- *moist heat* packs containing silicate gel. These are applied to the injury, with towels used as insulators between the packs and the injury.
- *whirlpool baths*, where the injury is immersed in a small spa bath containing water at the desired temperature (may be hot or cold) and the injury massaged by the movement of the fluid
- *contrast baths*, where the water temperature is alternated after five minutes or so between hot and cold. This increases local circulation by causing vasodilation (from hot water) and vasoconstriction (from cold water) of the capillaries in the injured area.
- *microwave diathermy*, which is used to heat deeper tissue, particularly tissue with a higher water content such as muscle and blood. With a towel placed over the skin, the tissue surrounding the injury is heated to approximately 42 °C and this temperature maintained for a period not exceeding 30 minutes.
- *ultrasound therapy*, which uses high frequency sound waves to produce heat energy. This is more effective in denser tissue, such as bone and ligament.
- *infrared therapy*, which uses infrared light or radiation to generate heat. The light penetrates the skin and heats the tissues directly beneath the surface. It primarily uses thermal energy to increase blood flow and reduce muscle tension.

10.5.5 Return-to-play policy and procedures

Injured athletes should not return to play until their injury has completely healed. Even then, specific procedures need to be followed and precautions taken to ensure the injury does not recur. In the case of head injuries such as concussion, a medical clearance is essential.

Indicators of readiness to return to play

Effective treatment and rehabilitation ensure that the healing process has resulted in measurable improvements to the injured area. These include:

- *elasticity*. The new tissue has been stretched, promoting lengthways elasticity and resultant flexibility.
- *strength*. The new tissue is strong and able to support the body in stressful movements.
- *mobility*. The athlete has gained full movement, particularly in terms of agility.
- *pain free*. The injury is pain free during both light exercise and strenuous work.
- *balance*. The injured person is able to balance his or her body on the injured limb. Until this function is achieved, the rehabilitation process is not complete.

FIGURE 10.26 Athletes should practise sport-specific skills to ensure they are ready to return to play.

These fitness indicators can be satistfied when observing pre and post-fitness data to determine if the athlete is at pre-injury status.

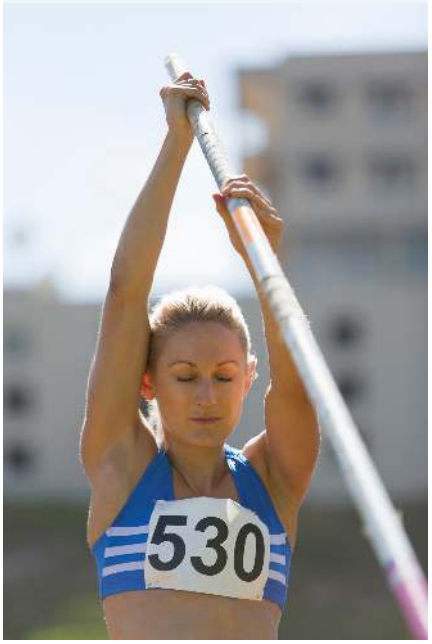
Monitoring progress

To monitor progress, compare results from a pre-test taken before the injury to a post-test taken after the injury. This helps determine if the athlete has lost fitness components such as speed and agility. The tests should include sport-specific movements. For example, if knee ligaments were damaged, an agility test such as the Illinois test would be appropriate, while a grip strength or power test would not be.

Psychological readiness

Physical readiness alone is not enough for an athlete to return to play. Psychological readiness, supported by confidence and a positive outlook, is also crucial to prevent re-injury. Rehabilitation personnel may find it difficult to assess psychological readiness. Some athletes may want to return to play before fully recovering, while others may feel pressured to return despite lacking confidence in their recovery. Both situations risk re-injury. A balance of motivation, self-assurance and common sense is essential for a safe return to play.

FIGURE 10.27 Psychological readiness is important to ensure athletes are ready to perform the skills required. For example, a pole vaulter would need to be prepared psychologically to enable focus ahead of vaulting.



Specific warm-up procedures

Athletes returning from injury must ensure they are fully warmed up and have properly stretched their muscle groups before training or playing. The warm-up should be specific to the injured area. For example, if a sprinter had a hamstring injury, additional stretching for both quadriceps and hamstrings is recommended to ensure these muscles are safely extended beyond what will be required in competition.

Return-to-play policies and procedures

The decision on when a player can return to play (RTP) varies by sport; however, they all emphasise gradual progression, monitoring and medical clearance. In amateur sports, this decision is usually made in consultation with a doctor, physiotherapist or sports trainer. At the professional level, there are often policies that outline procedures to ensure a player is free of injury. Returning to play too soon can be costly for both the athlete and the team.

Application to different sports

Each sport has specific RTP policies and procedures, but many are similar depending on the injury type. These typically involve medical assessment and clearance, followed by graduated exercise, light conditioning and sport-specific drills. Monitoring and evaluation ensure there is no pain or aggravation of the injury. Once medical professionals and the athlete assess the injury and psychological readiness, competition can resume.

Some examples of RTP policies and procedures for different sports are given below.

AFL

The AFL has a comprehensive RTP policy focusing on injury rehabilitation and risk mitigation.

- Initial assessment — after injury, the player must be assessed by a qualified medical professional such as a physiotherapist, sports trainer or doctor.
- Rehabilitation phases — the player undergoes a rehabilitation program designed by the sports medical team and this includes strength, conditioning and sport-specific drills.
- Gradual return — players progress from non-contact training to full-contact practice. The RTP timeline can vary depending on the injury (e.g. ACL injuries might take 6–9 months).
- Graduated return to play protocol — includes five stages (e.g. Phase 1: pain-free activity, Phase 2: sport-specific drills, Phase 3: practice with contact, Phase 4: competition readiness, Phase 5: full return to play without restrictions).

Netball

Netball Australia follows a detailed RTP plan, which is often specific to the type of injury (e.g. ankle sprains, ACL injuries).

- Medical clearance — players need medical clearance from a physiotherapist or doctor before returning to play.
- Phased return — the return to netball involves 4–5 stages, starting from non-weight-bearing exercises to sport-specific drills, and finally, full team drills.
- Gradual exposure — players begin with light court movements, then progress to more intense exercises such as sprinting and change of direction, and eventually contact drills.
- Monitoring — ongoing assessments of the player's progress are done to ensure the risk of re-injury is minimal.

Tennis

For tennis players, the return to play process often follows a more individualised approach due to the high demand on joints (e.g. knees, shoulders).

- Physical assessment — a player's injury history is reviewed, and a rehabilitation program is created based on their condition.
- Stage-by-stage return — like other sports, tennis players follow stages like pain-free activity, light practice, and progressively increasing intensity.
- Rehabilitation — emphasis is placed on the player's flexibility, strength and conditioning.
- Fitness testing — players are assessed in physical tests (strength, flexibility, movement ability) to ensure readiness.

Swimming

In swimming, shoulder injuries are common due to the repetitive rotation action involved in freestyle, backstroke and butterfly.

- Physical therapy — after an injury, swimmers work closely with physiotherapists to regain flexibility and strength.
- Gradual swimming load — swimmers gradually reintroduce swimming at lower intensities before progressing to full swimming workouts.
- Testing and progression — swimmers are tested regularly on their fitness and technique to ensure that their rehabilitation is on track. Tests for flexibility and strength in the rotator cuff and scapular muscles are often required before a full return to competition.

Concussion

Concussion is an area where strict policies and procedures need to be adhered to in order to prevent further brain injury.

FIGURE 10.28 Medical clearance should be received before an athlete returns to play, especially after a concussion.

Contact sports such as NRL, rugby and AFL use baseline cognitive tests before the season to assess memory, balance and reaction time. These tests are compared to post-concussion results to ensure the athlete is ready to return to play. New concussion guidelines from the Australian Institute of Sport (AIS), Sports Medicine Australia and other associations were released on 1 February 2024, supporting both elite and recreational athletes. The AIS return-to-sport protocol for community and youth sport includes introduction of light exercise after an initial 24–48 hours of relative rest, followed by several checkpoints prior to return to sport.

The athlete is required to stop sport and rest for 24–48 hours after sustaining a concussion. Light physical activity can resume after this time so long as the activity doesn't worsen symptoms. This is then followed by sport-specific exercises (no head impact), non-contact training drills, full-contact practice once cleared by

a professional and lastly, full return to play. Competition should only resume after 21 days post-concussion and the athlete must have remained symptom free for at least 14 days. This is recommended by the AIS in the 'Graded Return to Sport Framework for Community and Youth'.

Each stage requires monitoring and evaluation for at least 24 hours and any return of symptoms, such as headache, requires the athlete to revert to the previous stage until they are symptom free.

Refer to the **AIS: graded return to sport framework for community and youth** weblink in the Resources panel to show how an athlete who has sustained a concussion should progress through different stages before returning to sport training and competition.

CASE STUDY 3

Concussion in sport: why making players sit out for 21 days afterwards is a good idea

By ***Hunter Bennett, Lecturer in Exercise Science, University of South Australia***

2 February 2024

The Australian Institute of Sport (AIS) this week released new guidelines for youth and community sport designed to change the way concussion is managed across the country.

While the guidelines contain a host of recommendations about on-field concussion management and identifying symptoms, the biggest changes relate to how a concussion is managed after it happens.

Specifically, all players who sustain a concussion should be symptom-free for at least 14 days before restarting contact training. This was already the advice for children, but now applies to community sport too. And notably, all players should wait a minimum 21 days after being concussed to return to competition.

This is in contrast to the previous recommendations made by many Australian sporting organisations, which typically enforce a ten to 14 day minimum period before a concussed athlete can return to competition.

The new guidelines address a number of recommendations from last year's Senate inquiry into concussions and repeated head trauma in contact sports. So what's the rationale for having people sit out for longer?

The dangers of concussion

Sport-related concussion has been defined as:

a traumatic brain injury caused by a direct blow to the head, neck or body resulting in an impulsive force being transmitted to the brain that occurs in sports and exercise-related activities.

Concussion in sport has become an increasingly hot topic in recent years – and for good reason. The effects of a concussion can include blood flow changes and inflammation affecting the brain.

In the short term, concussion can cause fatigue, light sensitivity and nausea, as well as more severe symptoms including behaviour change, loss of balance and coordination, and severe headaches.

There's also some evidence to suggest repeated concussions can have long-term effects. These include lasting reductions in cognitive function (how people think, make decisions, and process information), and in some instances, an increased risk of dementia in older adulthood.

Concussion in kids

Children who have previously had a concussion are almost four times more likely to get concussed in the future than those who have never been concussed before.

Similarly, our research has shown adolescent athletes who return from concussion are around 50% more likely to suffer any type of future injury than other athletes. My colleagues and I also found most athletes were returning to competition after roughly 12 days, which may suggest insufficient recovery is increasing their injury risk after concussion.

We don't know the exact reason children and adolescents take longer to recover from concussion, but it seems they do.

Recent evidence has indicated that children, on average, may not be fully recovered and able to return to sport until around 20 days after concussion, while adults may be recovered after closer to 14 days. However, this is not true for everyone, with some taking much longer to recover.

…

Source: Bennet, H. (2024), 'Concussion in sport: why making players sit out for 21 days afterwards is a good idea'. *The Conversation*, 2 February, https://theconversation.com/concussion-in-sport-why-making-players-sit-out-for-21-days-afterwards-is-a-good-idea-222504.

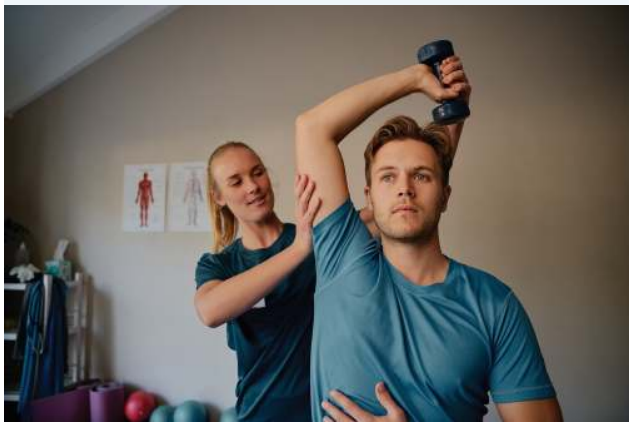
Case study questions

1. What are the new concussion guidelines for youth and community sport?
2. How many days should players wait to return to sport after being concussed?
3. What are the symptoms of concussion?
4. What are the benefits of the new guidelines?

Responsibility for return to play

The decision for an athlete to return to play should involve multiple individuals. Regular communication is essential to consider all aspects of the athlete's recovery, including physiological and psychological readiness.

FIGURE 10.29 Physiotherapists play a key role in supporting athletes return to play.



Some key individuals who are involved include:

- *the athlete*. Provides feedback on psychological readiness. Athletes may hesitate to return, especially after severe injuries. Psychological readiness is crucial to prevent further injury. The athlete should be pain-free and honest about any discomfort.
- *the coach.* Understands the sport's demands and observes the athlete during training to determine if they are performing at their pre-injury level.
- *sports trainers*. Assist the athlete throughout rehabilitation by administering exercises, monitoring progress and evaluating readiness.
- *physiotherapists.* Develop exercises and treat the injury. They monitor progress, range of motion and flexibility while strengthening the injured area.
- *doctors.* Often the primary decision-makers for clearing an athlete to return to play. They conduct evaluations, X-rays and ultrasounds to ensure the injury is healed.
- *sports psychologist*. Helps determine if the athlete is psychologically ready to return through monitoring and progress checks.

Overall, while the doctor may provide final clearance for return to play, there needs to be a collaborative approach in determining the athlete's physiological and psychological readiness to return to play.

DEPTH STUDY IDEA

Explore the psychological strategies used in injury management and prevention for athletes in a sport of your choice.

- Watch the video **The Adolescent Athlete: Strategies for Performance and Injury Management** in the Resources panel.
- Conduct a literature review on the use of psychological strategies for injury management and prevention.
- Interview sports psychologists and/or find interviews of athletes discussing their use of psychological strategies.

Create a podcast about the effectiveness of psychological strategies for athletes in managing injury and preventing injury.

10.5 ACTIVITIES

Concussion

1. a. Step 1: Investigate the new concussion guidelines using the **Concussion guidelines** weblink in the Resources panel.
   b. Step 2: Explain how coaches and athletes can manage concussions. Use the **How to manage concussions** weblink in the Resources panel to assist your research.

ACL in female athletes

2. Explain why female athletes are more likely to tear their ACL than males. Use the weblink **Women soccer players are more likely to tear their ACL than men** in the Resources panel to help with your answer.

Common sport injuries

3. Choose a sport and identify common injuries associated with the sport. Use the weblink **Injury factsheets** in the Resources panel to prepare a resource for the sport about the common injuries and management/prevention strategies.

TOTAPS

4. In pairs, role play a TOTAPS assessment provided by your teacher. Person A acts as the injured athlete and person B performs the assessment, documenting recommended actions and the reasoning for these actions. Person A and Person B swaps roles using a different scenario.

Level 1 sports trainer

5. Participate in the Level 1 Sports Trainer Course provided by Sports Medicine Australia. Further information can be found in the **Level 1 Sports Trainer** weblink in the Resources panel.

Return to play

6. In groups of six, select one of the following roles. Within your individual role, you will argue your case for determining the athlete's return to play following a sporting injury of your choice.
   - Athlete
   - Coach
   - Sports trainer
   - Physiotherapist
   - Doctor
   - Psychologist

on Resources

Weblinks Concussion guidelines
AIS: Graded Return to Sport Framework for Community and Youth
The Adoloescent Athlete: Strategies for Performance and Injury Management
Level 1 Sports Trainer
How to manage concussions
Women soccer players are more likely to tear their ACL than men
Injury factsheets

10.5 Exercises

learnon

10.5 Quick quiz on | 10.5 Exercise

Learning pathways

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

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Revise your knowledge

1. What are two examples of soft-tissue injuries?
2. Distinguish the difference between direct and indirect injuries.
3. What are the symptoms of a soft-tissue injury?
4. Outline the steps in RICER.
5. Describe the TOTAPS procedure.

Apply your knowledge

6. Read the following scenarios and classify them according to the type of injury most likely to have occurred in each case. Place each letter into the appropriate space in a grid like the one shown.
   a. A cricketer begins to run between the wickets and feels a sharp pain in their calf.
   b. A gymnast completes a routine on the parallel bars but lands heavily and twists her ankle.
   c. A baseball player misses a catch and the ball hits his front teeth.
   d. A long-distance freestyle swimmer feels discomfort in the shoulder 1200 metres into a race.
   e. A hockey player hears a crack as her shoulder collides with an opposing player's head.

	Hard tissue	Soft tissue
Direct		
Indirect		
Overuse		

7. Discuss the advantages of rest, ice, compression, elevation and referral in assisting recovery from soft-tissue injury.
8. Explain how the TOTAPS regime would be used in the assessment of a player whose ankle rolled outwards (suspected sprain) during a game of touch football.
9. An athlete dives towards the ground in an attempt to score a try in a game of touch football. The athlete hears a loud crack and remains on the ground, clutching the injured shoulder. Explain the assessment procedures that should be used to determine the nature and extent of this injury.
10. Choose a sport. Describe a physical test that could be used to indicate readiness to return to play.

10.5 Exam questions

Question 1 (3 marks)
Outline the indicators of readiness for return to play following injury.

Question 2 (4 marks)
Explain how application of cold assists in rehabilitating tissue damage.

Question 3 (4 marks)
Outline the benefits of psychological readiness before returning to play.

Question 4 (5 marks)
Discuss the problems that might be caused by playing with an injury.

Question 5 (8 marks)
Explain the rehabilitation procedures used to manage specific sporting injuries.

10.6 The impact of drug use

Syllabus: Discuss the impact of drug use on injury management and improving performance

Including:
- health implications
- ethical considerations
- drug testing

Drug use for injury management or performance enhancement can significantly impact athletes. Elite athletes must consider the potential negative consequences, including health risks, ethical issues (including fairness of competition, safety of athletes and age), and the possibility of banned substances being detected in drug tests.

Use of painkillers and anti-inflammatories for injury management

Using painkillers to allow athletes to play important matches is common in sports. While over-the-counter painkillers such as paracetamol can address minor pain, the use of prescription painkillers by injection is concerning. These painkillers mask pain that signals tissue or organ damage, potentially leading to further injury without the athlete's awareness. This can prolong the healing process and cause permanent damage if the injury worsens.

Athletes with higher pain tolerance may still need to address pain that alters their movements. Intense pain that distracts from performance should also be a signal to stop activity to prevent further injury and a longer rehabilitation period.

FIGURE 10.30 Pain can impact performance, leading athletes to use painkillers to manage pain to maintain performance.

The decision to use painkillers affects elite athletes more than everyday athletes. Key players, especially in high-stakes matches, often use painkillers to continue playing. This decision is usually made in consultation with the team doctor, trainer and coach, but ultimately, the athlete's future is at risk.

Athletes are consistently looking for ways to improve performance and some do so using performance enhancing drugs (PEDs).

The most common types of PEDs for athletes include:
- stimulants
- anabolic steroids
- human growth hormone (HGH)
- erythropoietin (EPO)
- beta blockers
- diuretics.

While these may enhance performance, there are health implications that need to be considered.

FIGURE 10.31 Athletes desire to win can lead them to taking performance enhancing drugs.

10.6.1 Health implications

Stimulants

Stimulants are drugs that stimulate the central nervous system. They increase heart rate, blood pressure, metabolism and body temperature. Endurance athletes may often use stimulants to reduce fatigue and sustain performance. Other athletes may use stimulants to increase alertness and focus.

Examples of stimulants include:

- amphetamines
- cocaine
- ecstasy
- ritalin
- nicotine
- caffeine.

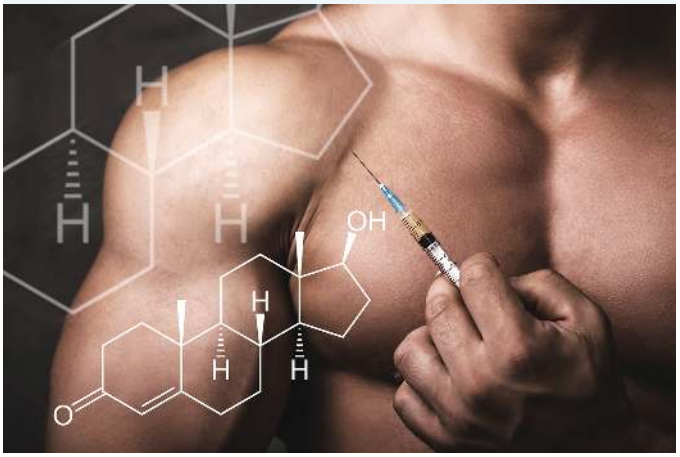
The health impactions vary depending on the type of stimulant and whether it is consumed in tablet form or injected, with injected being absorbed faster into the blood stream.

Caffeine is a popular stimulant as it's not on the banned substance list. However, it needs to be used with caution as high levels can cause a decrease in performance due to increased heart rate, impaired fine motor skills, anxiety or over-arousal. Too much caffeine can also impact sleep which can impact performance as discussed in topic 9.

Anabolic steroids

Steroids can be anabolic (tissue building) or androgenic (producing masculine characteristics such as strength, power, speed and aggressiveness). It is impossible to produce a steroid that is completely anabolic or completely androgenic. This is particularly significant to female athletes who take anabolic steroids to increase strength as they can gain unwanted male features such as facial and body hair in the process.

FIGURE 10.32 Athletes focusing on developing muscular strength may use steroids to give them an advantage.



Steroids were widely used in past decades to increase weight, strength and power and reduce the recovery time between workouts. They stimulate protein synthesis in muscle cells, while simultaneously arresting its breakdown. This increases the body's ability to use protein and prevent its degeneration. Steroid use has been an issue in sports such as weightlifting, body building, track and field (particularly throwing events) and some team sports where bulk and aggression is an advantage.

The effects of steroids depend on the dosage, regularity and period of use. They can include:

- testicular atrophy and a decreased level of reproductive hormone
- liver damage
- higher blood pressure as well as decreased HDL (high density lipoprotein) and increased LDL (low density lipoprotein), leading to increased chance of heart disease and high susceptibility to blood clotting
- increased nervous tension and possible manic or depressive episodes
- increased masculinity and heightened risk of musculo-tendinous injury.

stimulants drugs that stimulate the central nervous system

steroids derivatives of the male sex hormone testosterone and can cause development of masculine characteristics

The specific effects on women include:

- infertility
- masculine appearance, including deepening voice and facial hair
- increased aggressiveness.

Human growth hormone (HGH)

Human growth hormone (HGH) or somatotropin is a hormone produced naturally by the body that is responsible for growth. It exists in every cell in the body that contains growth hormone receptors. Taking artificial forms of the hormone can lead to increased muscle size and strength. It also acts in the mobilisation of fat and making it available as a source of energy. This allows glycogen to be held in storage for the later phase of endurance events, where a sprint finish may be required. Artificial forms of human growth hormone are taken by some athletes.

The long-term effects of using artificial growth hormone are serious and can include:

- overgrowth of face, hands and feet (acromegaly)
- gigantism
- muscle weakness
- diabetes
- heart disease
- disfigurement from bony overgrowth
- osteoporosis and arthritis.

Erythropoietin (EPO)

Erythropoietin (EPO) is a natural hormone that stimulates red blood cell production. It was originally developed for people with anaemia and kidney deficiencies to help them to manufacture extra red blood cells. EPO acts on bone marrow, stimulating red blood cell production. It is a form of 'blood doping', because the increased number of red blood cells allows athletes to absorb more oxygen and improve their stamina.

FIGURE 10.33 Endurance cycling is a sport that may use EPO to sustain performance.

Athletes whose performance could benefit from EPO use are those who feature in endurance events where sustained effort is required, such as marathons, triathlons and distance cycling. However, athletes taking EPO are also more at risk in endurance events because they lose valuable fluid, causing changes to blood consistency. EPO increases blood viscosity, contributing to poor circulation, blood clots and even stroke. It also causes chest pain, headache, high blood pressure, joint pain, fatigue and shortness of breath after each dose. It has caused death in a number of cases. The drug has performance enhancing properties and, until recently, it was undetectable by testing procedures. However, tests are now available that detect EPO in both blood and urine.

Beta blockers

Beta blockers are often prescribed for heart conditions. They lower the heart rate and have a relaxing effect, reducing anxiety. They can prevent muscle trembling and are often used in sports requiring accuracy and concentration such as archery, shooting and golf. Potential health implications can include:

- cold hands and feet
- fatigue
- low blood pressure
- dizziness

human growth hormone a naturally occurring substance that increases the rate at which amino acids are transported to skeletal muscle cells

erythropoietin (EPO) a hormone produced mainly by the kidneys that stimulates red blood cell production in the bone marrow

- nausea
- insomnia
- dry mouth and eyes.

Diuretics

Diuretics are drugs that increase the amount of fluid (water and urine) passing from the body. They are used to treat health problems such as liver and kidney disease. They have played a role in sports such as racing, boxing and weightlifting, where weight reduction is often essential. They are banned because they can clear evidence of steroid use from the body. Apart from the interruptions to training caused by the need to urinate frequently, some detrimental effects of diuretics include:

- dehydration
- dizziness and possible fainting
- headache
- loss of coordination
- heart and kidney failure.

While there are some benefits to performance from taking performance-enhancing drugs, these are often for short-term gains. The health implications from long-term use must be considered as they can shorten an athlete's career as well as impacting the athlete's long-term health and wellbeing.

10.6.2 Ethical considerations

There are many ethical considerations of drug use in sport, including fairness of competition, athlete health and safety, influence on young athletes, the integrity of the sport and age.

Fairness of competition

Performance enhancing drugs give athletes who choose to take them an unfair advantage over those who do not use them. This creates an uneven playing field and disadvantages athletes who rely on their own abilities, training and recovery methods. Not all athletes have access to PEDs, which further increases inequality and raises ethical concerns.

Athlete health and safety

Many PEDs have long-term health implications. Athletes may feel pressured to use PEDs to gain a competitive edge, often without fully understanding the health risks. Coaches and team doctors may also pressure athletes, creating ethical issues. In elite sports, players are sometimes required to return before fully healing from injuries, using strapping or painkillers to mask pain. This practice is dangerous and unethical, as it can lead to further injury and prolonged recovery.

Influence on young athletes

Elite athletes are often seen as role models. If PEDs become common for injury recovery or performance improvement, it may encourage younger athletes to use drugs without understanding the risks or ethical implications. Normalising PEDs can make young athletes feel they are necessary, compromising values such as hard work, resilience and training.

Integrity of sport

Sports are based on fair competition, where athletes compete using skill, technique, fitness, effort and abilities. Drugs introduce artificial enhancements that undermine the sport's integrity. Cheating with drugs can damage a sport's reputation, and athletes can lose trust and respect from teammates, competitors, coaches and supporters.

diuretic a drug that increases the amount of fluid (water and urine) passing from the body

Age

For younger athletes, using PEDs can disrupt natural growth and lead to long-term health consequences. This makes it ethically problematic to allow drug use in younger athletes, as their bodies may not be equipped to handle the drugs' effects. Younger athletes may be more vulnerable to pressure from coaches, peers or sponsors to use drugs in order to enhance performance. This can create an environment where minors feel compelled to use drugs to stay competitive, which raises concerns about exploitation and coercion.

Pressure to take PEDs

Athletes face pressure to perform, win and recover quickly. For example, winning an Olympic gold medal often comes with monetary incentives. This pressure can lead athletes to use drugs, impacting their autonomy and ability to make the best decisions for themselves. The need to perform and win can overshadow health concerns, raising ethical issues about protecting athletes' health and safety.

FIGURE 10.34 The pressure and glory of winning can lead some athletes to choose to take performance enhancing drugs.

Rules and regulations

Most sports organisations have strict anti-doping regulations that athletes are required to follow. Using banned drugs violates the rules put in place to promote fair play, especially when athletes try to mask and hide drugs taken from testing authorities such as Sports Integrity Australia, previously the Australian Sports Anti-Doping Authority (ASADA).

Drugs taken for medical reasons

For instance, certain anti-inflammatory drugs and painkillers can be prescribed to manage injuries, allowing athletes to handle pain during recovery. However, this practice can blur the line between necessary medical treatment and performance enhancement, as these medications may enable athletes to perform despite experiencing muscular pain. This raises ethical concerns about the distinction between proper medical use and artificial enhancement of performance.

CASE STUDY 4

The Enhanced Games: letting athletes use drugs could lead to worse problems than cheating

By ***John Williams Devine, Senior Lecturer in Ethics, Department of Sport and Exercise Sciences, Swansea University***

11 July 2023

What would sport be like if performance-enhancing drugs were allowed? How fast could the fastest athletes run? How high could they jump? How heavy could they lift? The Enhanced Games seeks to answer these questions by removing all restrictions on doping.

In lifting the ban on performance-enhancing drugs, the Enhanced Games challenges a core tenet of modern sports ethics – that sport should be doping-free.

When the first Enhanced Games takes place …, athletes in its five categories of competition – track and field, swimming, weightlifting, gymnastics and combat sports – will be allowed to ingest whatever substance they wish to improve their performance.

There will be no tests, no bans, no limits. For some, including the games' founder Aron D'Souza, the Enhanced Games is the next step in sport's evolution, but for others, it is a moral stain on the sporting landscape.

Advocates of 'enhanced sport' contend that permitting athletes to use whatever drugs they choose will allow sport to test the limits of human potential, to respect athletes' bodily autonomy, and to escape the unending cycle of cheating scandals generated by a failing anti-doping system.

…

Anti-doping rules limit the substances that athletes can use to reach peak performance. Anabolic steroids can help weightlifters to lift heavier and erythropoietin can help distance runners to run faster. So the prohibition of these substances appears to place a ceiling on the pursuit of sporting achievement.

Performance-enhancing drugs elevate the importance of certain physical attributes, such as strength and stamina.

Lifting the ban on drugs would alter the nature of sports by increasing the significance of this sub-set of physical attributes at the expense of other physical attributes, such as coordination and agility, as well as non-physical attributes such as strategic skill, mental resilience and technical proficiency.

…

A second argument advanced by advocates of the Enhanced Games is that lifting the ban affords athletes more extensive control over their bodies.

…

However, lifting the doping ban would allow – perhaps even incentivise – athletes to ingest dangerous or untested drugs.

…

Time to abandon a failed system?

The Enhanced Games may find reluctant support from those who oppose the use of performance-enhancing drugs in principle but have become disillusioned by the failure in practice of the World Anti-Doping Agency and national anti-doping agencies to contain the problem.

…However, lifting the doping ban would grant further competitive advantage to athletes who represent economic superpowers such as the US and China.

…

In a sporting world in which inequality of opportunity is already rampant, the removal of the doping ban would only deepen an existing moral failing.

Source: Devine, J.W. (2023), 'The Enhanced Games: letting athletes use drugs could lead to worse problems than cheating'. *The Conversation*, 11 July, https://theconversation.com/the-enhanced-games-letting-athletes-use-drugs-could-lead-to-worse-problems-than-cheating-209349.

Case study questions

1. What is the purpose of the Enhanced Games?
2. What are some of the benefits of the Enhanced Games for athletes?
3. To what extent does a PED promote inequity in an environment such as the Enhanced Games?

10.6.3 Drug testing

Benefits and limitations of anti-doping

Sample collection (also known as doping control or drug testing) is an essential part of promoting and protecting doping-free sport. It is the process to detect the use of a prohibited substance, or prohibited method, by an athlete. Sample collection consists of testing, conducted by an anti-doping organisation such as Sports Integrity Australia. Use the **Sports Integrity Australia** weblink in the Resources panel to find out more and watch a video on sample collection. Drug testing is random in nature, ranging from several times a week to once a month. The athlete is given no warning unless the drug testing is part of a competition where athletes are tested following a performance. With tests being random, it means more chance for testers to catch athletes who are using drugs.

FIGURE 10.35 Drug testing is essential in sport to try and keep competition fair for all competitors.

Sample collection in sport is now quite extensive throughout the world, with many thousands of tests performed each year.

The *benefits* of sample collection (testing) include the following.

- It protects the right of athletes to compete in a sporting environment free from doping.
- Athletes should be rewarded for their natural ability and training outcomes, not chemical enhancement.
- Knowing that athletes can be tested any time, anywhere, is a deterrent to athletes who might consider doping.
- Doping is harmful to the health of athletes.
- Athletes like being tested because they like being able to prove that they are competing clean.

The *limitations* of sample collection include the following.

- On 1 January each year, a revised World Anti-Doping Agency Prohibited List is released, so athletes must be aware of what is prohibited and keep up to date with their information.
- Because athletes have previously tampered with samples, athletes must remove clothing from the knees to the mid-torso, and from the hands to the elbows, and a chaperone (of the same gender as the athlete) must witness the urine sample leaving the athlete's body. This process can be confronting for some athletes.
- Testing is very costly, amounting to several millions of dollars annually worldwide.

DEPTH STUDY IDEA

Investigate three performance-enhancing drugs and research the following:

- How do specific PEDs accelerate recovery from injury?
- What are the health implications associated with the PEDs (both short-term and long-term)?
- How have anti-doping agencies such as the Australian Sports Anti-Doping Authority (ASADA) and the World Anti Doping Agency (WADA) responded to evolving PEDs technology?

10.6 ACTIVITIES

Drugs in sport

1. Investigate the **Drugs in Sport** weblink in the Resources panel. Write a report based on the findings from the site about the use of drugs in sport.
2. Find an athlete who has used a performance enhancing drug or another substance. Include details about the drug used, reasons for use, health implications, consequences and long-term effects.

Debate

3. Hold a class debate: 'Drugs are the only way athletes will be able to improve their performance'.

Drug-free injury management strategies

4. Research a variety of strategies athletes can use to manage an injury without the use of drugs.

on Resources

Weblinks Drugs in Sport
Sports Integrity Australia

10.6 Exercises

learnon

10.6 Quick quiz on | **10.6 Exercise**

Learning pathways

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

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Revise your knowledge

1. Identify three types of performance enhancing drugs.
2. Identify two risks associated with the use of stimulants to improve athletic performance.
3. Outline the benefits of EPO for endurance athletes.
4. What are some of the health implications from using steroids?
5. Outline two ethical considerations of drug use in sport.

Apply your knowledge

6. Why do athletes use performance-enhancing drugs?
7. Discuss the problems that might be caused by playing with an injury.
8. Explain how painkillers can affect an athlete's perception of injury and why this can be dangerous.
9. Discuss the benefits of the Enhanced Games.
10. Discuss the following statement: 'The only way that there will ever be a level playing field in elite sport is to allow all athletes to use performance enhancing drugs.'

10.6 Exam questions

Question 1 (3 marks)
Describe how stimulants can improve performance.

Question 2 (4 marks)
Outline the benefits and limitations of drug testing.

Question 3 (5 marks)
Why should athletes be cautious when using painkillers for injury management?

Question 4 (6 marks)
Discuss the health implications from using drugs to improve performance.

Question 5 (8 marks)
Discuss the ethical considerations associated with the use of drugs for improved performance.

10.7 Sample exam question response

Question

An athlete experiences an ankle sprain in their sport. **Explain** the management of this injury. **(8 marks)**

Criteria

Key knowledge	Marks
• Provides a comprehensive explanation of the management of the athlete's injury • Provides detailed examples	8
• Provides a sound explanation of the management of the athlete's injury • Provides examples	6–7
• Describes the management of the athlete's injury • Provides examples	4–5
• Demonstrates a basic understanding of the athlete's injury	2–3
• Provides some relevant information	1

Sample response

Breaking down the question

An athlete experiences an ankle sprain in their sport. Explain the management of this injury.

Identify the action word/s: Explain — relate cause and effect; make the relationships between things evident; provide reasons why and/or how

Syllabus terminology: management of injuries

Examples: must be related to an ankle sprain

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

Soft-tissue injuries such as an ankle sprain are managed using the RICER method[1] which works to decrease the degree of swelling, reduce recovery time and the amount of scar tissue.[2]

Rest is the first step to reduce blood flow to the injury and prevent further injury.[1] The player should stop play and minimise movement of the ankle. The athlete should not bear weight on the ankle nor use muscles surrounding it like the gastrocnemius as that would increase swelling and pain.[2] For example, the athlete may use crutches and lie on a lounge for long periods of time. This is used to decrease blood flow to the injured site and in turn decrease swelling or further injury.[3]

Ice is the next step in the RICER management procedure. The purpose of ice when applied to the ankle is to reduce pain, blood flow, swelling and tissue demand for oxygen. By applying ice to the ankle, blood flow is constricted (vasoconstriction) which enables swelling to be reduced.[2] An ice pack wrapped in a towel will be placed over the ankle for 20 minutes. This will be repeated for 20 minutes every hour for the next 24–48 hours to ensure swelling in minimised.[3]

Compression follows ice and is the next step in managing the ankle sprain.[1] The purpose of compression is to decrease bleeding and reduce swelling.[2] This may be done by securing the ice pack with a clear plastic wrap while the player is still on the court. After this time, an elastic bandage can be used around the ankle. It is important that the bandage is not applied too tightly as this could impact on swelling above or below the injury. Compression should be used over the next 24–48 hours which will also provide support to the ankle joint,[3] which is helpful depending on the grade of the sprain.[4]

Elevation is the next step in the process.[1] Elevation helps to decrease bleeding, swelling and reduce throbbing and pain.[2] This can be achieved by raising the ankle, ideally above the heart if possible to reduce blood flow to the injury site, and supporting it by placing something under the ankle such as a bag or rolled up towel while on court.[3] This should be done over the next few days or longer if needed to provide comfort and assist in the recovery process enabling wastes to be removed by the lymphatic system.[4]

Referral is the last step of the RICER method.[1] The referral is important in determining the severity of the sprain. As this sprain is a soft-tissue, indirect injury, the trainer won't be able to determine the nature or extent of the injury without seeking medical advice.[2] There will likely need to be an x-ray of the ankle to determine the grade of the injury.[3] Once the grade is established, a recommended rehabilitation program will be provided to ensure the injury heals and the player can return to play without further injuring the ankle. It is important to reassure the athlete, ensuring that pain is managed to further reduce distress and support the healing process.[4]

10.8 Review

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10.8.1 Topic summary

10.2 How biomechanics can develop efficient movements

- Biomechanics can enhance movement and performance across a variety of areas, including physical activity, sport-specific movements and functional movements.
- Biomechanics can help improve technique in physical activity to aid in sustaining movement and improving performance.
- Biomechanics will play an important role in sustaining movement and improving performance in sport-specific movements. Biomechanics can identify poor movement which may be increasing the risk of injury, increasing energy expenditure and fatigue as well as decreasing performance.
- Functional movements mimic activities in everyday life. These can include actions such as walking, lifting, climbing stairs, bending, reaching, carrying bags, squatting and pushing/pulling.

10.3 Recovery strategies for sustained movement and performance

- Recovery is essential for athletes as it allows the quick return to the normal physical and psychological state. Recovery strategies can be categorised as physiological or psychological.
- Physiological recovery involves the removal of metabolic by-products such as the build-up of lactic acid.
- The purpose of a cool-down following exercise is to gradually reduce heart rate and metabolism to the pre-exercise state. In doing this, a number of other elevated body functions, such as ventilation rate, blood distribution and adrenaline levels, gradually return to normal.
- Hydrotherapy involves the use of water to relax, soothe pain and assist metabolic recovery. Water provides support for movements and eliminates jarring and straining movements that are associated with land drills and field exercises.
- Psychological strategies are essential for athletes' recovery. Psychological strategies reduce stress and anxiety which can occur post-performance

10.4 The role technology can play to improve performance

- Training innovations involve new approaches, techniques or methods to help athletes improve performance.
- Innovation can lead to more effective training sessions as well as improve recovery and performance.
- Examples of training innovations using technology may include mobile apps, wearable technology, lactate testing, biomechanics analysis tools, virtual reality, data analytics, augmented reality (AR) Artificial Intelligence (AI) and smart equipment.
- Altitude simulation chambers simulate high-altitude conditions to enhance athletes' endurance and overall performance. Athletes train in chambers which have lower levels of oxygen to help promote the production of red blood cells.
- Technology is used to develop equipment used in sport that helps improve performance.
- Advances in materials are improving performance, making equipment more comfortable, lightweight and more streamlined.

- Technology plays an important role in recording and monitoring training and performance. For example, using sensor-enabled shoes and GPS to record and monitor training and performance.
- Examples may include wearable devices, smart clothing and biometric sensors, video analysis, force plate and pressure sensors, data analysis apps, running shoes, track surfaces, assistive devices (e.g. lightweight wheelchairs, audible balls) and AI.
- Artificial Intelligence is being used in sport to create more efficient, personalised training programs for athletes. AI can track data on athletes' performance, providing information about training adaptations and areas for improvement.

10.5 The management and prevention of sporting injuries

- Sports injuries are usually classified according to their cause. The most common classification is to identify injuries as *direct*, *indirect*, *soft tissue*, *hard tissue* and *overuse* injuries.
- Direct injuries result in fractures, dislocations, sprains and bruises. A shoulder dislocation caused by a tackle in football or a broken bone caused as a result of a collision between hockey players are examples of direct injuries.
- In contrast to direct injuries, indirect injuries are caused by an intrinsic force; that is, a force within the body.
- Soft-tissue injuries include damage to muscles, tendons, ligaments, fascia, nerves, fibrous tissue, blood vessels and synovial membranes. These are the most common types of injuries in sport.
- Overuse injuries result from intense or unreasonable use of joints or body areas. They are provoked by repetitive, low-impact exercise such as jogging or stepping.
- TOTAPS is used to assess the extent of injury to a player and to determine whether or not the injured person can return to the field.
- Management of soft-tissue injuries requires application of the RICER principle. RICER is an acronym that stands for *rest*, *ice*, *compression*, *elevation* and *referral*.
- Rehabilitation is the process of restoring the athlete to the pre-injury level of physical fitness. It involves mobilisation, stretching, conditioning, taping, training and testing as part of the assessment process.
- Injured athletes should not return to play until their injury has completely healed. Even then, specific procedures need to be followed and precaution taken to ensure the injury does not reoccur.
- Physical readiness is not sufficient to allow an athlete to return to play. Psychological preparedness underpinned by confidence and a positive outlook is also important in preventing reoccurrence of the injury.
- Each sport has specific return-to-play policies and procedures; however, many of these are similar depending on the type of injury.
- Concussion is an area where strict policies and procedures need to be adhered to prevent further brain injury.
- The return-to-play decision for an athlete should not be made in isolation but by a variety of individuals.

10.6 The impact of drug use

- Significant consideration needs to be taken when elite athletes take drugs for injury management and performance, as there can be negative consequences such as health implications, ethical considerations and drug testing which can detect banned substances.
- Prescription painkillers are taken to mask pain that would normally be present during the activity.
- Athletes are consistently looking for ways to improve performance and some do so through the use of performance-enhancing drugs (PEDs).
- Stimulants are drugs that stimulate the central nervous system. They increase heart rate, blood pressure, metabolism and body temperature.
- Steroids can be anabolic (tissue building) or androgenic (producing masculine characteristics such as strength, power, speed and aggressiveness).

- Human growth hormone (HGH) or somatotropin is a hormone produced naturally by the body that is responsible for growth.
- Athletes whose performance could benefit from erythropoietin use are those who feature in endurance events where sustained effort is required, such as marathons, triathlons and distance cycling.
- Ethical considerations include the impact on fairness of the competition, athlete's health and safety, age, influences on young athletes and the integrity of the sport.
- Athletes may feel pressured to use drugs which impacts their autonomy and ability to make a decision that's best for them. Athletes may feel the need to perform and win, disregarding the health implications that can arise from PEDs.
- Sample collection (also known as doping control or drug testing) is an essential part of promoting and protecting doping-free sport. It is the process to detect the use of a prohibited substance, or prohibited method, by an athlete.

DEPTH STUDY TASK

A complete depth study task is available in the Teacher resources.

Type: The use of biomechanics and technology in baseball

Time: 10 hours

Task description: Investigation with practical component

A task overview, description, resource/reference list (to relevant articles, websites and/or videos) and marking rubric are available in the Teacher resources.

on Resources

Digital documents Topic 10 summary (doc-43071)
Key terms glossary (doc-43072)
Revision quiz (doc-43073)

Interactivity Missing word interactive quiz (int-9367)

10.8 Exercises

learnon

10.8 Revision quiz on | **10.8 Exam questions**

10.8 Exam questions

Section I

Question 1 (1 mark)

What is the difference between direct and indirect injuries?

A. Direct injuries occur from external forces, while indirect injuries result from internal forces.
B. Direct injuries are caused by overuse, while indirect injuries are caused by sudden trauma.
C. Direct injuries are always more severe than indirect injuries.
D. Direct injuries affect muscles, while indirect injuries affect bones.

Question 2 (1 mark)

Identify two types of training innovations.

A. High-Intensity Interval Training (HIIT) and CrossFit
B. Yoga and Pilates
C. Weightlifting and Running
D. Swimming and Cycling

Question 3 (1 mark)

What is the RICER management procedure for soft-tissue injuries?

A. Rest, Ice, Compression, Elevation, Referral
B. Rest, Ice, Compression, Exercise, Referral
C. Rest, Ice, Compression, Elevation, Recovery
D. Rest, Ice, Compression, Elevation, Rehabilitation

Question 4 (1 mark)

What is EPO?

A. EPO is a painkiller that helps athletes recover faster.
B. EPO is a hormone that increases red blood cell production, enhancing oxygen delivery to muscles.
C. EPO is a steroid that builds muscle mass quickly.
D. EPO is a supplement that improves mental focus and concentration.

Section II

Question 5 (3 marks)

Outline how biomechanics can help improve performance for a gymnast performing a beam routine.

Question 6 (4 marks)

A hockey player is competing in a gala day involving several games. In the first game, they miss several strikes at goal. **How** can biomechanics be used to improve this player's performance?

Question 7 (4 marks)

What are the benefits of relaxation as a psychological strategy to assist athletes improve performance?

Question 8 (5 marks)

Describe the assessment procedure used to determine the nature and extent of a sports injury.

Question 9 (6 marks)

Explain the advantages and disadvantages related to drug testing elite athletes.

Question 10 (6 marks)

A netball player is competing in a gala day involving several games.

The player has just finished the quarter-final game and is scheduled to play the semi-final game. **Discuss** the psychological recovery strategies that could be used to improve the player's performance.

Question 11 (8 marks)

Justify the use of hydrotherapy as a recovery strategy for sustained movement and performance.

Question 12 (8 marks)

Source: *HSC 2018, PDHPE Exam, Section II, Q.30a*

An athlete running a 400-m race experiences a hamstring strain in the sprint towards the finish line. **Explain** the classification and management of the athlete's injury.

Question 13 (8 marks)

Source: *HSC 2018, PDHPE Exam, Section II, Q.30b*

Evaluate policies and procedures that address the ethical considerations in determining when an athlete returns to play from an injury.

Question 14 (12 marks)

Source: *HSC 2024, PDHPE Exam, Section II, Q.31b*

To what extent have advancements in sporting technology improved performance?

Section III

Question 15 (12 marks)

Refer to the following scenario.

A triathlete is competing in a race and feels pain in their knee. During the assessment of injury, the sports trainer identifies that the athlete has sustained an ACL injury. The trainer instructs the player to apply cold compression, immobilise the area and rest for the next week before starting training again.

Evaluate the trainer's advice and propose a suitable rehabilitation program for the athlete.

Glossary

absolute strength working with high resistance and low repetitions (1–6 reps)
acceleration the rate at which velocity changes in a given amount of time
accuracy refers to how close a measurement or calculation is to the standard or correct value, which is set by previous reliable studies
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
advocacy the act of championing or arguing for a particular issue or cause
advocate the process of arguing in support of a cause or position or acting on behalf of yourself or another individual to ensure that your or others' best interests are taken into account
advocating supporting a cause or position or acting on behalf of yourself or someone else to ensure that best interests are considered
aerobic interval training involves alternating sessions of work and recovery. The rest period is important in differentiating aerobic interval training from anaerobic interval training.
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).
aerobic training zone a level of intensity that causes the heart rate to be high enough to cause significant training gains
anaemia a condition where the body lacks enough red blood cells or hemoglobin to carry oxygen to the body's tissues
anaerobic interval training involves short, intense exercise bursts followed by rest, enhancing power, speed and lactic acid tolerance
anaerobic threshold a level of intensity in physical activity where the accumulation of lactic acid in the blood increases very quickly
anaerobic training physical activity that is performed at a high intensity for a short duration. A limited supply of stored glycogen is used as energy, not requiring oxygen.
anxiety uneasy emotional state that may be brought on by an actual or perceived threat to the safety and wellbeing of the individual
apprenticeship a system of training in which a person (the apprentice) learns a trade or skill through practical experience under the guidance of a skilled worker, often while working for a set period
arousal a specific level of anxiety and can be experienced prior to and during a performance
Artificial Intelligence (AI) the simulation of human intelligence processes by machines, especially computer systems. In healthcare, AI is used for tasks such as diagnosis, treatment planning and drug discovery.
assistive technology any item, piece of equipment or product system that is used to increase, maintain or improve the functional capabilities of the healthcare system
augmented increased to enhance the size, extent or value of something. For instance, augmented feedback might include visual or auditory stimuli from a coach or spectators that provide additional information to the athlete.
balance the ability to maintain equilibrium while either stationary or moving
ballistic stretching involves using quick, bouncing movements to push muscles beyond their normal range of motion
big data extremely large data sets that may be analysed computationally to reveal patterns, trends and associations, especially relating to human behaviour and interaction
biomechanical principles involve the mechanics of movement and the forces that cause it. Understanding biomechanics helps minimise injury risks, shorten rehabilitation time, improve sports performance, and promote mastery in sports.
biomechanics is a science concerned with forces and the effect of these forces on and within the human body

bulk billing a payment option in the Medicare system. The service provider (doctor) bills Medicare directly for the consultation fee, thereby accepting the Medicare benefit as full payment for the service, and the patient pays no fee to the doctor.
caffeine a naturally occurring stimulant from leaves, nuts and seeds of plants
calcium a mineral found naturally in many foods, particularly dairy products, and it is essential for bone growth
cancer a large group of diseases that are characterised by the uncontrolled growth and spread of abnormal cells.
carbohydrate loading the manipulation of training and nutrition prior to endurance events to maximise muscle glycogen (carbohydrate) stores
carbohydrates the most versatile fuel source available to supply energy for ATP resynthesis
carcinogens cancer-causing agents such as chemicals, pollutants, radiation, cigarette smoke and alcohol
cardiac output the amount of blood pumped by the heart per minute
cardiovascular disease (CVD) damage to, or disease of, the heart, arteries, veins and/or smaller blood vessels
carer a person who, through family relationship or friendship, looks after an older person or someone with a disability or chronic illness
chiropody involves diagnosis and treatment of disorders of the foot, ankle and lower leg
circuit training requires participants to move from one 'station' to another, performing specified exercises at each until they complete the circuit
concentration is the ability to link movement and awareness to the extent that the individual can focus on doing, rather than on thinking about doing
continuous training aerobic training where there is a sustained effort that has no rest intervals and usually lasts for at least 20 minutes
creatine a naturally occurring compound found in skeletal muscle. It is in the muscle that creatine is converted to creatine phosphate and thereafter assists in the resynthesis of ATP.
cryotherapy the use of cooling to treat injury or quicken recovery from performances, particularly those that involve collisions and/or sustained intensity
culturally and linguistically diverse (CALD) Australia's population includes many people who were born overseas, have a parent born overseas or speak a variety of languages. Together, these groups of people are known as culturally and linguistically diverse populations.
culturally appropriate healthcare healthcare that is respectful of and tailored to the cultural beliefs, practices and needs of diverse populations, ensuring that services are accessible and effective for individuals from different backgrounds
data citizenship the responsible and ethical use of data
data literacy the ability to read, understand, create and communicate data as information
data point a single piece of information or data
dehydration an excessive loss of water
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 factors that can have an impact on a person's or group's health status, either positively (protective factors) or negatively (risk factors)
DEXA scan (Dual-Energy X-ray Absorptiometry) a medical imaging test that measures bone density and body composition, including fat and lean mass. It provides precise data, helping athletes and trainers assess body composition to tailor training programs and monitor changes over time.
digital health the use of digital technologies to improve health and healthcare. This includes electronic health records, telehealth and mobile health apps.
direct injuries caused by an external force applied to the body, such as a collision with a person or object
disability is defined in terms of the lack of ability to perform everyday functions or activities. It refers to limitations in functional abilities.
dislocation the displacement of a bone at a joint
diuretic a drug that increases the amount of fluid (water and urine) passing from the body
drag the force that opposes the forward motion of a body or object reducing its speed or velocity
dynamic stretching uses speed and momentum with movements experienced in a game to increase flexibility
elective procedures those operations that are not classified as emergencies

electrolytes salts and minerals, such as sodium, potassium, calcium and magnesium, that are important for many body functions such as chemical breakdown and nerve conduction. Electrolytes can be lost through perspiration during exercise.

electronic health records (EHRs) digital versions of a patient's paper chart, containing their medical history, diagnoses, medications, treatment plans, immunisation dates, allergies, radiology images, and laboratory and test results

elite athlete an individual who competes at the highest levels of their sport, often requiring advanced skills, physical fitness and specialised training

equipment advances improvements in sports gear, tools or technology to improve performance and safety

equity the allocation of resources according to the needs of individuals and populations. The goal is to achieve equality of outcomes.

equity of access ensuring that everyone has fair and equal access to healthcare services, regardless of their location, socioeconomic status or other factors

ergogenic aid a substance or practice that improves or is believed to improve physical performance

erythropoietin (EPO) a hormone produced mainly by the kidneys that stimulates red blood cell production in the bone marrow

exercise assessment a systematic evaluation of an individual's physical capabilities, often involving health screening, pre-exercise questionnaires and performance tests

fartlek training ('speed play') participants vary their speed and the terrain on which they are working, ultimately engaging both anaerobic and aerobic energy systems

fast twitch muscle fibres reach peak tension quickly and are recruited for power and explosive movements such as throwing and lifting

fatigue an extreme feeling of tiredness along with a lack of energy that can interfere with the body's ability to sustain movement

fats the most concentrated form of energy for ATP resynthesis

FITT principle Frequency, Intensity, Time and Type. It is a guideline used in designing exercise programs, emphasising how often (frequency), how hard (intensity), how long (time), and what kind of exercise (type) to engage in.

flexibility the range through which joints and body parts are able to move

force the push or pull acting on a body or object

fracture a break in a bone

functional movements mimic activities in everyday life

glycaemic index is 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

goals are targets that we direct our efforts towards. They can relate to either performance or behaviour.

haemoglobin the substance in blood that binds to oxygen and transports it around the body

hard tissue injuries injuries that cause damage to bones and teeth

health apps software programs on mobile devices that process health-related data for users, helping them manage their health and wellbeing

health behaviours a person's beliefs and actions regarding their health and wellbeing. For example, tobacco use, alcohol consumption, physical activity or dietary behaviour.

health determinants the range of health behaviours, personal biomedical factors, environmental factors and socioeconomic factors, as identified by the Australian Institute of Health and Welfare, that determine the health status of individuals and populations

health screening the assessment of an individual's medical history, risk factors and current health status to identify any potential issues that could impact their ability to safely participate in exercise

health services a broad range of services provided to individuals or communities to promote, maintain or restore health, including preventive, diagnostic, therapeutic and rehabilitative services

healthcare expenditure the allocation of funding and other economic resources for the provision and consumption of health services

healthcare professionals trained individuals who provide medical services and support, including doctors, nurses, therapists and allied health practitioners, who are responsible for patient care and health promotion

healthy ageing the process of developing and maintaining the functioning ability that enables wellbeing in their older age (WHO)

Healthy Cities Illawarra an initiative aimed at improving the health and wellbeing of communities in the Illawarra region of NSW, focusing on urban planning, sustainable development and community engagement to create healthier living environments

High Intensity Interval Training (HIIT) involves repeated bouts of high-intensity exercise followed by varying periods of complete rest or recovery at lower intensity

holistic an approach that considers the whole person, including physical, mental, emotional and social aspects, in the assessment and treatment of health and wellbeing, recognising the interconnectedness of these elements

human growth hormone a naturally occurring substance that increases the rate at which amino acids are transported to skeletal muscle cells

hydration involves supplying sufficient water to the body's cells

hydrotherapy the use of water to relax, soothe pain and assist metabolic recovery

immobilise restricting movement in the injured area by using splints and bandages

incidence the number of new cases (of an illness or event, and so on) 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

indirect injuries caused by an intrinsic force; that is, a force within the body

inequities unfair differences in levels of health status between groups in a society

intergenerational trauma the emotional and psychological effects of trauma experienced by one generation that are passed down to subsequent generations, affecting their wellbeing even without direct experience of the trauma

interoperability the ability of different information systems, devices and applications to connect, exchange and use information in a coordinated manner

inverted U hypothesis a theory that suggests that performance improves with increasing arousal to a point beyond which performance will deteriorate

iron a mineral naturally present in many foods and contributes to producing haemoglobin, responsible for carrying oxygen to working muscles

kinematics movements of the body

kinetics forces acting on the body

levy a payment collected by the government from a person's income

life expectancy measures how long, on average, a person is expected to live, based on current age and sex-specific death rates. It is often expressed as the number of years a person born today is expected to live.

linear motion when the body travels in one direction

lung capacity the amount of air that the lungs can hold

macrocycles are long-term planning periods or overviews

macronutrients energy-providing chemical substances, or the main nutrients needed by the human body. These include carbohydrates, fats and proteins.

magnesium a mineral that is essential for healthy muscles, nerves, bones and blood sugar levels

Maranguka Justice Reinvestment a strategy aimed at reducing crime and incarceration rates by redirecting funds from the criminal justice system into community programs that address the underlying causes of crime, such as poverty, lack of education and mental health issues

Medicare Australia's public-funded universal healthcare system, ensuring all Australians have access to free or low-cost medical, optometric and hospital care

mental rehearsal is the technique of picturing the performance or skill before executing it

metastases secondary or new tumours, which may develop some distance from the original malignant tumour

microcycles are short training cycles containing specific details and usually cover a period of about 7–10 days

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 and minerals.

minerals inorganic substances found in the body that are necessary for the body to function adequately
mitochondria cell organelles that produce energy (ATP) through cellular respiration and have their own DNA
momentum the quantity of motion that a body or object 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
multifaceted approach a strategy that uses multiple methods or perspectives to address a complex issue, recognising that no single solution is enough to achieve desired outcomes
muscle hypertrophy a term that refers to muscle growth together with an increase in the size of muscle cells
myoglobin a protein found in muscle cells that stores and transports oxygen, helping to supply oxygen to muscles during physical activity
neoplasm an abnormal mass of cells that forces its way among healthy cells and interferes with their normal functioning
OECD Organisation for Economic Co-operation and Development. An international organisation that develops policies for a range of social, economic and environmental challenges.
optometry a healthcare profession that addresses problems with eyes and vision
overuse injuries caused by overuse of specific body regions over long periods of time
oxygen uptake the ability of the working muscles to use the oxygen being delivered
pap smears a medical test that screens for cervical cancer by collecting cells from the cervix to detect any abnormalities
PBS Safety Net caps the amount a family will pay for PBS subsidised medications in a calendar year
peaking the phase of training in which performance is optimised to meet the demands of a race, competition or series
performance and fitness testing various evaluations used to measure an individual's physical capabilities in specific areas such as cardiovascular endurance, strength, flexibility and agility. These tests provide valuable data that informs training programs, ensuring they are tailored to the athlete's needs.
Pharmaceutical Benefits Scheme (PBS) a Commonwealth Government program that provides subsidised prescription drugs to Australian residents, ensuring affordable access to a range of essential medicines
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
plateauing a period during training when an individual experiences little to no progress in performance or fitness improvements despite continued effort
plyometric plyometric exercises are high-intensity movements that involve explosive actions, such as jumping or bounding, designed to improve power and speed
PNF stretching a progressive cycle incorporating a static stretch, an isometric contraction and a period of relaxation in the lengthened position. It is aimed at stretching and strengthening muscles in a safe movement.
pre-exercise questionnaires forms filled out by individuals before beginning an exercise program or assessment. They gather information about an individual's health history, current fitness levels and any concerns, helping exercise and fitness professionals design safe and effective exercise regimens.
precision surgery a surgical approach that uses advanced technologies such as robotics and imaging to improve accuracy and minimise invasiveness
prevalence the number or proportion (of cases, instances, and so forth) in a population at a given time. For example, in relation to cancer, it refers to the number of people alive who had been diagnosed with cancer in a prescribed period (usually 1, 5, 10 or 26 years).
prevention and early intervention strategies aimed at preventing health issues or addressing them early on to reduce their impact, including education, health screens and access to resources
primary investigation a research methodology in which the researcher directly collects data, rather than relying on data collected from previous studies
proactive recovery emphasises immediate refuelling and rehydration that continues until a pre-event state is obtained

protein an essential component of a balanced diet. Protein allows for muscle growth and repair, fights disease, helps chemical reactions and transports materials.
psychiatric hospitals care for patients diagnosed with mental illness
psychosocial stressors life situations that create an unusual or intense level of stress
reactive force when one body or object exerts force on another and the second object exerts an equal reaction force on the object
recreational participant an individual who engages in physical activity for enjoyment, health or fitness rather than for competitive purposes
rehabilitation the process of restoring the athlete to the pre-injury level of physical fitness
relaxation techniques are a series of techniques that seek to control the body's response to stress
reliability the degree to which a measurement can be duplicated on multiple occasions, assuming that the controlled variables remain the same
residential care care given to a patient away from their home. It takes into account the needs and wishes of the person. An example of high-level residential care is a clinic that provides help and treatment to sufferers of anorexia.
risky health behaviours a health behaviour is considered risky when it increases the likelihood of negative health outcomes, such as injury, illness or premature death
SDG 3: Good Health and Wellbeing a goal aimed at ensuring healthy lives and promoting wellbeing for all at all ages, focusing on reducing maternal and child mortality, combating diseases and providing universal health coverage
SDG 4: Quality Education a goal aimed at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all, emphasising the need for access to education and quality learning environments
SDG 10: Reduced Inequalities a goal focused on reducing inequality within and among countries, promoting social, economic and political inclusion of all individuals, regardless of their background or circumstances
SDG 11: Sustainable Cities and Communities a goal aimed at making cities and human settlements inclusive, safe, resilient and sustainable, addressing urbanisation challenges and improving the quality of life for urban residents
skill and tactical development involves improving specific abilities required for a sport and enhancing strategies to outmanoeuvre opponents, often through practice, analysis and applying game situations
slow twitch muscle fibres contract slowly and for long periods of time. They are recruited for endurance-type activities such as marathons.
socioeconomic status a measure of an individual's or group's social and economic position, often determined by income, education and occupation
socioeconomically disadvantaged individuals or groups with limited access to financial resources, education and healthcare, resulting in poorer quality of life and health outcomes
sociological causes societal influences or reasons. These include social relationships, social interaction and culture of everyday life.
soft tissue injuries injuries to all tissue other than bones and teeth
speed the ability to perform body movements quickly
sprains arise from the stretching or tearing of a ligament
Sprint Interval Training (SIT) a high-intensity workout method involving short bursts of all-out effort, followed by rest or low-intensity recovery, repeated multiple times in a session
stability the ability of a body or object to maintain balance and resist movements to ensure control during dynamic or static activities
static stretching a safe form of stretching in which the stretch is held for a period of 10–30 seconds
steroids derivatives of the male sex hormone testosterone and can cause development of masculine characteristics
stimulants drugs that stimulate the central nervous system
strains occur when a muscle or tendon is stretched or torn
strength the ability of a muscle or muscle group to exert a force against a resistance
strength endurance working with low resistance and high repetitions (15–20 reps)

stress physiological or psychological influence that produces a state of tension in a person

stress fractures small incomplete bone fractures caused by repeated pounding, usually on hard surfaces

stretch reflex an involuntary muscle contraction that prevents fibre damage if muscles are lengthened beyond their normal range

stroke volume the amount of blood ejected by the left ventricle of the heart during a contraction. It is measured in mL/beat.

supplements products designed to give the body nutrients that might be missing from the diet to meet dietary requirements

Sustainable Development Goals (SDGs) a set of 17 global goals developed by the United Nations 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.

tapering a period immediately before competition when the volume and intensity of training is reduced

technology the application of scientific knowledge for practical purposes, especially in industry. In the context of healthcare, this includes medical devices, IT systems, algorithms and AI.

telehealth the delivery of healthcare services remotely using telecommunications technology, allowing patients to consult with healthcare providers through video calls, phone calls or online messaging, enhancing access to care

telehealth the use of telecommunications technology to provide healthcare services remotely

traineeship structured training programs that provide individuals, often students or recent graduates, with practical experience in a specific field or profession, combining on-the-job training with educational components

training innovations new or improved techniques, programs or technologies used to enhance an athlete's performance

triangulation using several data collection techniques in order to validate findings

tumour a swelling or enlargement caused by a clump of abnormal cells

unconscious bias the attitudes or social stereotypes about certain groups of people that individuals form outside their own conscious awareness. They can affect our understanding, actions and decisions.

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

vasoconstriction a decrease in blood vessel size, causing less blood to be supplied to the area that is serviced by that blood vessel

velocity the rate of positional change of an object

vitamin B12 a micronutrient that assists in producing red blood cells to transport oxygen to working muscles

vitamins inorganic compounds that are essential to maintaining bodily functions

volunteer a person who offers to perform a service for the community on a voluntary basis

wellbeing a sustainable state characterised by predominantly positive feelings, attitudes and relationships. It involves resilience, self-efficacy and a high level of satisfaction with self.

INDEX

A

Aboriginal and Torres Strait Islander Peoples 37, 47–53
  cancer 93
  cardiovascular disease (CVD) 88
  communities 72
  in decision-making processes 51
  health 230–1
  health and wellbeing 72–3
  healthcare system 124–6
  health gap 49
  health status 50–3
  population by remoteness area 59
  specific needs and cultural values of 50
Aboriginal Community Controlled Health Services (ACCHSs) 124
Aboriginal Community-Controlled Health Organisations (ACCHOs) 50
absolute strength 282, 302
academic blogs 26
academic essay 22
acceleration 413
accessibility of healthcare facilities 69
ACCHOs. *see* Aboriginal Community-Controlled Health Organisations
ACCHSs. *see* Aboriginal Community Controlled Health Services
accuracy 16–18, 158–60
  definition 17
ACE-Prevention project. *see* Assessing Cost Effectiveness of Prevention project
acupuncture 151
adenosine triphosphate (ATP) 369, 382
advocacy 104, 138
advocate 104, 221
aerobic interval training 282–3
aerobic threshold 302, 303
aerobic training 280–4
  aerobic interval training 282–3
  circuit training 283–4
  continuous training 280–1
  fartlek training 281–2
  and physiological adaptations 314–16
  specificity in 300–1
aerobic training zone 302
Aged Care Research and Industry Innovation Australia 104
aged care workforce development 104
ageing population 92, 98–108, 161
  challenges 100–3
  current and future strategies 103–4
    lifelong learning 104
    policy reform 103
    technology integration 103
  governments and non-governmental agencies 104–6
  opportunities 100
ageing workforce 101
ageism 71
age-related health needs 231
agility tests 252
AIHW. *see* Australian Institute of Health and Welfare
alcohol consumption 66
alcohol-related health issues 40
Allison, Fiona 224
altitude simulation chambers 428
AMA. *see* Australian Medical Association
anabolic steroids 449–50
anaemia 393
anaerobic interval training 277
anaerobic threshold 302
anaerobic training 277–80, 286
  anaerobic interval training 277
  High Intensity Interval Training (HIIT) 278
  plyometric training 279–80
  resistance training 280
  Sprint Interval Training (SIT) 278
ankle sprains 435
anti-inflammatories 448–9
anxiety 344–5
  state 345
  trait 344–5
apprenticeship 232, 236
arousal 346–7
artificial intelligence (AI) 10, 184–7, 426, 431–2
Assessing Cost Effectiveness of Prevention (ACE-Prevention) project 140
assistive technology 187–90, 429–30
atherosclerosis 84
athlete reflection 332
athletes 345
  dietary requirements of 366–9
  health and safety 451
  relaxation techniques by 422
attention skills (focusing) 347–8
audible balls 430
augmented 426
augmented reality (AR) 427
Australia
  health *see* health status of Australians
  healthcare system *see* healthcare system
  living with dementia 101
  population 98
  primary and secondary healthcare 120
Australian Adult Pre-Exercise Screening System 247
Australian Bureau of Statistics (ABS) 67
Australian Digital Health Agency 194
Australian Government Telehealth Pilots Program 177
Australian Institute of Health and Welfare (AIHW) 37, 41, 58, 67, 92, 126
Australian Institute of Sport guidelines 371
Australian Medical Association (AMA) 78, 158
Australian Sports Anti-Doping Authority (ASADA) 454
awareness 104

B

Baade, Peter 94
balance 412
ballistic stretching 286
benign tumours 90
  in breast 90
beta blockers 450–1
big data 201–8
  cure and manage diseases 204
  privacy and confidentiality 204–6
  reducing healthcare spending 203–4
  use of 202–3
biomechanical principles 411

biomechanics 411–18
analysis tools 427–8
definition 411
functional movements 415–18
and recreational running 412
and recreational swimming 412–13
skills in sport 417
sport-specific movements 413–15
blog
benefits of 26
regular 26
writing 26–7
Bloomberg Global Health Index in 2024 124
body weight exercises 291
Bourke, Justice Reinvestment program in 223–5
brainstorming 8
bulk bill 143
burden of disease 38

C

caffeine 397, 449
calcium 393–4
deficiency 394
CALD populations. *see* culturally and linguistically diverse populations
callisthenics 329
cancer 89–96
Aboriginal and Torres Strait Islander Peoples 93
causes of 92
disparities laid bare 94
levels of remoteness 94–7
morbidity 92
mortality 91
risk and protective factors for 92–3
socioeconomic disadvantage 93–4
carbohydrate loading 371–2
carbohydrates 367–70
carcinogens 91
cardiac output 308–9
cardiovascular disease (CVD) 40 83–9
Aboriginal and Torres Strait Islander Peoples 88
hospitalisations rates 87
level of remoteness 88
modifiable risk factors for 87, 88
morbidity 86–7
mortality 85–6, 89
risk and protective factors 87–8
socioeconomic disadvantage 89
carers 101
Carrison, Tegan 56
Carter, Rob 140
cerebrovascular disease 83
CHD. *see* coronary heart disease
Child and Adolescent Mental Health Services 134
Chinese Medicine Board of Australia 152
chiropody 122
chronic conditions 37, 83–97
cancer 89–96
cardiovascular disease (CVD) 83–9
chronic diseases 100, 139
chronic health conditions 134–5
chronic illnesses 60
chronic obstructive pulmonary disease (COPD) 42
circuit training 283–4
coaches 355
coach evaluation 332
cold applications 440
cold water immersion (CWI) 420
commonwealth-funded programs 146–8
current and future generations 147–8
My Aged Care 146–7
National Disability Insurance Scheme (NDIS) 146
communication 3, 21–7
essay writing 22–3
multimodal presentation 24–5
portfolio of evidence 21–2
unseen timed response 25
viva voce 23
community support services 71
community supports 123
community-based health programs 71
community-driven health programs 231
community's health status 221–36
Aboriginal and Torres Strait Islander Peoples' health 230–1
addressing age-related health needs 231
advocate and improve 229–32
education and employment opportunities 231–2
goals applied in 222–5
health issues for 226–9
strategies 232–4
strengthening access to healthcare services 229–30
community supports 123
community support services 71
competition, fairness of 451
competition phases 335–7
in-season (competition phase) 336–7
off-season (transition phase) 337
pre-season (preparation phase) 335–6
subphases 337–9
complementary healthcare approaches 150–7
products and services available 151–2
complementary medicine 152–5
Australia 152
comprehensive data 76
concentration 347–8
concussion 443–5
conditioning 331, 439–40
conditioning circuit 284
confidentiality 204–6
consolidating knowledge 4, 9–10
continuous monitoring 262–6
continuous training 280–1
controlled variables 17
cool-down 419–20
COPD. *see* chronic obstructive pulmonary disease
coronary heart disease (CHD) 37, 83, 85, 138
cortisol 421
creatine 370
definition 397
products 397–400
credibility 158–60
critical health consumer 157–60
accuracy and credibility 158–60
informed decisions 157
cryotherapy 420
cultural factors 66
culturally and linguistically diverse (CALD) populations 65–7, 134–5
culturally appropriate healthcare 230–1
cultural norms 60
Cultural Safety Monitoring Framework 124
culture of everyday life 41
current physical activity 247
CVD. *see* cardiovascular disease
CWI. *see* cold water immersion
cycle ergometer test 252

D

DALYs. *see* Disability-Adjusted Life Years
Damman, Christopher 367
Danila Dilba Health Service 51
data
  analysing and interpreting 18–21
data citizenship 197
data-driven approach 258
data literacy 197
data points 16–18
  definition 17
data reliability 16–18
data security measures 197
data standards 197
daVinci Robotic Surgical System 177
Daylight, Daniel 224
death
  ill health and premature 41, 42
  leading causes of 39
  by sex and remoteness 60
deep breathing exercises 422
deep learning 184
dehydration 385
Delayed Onset Muscle Soreness (DOMS) 420
dementia 37, 38, 101
dependent variable 17
  definition 17
depth studies 4–8
  communication 21–7
  data reliability 16–18
  deepening knowledge 7–8
  knowledge and skills 6–7
  planning for 8–16
    consolidating knowledge 9–10
  research-based 5
  topic on 4
  types of 4–6
  validity and accuracy 16–18
detailed performance analysis 262
determinants
  definition 47
  health 47
    population group 49–50
DEXA scan 261
diabetes 203
dietary behaviours 66
dietary requirements
  of athletes 366–9
    carbohydrates 367–9
  of different sports 375–7
  fluid intake requirements 374–5
  during performance 373
  post-performance 373–4
  pre-performance 369–72
    carbohydrate loading 371–2
    carbohydrates 369–70
    creatine 370
    fats 370
    protein 370
digital health
  challenges and opportunities 196–200
    data literacy and data citizenship 197
    equity of access 196–7
    interoperability and data standards 197
    security and privacy 197–201
  in connecting health information 195–200
  definition 191
  in healthcare system 191–201
  services 193–5
Digital Health Blueprint and Action Plan 198
digital platforms 428
direct injuries 434
disability
  definition 67
  individuals with 126–7
  people with 67–9
  prevalence 67
  psychological distress with 67
  status 68
Disability-Adjusted Life Years (DALYs) 38
discrimination 71
disease burden 38
dislocation 437
diuretics 451
doping control 454
drag 412, 413
drug testing 454–5
drug use, impact of 448–56
  ethical considerations 451–3
    athlete health and safety 451
    fairness of competition 451
    integrity of sport 451–2
    medical reasons 452–3
    pressure to take PEDs 452
    rules and regulations 452
    young athletes 451
  health implications 449–51
    anabolic steroids 449–50
    beta blockers 450–1
    diuretics 451
    erythropoietin 450
    human growth hormone 450
    stimulants 449
Duncan, Thomas 224
dynamic stretching 287

E

e-cigarettes 41
  by socioeconomic area 54
Eid al-Fitr 66
elective procedures 121
electrolytes 373
electronic health records 184, 191
elite athletes 246, 247
  exercise assessment and training programs for 262–6
    continuous monitoring 262–6
    detailed performance analysis 262
    goal setting and periodisation 262
    sport-specific training 262
  male and female 311
  performance/fitness testing for 250–60
  tapering 339
emerging health technologies 161
employment opportunities 60, 231–2
endurance training 313
energy gels 395
environmental conditions 355
environmental hazards 328
equipment advances 425, 428–30
equity
  definition 123
equity of access 123–4, 142, 196–7
ergogenic aid 397
erythropoietin (EPO) 311, 450
essay writing 22–3
exercise assessment
  definition 260
  personalisation 260–1
  progress monitoring 261
  and training programs
    for elite athletes 262–6
    for recreational participants 260–2
exercise levels and goals 247

F

fartlek training 281–2, 311
fast twitch muscle fibres 313–17
fatigue 378, 379, 386–90
fats 370
Felton, Paul 414

females
health inequities of 43
life expectancy for 38–9
financial support 71
finger dislocations 438
fitness components 341–3
fitness training. *see* conditioning
FITT principle 247
flexibility 284
flexibility exercises 296
flexibility training 284–8
ballistic stretching 286
dynamic stretching 287
PNF stretching 287–8
static stretching 285–6
stretching methods used in 285
fluid intake requirements 374–5
force 413
fractures 434, 435, 437
dislocations 437
management 437
types of 437
functional movements 415–18

G

games-centred approach 354
gastrocnemius stretch 439
GATE framework 188, 189
gender pain gap 44
general population 38–9
general practitioners (GPs) 79, 121, 122
generative AI 21
Global Positioning System (GPS) 430
gluconeogenesis 426
glycaemic index (GI) 367
glycogen 369
glycolysis 369
goals
definition 349
setting 262, 349–52
government
vs. non-government organisations 133–8
government intervention 103
government policies 41
government sector 129–31
Australian government 129–30
local government 131
state and territory governments 130–1
graduated exercise 439–40
conditioning 439–40
stretching 439
graphs, types of 18
Gupta, Sahen 422

H

haem iron 393
haemoglobin 311
haemoglobin level 311–12
hamstring 439
hard tissue injuries 434, 435
dislocation 437
fractures 437
health 174–81
Aboriginal and Torres Strait Islander Peoples 230–1
big data 201–8
determinants 47
groups experiencing inequities in 46–6
issues, diagnosis of 175–6
measuring 174
monitoring 174
precision surgery 176–9
health and safety considerations 328
health apps 152, 181–4, 193
definition 181
health behaviours 66
cultural factors 66
definition 40
healthcare demand 100
healthcare facilities 119
and services 120–3
equity of access 123–4
range and types of 120–3
healthcare infrastructure 104
healthcare professionals 230
healthcare services, strengthening access to 229–30
healthcare system 119–29
Aboriginal and Torres Strait Islander Peoples 124–6
complementary healthcare approaches 150–7
critical health consumer 157–60
digital health in 191–201
emerging changes and challenges 161–5
features and roles of 123
future opportunities for 124–7
individuals with disability 126–7
in rural and remote locations 124
government and non-government organisations 133–8
person-centred healthcare 133, 134
health expenditure and impact 138–50
healthcare vs. prevention 138–42
primary and secondary healthcare 120
range and types of 120–3
community supports 123
health-related services 122
medical services 122
mental health services 121–2
nursing homes 121
pharmaceuticals 122–3
public and private 120–1
role 119–20
shared responsibility for 129–33
technology and data in 172
health determinants 219
health education programs 69
health expenditure
commonwealth-funded programs 146–8
definition 138
healthcare vs. prevention 138–42
and impact 138–50
Medicare 142–3
on preventative programs 139
private health insurance 143–6
sustainability, access and equity 142
health gap 49
health implications, drug use 449–51
health inequities 41
females 42–3
groups experiencing 46–76
Aboriginal and Torres Strait Islander Peoples 47–53
culturally and linguistically diverse populations 65–7
older people 69–74
people in rural and remote areas 58–64
people with disability 67–9
socioeconomically disadvantaged people 53–8
males 41
in mental healthcare 56–7
people with disability 68
for rural and remote people 60–3
health insurance 144–5

health issues
for community 226–9
education 229
employment 229
income 229
in Western NSW 227
health-related fitness components 252
health-related services 122
health screening 246–50
current physical activity/exercise levels and goals 247
definition 246
exercise assessments 260–7
high-risk groups 248
performance and fitness testing 250–60
and pre-exercise questionnaires 246–7
health services 225
health status of Australians 37–46
ageing population on 98–108
chronic conditions 83–97
diseases and injury in 83–97
epidemiological data 37–8
health inequities *see* health inequities
life expectancy 39
morbidity 38
mortality 38–9
and other OECD countries 76–83
risky health behaviours 40–1
culture of everyday life 41
social interaction 40
social relationships 40
health status of community 221–36
Healthy Cities Illawarra 222–3
Justice Reinvestment 223–5
healthy ageing 99–100
Healthy Cities Illawarra 222–3, 225
healthy migrant effect 65, 134
Heaney, Chelsea 94
hearing aids 188
heart attack 84
heart disease 42
heart failure 84
heart rate 307–8
heat applications 440–1
heat energy 441
Hensher, Martin 52
herbal medicine 152
HGH. *see* human growth hormone
High Intensity Interval Training (HIIT) 278
holistic 133
definition 218
nature of SDGs 218–20
home care services 103
hospitals 120–1
human growth hormone (HGH) 450
hydration 385–90
hydrotherapy 420–1
hyperthermia 355
hypothermia 355

I

IMG. *see* International Medical Graduate
immobilise 437
incidence 46
income 229
independent variable 17
definition 17
indirect injuries 434
individual and group sports 326
psychological strategies 344–53
anxiety 344–5
arousal 346–7
strategies and tactics 353–8
development 353–4
environmental conditions 355
group strengths and weaknesses 355–7
training session 328–34
athlete reflection and/or coach evaluation 332
conditioning 331
health and safety considerations 328
overview/aim of 328–9
skill instruction and practice 330–1
strategies and tactics 332
warm-up and cool-down 329–30
inequities 37
informed decisions 157
in-home services 71
injury prevention 261–2
in-season (competition phase) 336–7
intense concentration 348
intergenerational learning 100
intergenerational trauma 50
international benchmarking 76
international health performance 161–2
International Medical Graduate (IMG) 64
interoperability 197
inverted U hypothesis 346
IPTAAS. *see* Isolated Patients Travel and Accommodation Assistance Scheme
iron 393
Isolated Patients Travel and Accommodation Assistance Scheme (IPTAAS) 56
isometric programs 289
isotonic programs 289, 291, 292

J

journal article 23–4
standard format of 24
Justice Reinvestment 223–5

K

kinematics 411
kinetics 411
knowledge gap 124

L

labour force 229
lactate testing 426–7
large language model tools (LLMs) 186
LASIK laser eye surgery 177
leg presses/cycling 261
levy 144
life expectancy 39
Aboriginal and Torres Strait Islander Peoples 48
Australia in 80–1
definition 37
for females 38–9
for males 38–9
non-Indigenous Australians 48
lifelong learning 104
lifetime health cover loading 145
lifting boxes 416
linear motion 412
literature review 25–6
LLMs. *see* large language model tools
local government 131
long-term goals 350
lung cancer 91
lung capacity 310–11

M

machine learning 184
macrocycles 337
macronutrients 366
magnesium 393
males
health inequities of 41–2
life expectancy for 38–9

malignant tumours 90
Maranguka Justice Reinvestment 223, 225
marketing and media 41
massage 151
maximal heart rate (MHR) 278, 302
maximal oxygen uptake (VO_2 max) 310
McKendry, James 383
media and marketing 41
medical imaging 184
medical professionals 175, 248
medical services 122
Medicare 120, 124, 142–3
  and private health insurance 144
Medicare and Pharmaceutical Benefits Scheme 196
Medicare levy 142
Medicare levy surcharge (MLS) 144–5
Medicare system 77
meditation 151, 422
mental healthcare 79, 121, 126
mental health disorders 79
mental health services 79, 121–2
mental illness 37
mental rehearsal 348–9
mental relaxation 349
mesocycles 338
metastases 90
MHR. *see* maximal heart rate
microcycles 337
micronutrients 366, 392–4
  calcium 393–4
  iron 393
  magnesium 393
  multivitamins 394
  vitamin B12 392–3
mindfulness meditation 422
minerals 367, 392
minimally invasive techniques 176
mitochondria 310, 368
modified games 294–5
momentum 413
monitoring health 174
morbidity 37–8
  cancer 92
  cardiovascular disease (CVD) 86–7
  definition 37
mortality 37–9
  cancer 92
  cardiovascular disease (CVD) 85–6
  definition 37
multifaceted approach 225
multimodal presentation 24–5
multivitamins 394
muscle hypertrophy 288, 312–13
My Aged Care 146–7
My Health Record 193–5, 202
myoglobin 313
'My QuitBuddy' app 56

N

National Aboriginal and Torres Strait Islander Health Plan 2021–2031 Vision 125
National Data Health Strategy 197
National Disability Insurance Scheme (NDIS) 69, 77, 134, 146, 188, 202
National Health Data Hub 203
National Mental Health Strategy (Sweden) 79–82
national research priority 99
National Rural Health Alliance 124
naturopathy 151
NDIS. *see* National Disability Insurance Scheme
neoplasm 89
neural network 184
non-governmental agencies 104–6
non-government organisations
  government *vs.* 133–8
non-government sector 131–2
  not-for-profit community groups 131–2
  private sector 131
non-haem iron 393
not-for-profit community groups 131–2
NSW 'Fee-Free' training program 56
nursing homes 121
nutrition 382–90, 403–4
nutritional technologies 426
NuVasive Pulse System 177

O

OAMS. *see* Orange Aboriginal Medical Service
off-season (transition phase) 337
older people 69–74
Older People's Mental Health Services (OPMH) 233
op-ed 27
opinion story 27
optimal arousal 346–7
optometry 122
Orange Aboriginal Medical Service (OAMS) 124
Organisation for Economic Co-operation and Development (OECD) countries 76–83
  Australia rank in 76–7
  National Mental Health Strategy (Sweden) 79–82
  rank higher or lower than Australia 78
  soft drink industry levy (United Kingdom) 78–9
Osgood-Schlatter Disease 434
overtraining 337
overuse injuries 434, 435
oxygen uptake 310–11

P

painkillers 448–9
pap smears 53
PBS. *see* Pharmaceutical Benefits Scheme
PBS Safety Net 123
peaking 339
people
  older people 69–74
  in rural and remote areas 58–64
  pension 100
  retirement system pressures 100
  socioeconomically disadvantaged 53–8
people with disability 67–9
  in Australia 68
  health inequities for 68
performance and fitness testing
  definition 250
  importance of 250
  for recreational participants and elite athletes 250–60
  selecting and conducting appropriate 251–7
performance enhancing drugs (PEDs) 448
  ethical considerations 451–52
  health implications 449–51
performance improvement
  biomechanics for 411
  equipment advances 428–30
  recording and monitoring training and 430–2
    artificial intelligence 431–2
  role of technology 425–33
    altitude simulation chambers 428
    augmented reality 427
    biomechanics analysis tools 427–8
    lactate testing 426–7

other technologies 428
smart resistance machines 427
training innovations 426–8
virtual reality 427
sporting injuries, management and prevention of 433–48
periodisation 262
peripheral vascular disease 83
personalisation 260–1
personalised treatment 176
person-centred healthcare 133, 134
Pharmaceutical Benefits Scheme (PBS) 77, 122
pharmaceuticals 122–3
phosphocreatine (PCr) 370
physical activity 411–13, 434, 435
physiological adaptations 314–16
physiological recovery 419–21
Pilates 412
planning
for depth studies 8–16
primary investigation 9, 13, 14
secondary investigation 9
plateauing 258
plyometrics 262, 279
plyometric training 279–80
PNF stretching 287
policy guidance 76
policy reform 103
portfolio 21–2
post-performance dietary requirements 373–4
power 280
pre-exercise questionnaires 246–7
pre-performance dietary requirements 369–72
carbohydrate loading 371–2
carbohydrates 369–70
creatine 370
fats 370
protein 370
pre-season (preparation phase) 335–6
precision surgery 176–9
prevalence 46
prevention 138–42
injury 261–2
prevention and early intervention 226
primary investigation 4, 7–8, 13–16
depth study plan for 13, 14
planning 9
types of 7
privacy 197–201
and confidentiality 204–6
private health insurance 143–6
private sector 131
proactive recovery 374
progressive mobilisation 438–9
progressive muscle relaxation (PMR) 349, 422
progressive overload 283, 290, 298–300, 308
progress monitoring 261
Project Youth 134
proprioceptive neuromuscular facilitation (PNF) stretching 287–8, 439
prosthetics 188
protein 370, 383, 394–6
psychiatric hospitals 121
psychological distress 67
psychological readiness 442
psychological strategies 344–53
anxiety 344–5
arousal 346–7
concentration/attention skills (focusing) 347–8
goal setting 349–52
mental rehearsal/visualisation 348–9
relaxation techniques 349
stress 345–6
psychosocial stressors 55

Q

qualitative data 19–21
data collection and analysis 20–1
identifying themes 19
patterns and relationships 19
using codes 19
quantitative data 18–19

R

reactive force 412
recovery strategies 419–25
hydrotherapy 420–1
physiological 419–21
recreational participants 246, 247
exercise assessment and training programs for 260–2
performance/fitness testing for 250–60
recreational running 412
recreational swimming 412–13
references 24
regular blog 26
regular meditation 422
regular fitness testing 250
rehabilitation 438
rehabilitation procedures 438–41
graduated exercise 439–40
progressive mobilisation 438–9
training 440
relaxation techniques 349
reliability 16
definition 17
remote monitoring 177–8
research-based depth study 5
residential care 129
resistance bands 291
resistance training 280
return-to-play policy and procedures 441–7
concussion 443–5
monitoring progress 441–2
netball 443
psychological readiness 442
responsibility 445–7
specific warm-up procedures 442
swimming 443
tennis 443
reversibility 300, 309
RICER principle 436, 438
risky health behaviours 37
sociological causes of 40–1
culture of everyday life 41
social interaction 40
social relationships 40
robotic assistance 176
robots 185
Royal Flying Doctor Service 63
rural and remote areas, people in 58–64
Rural Clinical School (RCS) programs 64
rural medical training programs 229–30

S

Safety Net Concession Card 123
SDG 3: Good Health and Wellbeing 217, 221–36
SDG 4: Quality Education 217, 221–36
SDG 10: Reduced Inequalities 217, 221–36
SDG 11: Sustainable Cities and Communities 217–18
secondary investigation 4, 6–7
knowledge and skills 10–13
planning 9
sensor technology 430
SES. *see* socioeconomic status

shared responsibility, for healthcare system 129–33
government sector 129–31
Australian government 129–30
local government 131
state and territory governments 130–1
short-term goals 350
shoulder dislocation 438
SIT. *see* Sprint Interval Training
skill
instruction and practice 330–1
requirements 341–3
skill and tactical development 293–7
drills 294
games for specific outcomes 295–7
modified games 294–5
skill-related fitness components 252
skills practices 294
sleep 378–82, 403–4
nutrition and hydration 386–90
quantity and quality of 379
slow twitch muscle fibres 313–17
smart equipment 428
SMART goals 350
smart resistance machines 427
smartwatches 174
smoking 41, 54
social interaction 40
social isolation 101
social participation programs 71
social relationships 40
socioeconomic disadvantage
cancer 93–4
cardiovascular disease (CVD) 89
challenges faced by 55
of health inequities 55
health status 55–8
population group 53–5
socioeconomic status (SES) 53, 123
sociological causes 37
soft drink industry levy (United Kingdom) 78–9
soft tissue injuries 434, 436–7
Sparke, Claire 134
specificity 300–1, 307, 336, 440
speech software 188
speed 413
sporting injuries
assessment of 435
TOTAPS 435
classification of 433–4
direct and indirect injuries 434
soft and hard tissue injuries 434
management of 433–8, 448
hard tissue injuries 437–8
soft tissue injuries 436–7
prevention 433–48
rehabilitation procedures 438–41
return-to-play policy and procedures 441–7
sport, integrity of 451–2
sports gels 395
sport specific attributes 341–3
sport-specific movements 413–15
sport-specific training 262
sprain 434
Sprint Interval Training (SIT) 278
SRHS. *see* Stronger Rural Health Strategy
stability 412
state and territory governments 130–1
state anxiety 345
static stretching 285–6, 419
steroids 449
stimulants 449
strains 434
strength 288
strength endurance 302
strength training 288–93
stress 345–6
stress fractures 434, 435
stressors 345
stress reduction 421
stretching exercises 329
stretching methods 285
stretch reflex 286
stroke mortality rates 86
stroke volume 308–9
Stronger Rural Health Strategy (SRHS) 63–4
subluxation 438
subphases 337–9
supplements 391–2
caffeine 397
creatine products 397–400
micronutrients 392–4
protein 394–6
surgical robots 185
sustainability 142
Sustainable Development Goals (SDGs) 214
definition 216
holistic nature of 218–20
key features of 216–20
progress and connections 234
SDG 3: Good Health and Wellbeing 217, 221–36
SDG 4: Quality Education 217, 221–36
SDG 10: Reduced Inequalities 217, 221–36
SDG 11: Sustainable Cities and Communities 217–18
sustained movement
biomechanics for 411
and recreational running 412
and recreational swimming 412–13
functional movements 415–18
skills in sport 417
sport-specific movements 413–15
recovery strategies for 419–25

T

tapering 339–41, 371–2
taping 438
team strategy 356
technology 174–81
new technologies and treatments 181–91
artificial intelligence 184–7
assistive technology 187–90
health apps 181–4
speech software and 188
technology integration 103
telehealth 124, 192
definition 230
infrastructure 230
telehealth services 103
thermotherapy 440
30-second wingate test 256
3D printing 181
total body fitness 440
TOTAPS test 435
traineeship programs 232, 236
training 440
aerobic 280–4
anaerobic 277–80
flexibility 284–8
health and safety considerations 328
for individual and group sports 326

improved performance 307–18
methods 277–98
monitoring 430–2
physiological adaptations 307–18
plyometric 279–80
principles 298–307
cardiac output 308–9
fast/slow twitch muscle fibres 313–17
haemoglobin level 311–12
heart rate 307–8
muscle hypertrophy 312–13
oxygen uptake and lung capacity 310–11
progressive overload 298–300
reversibility 300
specificity 300–1
stroke volume 308–9
training thresholds 302–4
variety 301–2
warm-up and cool-down 304–6
recording 430–2
resistance 280
skill and tactical development 293–7
drills 294
games for specific outcomes 295–7
modified games 294–5
strength 288–93
types 277–98
types and methods 297
training innovations 426–8
training programs
exercise assessments in
for elite athletes 262–6
for recreational participants 260–2
training thresholds 302–4, 312
trait anxiety 344–5
triangulation 20
tumour 89
types of 90
two-step authentication system 204, 205

U

unconscious bias 43, 68
unseen timed response 25
urban planning 104

V

validity 16–18
definition 17
variables 16
definition 16
types of 16
variety, training principle 301–2
vasoconstriction 420
velocity 413
virtual reality 426–7
visualisation 348–9
vital capacity 310
vitamin B12 392–3
vitamins 367, 392
viva voce 23
volunteers 101
Vos, Theo 140

W

walking technique 417
warm-up and cool-down 304–6, 329–30
warm-up procedures 442
warm water immersion 420
wearable devices 174
wearable technology 103
weightlifters 277
well-balanced isotonic programs 290
wellbeing 217
social media on 19
Western NSW
communities in 227
education 229
employment 229
health issues faced in 227
key insights 228
Primary Health Network 226
wheelchair technology 430
WHO. *see* World Health Organization
work-related stress 40
World Health Organization (WHO) 99, 186
GATE framework 188, 189
healthy ageing 99–100
writing
blog 26–7
essay 22–3
journal article 23–4
literature review 25–6
op-ed 27
Wylie, Emma 64

Y

yearly training programs 327, 334
peaking 339
phases of competition 335–7
in-season (competition phase) 336–7
off-season (transition phase) 337
pre-season (preparation phase) 335–6
sport specific attributes 341–3
subphases 337–9
tapering 339–41
Youth Summit 19–20
yo-yo intermittent recovery test 254
yo-yo test 252, 254
Yussuf, Ahmed 79, 101