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The first year of COVID-19 in Australia: direct and indirect health effects

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Summary

At the beginning of the COVID-19 pandemic, there were many uncertainties around how Australia would be affected: how many cases and deaths would occur; would the health system be able to manage; what other parts of society would be disrupted; and would mental health and various social factors be adversely affected.

Now that the first year has passed, a number of these have been clarified; however, challenges continue to emerge. At the time of writing, key challenges were the emergence of new variants of the virus, and how quickly vaccines could be rolled out to the community. And while the severity of the situation in other countries continues, the risk of flow-on effects to Australia remains.

This report looks at the direct and indirect health effects of COVID-19 in Australia. This includes information on case numbers, deaths, burden of disease, impact on other diseases such as mental health, and changes in health behaviours. The impact on health services and on social determinants of health is also examined. It draws on data from a range of sources including disease surveillance systems, death registrations, hospitalisations, MBS and PBS, and surveys.

The report covers the first year of the pandemic, to around April/May 2021. Where possible, the most recent data available at the time of writing is included, however due to the timing of different data collections, some data are only available for periods within 2020. It does not include data on the latest wave of cases that began in June 2021.

Direct health effects

The first year resulted in the following numbers of cases and deaths in Australia:

- Up to the end of 2020, there were around 28,500 cases of COVID-19, with 2 distinct peaks (or 'waves')—one in March/April (affecting all states and territories with most infections being acquired overseas) and one in June to September (mainly affecting Victoria with most infections being acquired via community transmission). In 2020, the majority of cases were notified in Victoria.
- There were around 900 deaths from COVID-19 in Australia in 2020 (909 notified through surveillance systems and 866 registered and compiled by the ABS).
  - 89% of deaths were in Victoria and 7% in NSW.
  - The majority of deaths were in the older age groups: 24% in the 85–89 year age group and 34% in those aged 90 and over.
- By 20 June 2021, there had been just over 30,000 confirmed cases of COVID-19 and 910 deaths in Australia.

Hospitals were protected from being overwhelmed

- The key aim of protecting hospitals was achieved. During 2020, around 12.5% of people with COVID-19 were admitted to hospital for treatment of the disease.

The burden of disease from COVID-19 in Australia in 2020 was modest

- There were just over 8,400 disability-adjusted life years (DALYs) lost in 2020 from COVID-19 in Australia; 97% of this disease burden was from fatal cases. This is much lower than the burden due to leading diseases in Australia. For example, coronary heart disease (CHD) was responsible for around 312,000 DALYs in 2018.

Some groups in the population were more affected than others

- During 2020, 7% of all COVID-19 cases in Australia and 75% of all deaths were in people living in residential aged care facilities.
- Up to early July 2020, it was estimated that health care workers in Australia were 2.7 times as likely to contract COVID-19 as the general community.
- There were almost 4 times as many deaths due to COVID-19 for people living in the lowest socioeconomic group compared with the highest socioeconomic group, and age-standardised mortality rates were 2.6 times as high.

There were only a small number of cases in the Aboriginal and Torres Strait Islander community

- This community comprises 3.3% of the Australian population but only 0.5% of all cases despite being at increased risk of severe COVID-19 disease or death.
- As at 25 April 2021, there had been 153 confirmed cases and no COVID-related fatalities among Aboriginal and Torres Strait Islander peoples.

Australia is one of only a small number of comparable countries to have kept cases and deaths at a relatively low level

- If Australia had experienced the same crude case and death rates as 3 comparable countries—Canada, Sweden and the United Kingdom—there would have been between 680,000 and 2 million cases instead of the 28,500 that did occur, and between 15 and 46 times the number of deaths.
- If Australia had experienced the same rates as New Zealand, there would have been around 18,000 fewer cases and 780 fewer deaths.

Indirect health effects

There were fewer deaths from other causes

- During 2020, Australia recorded lower than expected total mortality rates (excluding coroner-certified deaths) compared with age-standardised mortality rates for the previous 5 years. This is in contrast to many other countries where excess mortality (higher than expected deaths) was observed.
- Age-standardised death rates for influenza and pneumonia, and chronic lower respiratory infections were lower in 2020 than the previous 5-year average, and were particularly low during the winter months.

Influenza notifications and injuries experienced declines

- During 2020, rates of laboratory-confirmed influenza were substantially lower than expected from April onwards.
- There was also a reduction in injuries due to falls and road traffic accidents, with fewer presentations to hospital emergency departments and road deaths.

There were adverse impacts on mental health for young people

- The initial impacts of the pandemic in Australia appeared to have increased levels of psychological distress, particularly for adults aged 18–45. By April 2021, the average level of psychological distress had returned to pre-pandemic levels, however continued to be higher for young people.
- The proportion of people experiencing severe psychological distress also continued to be higher in April 2021 (9.7%) than in February 2017 (8.4%).

Suicide rates have remained at pre-pandemic levels

- The number of deaths by suicide in NSW, Victoria and Queensland have remained at similar levels to previous years.

There was a mixed picture for health behaviours, with some people improving and some worsening

- From data for the period April to June 2020:
  - Similar proportions of people had increased as had decreased exercise and other physical activity.
  - Of those adults who usually drank alcohol, 20% had increased their consumption compared with before COVID-19 restrictions. Different data sources showed that between 13% and 27% had decreased it.

Impact on health services

There were many changes in how the health system operated and was used, for example:

- Elective admissions involving surgery in public hospitals decreased by 9.3% in 2019–20.
- Some services in the community had considerable reductions in April 2020 at the height of the initial restrictions. For optometry, this led to an overall 8.1% fall in the number of services in 2020 compared with 2019.
- There was a steady rise in the number of mental health services subsidised by Medicare between mid-March and mid-December 2020, which likely reflects increased need and increased availability of services during this period.
- From January to June 2020 there were 145,000 fewer mammograms through BreastScreen Australia compared with the same period in 2018. From July to September 2020 there were 12,000 more.

Some areas maintained similar levels, for example:

- In 2020, there was a 3.4% increase in Medicare-subsidised general practitioner (GP) visits compared with 2019, a similar rise to those in recent years.
- Medicare-subsidised GP services for chronic disease management items showed falls in services at the start of the pandemic, followed by recovery to somewhat above previous levels of use.

New telehealth arrangements supported many areas

- Maintenance of visits to GPs was supported by uptake of new telemedicine provisions—by April 2020, 36% of GP consultations were delivered by phone or video. This level continued until August, followed by some reductions towards the end of 2020.
- Telehealth services accounted for nearly 33% of Medicare-subsidised mental health services between mid-March and the end of December 2020.

Impact on social determinants

Substantial changes in income and labour force for many people

- A number of government support programs were put in place during this period—notably, the JobKeeper subsidy and the Coronavirus Supplement paid to recipients of JobSeeker. These payments contributed to reductions in poverty for some groups, such as single parent families (from 20% in February 2020 to 8% in June 2020), but many people did have falls in income.

- In April 2020, 20% of people in the labour force were either unemployed or underemployed. By June 2021 this had declined to 12.8%, below late 2019 levels.
  - Unemployment increased from 5.1% in February 2020 to a peak of 7.5% in July 2020. It returned to pre-pandemic levels by May 2021, and by June 2021 it was lower (4.9%).
  - By June 2021, employment was higher than before the pandemic (1.2% higher than March 2020).

The restrictions may have had an effect on family and domestic violence and child abuse and neglect

- An online survey of 15,000 women found that 5% experienced physical or sexual violence from a current or former cohabiting partner between February and May 2020. For 65% of these women, it was the first time the violence had occurred or the violence had increased in frequency or severity.
- An increase in suspected child abuse and neglect notifications after April 2020 was larger than in post school break periods in previous years, suggesting the COVID-19 restrictions may have had an added effect.

Introduction

Introduction

The information and data provided in this report were the most recent data available and accurate at the time of writing. However, given the dynamic and ongoing nature of the pandemic there may be updates, changes or revisions to the underlying data and/or information as more is learnt about the disease and its impact on the population. Some analyses are also preliminary and in some instances less complex than would usually be the case, reflecting the limited amount of some detailed data available at the time of writing.

This report covers the first year of the pandemic in Australia, to around April/May 2021. It does not include data on the latest wave that began in June 2021.

COVID-19 is a disease caused by the new coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It is a major health threat and has caused an international crisis, which has led to substantial disruption to almost all parts of society worldwide. The outbreak first came to international notice through a cluster of unexplained pneumonia cases in Wuhan, China, in late December 2019. The COVID-19 epidemic was declared a pandemic (the worldwide spread of a new infectious disease) by the World Health Organization (WHO) on 11 March 2020, and by 27 June 2021 there had been nearly 180 million confirmed cases and 3.9 million deaths reported worldwide (WHO 2021a).

There are several reasons why COVID-19 has become such a major crisis. Briefly, it being caused by a virus not previously seen in humans, there was initially no, and now only limited, immunity in the population. Similarly, there was no vaccine or specific treatment at the start of the pandemic. It is also highly infectious and affects some people severely. It was therefore important to protect the health of vulnerable people and prevent the health system being overwhelmed with many severe cases presenting to hospital at once. The only practical way to contain its spread until the development of vaccines was by public health measures such as travel bans and quarantine, strong physical distancing policies and practices (such as closure of non-essential services and keeping a minimum distance between people), wearing masks (and other personal protective equipment), personal hygiene and strong case detection and isolation. These restrictions have had a serious impact on economies and societies across the world, with travel, trade and people’s ability to work, attend school and socialise all affected. The vaccines provide the prospect that the crisis may be able to be contained, but it is likely that a combination of public health measures and the vaccines will be needed for some time to come.

Most countries have not had recent experience with similar epidemics, making the adjustment to new ways of living challenging. However, the threat of a pandemic was recognised internationally before the emergence of the virus (Ziegler et al. 2018) and Australia had its own well-developed system of public health response to communicable diseases (WHO 2018). The Australian Government developed an emergency response plan specifically for COVID-19, which was released on 27 February 2020 (Department of Health 2020b).

The Communicable Diseases Network Australia (CDNA) provides national public health coordination and leadership, and supports best practice for the prevention and control of communicable diseases (Department of Health 2015a). CDNA coordinates the national surveillance of an agreed list of communicable diseases in Australia. Part of this surveillance function is to collate the data collected by states and territories regarding notifiable communicable diseases into a de-identified national data set—the National Notifiable Diseases Surveillance System (NNDSS). In addition, the Public Health Laboratory Network is a collaborative group of laboratory representatives that contributes laboratory-level expertise to the response to infections of public health importance (Department of Health 2020g). There are also Centres of Research Excellence that can provide valuable real-time clinical, public health and health services research which contributes to both the national and international efforts to combat the pandemic (Doherty Institute 2020).

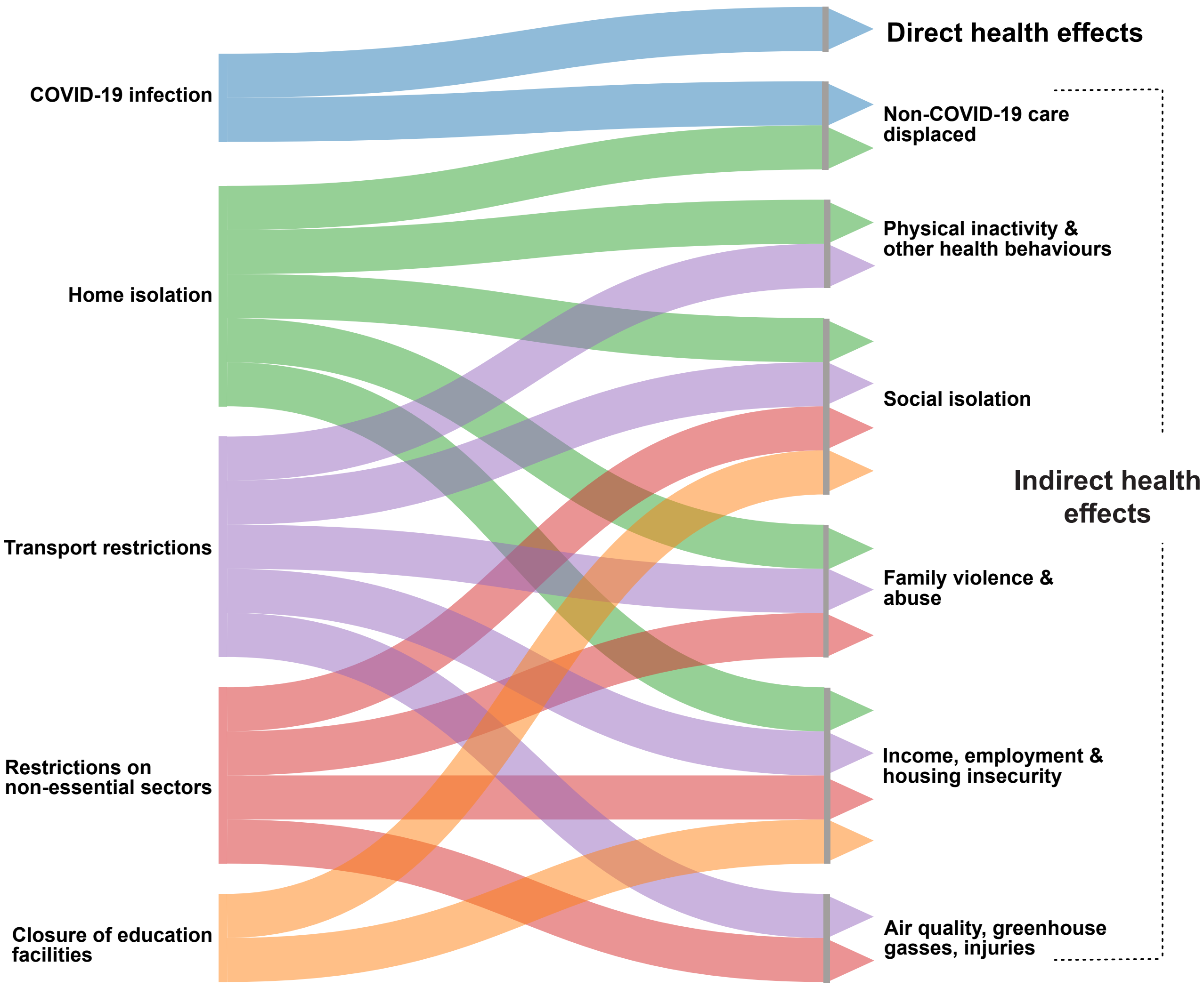
At the time of writing, Australia has avoided the severe health impacts seen in many other countries, where there have been large numbers of severe cases and deaths, putting a huge strain on health systems, economies and population wellbeing (MacIntyre & Heslop 2020). While we do not yet have detailed knowledge of which specific factors may have contributed to the favourable situation in Australia, the early implementation of international travel restrictions and physical distancing measures in combination with one of the highest testing rates in the world have played a key role (Cheng & Williamson 2020).

We remain in an evolving situation, with many facets of the epidemic not yet fully understood, though research continues to become available to fill some of the gaps in knowledge. Similarly, due to the rapid development of some of the data collections currently available and the speed at which the data are collected and processed, the completeness and accuracy of the data may improve over time; therefore, some data in this report are preliminary. There are also a number of areas where national data are not yet available.

This report is a synthesis of available data and information on the direct and indirect health effects of COVID-19, and also contains new analysis in a number of areas. The report looks at the situation in Australia over the first year of the pandemic, with some data available into 2021 and others only available for periods within 2020. This report follows an earlier article published in Australia's Health 2020 which looked at the first 4 months of the pandemic in Australia. It draws on data from a range of sources including disease surveillance systems, death registrations, hospitalisations, MBS and PBS, and surveys.

The direct and indirect health effects of the pandemic range from the effects on an individual with COVID-19 and the flow-on to the health system, through to the short- and longer-term impacts of the disruption to society due to the measures put in place to contain the virus. These potential indirect effects are wide-ranging and include impacts on mental health, health care for other conditions and health behaviours (Figure 1). For some people there have been positive changes, but for many others many challenges have arisen. Also important are the impacts on social determinants of health (the circumstances of an individual's living conditions such as education, income, employment, housing and family situation), as shown in Figure 1, which have the potential to affect people's lives for many years to come.

Figure 1: Potential pathways between COVID-19 public health measures and health effects



Source: Adapted from Douglas et al. 2020.

This report is organised across this spectrum from direct to indirect health effects along with background and a focus on data innovation:

- Chapter 1 provides a summary of what we know about the virus and disease, and its prevention and treatment. This chapter is provided as background for the rest of the report, and is not intended to be a full description of the complex and evolving evidence base. It includes sections on vaccines and variants of concern using available information at the time of drafting.
- Chapter 2 on the direct effects of the virus includes information on the volume and severity of cases in Australia, new analysis on the burden of disease from COVID-19, a focus on particular population groups, and comparisons with other countries.
- Chapter 3 on the indirect health effects looks at a number of health behaviours and diseases that have been affected by COVID-19, including deaths, mental health, other respiratory infections and injuries.

- Chapter 4 looks at available information on the various changes that occurred within the health system due to these direct and indirect health effects, and available information is presented in Chapter 2.
- Chapter 5 explores the impact of COVID-19 on social determinants.
- Chapter 6 discusses some data and other innovations that have developed throughout the pandemic.

Box 1: Definitions of some key terms used in this report (see Glossary for additional terms)

age-standardised rate: A rate that takes into account the age structure of the population.

associated causes of death: The term 'associated causes' is used when referring to conditions other than the underlying cause of death when using the International Classification of Diseases (ICD). Associated causes can include diseases that are part of the chain of events leading to death; risk factors; and co-morbid conditions.

burden of disease: Term referring to the quantified impact of a disease or injury on a population, using the disability-adjusted life years (DALY) measure.

case-fatality rate: The proportion of cases of a specified condition that are fatal within a specified time.

disability-adjusted life years (DALY): A measure (in years) of healthy life lost, either through premature death, defined as dying before the ideal life span (YLL) or, equivalently, through living with ill health due to illness or injury (YLD). It is often used synonymously with 'health loss'.

epidemic: A widespread occurrence of an infectious disease in a community at a particular time.

incidence: The number of new cases (of an illness or injury) occurring during a given period.

life expectancy: The number of years a person of a particular age can expect to live.

pandemic: An epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people.

underlying cause of death: The underlying cause of death refers to the disease or injury that initiated the train of morbid events leading directly to death or the circumstances of the accident or violence that produced the injury.

waves: A wave implies a rising number of sick individuals, a defined peak, and then a decline. The word 'wave' implies a natural pattern of peaks and valleys. It hints that even during a lull, future outbreaks of disease are possible (Wagner 2020).

1

What we know about the disease

Summary: 1 What we know about the disease

Disease characteristics

- COVID-19 is a highly infectious disease with a wide spectrum of severity. Many people experience mild to moderate disease, but some develop very serious illnesses and it has a higher death rate than many common infectious diseases.
- It is spread by both relatively large sized 'droplets' and smaller 'aerosol' particles. The latter highlights the importance of mask wearing and ventilation of enclosed spaces.
- COVID-19 became a worldwide crisis due to its severity and high transmission rates (as there was initially no population immunity or vaccine and it can be transmitted by people who are not very ill).
- Four variants of concern have been detected in Australia (at end of May 2021) which all appear to have increased transmission rates.

Prevention and treatment

- A combination of actions provides the best chance of preventing transmission of the virus. They include actions aiming to keep the virus out of the country or region—travel bans and quarantining of people entering—and actions aimed at reducing transmission once the virus is present—bans on social gatherings; mask wearing; working or educating from home; handwashing; and testing if symptoms develop.
- High levels of testing and thorough contact tracing aim to ensure no case is missed. Support for contact tracing includes genomic sequencing and waste-water testing.
- Once a case is found, strict isolation and quarantining of close contacts reduces the risk of further transmission.
- Treatment for COVID-19 includes supportive care matched to the level of severity, whether that is at home, in hospital or in an Intensive Care Unit.
- During 2020, evidence emerged that some drug treatments are beneficial for people with more severe disease, such as corticosteroids.
- Development of vaccines in 2020—by far the fastest in history—provides the largest potential for controlling the virus. It is expected that other prevention actions will still be needed for many months.
- Australia currently has 2 vaccines provisionally approved for use as they have been assessed to be safe and effective against developing COVID-19 disease (Pfizer and AstraZeneca) and 1 under investigation for use (Novavax).
- Available COVID-19 vaccines reduce the level of disease but evidence is not yet definitive on how effectively they reduce infection rates or transmission.
- Recent links between AstraZeneca vaccine and rare but serious blood clotting resulted in changed advice that the Pfizer vaccine is now preferred for people under 60.
- The vaccine rollout in Australia began on 21 February 2021, and by 5 July more than 8,255,000 doses had been given.

Disease characteristics

COVID-19 is a highly infectious disease, predominantly of the respiratory system, caused by the coronavirus SARS-CoV-2 (Box 1.1). It has a wide spectrum of severity. Common early symptoms are similar to other respiratory illnesses, such as fever, cough, sore throat, runny nose, tiredness and shortness of breath. However, the infection can have a wide variety of manifestations, including diarrhoea, headache, aches and pains, and loss of smell or taste (CDNA 2021b; WHO 2020c). In some people the infection can progress to become a more severe disease—tending to develop in the second week—with the immune system overreacting, resulting in inflammation and lack of oxygen to many parts of the body. This can lead to multiple organ failure and death. A potentially very serious disease in children has also been associated with COVID-19—known as multisystem inflammatory syndrome in children (Rubens et al. 2021). Another unusual feature of the COVID-19 illness is a propensity to form blood clots. This appears to be more common in critically ill patients, can involve both the arteries and veins, and can lead to life-threatening complications such as stroke and pulmonary embolism (Willyard 2020). As time has passed, evidence of longer term effects have also emerged. These are discussed in the section on 'post-COVID-19 syndrome' in chapter 2.

Box 1.1: What are coronaviruses?

Coronaviruses are RNA (Ribonucleic acid, which is a molecule similar to DNA) viruses that are found mainly in animals. Under an electron microscope, they give the appearance of the corona of the sun, hence the name 'coronavirus'. Seven coronaviruses have occurred in the human population. Four of these (OC43, HKU1, NL63, 229E) have been circulating for many years, and account for about 20% of the cases of common cold. The remaining 3 coronaviruses cause more serious illnesses, namely Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS) and now the Coronavirus Disease 2019 (COVID-19). SARS-CoV-2 is the virus that causes COVID-19. This virus is 96% genetically similar to a bat virus. It is therefore likely that SARS-CoV-2 originated in bats before moving to humans through an intermediate animal host (Andersen et al. 2020).

The severity spectrum ranges from asymptomatic (no symptoms), to mild/moderate disease (symptoms confined to the upper respiratory system, or flu-like symptoms serious enough to keep someone off work), to severe (with pneumonia, respiratory failure, septic shock, organ failure and potentially death). Estimates of the proportion of cases that are truly asymptomatic (that is, excluding pre-symptomatic cases) range between 4% and 41%, and a meta-analysis combining the highest quality studies estimated that the overall asymptomatic rate was 17% (95% CI 14–20) (Byambasuren et al. 2020). Australian data indicate that about 14% of cases develop disease severe enough for admission to hospital, and 3% received treatment in an Intensive Care Unit (ICU) (COVID-19 NIRST 2021a). Recent estimates of case-fatality rates (the percentage of known cases that are fatal) in Australia are 3.1% for males and 3.2% for females, but with a wide range depending on age: from close to 0 for those under 50 years, up to 33.7% for those 80 years or over (COVID-19 NIRST 2021a). Further details are provided in Chapter 2.

As well as age, other factors can increase the risk of severe disease. These appear to include smoking (WHO 2020f), obesity (Simonnet et al. 2020), and having chronic conditions such as heart or respiratory disease, dementia, diabetes or cancer (AIHW 2021e; Department of Health 2020c). At even more risk are those with multiple comorbidities or who are immunocompromised due to disease or therapy (Liang et al. 2020). Disadvantaged groups are at increased risk for a range of reasons, including their higher rates of these risk factors and overcrowded housing (PHE 2020).

The COVID-19 virus spreads in a similar manner to other respiratory viruses, when an infected person breaths out infectious material which is able to enter another person's respiratory tract. Earlier in the pandemic it was thought that the main mode of transmission was via relatively large-sized 'droplets' from the infected person. These may also remain on surfaces which can then be touched by another person making it possible to transfer the virus to their respiratory tract by touching their face (Department of Health 2021j). As the pandemic has progressed, it has become clearer that an important mode of transmission is via much smaller 'aerosol' particles. This in turn has increased the public health messages in relation to the importance of mask wearing and ventilation for enclosed spaces (CDNA 2021b; NSW Health 2021a).

The primary reasons COVID-19 has become a worldwide crisis are its severity in combination with high transmission rates. These high transmission rates are driven by a number of factors: it is a new virus and thus there was no immunity in the population; there was no vaccine until recently and currently only a small proportion of the world's population has been immunised; and it can be transmitted by people who are not very ill (such as those with no or very mild symptoms), allowing it to spread throughout the community 'under the radar' (MacIntyre & Heslop 2020). In addition, peak infectiousness appears to occur prior to or just after symptoms develop (He et al. 2020). This contrasts with the SARS outbreak of 2003, where cases became infectious only after they became unwell, and where the peak infectiousness occurred later in the illness. This made it easier for SARS cases to be identified and isolated as soon as they developed symptoms, significantly reducing the risk of further transmission. COVID-19 also spread very quickly around the world due to high levels of international travel prior to travel bans.

The median incubation period of 5–6 days (though ranging from 1 to 14 days) (McAloon et al. 2020, WHO 2020b) and high transmission rates result in rapid growth in the spread of the infection if measures are not in place to stop the chains of transmission.

Some infections lead to lifelong immunity—they can never be contracted again. However, this is not the case for all infections. Earlier in the pandemic it was unclear into which category COVID-19 fell. Some people with COVID-19 have been shown to develop a strong immune response to the virus, suggesting that they will be immune to further infection (Thevarajan et al. 2020); however, the duration of that immunity was unclear. More recent evidence appears to suggest that, for those people who develop good immunity, it does last for at least 8 months (Hartley et al. 2020; Choe et al. 2021).

Variants of concern

Viruses change over time and are thus expected to mutate, and there is a higher chance of mutations appearing when the virus is highly prevalent (WHO 2021d). These mutations can change transmissibility, severity, effectiveness of vaccines and effectiveness of testing. New mutations that have adverse changes in these characteristics are classified as 'variants of concern' (WHO 2021c).

Recently, a number of COVID-19 variants of concern have emerged. The 4 that have been detected in Australia are described in Table 1.1.

Table 1.1: SARS-CoV-2 variants of concern characteristics as at 26 July 2021

WHO label[a]/Lineage	Country first detected	Transmission	Disease severity	Vaccine effectiveness	Cases in Australia[b]
Alpha B.1.1.7	United Kingdom Sept 2020	Increased transmission 43–90% increased transmission compared with original variant (Davies, Abbott et al. 2021)	Increased mortality rates (Challen et al. 2021; Davies, Jarvis et al. 2021)	Early evidence suggests vaccines are still effective (CDC 2021b)	526
Beta B.1.351	South Africa Dec 2020	~50% increased transmission (Pearson et al. 2021)	Appears to cause more severe disease (ECDC 2021b)	Lower vaccine effectiveness particularly for AstraZeneca vaccine (Madhi et al. 2021)	94
Gamma P1	Brazil Dec 2020	Appears to be more transmissible (ECDC 2021b; Nature 2021)	Appears to cause more severe disease (ECDC 2021b)	Mixed findings on vaccine effectiveness (CDC 2021b; ECDC 2021b)	7
Delta B.1.617.2	India Dec 2020–Feb 2021	Increased transmission (ECDC 2021b)	Unknown impact on severity	Vaccines appear to be effective (ECDC 2021a)	934

(a) WHO developed labels for variants of concern on 31 May 2021; https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/.

(b) As at 26 July 2021.

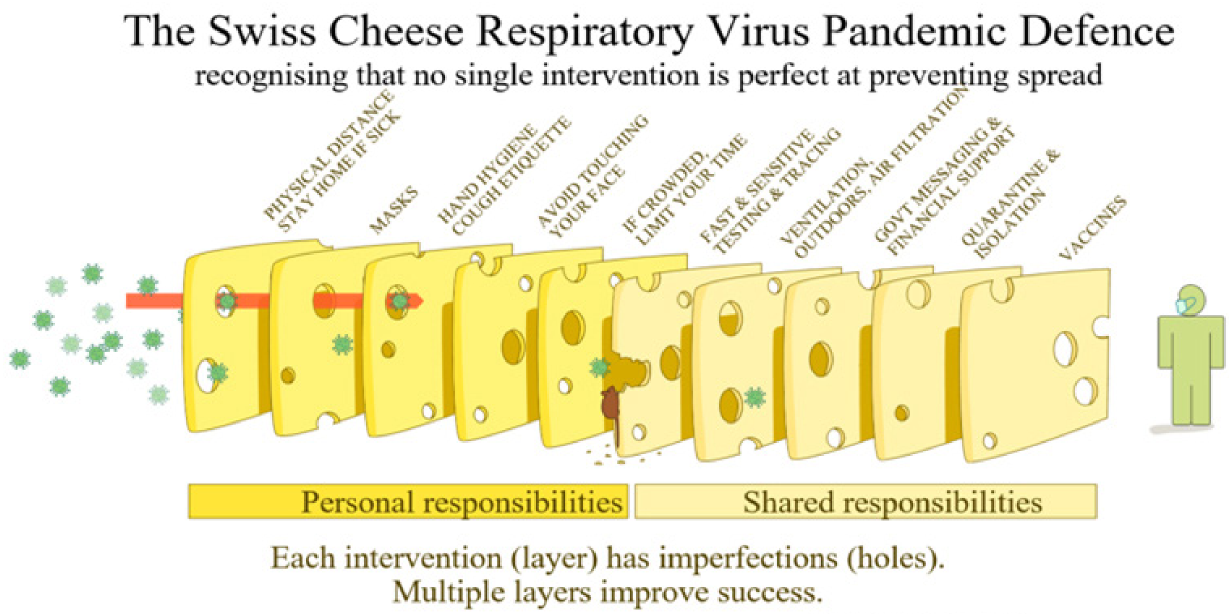
Source: https://www.cdgn.org.au/variants-of-concern.

By 26 July 2021, there had been 526 cases of Alpha (B.1.1.7) in Australia, 94 of Beta (B.1.351), 7 of Gamma (P1) and 934 of Delta (B.1.617.2), the vast majority in hotel quarantine (CDGN 2021). These variants of concern have the potential to greatly increase the challenges involved in controlling the virus. This can be seen in Brazil (where the Gamma variant became dominant) which experienced a very large increase in cases and deaths, and the hospital system has been severely tested (Taylor 2021). More recently, the sharp increase in COVID-19 cases and deaths in India and surrounding countries has been associated with a rising proportion of Kappa (B.1.617.1) and Delta (B.1.617.2) viruses (ECDC 2021a).

Prevention, control and treatment

There are a range of measures in place to reduce the spread and/or impact of the virus. These include public health measures to prevent or control the virus; diagnosis and treatment measures; and, more recently, vaccines have been added to the measures available. As none of these measures are 100% effective, it is necessary to have a range of measures to ensure protection for the community (Figure 1.1).

Figure 1.1: Swiss cheese model of virus defence



Source: Mackay 2020.

Public health response

The aim of public health interventions is to stop or slow transmission of the virus. Until the development of vaccines, these interventions were the only control measures available. While vaccines are becoming available now, until the number of people vaccinated in Australia and other countries increases substantially, public health measures will remain a very important part of the control strategy.

The various measures are described in the sections below. The general timing of implementation of these in Australia as a whole and various states and territories is summarised in Table 1.2.

Table 1.2: Public health measures introduced in response to COVID-19, Australia, 2020

Date (2020)	Public health measure
15 March	All overseas arrivals required to self-quarantine for 14 days and cruise ship arrivals banned.
16 March	Non-essential static gatherings of >500 people banned.
18 March	Restrictions on indoor gatherings.
20 March	• Travel ban on foreign nationals entering Australia. • Restriction of travel to remote communities.
21 March	Some states and territories close borders to non-essential travel.
28 March	All people entering Australia required to undertake a mandatory 14-day quarantine at designated facilities (e.g. hotels) in their port of arrival.
29 March	Public gatherings limited to 2 persons.
27 April	Start of easing restrictions in some states and territories.
8 May	Government announces 3-step plan to ease COVID-19 restrictions. Implementation to vary in states and territories.
1 July	Victoria implements lockdowns on 'hotspot' suburbs.
8 July	• NSW/Vic border closes. • Stage 3 lockdown of Melbourne and Mitchell Shire.
2 August	• Stage 4 restrictions for metropolitan Melbourne. • Stage 3 restrictions for regional Victoria.
13 September	Victoria commenced easing of restrictions against the 'roadmap to reopening'.
16 October	Some states and territories commence opening for quarantine free travel from New Zealand.
19 November	South Australia implements lockdowns in response to a cluster (revoked on 22 November).
22 November	Victoria moves to the last step in the 'roadmap to reopening'.
17 December	NSW implements restrictions on hotspot suburbs (Northern Beaches cluster).
31 December	Victoria implements restrictions in response to a cluster.

Keys: National / Subnational

Source: COVID-19 National Incident Room Surveillance Team. COVID-19 Australia: Epidemiology Report 32. Four-week reporting period ending 3 January 2021.

Three major groups of prevention actions are instigated or undertaken by the public health workforce: policies aimed at the population level; actions that can be taken by individuals; and case isolation and contact tracing/quarantine. Vaccines are described in their own section below.

Population-level actions

Population-wide interventions aim to stop the chain of transmission of the virus. These focus on reducing the number of interactions between individuals and ensuring physical distancing measures and masks are used when interactions are unavoidable. These interventions can be mandated using laws or fines, or advisory notices. Examples of interventions Australia has used include travel bans, bans on social gatherings of a certain size, closing pubs and clubs, mandatory mask-wearing and encouraging people to work or educate from home. These measures have a substantial impact on people's lives. Governments have needed to mitigate the income, employment and social isolation effects with substantial policies and programs.

Individual-level actions

As well as encouraging individuals to follow the population-wide measures outlined above, there are other behaviours individuals can follow to reduce their risk of contracting or spreading the virus. These focus on wearing masks, regular handwashing or sanitising, not touching the face, cleaning and disinfecting surfaces and objects you use often, good respiratory hygiene, staying home when unwell and getting tested for SARS-CoV-2 (Department of Health 2021i). In addition, individuals are encouraged to follow physical distancing measures including staying 1.5 metres away from other people and working from home when possible. During this pandemic, the issue of 'presenteeism' has also come to the forefront, which refers to people coming into work when they are unwell. They might do this for a variety of reasons, such as concerns over letting their colleagues down by not turning up, fear of losing their job, or worries about not being paid. However, given the risk of an infected worker introducing COVID-19 into the workplace, presenteeism is now being actively discouraged.

Isolation of cases, and contact tracing and quarantine

Alongside prevention measures, a vital component of the public health response is isolation of cases and quarantine of cases' contacts or others at high risk, to stop transmission of the virus. The first step aims to find as many cases as possible, which relies on high levels of testing of suspected COVID-19 cases, and then to isolate them from other people until they are considered to be no longer infectious. The second step is contact tracing, which aims to identify all people who had close interactions with the cases while they were infectious. This has been supported throughout the pandemic with innovations such as genomic sequencing, waste water testing and check-in applications (see Chapter 6 for more information on these innovations). Quarantine is then required for those considered to have been potentially exposed to a case, including overseas arrivals, and they are monitored to see if they develop symptoms. The detailed requirements for each of these steps are updated in the National Guidelines, as new information becomes available (CDNA 2021b). Sometimes, quarantine of close contacts of contacts will be used during an outbreak.

Diagnosis and treatment

Acute COVID-19 is usually diagnosed in Australia by taking a swab of the nose/throat or of sputum (mucus from the respiratory tract) to detect genetic material from the virus (TGA 2020). Although there are now over 30 point-of-care assays that have been approved by the Therapeutic Goods Administration (TGA) which can provide rapid results (NSW Health 2021c), there are restricted conditions for using them, and at this stage they are not widely used. A blood test can identify those with an immune response from past infection, which may have been asymptomatic or undiagnosed (CDNA 2021b).

Supportive care for mild-moderate cases is likely to include common symptom relievers such as paracetamol. For more severe cases, treatment in hospital and supplemental oxygen therapy may be required. For critical cases, this supportive care may require admission to ICUs, often with various advanced technology treatments such as mechanical ventilation.

Over the course of the first year of the pandemic, there have been some developments in the treatment of more severe cases of COVID-19. Clinical trials have been conducted to test the effectiveness of a range of treatments. Examples of these that are now being used include corticosteroids, which have been shown to reduce deaths among patients with more severe disease (RECOVERY Collaborative Group 2021; REMAP-CAP Investigators 2020) and blood thinners to reduce the chance of dangerous clot formation which has been associated with a risk of stroke for people with COVID-19. In addition to corticosteroids, the Australian National COVID-19 Clinical Evidence Taskforce (2021) has conditionally recommended the use of a number of medications that are likely to reduce the risk of death in certain sick patients with COVID-19.

Vaccines

A vaccine is the best way to rapidly build immunity against the virus and protect the population from developing disease. From when the COVID-19 virus first emerged, scientists across the world have been working on developing and testing candidates for vaccines using a number of technologies.

Vaccines are products that stimulate a person's immune system to produce immunity to a specific disease, protecting the person from that disease (CDC 2021a). They work with the body's natural defences to safely develop immunity and thus train the immune system to quickly recognise and respond to viruses and bacteria (CDC 2018; Department of Health 2021a; WHO 2020d).

This section provides broad background on the development of COVID-19 vaccines, and contains information available at the time of finalising the report in early July 2021. At that time, the situation in relation to these vaccines was changing rapidly, and that is expected to continue for the foreseeable future.

Vaccines used in Australia undergo a rigorous, independent assessment process to ensure they are safe and effective (Box 1.2).

Box 1.2: COVID-19 vaccine approval in Australia

The TGA is responsible for assessing all vaccines—including those being developed for COVID-19—before they can be used in Australia, and vaccines are registered only if the benefits are much greater than the risks.

The initial approval for COVID-19 vaccines is categorised as 'provisional'. This follows a full assessment process (unlike 'emergency' approval given in some other countries) but also reflects that more time is needed to assess longer-term impacts before general approval being granted. The key steps are:

- Pre-application—which determines whether a sponsor (usually a pharmaceutical company) is eligible to apply for provisional registration. Aspects like preliminary clinical data and clinical need are assessed.
- Application for provisional registration—this includes comprehensive information and data from clinical studies (including Phase 1, 2 and 3 trials), non-clinical/toxicology studies, chemistry, manufacturing and risk management. These data can be received through a 'rolling submission' to expedite the application process.
- Evaluation—this occurs in multiple phases by technical experts. Advice from the Advisory Committee on Vaccines, an independent committee of external experts, is also part of this process.
- Decision—on whether to register the vaccine provisionally is made by the TGA, based on the benefits outweighing the risks. For this approval to be granted, the safety, quality and effectiveness of the vaccine has to be established.
- Registrations—provisional approval is for 2 years, which can be extended for up to another 4 years.
- Monitoring—the TGA actively monitors vaccines in Australia on an ongoing basis, and has strong procedures for investigating any safety issues that may arise. Information from a number of sources is used, such as adverse event reports, international regulators and the medical literature.

Full ('general') registration can then follow at a later date. Following TGA approval, the Australian Government then determines whether it will include a vaccine in its subsidised immunisation program.

Source: TGA 2021a.

What vaccines protect against

Current COVID-19 vaccines have been shown to reduce the level of disease in the vaccinated population (which is the primary aim of a vaccine). However, at the time of writing, evidence was still emerging on how effectively they reduce infection rates or stop transmission of the virus (see further details below). In addition, the proportion of the population immunised is currently not sufficient to prevent spread. It is therefore essential that border protection measures such as travel bans and quarantining continue, particularly given the high numbers of cases in other countries, and the use of other public health measures also continue to be implemented when outbreaks occur. Even with highly effective vaccines and with high population coverage, vaccines may still not protect everyone in the community fully (as some people may not be vaccinated or may have 'breakthrough' infection even if vaccinated).

The ideal outcome from vaccination is to stop an individual becoming infected with the virus, but this has rarely been achieved (Caddy 2021). There are a number of other goals for vaccination—prevention of death, severe disease, or milder disease—corresponding to different levels of immunity generated by a vaccine. Initial development of a vaccine focuses on preventing disease, and in particular severe disease. Initial trials have reduction of disease as their main outcome, rather than reduction in transmission of the virus.

The development of vaccines for other diseases has a varied history—some have achieved complete eradication, while others have had more challenges (Box 1.3).

Box 1.3: Examples of vaccine development for other diseases

Complete eradication of polio in most parts of the world: Polio, which is a gastrointestinal virus, had a large impact on population health prior to vaccine development, with many people dying from the disease or left with life-long severe disabilities, including the inability to breathe except in an 'iron lung'. The first polio vaccine was developed in 1955 by Jonas Salk and colleagues; it was an injected vaccine of a killed virus. In 1961, an oral vaccine was developed by Albert Sabin and colleagues, which was a weakened version of a live virus. Widespread use of the oral vaccine in the mid-1950s led to sharp declines in the prevalence of the disease. Only Afghanistan and Pakistan are currently classified as having endemic (regularly found) cases of polio (GPEI 2021; NMA 2020).

Never-ending battle with influenza: Influenza viruses are single-stranded RNA orthomyxoviruses and are classified as types A, B, C and D (A and B cause the most severe disease in humans). Types A and B mutate often (known as 'antigenic drift'), resulting in the need for new vaccines annually. A more dramatic change can also happen ('antigenic shift') which can result in severe influenza pandemics (Department of Health 2021a). Annual influenza vaccination is required to provide coverage against these changes in the virus. Vaccine effectiveness varies from year to year, but is generally found to be 30–60% effective against the outcome being measured (for example, GP visit or hospitalisation (Department of Health & CDNA 2018).

Vaccines not successfully developed for some diseases: there are a number of diseases for which vaccine development has been ongoing but as yet no successful vaccine is available. An example is the human immunodeficiency virus (HIV) which was identified in 1984, and has infected many people worldwide. Control in some countries including Australia has been through public health prevention measures, and treatments have also become available which have turned the infection into a manageable chronic disease. Although development has been under way for more than 30 years, no successful vaccine is yet available (College of Physicians of Philadelphia 2021).

The aim of vaccine use is to prevent severe disease or death, and develop 'herd immunity' in the population. This occurs when a high enough proportion of the population has immunity to the disease to ensure that the population as a whole is resistant to invasion and spread of a disease (WHO 2020a). At the beginning of the COVID-19 pandemic some countries aimed to reach herd immunity through natural infection, but it is now thought that herd immunity can be achieved only through vaccination (Rasmussen 2020).

The proportion of the population needed to achieve herd immunity varies depending on a number of factors including the effectiveness of the vaccine, how the disease spreads, the distribution of immune and susceptible people, and environmental factors. Even with a high proportion of people vaccinated, it is still unclear whether herd immunity will be possible for COVID-19 due to lack of certainty around the effectiveness of vaccines in preventing transmission; how long immunity may last; and whether available vaccines will be effective against new variants (Aschwanden 2021).

COVID-19 vaccine development

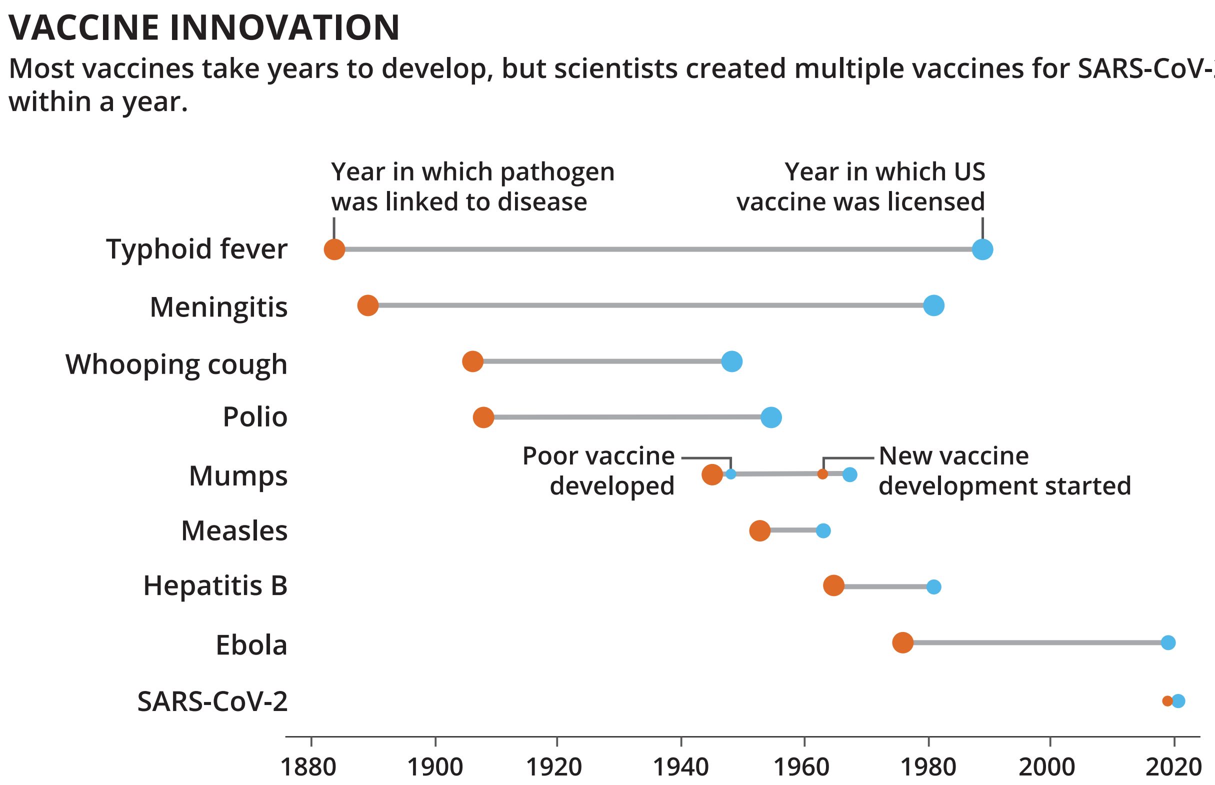
COVID-19 vaccine development began early in 2020, and by March 2021 there were 2 COVID-19 vaccines approved for use in Australia, at least another 5 in widespread use worldwide, and another 100 in clinical development (LSHTM 2021; WHO 2021d) (Table 1.3).

Table 1.3: Key dates in vaccine development and approval

Date	Event	Reference
2020		
10 January	Genetic sequence of SARS-CoV-2 published	National Center for Biotechnology Information 2020
14 July	Phase 1/2 clinical trial data on Moderna mRNA vaccine published in the New England Journal of Medicine	Jackson et al. 2020
27 July	Moderna and Pfizer vaccines enter Phase 3 clinical trials	NIH 2020 Pfizer 2020b
9 November	US-based Pfizer and German company BioNTech presented preliminary data indicating their coronavirus vaccine was over 90% effective	Pfizer 2020a
2 December	UK regulators authorized the Pfizer vaccine for emergency use.	Ledford et al. 2020
8 December	UK began vaccinating people over 80 and some health care workers with the Pfizer vaccine.	BBC 2020
11 December	Pfizer vaccine received emergency use approval by US Food and Drug Administration	US FDA 2020
14 December	US started administering the Pfizer vaccine to health care workers	ABC News 2020b
30 December	The UK regulators approved the AstraZeneca vaccine for emergency use	MHRA 2020
2021		
25 January	The TGA provisionally approved the Pfizer COVID-19 vaccine for use in Australia for people aged 18 years and over	TGA 2021f
15 February	First batch of Pfizer vaccine arrived in Australia	ABC News 2021b
16 February	The AstraZeneca vaccine provisionally approved for use in Australia by the TGA	TGA 2021e
21 February	First doses of COVID-19 vaccine given to Australians (Pfizer vaccine)	ABC News 2021a
28 February	First vials of AstraZeneca vaccine arrive in Australia	The Age 2021
21 March	TGA approved domestic production of AstraZeneca's COVID-19 vaccine	TGA 2021d
13 May	Australian Government announced securing access to 25 million doses of the Moderna COVID-19 vaccine	Hunt 2021

The development of the COVID-19 vaccines is by far the fastest in history, with the best previously being the mumps vaccine which took 4 years to develop in the 1960s (Ball 2020). The vaccine development time for a number of other diseases was considerably longer (Figure 1.2). It is also the first ever vaccine for a coronavirus.

Figure 1.2: Timeline of vaccine development for other diseases



Sources: Our World in Data; *Nature* analysis.

A number of factors contributed to the speed of development, including:

- fast release of the RNA sequence for the SARS-CoV-2 virus by China. The first US clinical trials began 66 days later (Abbasi 2020)
- substantial funding and resources being made available due to the worldwide crisis
- being able to build on previous research (including on vaccines for SARS and MERS)
- multiple vaccines in development (as it is usual for many potential vaccines not to be successful)
- phases of the trial usually done sequentially being done in parallel
- ability to reach valid ‘end-points’ in the trial more quickly than usual due to the large number of people infected with the virus
- regulators approving more quickly than when following standard processes
- faster manufacturing (Ball 2020; Department of Health 2021c).

COVID-19 vaccines planned for use in Australia

The first COVID-19 vaccine to gain approval for use in Australia by the TGA was the BNT162b2 (BioNTech/Pfizer) vaccine (TGA 2021f), approved on 25 January 2021 exactly 1 year after the first case was diagnosed in Australia (Table 1.1). This vaccine implements new technology using mRNA ('messenger RNA') that enables cells to make a protein which triggers an immune response to produce antibodies against the virus (CDC 2021c).

There are 3 other vaccines for which the Australian Government has supply agreements (Department of Health 2021c). One, the Moderna vaccine, is also an mRNA vaccine. The other 2 have different mechanisms to deliver the vaccine to the cells which then trigger the immune response: the University of Oxford/AstraZeneca (viral vector) and Novavax (protein subunit) vaccines. Australia also has agreement to receive vaccines through the COVID-19 Vaccines Global Access (COVAX) facility, a global program aiming to provide fair access to vaccines around the world. Australia has made financial commitments through COVAX to provide vaccines for lower-income countries (Australian Government 2020).

The Oxford/AstraZeneca vaccine has also been approved for use in Australia. Both of the currently approved vaccines in Australia require 2 doses. Prior to approval for use, these vaccines have undergone Phase 1, 2 and 3 vaccine trials to test and confirm their safety, dosage and effectiveness.

By receiving provisional approval for use in Australia from the TGA for adults the Pfizer and AstraZeneca vaccines have been assessed to be safe and effective against developing COVID-19 disease following the TGA's full review using the usual provisional approval process (the TGA does not have a mechanism for emergency use authorisations). This means that the provisional approval was based on the available early, but promising, efficacy and safety data from large clinical trials which demonstrated that benefits of vaccination outweigh any risks. Even after provisional approval, the TGA continues to review the data from ongoing safety and efficacy clinical trials to ensure that the benefits still outweigh any risks. Further, the TGA is closely monitoring the safety of COVID-19 vaccines using a strong and well established vaccines surveillance system to rapidly detect, investigate and act on emerging safety signals to determine whether ongoing approval is appropriate (TGA 2021b).

Recent links between the AstraZeneca vaccine and a rare but serious condition involving blood clotting and low platelet levels called thrombosis with thrombocytopenia syndrome (TTS) have resulted in expert advice from the Australian Technical Advisory Group on Immunisation (ATAGI) that the current alternative available vaccine (Pfizer) is preferred for people aged under 60 (ATAGI 2021a, ATAGI 2021b, ATAGI 2021c).

The Advisory Committee on Immunization Practices in the United States have advised that myocarditis and pericarditis (inflammation of the heart muscle and the heart lining respectively) have occurred following use of the Pfizer vaccine. This has mostly been in young men after the second dose of the vaccine. However, these conditions are mild and side effects rare (TGA 2021c).

Vaccine efficacy in clinical trials

The reported efficacy against systematic infection following 2 doses of the Pfizer vaccine is 95% (Polack et al. 2020). Early trials of the AstraZeneca vaccine suggest a longer interval between the two doses of the vaccine was better than a shorter one. Efficacy against symptomatic infection was 55% (95% CI: 33–70) when 2 doses were given 4 weeks apart, compared with 81% (95% CI: 60–91) when given 12 weeks apart (Voysey et al. 2021). On this basis, ATAGI recommended a routine preferred interval of 12 weeks between the first and second dose of AstraZeneca in non-outbreak settings. The minimum interval between doses is 4 weeks (ATAGI 2021d).

Vaccine effectiveness in the population

Early data from other countries shows promising effects in vaccinated populations. While there have been clear declines in the number of cases in countries with the highest vaccine rates (such as the United Kingdom and Israel), these improvements may also reflect other factors such as the impact of shutdowns. However, a number of studies provide more specific data for particular vaccines.

The effectiveness of Pfizer has been studied in vaccination programs in countries such as Israel, USA and the UK. Effectiveness data for the AstraZeneca vaccine are available from studies mainly in the UK.

- In a large-scale study in Israel that included over 1.1 million people aged 16 years and over, effectiveness of the Pfizer vaccine from 7 days after 2 doses was 94% (95% CI: 87–98%) in preventing symptomatic infection, 87% (95% CI: 55–100%) against COVID-19 hospitalisations and 92% (95% CI: 75–100%) against severe disease (Dagan et al. 2021).
- A prospective cohort study in Scotland found effectiveness of the AstraZeneca vaccine against COVID-19 hospitalisations was 88% (95% CI: 75–94%) for the first dose in 28 to 34 days after vaccination (Vasileiou et al. 2021).
- A large population-based cohort study in the UK that included about 375,000 participants aged 16 years and over reported effectiveness against symptomatic infections after two doses of either the Pfizer or AstraZeneca vaccine to be 95% (95% CI: 90–97%) (Pritchard et al 2021). The study concluded there was no evidence that the vaccine effectiveness against new infections differed between the two vaccines after one or two doses.
- Regarding the Delta variant, data from the UK found one dose of the Pfizer vaccine provided 34% (95% CI: 21–44%) effectiveness against the Delta variant compared to 51% (95% CI: 47–55%) effectiveness against the Alpha variant. Two doses of the AstraZeneca and Pfizer vaccines provided 60% (95% CI: 29–77%) and 88% (95% CI: 78–93%) effectiveness compared to 66% (95% CI: 54–75%) and 93% (95% CI: 90–96%) respectively with the Alpha variant (Lopez Bernal et al. 2021).
- Further research from the UK has demonstrated that both AstraZeneca and Pfizer vaccines are very effective against hospitalisation with the Delta variant. A single dose of the AstraZeneca or Pfizer vaccines was 71% (95% CI: 51–83%) and 94% (95% CI: 46–99%) effective respectively, while two doses were 92% (95% CI: 75–97%) and 96% (95% CI: 86–99%) effective respectively (Stowe et al. 2021).

These high effectiveness estimates are particularly encouraging as effectiveness (in the real world) is often lower than the efficacy estimates from the selective groups and control in clinical trials, with many more variables affecting the outcomes.

There is not yet definitive proof that vaccination stops transmission of the virus, but there are encouraging signs in relation to this (Daniel et al. 2021, Hall et al. 2021, Harris et al. 2021, Levine-Tiefenbrun et al 2021, Petter et al. 2021 [preprint]). Taken together, these studies suggest that COVID-19 vaccination is likely to reduce transmission, but further data are needed to be definitive. At the time of writing, evidence also pointed to effective vaccines being available for all major variants of concern (Abu-Raddad et al. 2021, CDC 2021b, Novavax 2021, Topol 2021).

Vaccine rollout in Australia

The vaccine rollout is under way in Australia, and the situation is evolving daily and subject to change. This section provides information as at July 2021.

The Australian Government released a plan for the rollout (Department of Health 2021b) which included 5 phases prioritising the first vaccinations for the populations most at risk of infection or severe disease.

The first vaccines were administered to Australians on 21 February 2021. By 5 July, more than 8,255,000 doses had been given (with more than 1,877,000 being second doses) (Department of Health 2021h). As Australia has had fewer COVID-19 cases than many other countries, there is a higher proportion of the population with no immunity to the disease, increasing the chance of the virus spreading throughout the community (WHO 2021b).

What we still need to know

There remain a number of aspects requiring more clarity, and a number of potential improvements to the current vaccines. While there is strong evidence that these vaccines will be beneficial in reducing severe disease in the community—which has immediate benefits to individuals and the health system—evidence is still emerging on how well they prevent transmission of the virus or how long any immunity from natural infection or vaccination lasts. There are also potential challenges with the appearance of new variants which have the potential to reduce the protection provided by current vaccines. Modifications to the vaccines will be needed in the future to deal with the mutations (as happens with the annual formulations of the influenza vaccine). Other potential improvements being researched include reducing the number of doses to 1 and potentially being able to combine the COVID-19 vaccine with other vaccines for ease of administration (Shaw et al. 2021).

Challenges remain worldwide in securing sufficient supply of the vaccines, given the unprecedented demand. In addition, equity of access to and uptake of vaccines remains a challenge, both globally and within countries (Hughes et al. 2021; NHS England 2021; OECD 2021).

2

Direct health impact of COVID-19

Summary: 2 Direct health impact of COVID-19

Cases in Australia

- During 2020, there were around 28,500 cases of COVID-19 in Australia, with 2 distinct peaks (or 'waves')—1 in March to April, and 1 in June to September.
- The first affected all states and territories while the second was almost completely in Victoria. Over the whole year, the majority of cases were notified in Victoria.
- The first wave was dominated by infections brought into Australia largely by travellers returning from overseas. The second wave was dominated by infections mainly acquired via person-to-person transmission within the community.
- Testing rates need to be high and test positivity rates low to ensure cases are not missed. Testing was higher during outbreaks including those in Victoria, South Australia and NSW. Positivity rates remained well below the often used threshold of 5%. The peak of 2.7% was reached during the second wave in Victoria.

Severity

- A broad spectrum of severity is associated with the acute effects of COVID-19, ranging from asymptomatic and mild, to very severe and death.
- There were 909 deaths from COVID-19 notified through state and territory surveillance systems and 866 deaths registered and compiled by the ABS in Australia in 2020; 89% of deaths were in Victoria and 7% in NSW.
- The majority of deaths were in the older age groups: 24% in the 85–89 year age group and another 34% in those aged 90 and over.
- There were steep increases in death rates across the age groups, and higher rates for males than females particularly in the oldest age groups.
- The risk of dying after contracting COVID-19 (case-fatality) rises very sharply with age and rates are consistently higher for men than women. In 2020, case-fatality rates were below 1% for males and females aged up to and including 50–59. For the 80–89 year age group they were 35% for men and 25% for women.
- The 2 waves of the pandemic are reflected in much higher numbers of COVID-19 hospitalisations, and there were generally increasing hospitalisation rates with increasing age.
- The key aim of protecting hospitals from becoming overwhelmed was achieved. During 2020, around 12.5% of people with COVID-19 were admitted to hospital for treatment of the disease.
- There were 225 hospitalisations involving care in ICU up to the end of June 2020 —reflecting the most critically ill cases.
- A multi-organ syndrome of longer-term impacts of COVID-19 is being increasingly recognised, commonly known as 'long COVID'. There is no standard definition as yet, and evidence is still emerging on this condition.

Burden of disease

- There were 8,400 disability-adjusted life years (DALYs) lost in 2020 in Australia: over 4,600 for men and less than 3,800 for women.
- 97% of the disease burden arose from fatal cases, with an estimated 8,100 years of life lost (YLLs) from premature death. Three-quarters (76%) of YLLs in men and 86% in women occurred in those aged 70 and over.
- The small number of years of healthy life lost from living with COVID-19 (non-fatal burden) (290 YLD) had a different age profile, with the largest burden occurring in ages 20–39.
- These burden of disease estimates for COVID-19 are much lower than the leading diseases in Australia and for all lower respiratory infections. By comparison, coronary heart disease was the leading cause of burden in 2018 with around 312,000 DALYs, and lower respiratory infections including influenza and pneumonia was responsible for around 80,500 DALYs in 2018.
- The lower burden for COVID-19 reflects the success Australia has had in containing the virus. In comparison, the burden from COVID-19 in Scotland would have likely made it the second-leading cause of burden behind coronary heart disease.

Population groups

A number of groups are at increased risk of contracting COVID-19 or dying from it:

- During 2020, 7% of all COVID-19 cases in Australia and 75% of all deaths were in people living in residential aged care facilities.
- Up to early July 2020, it is estimated that health care workers in Australia were 2.7 times as likely to contract COVID-19 as people in the general community.
- In Victoria, 22% of health care workers who acquired COVID-19 acquired the disease at work during the first wave, compared with 69% in the second wave.
- Although at increased risk of severe COVID-19 disease or death, confirmed cases in the Aboriginal and Torres Strait Islander community up to mid-March 2021 were relatively small—0.5% of all cases in a group comprising 3.3% of the Australian population. There have been no COVID-related fatalities in 2020 among Aboriginal and Torres Strait Islander peoples. This followed early action by Aboriginal and Torres Strait Islander leaders and communities in partnership with governments.
- There were almost 4 times as many deaths due to COVID-19 among people from the lowest socioeconomic group compared with the highest group, and age-standardised mortality rates were 2.6 times as high.

Comparison with other countries

- If Australia had experienced the same crude case and death rates as 3 comparable countries—Canada, Sweden and the United Kingdom—there would have been between 680,000 and 2 million cases instead of the 28,500 that did occur, and between 15 and 46 times the number of deaths.
- In contrast, if the rates in New Zealand had applied there would have been around 18,000 fewer cases and 780 fewer deaths.

COVID-19 is a highly infectious and potentially severe disease. Prior to vaccine development there was very little immunity which meant that almost the whole population was at risk of being infected with the COVID-19 virus (Department of Health 2020h).

The direct health effects of COVID-19 include short-, medium- and longer-term impacts among people who develop the disease. The acute symptoms of the illness can progress to very severe disease and potentially result in death. Symptoms can remain for many weeks and even months. As well as symptomatic disease, people can also be infected with the virus without experiencing any symptoms.

Detailed data are now available on the number of cases, deaths and hospitalisations. This means there are now more data on non-fatal cases, not only fatal ones, providing a more detailed picture of the severity of the disease. This makes it now possible to undertake a full burden of disease analysis, as described below.

This chapter also looks at a number of particular population groups, and compares the Australian experience to those in selected other countries.

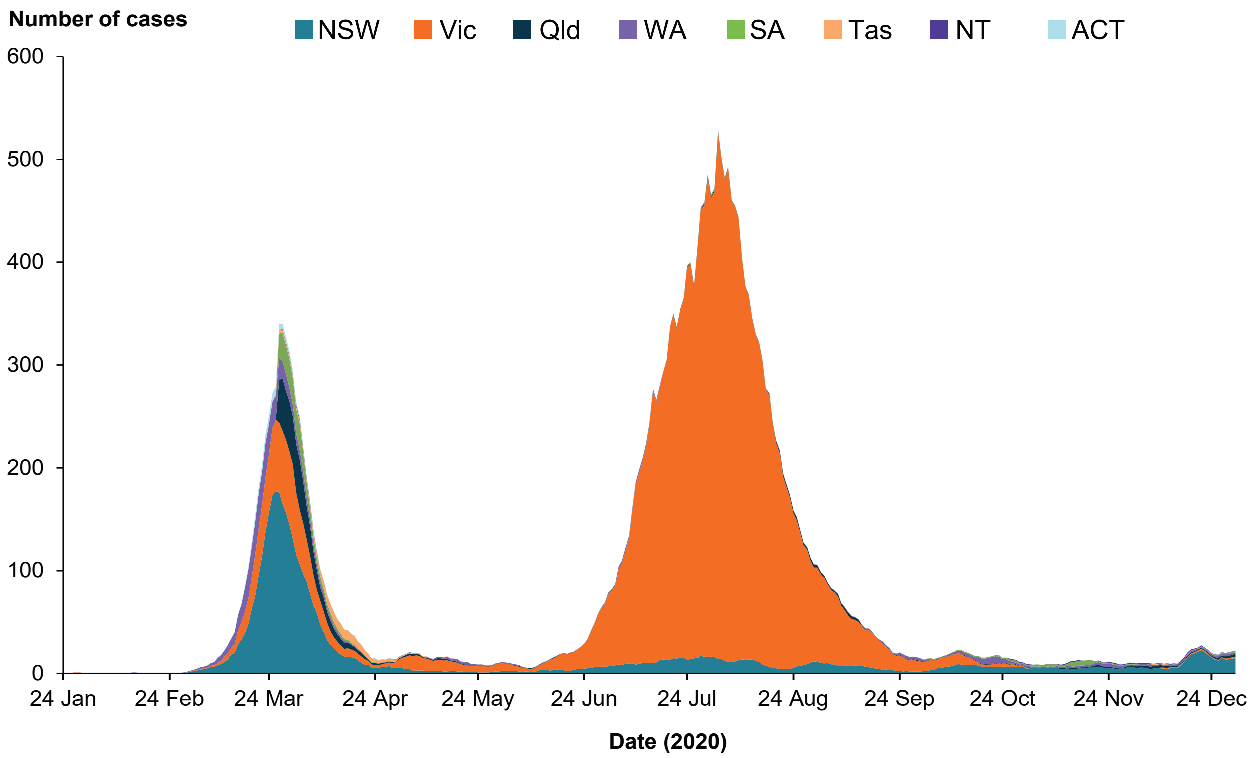
Cases in Australia

Data for this section primarily come from the website www.covid19data.com.au, which contains data collated from each of the states and territories. Case data by age and sex was obtained from the COVID-19 epidemiology reports released regularly by the Department of Health, which uses the National Notifiable Diseases Surveillance System (NNDSS) as the data source. The NNDSS was established in 1990 and contains national surveillance data for more than 60 communicable diseases or disease groups (Department of Health 2015b).

Cases by location and source of infection

During 2020, there were around 28,500 cases of COVID-19 in Australia. As is the nature of infectious diseases, outbreaks occur at different times and in various locations. In Australia, there have been 2 distinct peaks (or 'waves') in the number of cases (based on 7-day moving averages to smooth large day-to-day variation; Figure 2.1), 1 in March/April and 1 in June to September. As well as lasting longer, the second wave had a slightly higher 7-day average peak of just over 500 cases per day compared with almost 300 per day in the first wave. The first peak affected all states and territories—although NSW had the largest number—while the second was almost completely in Victoria. Over the whole of 2020, the majority of cases were in Victoria. Smaller spikes at the end of the year in NSW largely correspond to clusters of cases in Sydney, particularly the Northern Beaches.

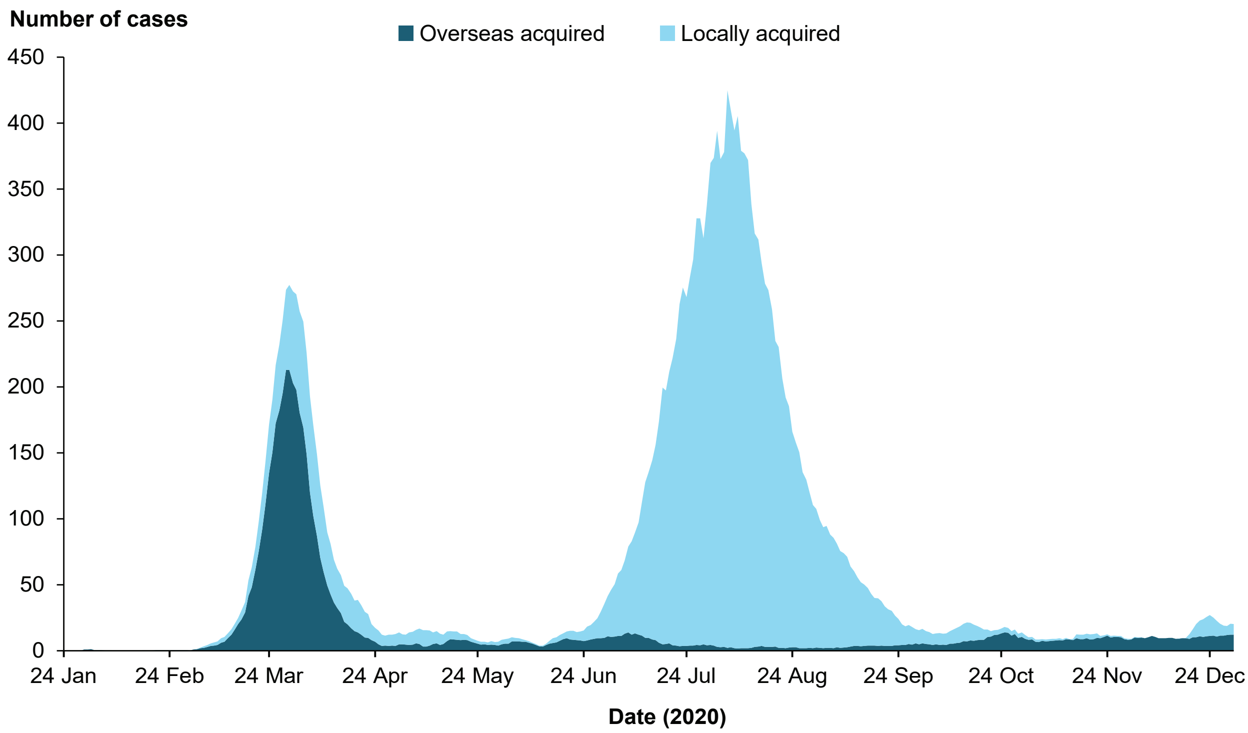
Figure 2.1: Cases of COVID-19 in 2020, 7-day moving average, by state and territory



Source: www.covid19data.com.au.

Looking at these data by source of infection also demonstrates the difference between the 2 main waves in 2020 (Figure 2.2). The first was dominated by infections brought into Australia from overseas, largely by returned travellers. The second was largely from increased transmission within the community. This demonstrates how quickly the virus can increase from a small number of cases in the community. In the months following the second wave, most cases were imported from overseas until near the end of the year when the Sydney clusters arose from person-to-person transmission within the community.

Figure 2.2: Cases of COVID-19 in 2020, 7-day moving average, by source of acquisition



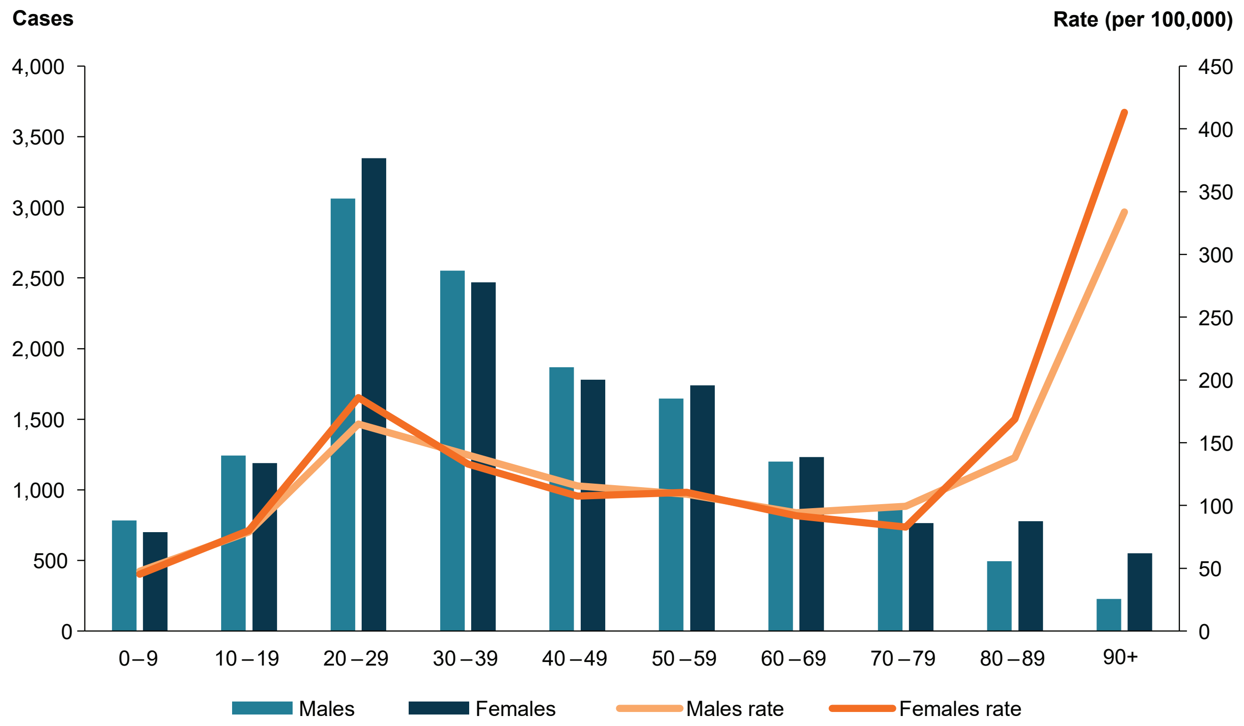
Source: www.covid19data.com.au.

By 20 June 2021 there had been 30,028 confirmed cases of COVID-19 in Australia, and 910 deaths (COVID-19 NIRST 2021c).

Cases by age and sex

The number of cases varied by age and sex during the year (Figure 2.3). People aged 20–29 had the highest number of cases followed by those aged 30–39. Rates of cases were generally similar for males and females in 2020 with some exceptions: rates for females were higher than males in the 20–29 and 80+ age groups.

Figure 2.3: Number and rates of cases of COVID-19 by age and sex, 2020



Source: COVID-19 Australia: Epidemiology Report 32: reporting period ending 3 January 2021. Communicable Diseases Intelligence Volume 45.

Testing rates

Testing rates need to be high to ensure that cases are not missed—particularly given the spread from people with mild or no symptoms which means the virus can go undetected for a number of weeks before a severe case becomes apparent. The appropriate level of testing at a particular time will depend on the level of virus in the community and other factors affecting the risk of infection. Finding all cases is essential for comprehensive contact tracing, case isolation and contact quarantine. Apart from the very beginning of the epidemic, testing has been available for all Australians, and there has been encouragement for people to come forward for testing with even the slightest symptoms, particularly in response to community clusters (CDNA & PHLN 2021). Detection of the virus in wastewater, a potential indicator of community cases, may also act as a driver for more people to get tested (see Chapter 6 for more detail on wastewater testing).

There are 2 important measures to help assess the adequacy of testing:

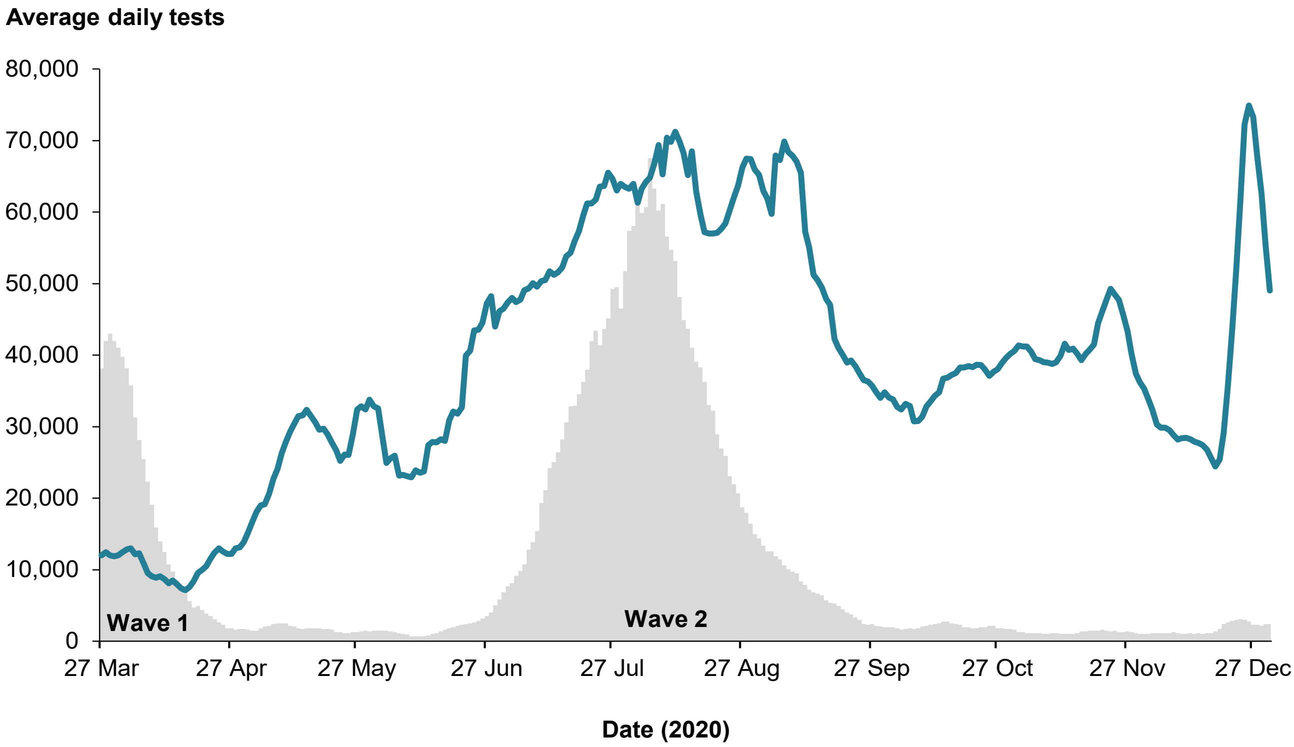
- Number of tests, either expressed as the total number or a rate. This needs to be large, and to increase when there are outbreaks or other reasons for concern.
- Positivity rate, that is the percentage of people tested who have positive results. High positivity may indicate there are many cases not being detected.

There are 2 ways to lower a test positivity rate: either by decreasing the number of positive tests (the numerator) or by increasing the total number of tests (the denominator). A comprehensive testing and public health program to control virus spread would achieve both of these (Fricker 2020).

The combination of these 2 measures provides a level of confidence in the data—if the volume of testing remains high and positivity rates remain low then it is likely that the count of cases is comprehensive (Dowdy & D'Souza 2020). This assists in determining whether the testing has been scaled to the size of the problem (more tests when an outbreak occurs).

National testing data for COVID-19 in Australia are available from the end of March 2020. Testing increased substantially following wave 1 and continued to increase during wave 2 (Figure 2.4), reaching a peak of just over 71,000 in early August 2020. The amount of testing fluctuated for the remainder of the year as outbreaks occurred. It is important to note that testing data are also affected by testing programs for border and health care workers and people being tested multiple times.

Figure 2.4: Number of daily COVID-19 tests (7-day average), March–December 2020, Australia

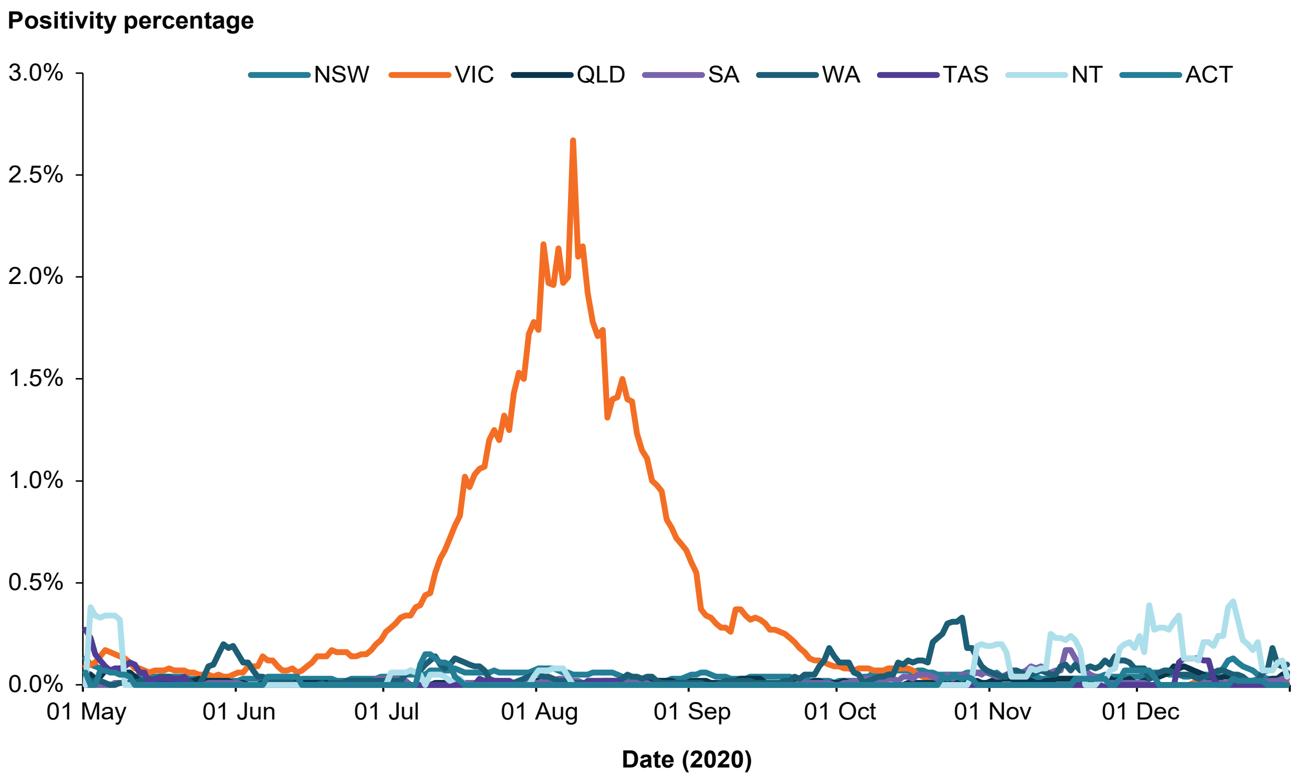


Source: www.covid19data.com.au.

Interpreting positivity rates can be complex, and needs to be done in relation to overall testing volume and representativeness of those being tested. Nevertheless, it provides an indication of potential missed cases in the community. While there is no set level at which there would be concern, earlier in the pandemic the WHO noted that the test positivity rate from a comprehensive testing program should be at or below 5% for at least 14 days before a region could relax restrictions or begin reopening (Dowdy & D'Souza 2020).

Positivity rates in Australia remained well below 5%, and mostly below 0.5% even though these data include overseas-acquired cases detected in quarantine (Figure 2.5). The only period when this very low rate was exceeded was during the second wave of infections in Victoria, when positivity reached just over 2.7% at its peak.

Figure 2.5: Percentage of tests returning positive results by state and territory, May–December 2020

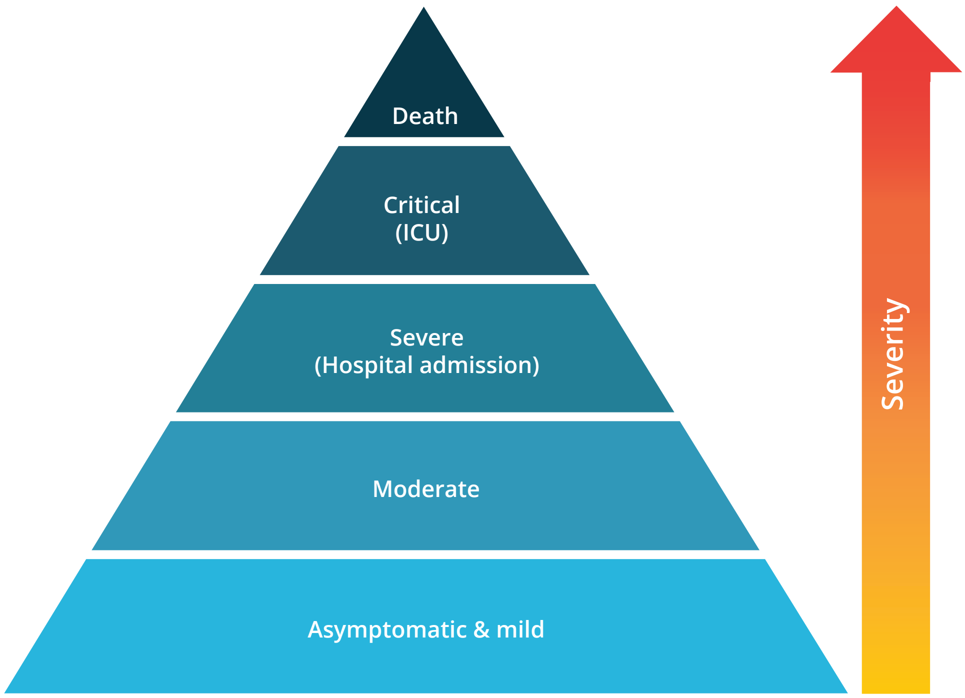


Source: www.covid19data.com.au.

Severity

There is a spectrum of severity associated with the acute effects of COVID-19 as noted in Chapter 1, ranging from asymptomatic and mild, to very severe and death. This general range in severity is depicted in Figure 2.6.

Figure 2.6: Severity pyramid for acute COVID-19



This section presents data relevant to the top 3 components of the pyramid, starting with deaths from COVID-19. The critical category is commonly equated to those people admitted to ICUs and the severe category to others admitted to hospital for treatment (Rommel et al. 2021; Wyper et al. 2021). These categories are covered in the hospital section below.

As the pandemic has progressed, evidence has emerged of a longer duration of symptoms for some people. This has been labelled 'post-COVID-19 syndrome', or more commonly 'long COVID-19'. Further information on this syndrome is contained in the last section below.

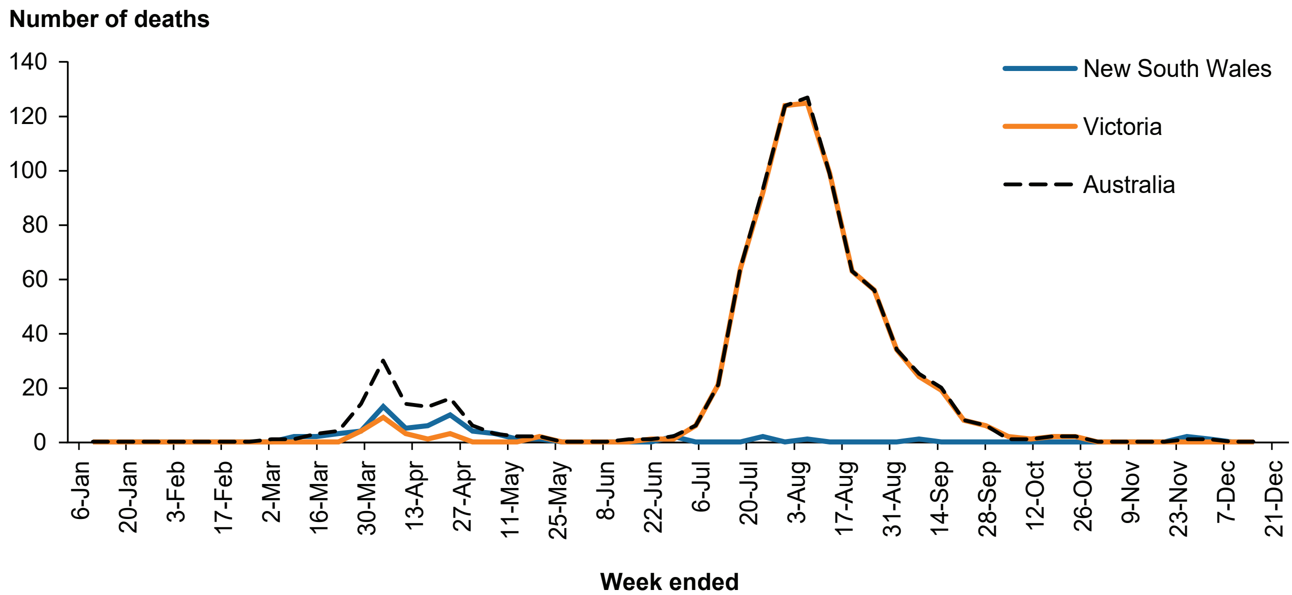
Deaths

A death directly due to COVID-19 is defined as a death resulting from a clinically compatible illness, in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID disease (for example, trauma) (WHO 2020e) (see Appendix A for detail on how COVID-19 deaths are coded in Australia).

During 2020, there was a total of 909 deaths due to COVID-19 collected through the NNDSS (Department of Health 2021f) and 866 deaths registered and compiled by the ABS and included in the official statistics for reporting on all deaths in Australia (ABS unpublished data). Data presented below on deaths due to COVID-19 are from ABS death registrations data which provide additional detail on associated causes of death not collected as part of the NNDSS. Appendix A provides further information on the differences between these 2 data sources and a comparison of COVID-19 death counts in 2020 from both sources.

Of the 866 COVID-19 deaths registered in 2020, 89% were in Victoria and 7% were in New South Wales. The peaks in deaths due to COVID-19 followed the 2 waves of COVID-19 infections (Figure 2.1), but there were many more deaths in the second wave (over 700) (Figure 2.7).

Figure 2.7: Number of COVID-19 deaths in Australia, by week, NSW, Victoria and Australia, 2020

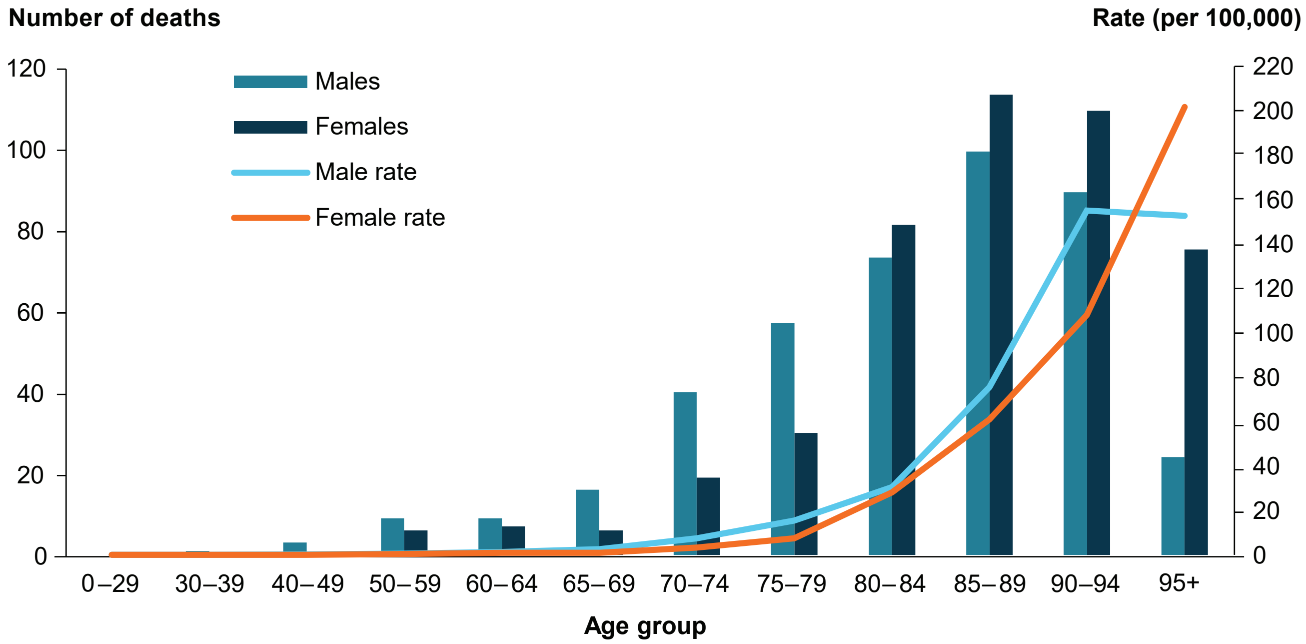


Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

Deaths by age and sex

Just over half of the 866 COVID-19 deaths registered in Australia in 2020 (446; 51.5%) were for females. The majority of COVID-19 deaths were in the older age groups: 24% in the 85–89 year group and another 34% in those aged 90 and over. There were more male than female deaths in the younger age groups and up to age 75–79, after which there were more female deaths (Figure 2.8). There were steep increases in death rates across the age groups and higher rates for males than females, particularly in the oldest age groups with the exception of the 95 and over age group which is subject to small numbers for males in the denominator population and should be interpreted with caution.

Figure 2.8: Number and rate of COVID-19 deaths in Australia, by age and sex, 2020



Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

The median age at death for COVID-19 registered deaths was 87 years, which is higher than that for all causes of death in 2020 (83 years) (ABS unpublished data). This partly reflects the high number of COVID-19 deaths among the elderly who resided in aged care facilities during the second wave of the pandemic. Compared with the top 7 leading causes of death occurring in 2019 as well as suicide (10th), pneumonia (15th) and influenza (43rd), the median age at death for COVID-19 was:

- higher than the leading cause of death—coronary heart disease (84 years), diabetes (82), chronic lower respiratory diseases (80), bowel cancer (77), lung cancer (74) and suicide (43)
- similar to influenza (87) and stroke (86)
- lower than the second-leading cause of death—dementia (89), and pneumonia (89) (AIHW unpublished data).

COVID-19 and associated causes of death

Associated causes are causes that contributed to the death and can be either conditions listed in the causal sequence (the chain of events leading to death), or pre-existing chronic conditions. Examining conditions in the causal sequence can provide insights into how a disease progresses and leads to death. Examining pre-existing chronic conditions provides an understanding of diseases that may increase the risk of COVID-19 complications and therefore increase the risk of death. Both can inform prevention and intervention policies. A number of conditions have been shown to increase risk of death due to COVID-19, such as cancer, chronic kidney disease, type 2 diabetes, respiratory disease, heart disease and hypertension (British Heart Foundation 2020, Ng et al. 2021).

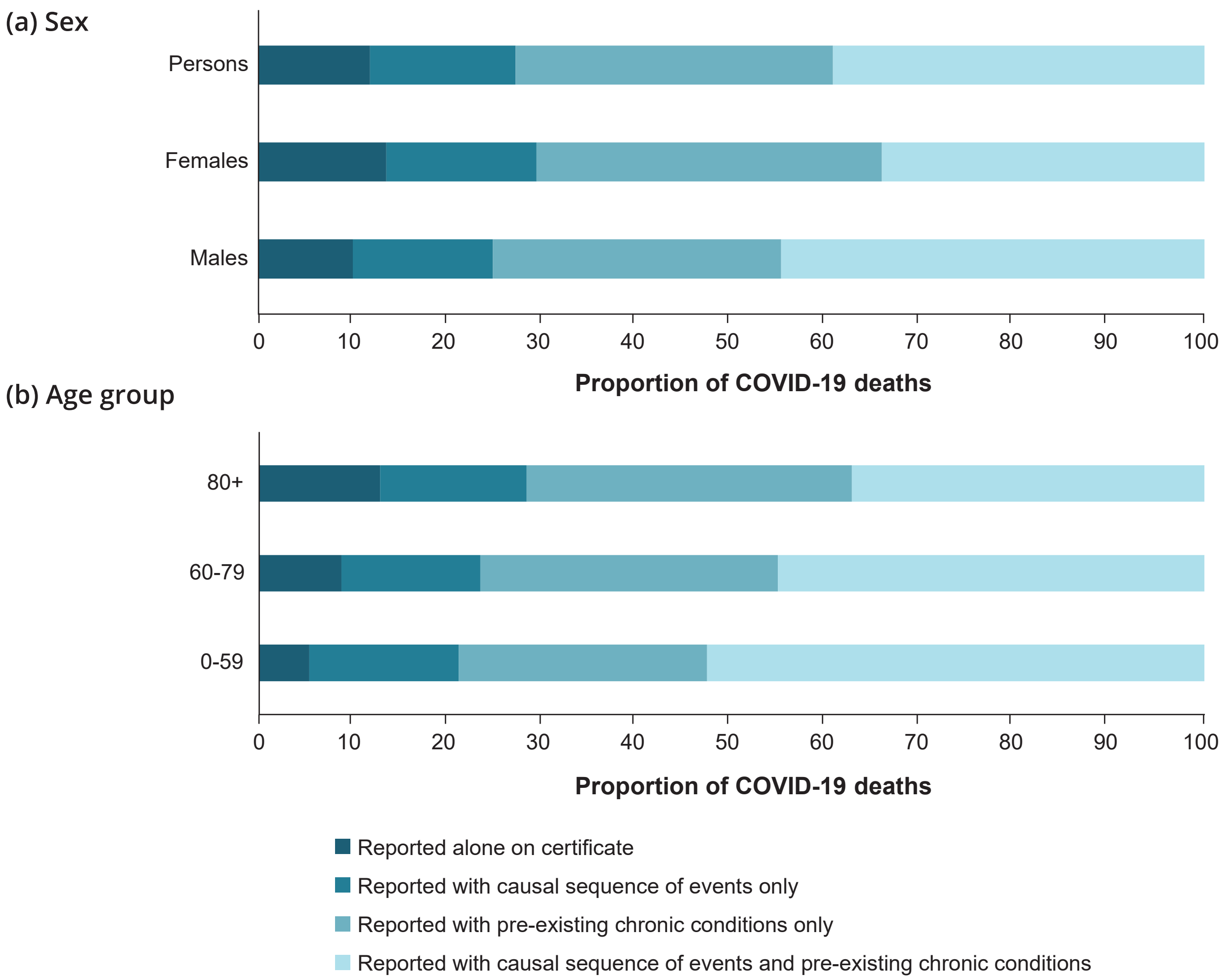
The associated cause of death data presented below are based on provisional mortality data from the ABS based on death registrations in Australia.

Overall in 2020, 88% of deaths due to COVID-19 had associated causes listed on the death certificate. COVID-19 deaths had an average of 2.4 associated causes recorded (ABS 2020a).

Over half (55%) of COVID-19 deaths in 2020 had a condition listed in the causal sequence on the certificate, and almost three-quarters (73%) of COVID-19 deaths were among people who had pre-existing chronic conditions.

A higher proportion of COVID-19 deaths in males had associated causes reported compared with females—mainly driven by a higher proportion of deaths reported with both a causal sequence of events and pre-existing chronic diseases (Figure 2.9). A similar pattern was evident by age, with higher proportions of COVID-19 deaths having associated causes of death in the younger age groups compared with the older age groups.

Figure 2.9: Proportion of COVID-19 deaths that had associated causes of death, by sex (a) and broad age group (b), 2020



Note: Data for those aged 0–59 should be interpreted with caution due to the small number of COVID-19 deaths reported for this age-group.
Source: AIHW analysis of ABS Provisional Mortality Statistics: Customised Report.

Pneumonia was the most common condition reported in the causal sequence as an associated cause for COVID-19 deaths (56%). Respiratory failure, other infections, cardiac complications and renal failure were other common conditions certified in the causal sequence (Table 2.1).

Table 2.1: Most commonly certified conditions in the causal sequence reported as associated causes of COVID-19 deaths, 2020

Condition (ICD-10 codes)	Number	%
Pneumonia (J12–J18)	266	56.2
Respiratory failure (J96, R09.2)	68	14.4
Other infections (A41, A49.8, A49.9, B34.8, B37.7, J06.9, J22)	60	12.7
Acute cardiac complications (I20.9, I21, I46, I51.4, R00)	45	9.5
Renal failure (N00.9, N17, N19)	35	7.4
Delirium (F05)	33	7.0
Other organ failure (K72.9, R68.8)	32	6.8
Acute Respiratory Distress Syndrome (J80)	26	5.5

Note: Proportions do not sum to 100% as a death may have more than one associated causes of death recorded.
Source: ABS Provisional Mortality Statistics: Customised Report.

Dementia was a pre-existing chronic condition reported as an associated cause in 41% of COVID-19 deaths in 2020. Dementia is the second-leading cause of death in the general Australian population and a common associated cause in deaths due to other conditions such as influenza and pneumonia, especially in the older age groups which had the highest numbers of COVID-19 deaths.

Chronic heart diseases, diabetes, hypertension, and chronic lower respiratory diseases were other common chronic conditions certified in 33%, 18%, 15% and 15% respectively of deaths due to COVID-19 (Table 2.2).

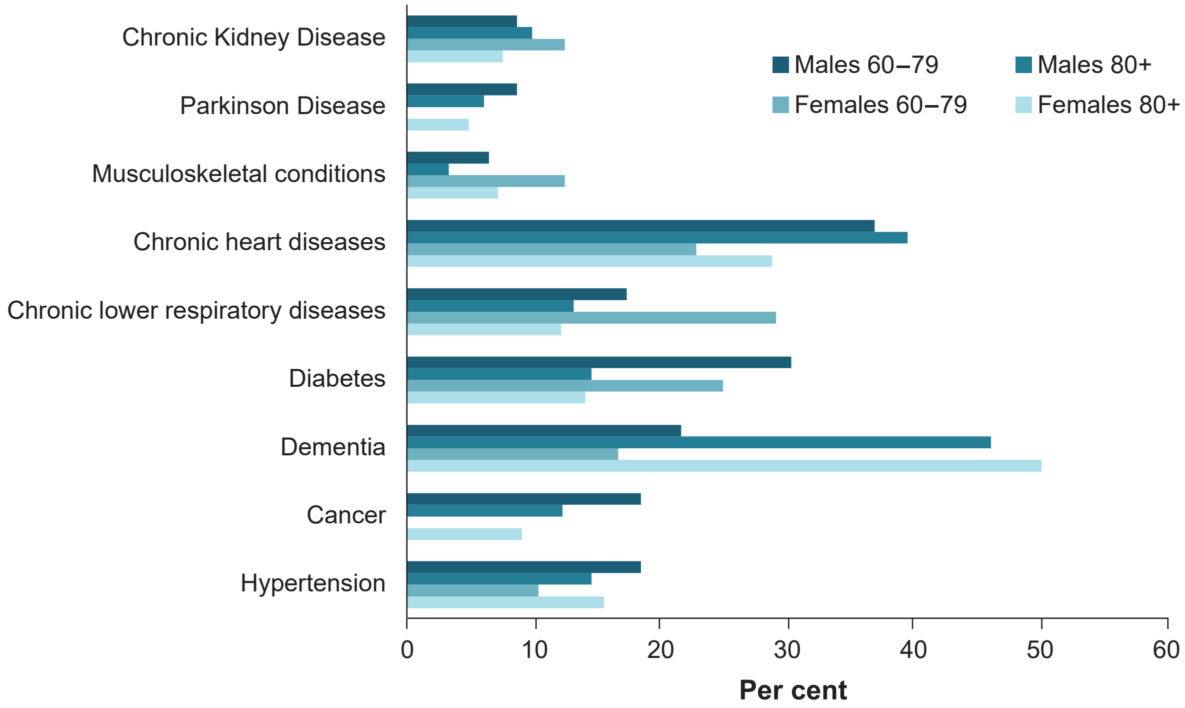
Table 2.2: Most commonly certified pre-existing chronic conditions reported as associated causes of COVID-19 deaths

Condition (ICD-10 codes)	Number	%
Dementia (F01, F03, G30)	258	40.9
Chronic heart diseases (I24, I25, I30–I45, I47–I50, I51.0–I51.3, I51.6–I51.9)	209	33.1
Diabetes (E10–E14)	112	17.7
Hypertension (I10–I15)	96	15.2
Chronic lower respiratory diseases (J40–J47)	92	14.6
Cancer (neoplasms) (C00–D48)	74	11.7
Chronic kidney disease (N18)	56	8.9
Diseases of the musculoskeletal system and connective tissue (M00–M99)	40	6.3
Parkinson disease (G20)	37	5.9

Note: Proportions do not sum to 100% as a death may have more than one associated causes of death recorded.
Source: ABS Provisional Mortality Statistics: Customised Report.

Males who died from COVID-19 were more likely than females to have chronic heart diseases recorded as an associated cause of death, regardless of age. Chronic lower respiratory diseases, chronic kidney disease and musculoskeletal conditions were more common associated causes of death for females aged 60–79 who died from COVID-19 (compared to males aged 60–79 and people aged 80 and over) (Figure 2.10). Diabetes was a more common associated cause of death among people aged 60–79 who died from COVID-19 compared to those aged 80 and over. Dementia was a more common associated cause of COVID-19 deaths among people aged 80 and over (Figure 2.10).

Figure 2.10: Proportion of COVID-19 deaths with pre-existing chronic conditions listed as associated causes, by broad age group and sex, 2020



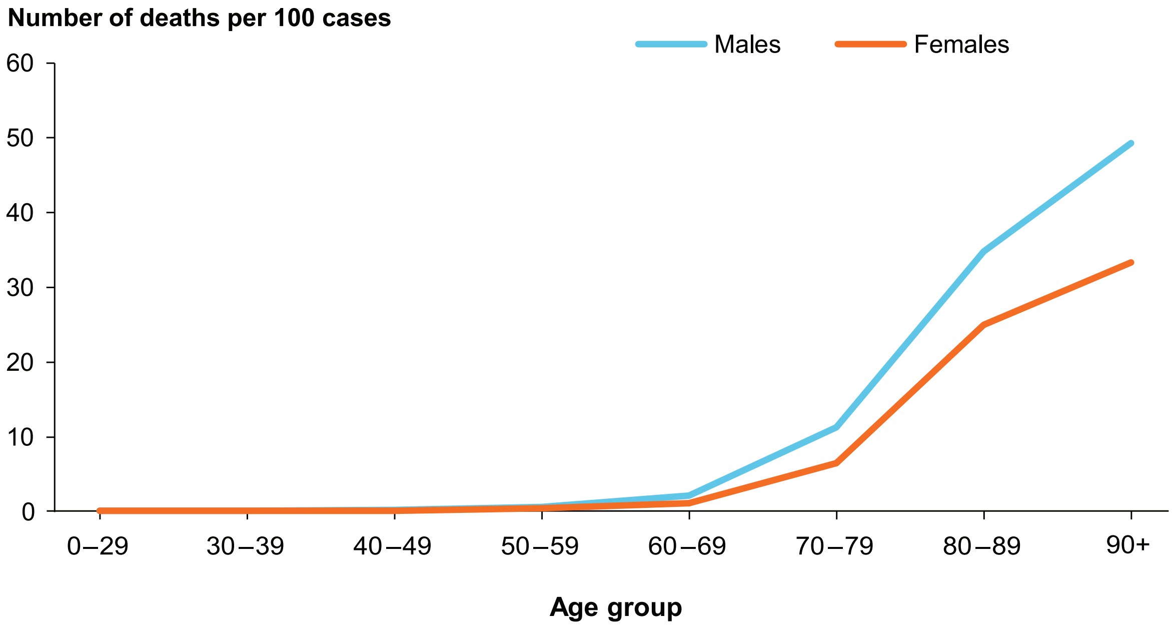
Note: Numbers are too small to report the proportion of COVID-19 deaths with cancer and Parkinson disease as associated causes of death for females aged 60–79.

Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

Case-fatality rates

Case-fatality rates measure the proportion of cases that die during a given time period. The chance of dying after contracting COVID-19 rose very sharply with age, from about age 70, and rates were consistently higher for males than females (Figure 2.11). Rates remain below 1% up to and including the 50–59 age group for both males and females. For the 70–79 age group, case-fatality rates in 2020 were 11% and 6.4% for males and females, respectively. For the 80–89 group they were 35% and 25%.

Figure 2.11: Case-fatality rates for COVID-19 in Australia, by age group, 2020



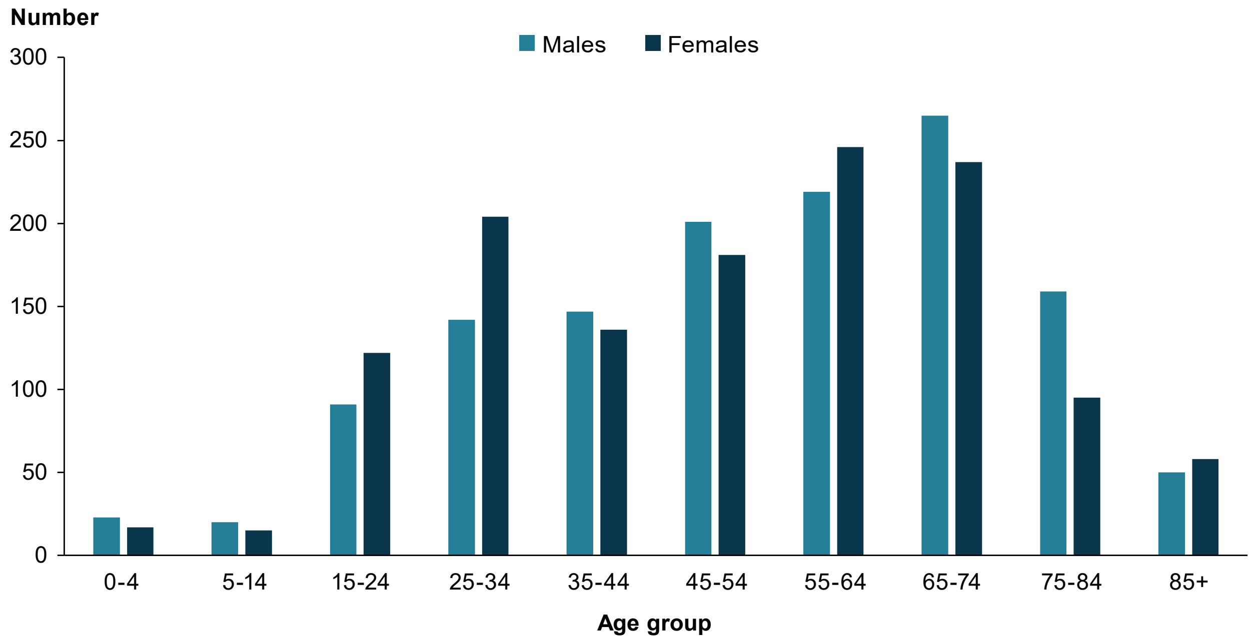
Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report (for deaths) and COVID-19 Australia: Epidemiology Report 32: reporting period ending 3 January 2021. Communicable Diseases Intelligence Volume 45 (for cases).

Hospitalised cases

Information on the number of people with COVID-19 hospitalised for treatment of their disease provides an indication of the extent of more severe disease in the community. The majority of information presented below on COVID-19 hospitalisations uses data from the AIHW National Hospital Morbidity Database for the first 6 months of 2020. Note that these data are based on episodes of care which may mean that some people are counted more than once in the data, for example if they are transferred from one hospital to another.

A key aim in containing the spread of the virus was to protect hospitals from becoming overwhelmed. Australia's success in containing the spread in 2020 resulted in the number of hospitalisations remaining manageable, with an estimated 12.5% of people with COVID-19 in 2020 being admitted to hospital for treatment of the disease (COVID-19 NIRST 2021b). This is reflected in data for the first half of 2020, when there were just over 2,600 hospitalisations for people with COVID-19. The pattern across age groups shows generally increasing numbers of hospitalisations with increasing age until the oldest age groups (Figure 2.12).

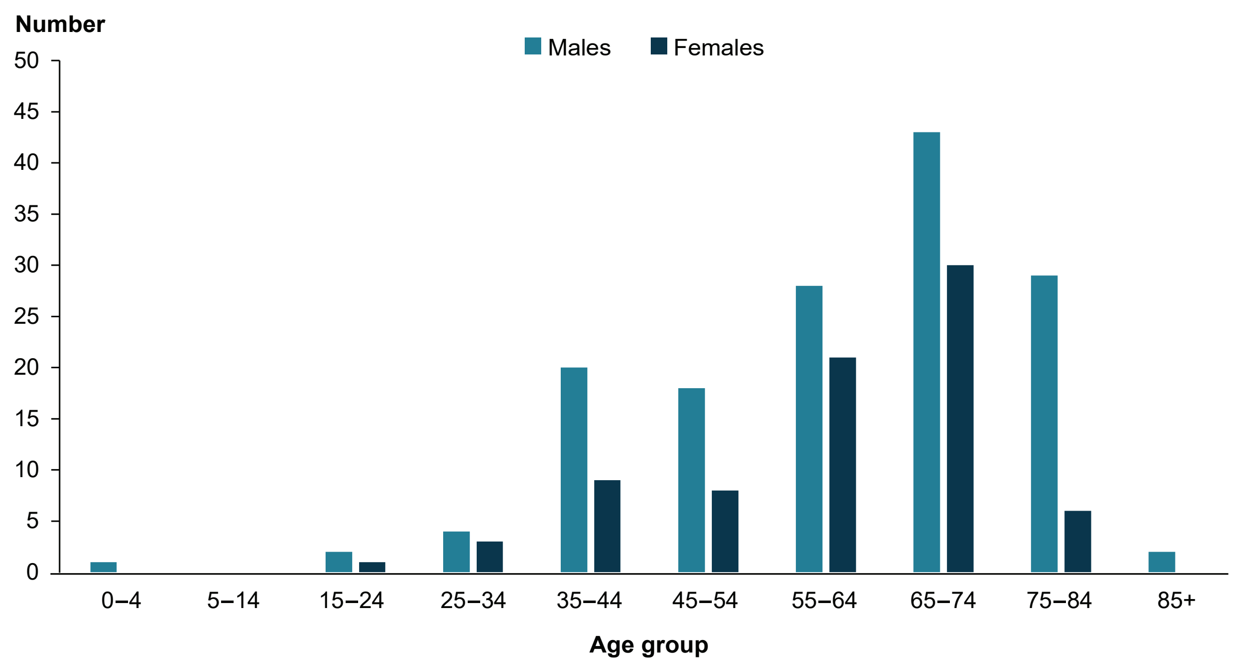
Figure 2.12: Number of COVID-19 hospitalisations, by age and sex, 1 January to 30 June 2020



Source: https://www.aihw.gov.au/reports-data/myhospitals/intersection/activity/apc.

Again in the first half of 2020, there were 225 hospitalisations involving care in ICU for people with COVID-19. Only a small number of these hospitalisations were for people aged over 80. This indicates that a proportion of critical cases may have been treated in general hospital wards or residential aged care facilities and not admitted to ICU, particularly cases in the older age groups. The age groups with the largest number of hospitalisations involving ICU care were the 55–64 and 65–74 age groups (Figure 2.13).

Figure 2.13: Number of COVID-19 hospitalisations admitted to Intensive Care Unit, by age and sex, 1 January to 30 June 2020



Source: https://www.aihw.gov.au/reports-data/myhospitals/intersection/activity/apc.

Length of stay in hospital increased with age, from 5 days on average for those under 18 (using data to 25 October 2020) to 12 days on average for those 80 and over (COVID-19 NIRST 2020b). The median length of stay in ICU to the end of June 2020 was 16 days for those on mechanical ventilation and 3 days for others (Burrell et al. 2021).

Post-COVID-19 syndrome (long COVID)

Many viral infections have a period of ongoing symptoms in some people in the subacute phase immediately following the acute stage of the disease. This is also the case with COVID-19, with many people experiencing fatigue in particular, often resolving after 8–12 weeks (NIHR 2021).

There is now also evidence that there is an even longer period of chronic symptoms for some people, similar to some other infectious diseases such as Epstein-Barr virus (Arai 2021). Patient and clinical experience, emerging data and elapsed time have led to a multi-organ syndrome being increasingly recognised (Nalbandian et al. 2021). It has been termed post-COVID-19 syndrome, but is more commonly known as 'long COVID'. There is no standard definition as yet, however one based on particular symptoms persisting after 12 weeks is often used and that is the primary focus presented here. Note that evidence is still emerging—partly due to the elapsed time needed to measure persistence of symptoms.

Many symptoms have been listed for this syndrome, including shortness of breath, chest pain or tightness, palpitations, cognitive impairment, fatigue, and anxiety/depression (Nalbandian et al. 2021). The syndrome can have a relapsing or steady course (NIHR 2021).

There is enormous variation in prevalence estimates from various studies (NIHR 2021). Studies vary in definitions, size of sample, whether the cases were exclusively hospitalised or community cases, whether laboratory confirmation of diagnosis was used, self-reported versus clinical assessment, length of follow-up and whether there is a control group.

A recently published Australian study reported recovery times for 94% of all COVID-19 cases diagnosed in NSW between January and May 2020: 20% had not recovered by 30 days, 9% by 60 days and 7% by 90 days (Liu et al. 2021). Taking into account that 1.8% of cases died from COVID-19, the authors noted that around 5% of cases had not recovered at 90 days. Recovery time increased with age; women recovered more slowly than men; and those with pre-existing comorbidities were slower to recover than those without.

A large household survey is being conducted in the United Kingdom (where COVID-19 was present in large numbers) (ONS 2021). A sample of more than 20,000 participants who tested positive for COVID-19 provided data for the analysis, and a control group was also included. Overall, 13.7% (95% CI: 10.8–17.4) of people with COVID-19 reported they still had persistent symptoms 12 weeks after their initial diagnosis. In the control group (matched by age and sex), who were unlikely to have contracted COVID, 1.7% (95% CI: 1.4–2.1) had similar symptoms. Of those with symptoms at 12 weeks, 61.6% experienced at least some limitation in their day-to-day activities as a result, and 17.9% reported that their day-to-day activities had been limited a lot.

As with the United Kingdom study presented above, another smaller study (177 participants) conducted in the United States also included a control group (Logue et al. 2021). That study found that 33% of participants still had symptoms after 6 months, compared with 5% in the control group with similar symptoms.

Nalbandian and others (2021) reviewed a number of papers, including 2 with at least 2–3 months follow-up. These studies had quite high prevalence of ongoing symptoms: 51% and 76% (Moreno-Pérez et al. 2021; Huang, Huang et al. 2021).

Common patterns among various studies were higher rates in women than men, and higher rates in younger people than would be expected given the severity profile of COVID-19 (Huang, Pinto et al. 2021 [preprint]; NIHR 2021). Some studies also showed declines in quality of life among the group with ongoing symptoms (Logue et al. 2021; Halpin et al. 2020).

A large study in the US examined longitudinal data of healthcare insurance claim records of almost two million people with COVID-19. They discovered that at least 23% had at least one post-COVID-19 condition. Although the percentage was higher in those hospitalised with COVID-19 (50%), 19% of asymptomatic cases also had post-COVID-19 conditions. In descending order, the most common symptoms were pain, breathing difficulties, hyperlipidaemia, malaise and fatigue, and hypertension. Mental health disorders were also prevalent among this group, including depression, anxiety, adjustment disorders and tic disorders (FAIR Health 2021).

Another US study of 73,435 users of Veterans Health Administration (VHA) with COVID-19 not requiring hospitalisation were matched against almost 5 million VHA users without COVID-19. It reported a significantly higher risk of death and an increased use of healthcare resources in those with COVID-19 after the first 30 days of their illness (Al-Aly et al. 2021).

It is acknowledged that the characteristics of long COVID-19 are not yet well understood, and studies are continuing to provide further clarity (NIHR 2021).

Burden of disease

Burden of disease analysis quantifies the gap between a population's actual health and an ideal level of health—that is, every individual living without disease or injury to the theoretical maximum life expectancy—in a given year. This summary measure of the impact of diseases and injuries reflects both illness in the population (frequency and severity) and deaths (frequency and age at death) using comparable metrics. It is one of the most commonly used summary measures of population health, and is valuable when comparing across different diseases, across population groups, and between fatal and non-fatal effects.

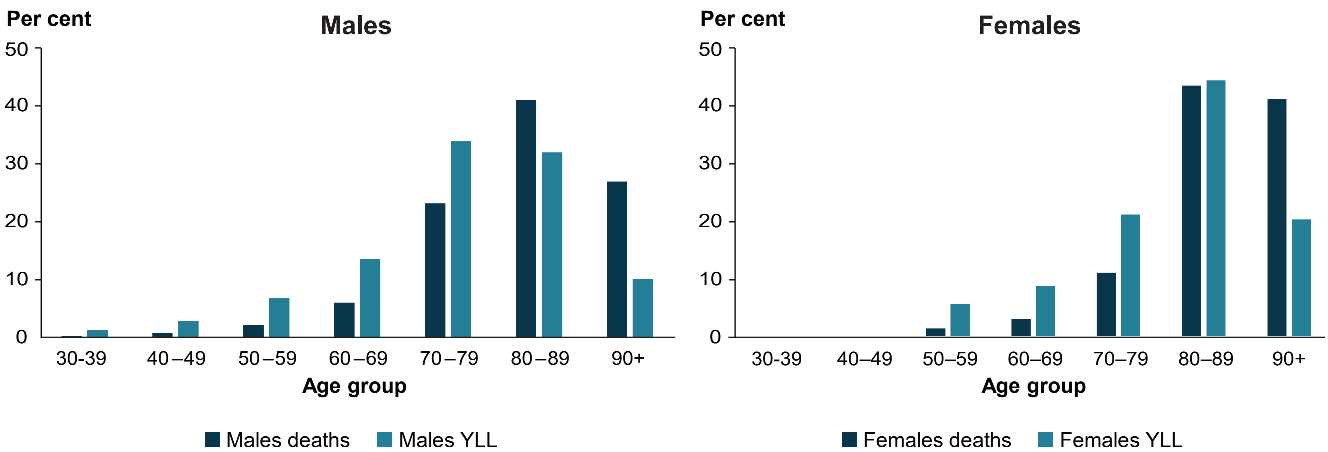
Burden of disease is measured using the summary measure disability-adjusted life years (DALYs). One DALY is 1 year of 'healthy life' lost due to illness (non-fatal burden, Years lived with disability (YLD)) and/or death (fatal burden, Years of life lost (YLL))—the more DALYs associated with a disease or injury, the greater the burden.

Burden of disease data on COVID-19 provide valuable information on the impact of the disease, including both fatal and non-fatal effects. Non-fatal effects received less focus in the earlier stages of the pandemic, but now that further data are available, burden of disease analysis can be used to examine the full population-level impact of the disease. Initial estimates of the fatal burden in Australia were produced in mid-2020, reflecting deaths up to the end of May 2020 (AIHW 2020g). It is now possible to produce the first estimates of the non-fatal burden, as well as update the fatal burden component. The analysis draws on methods and inputs being developed in other countries reflecting current understanding about this new disease. Further knowledge may emerge that would require updates to the methods in the future. Appendix B provides more detail on the methods used for the calculations presented here on the burden from COVID-19 in 2020.

Fatal burden

Fatal burden estimates presented below are based on ABS death registration data on COVID-19 deaths. During 2020, an estimated 8,100 years of life were lost to COVID-19 in Australia; 55% were among males. Men younger than 70 years of age accounted for 9.0% of deaths, but 24% of YLLs (Figure 2.14). The corresponding figures for women were 4.3% and 14%.

Figure 2.14: Percentage of total COVID-19 deaths and YLL in each age group, 2020



Source: AIHW analysis as detailed in Appendix B.

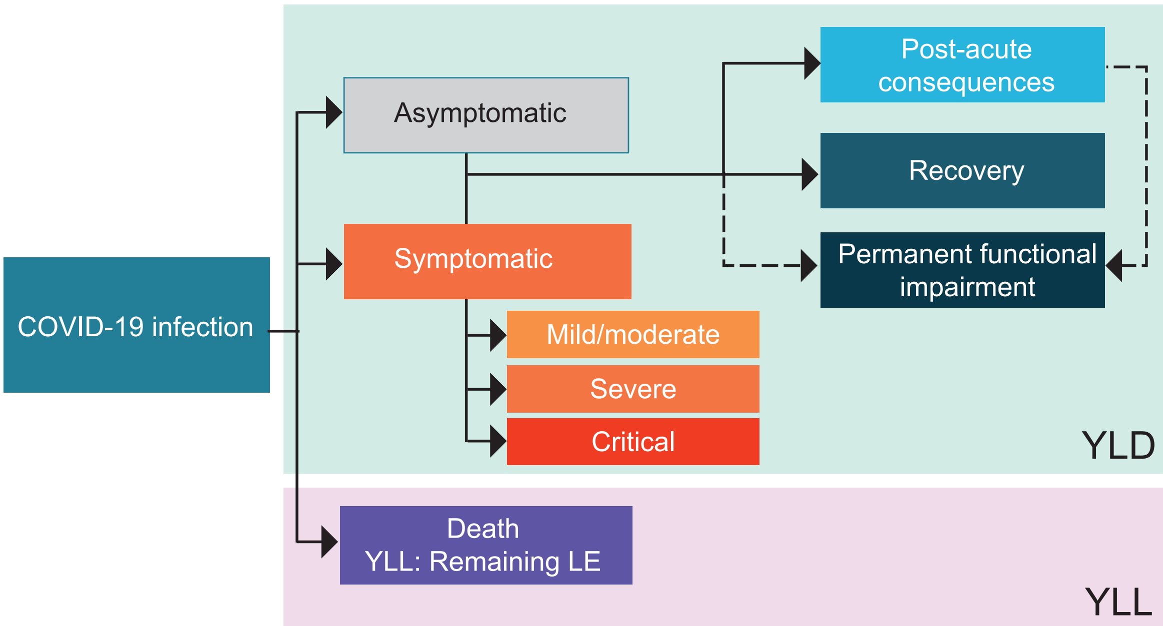
Total YLLs equate to 10.7 years lost per man dying from COVID-19 and 8.1 years per woman, using the ideal life expectancy for each age group used in the ABDS (Murray et al. 2012). Using the actual Australian life expectancies bring the years lost per person dying to 9.0 and 7.9 for men and women respectively.

There has been some debate about the suitability of using an ideal life expectancy when many of the deaths have occurred among the frail elderly who may have a shorter expected life expectancy than others of the same age (Wyper et al. 2021). We have followed the approach of general burden of disease studies, as well as international studies of the burden from COVID-19 (Jo et al. 2020, Wyper et al. 2021), and continued to use an ideal life expectancy approach. This maintains comparability with the analysis for other diseases, and the approach taken in other studies. Additionally, as a health gap measure, the comparison needs to use an ideal life expectancy rather than an individual's life expectancy.

Non-fatal burden

Non-fatal burden has been calculated by apportioning the number of confirmed COVID-19 cases in Australia into different severity categories, from asymptomatic to critical (see Figure 2.15 and further information in Appendix B).

Figure 2.15: Conceptual model for COVID-19 burden of disease analysis

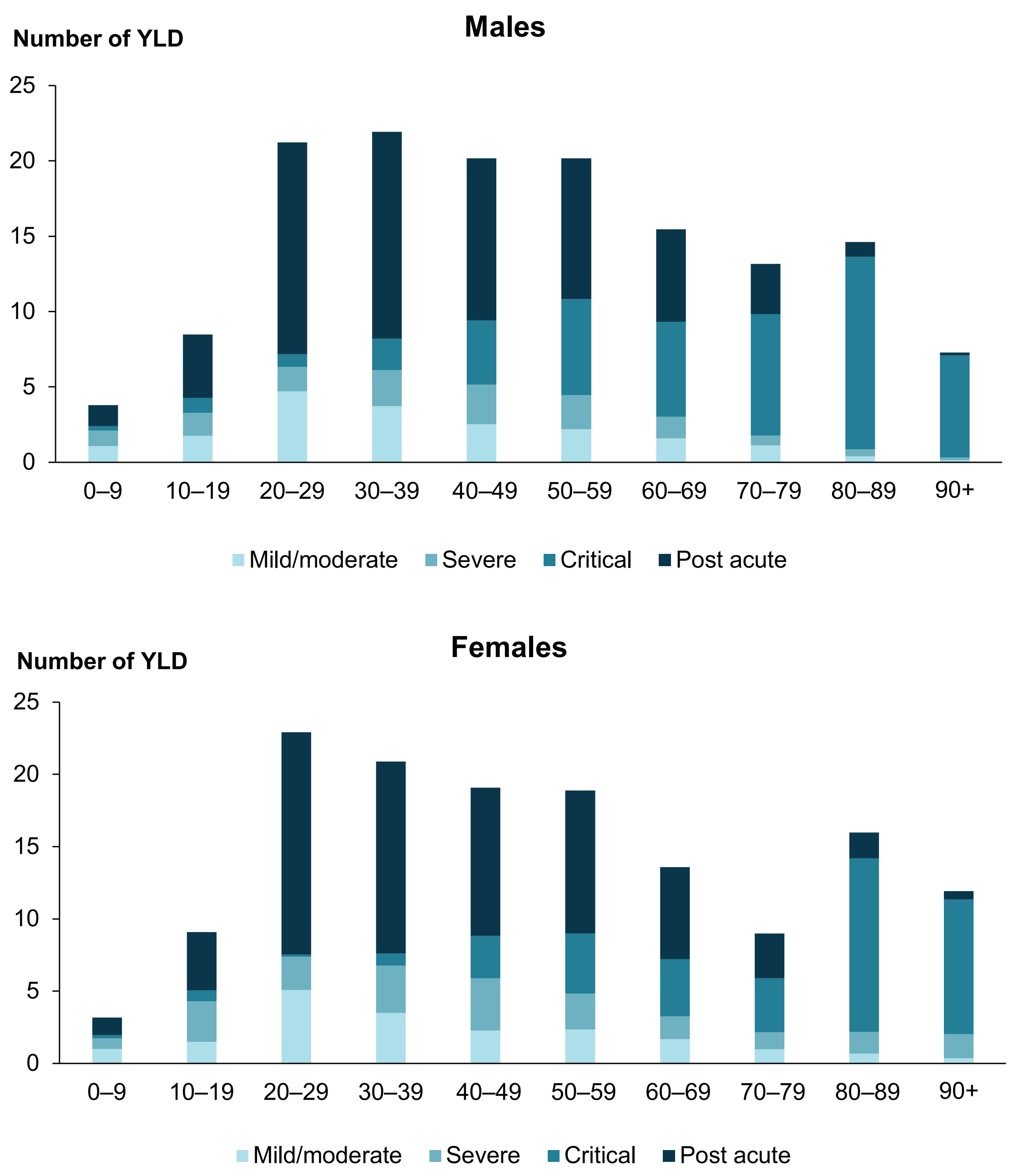


Note: Post-acute consequences includes long COVID.
Source: EBDN 2020.

Data used here come from the NNDSS on the overall number of cases and the AIHW National Hospital Morbidity Database (NHMD) on hospitalisations. A separate calculation was made for those with long COVID, using assumptions based on overseas experience. Standard burden of disease approaches are then used to calculated the non-fatal burden.

There were considerably fewer years lived with disability (YLDs) due to COVID-19 than years of life lost (YLLs)—146 YLDs for men and 144 for women in 2020. There is also a different age profile for YLDs compared with YLLs, with the largest number occurring in the 20–29 and 30–39 year age groups (Figure 2.16), which reflects the higher volume of cases in those age groups. The largest proportion of YLDs came from the post-acute category (long COVID-19)—44% of the YLDs for men, and 46% for women, again driven by the relatively high burden in the young adult age groups. The next largest category was the critical group, with 33% of YLDs for men and 26% for women. The increasing severity as age increased resulted in much higher proportions of the burden coming from the critical category for the older age groups. For example, for men in their 80s, 87% of the non-fatal burden was due to the critical category. For women of the same age this figure was 75%.

Figure 2.16: Number of YLDs for COVID-19 by severity category and sex, 2020

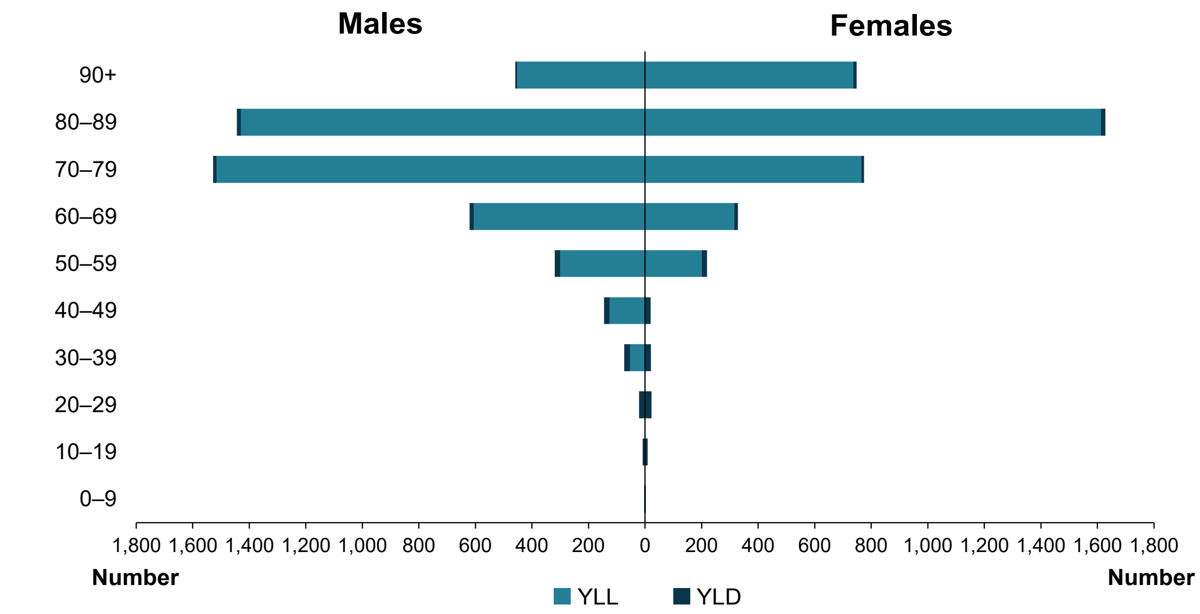


Source: AIHW analysis as detailed in Appendix B.

Total burden

Adding YLLs and YLDs together results in just over 4,600 DALYs for men and more than 3,800 for women, giving a total of 8,400 DALYs from COVID-19 in Australia in 2020. These figures for total burden show the dominance of fatal burden for COVID-19 particularly at older ages (Figure 2.17): 97% of DALYs came from YLLs for males and 96% for females. YLLs were also found to account for a large proportion (90% or more) of total DALYs in analyses undertaken in Korea and Scotland (Jo et al. 2020, Wyper et al. 2021).

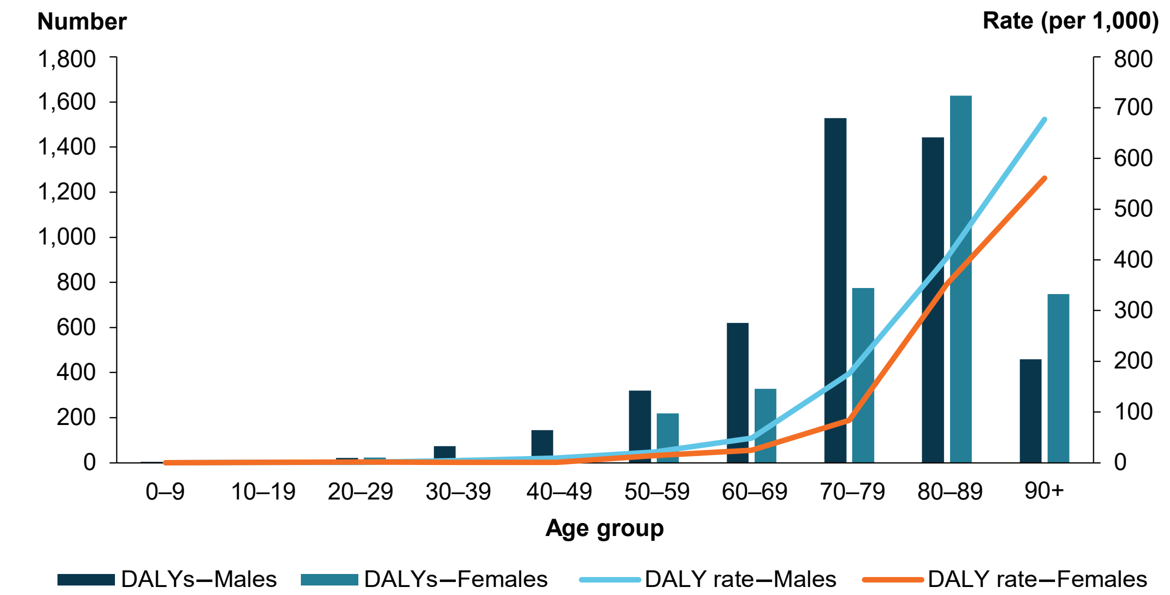
Figure 2.17: Total burden (DALYs) for COVID-19, disaggregated into YLLs and YLDs, by sex, 2020



Source: AIHW analysis as detailed in Appendix B.

While numbers of DALYs were higher in the 70–79 and 80–89 age groups, rates were highest for the 90+ age group (Figure 2.18). Rates remained relatively low from the youngest to the 60–69 age group for men and women. For men, the rates then increased sharply into the older age groups and were higher than for women. For women the sharper increases were apparent from the 70–79 age group.

Figure 2.18: Total burden (DALYs) for COVID-19: numbers and rates, 2020



Source: AIHW analysis as detailed in Appendix B.

The COVID-19 burden of disease estimates for Australia are much lower than for the leading diseases. For example, coronary heart disease was the leading cause of burden in 2018 with around 312,000 DALYs (AIHW forthcoming 2021), much higher than the 8,400 estimated for COVID-19 in 2020 which would rank around 135th based on 2018 numbers. Estimated COVID-19 DALY numbers are also much lower than for lower respiratory infections including influenza and pneumonia, responsible for around 80,500 DALY in 2018 (AIHW forthcoming 2021).

The lower burden for COVID-19 in Australia compared with other diseases reflects the success Australia has had in containing the virus in 2020. Analysis for Scotland using very similar methods to those used in this Australian analysis shows that COVID-19 would likely be the second-leading cause of burden in that country in 2020, behind coronary heart disease (Wyper et al. 2021).

Population groups

This section provides further detail on selected population groups—of particular interest but also with available data. Included here are aged care residents, health and aged care workers, Aboriginal and Torres Strait Islander people, and those from particular socioeconomic groups. People with disability, or those in prisons, the homeless, and people receiving aged care support services in the community are also potential populations of interest for whom little data are currently available.

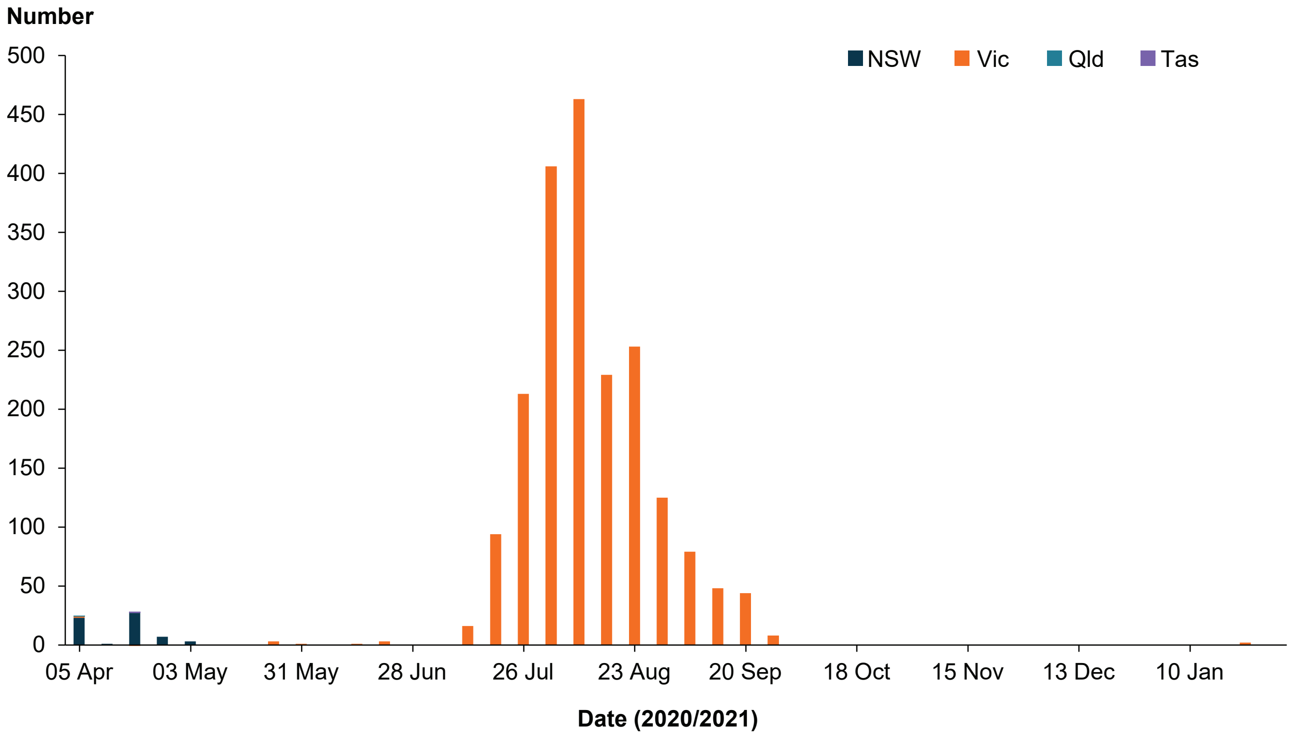
Aged care residents

Given that older people are at greater risk of poorer outcomes due to COVID-19 than younger people (Holt et al. 2020), and that people living in residential aged care often live in close proximity to each other, the aged care sector is a high-risk setting (Comas-Herrera et al. 2020). Residential aged care facilities often deal with infectious disease outbreaks, such as influenza and gastrointestinal illness (Kirk et al. 2010), and have procedures in place to respond to and manage them (CDNA 2017).

As of 12 March 2021, there had been 2,029 confirmed cases of COVID-19 among people living in residential aged care facilities in Australia, with 678 associated deaths (Department of Health 2021g). This was 7% of all confirmed cases in Australia, and 75% of all reported COVID-19 deaths. 127 facilities were affected by 2 or more positive cases across 4 states and territories.

The first outbreaks in residential aged care in Australia occurred in New South Wales in April 2020 (Figure 2.19), resulting in 61 confirmed cases. The outbreaks were challenging to contain and highlighted the risk to people living in residential aged care (Aged Care Quality and Safety Commission 2020; Gilbert 2020). There were also single cases in each of Queensland and Tasmania. After this, there were only sporadic cases in residential aged care until July when a number of outbreaks occurred in Victoria resulting in a large number of cases. The number of weekly cases peaked in early August, and there was a total of 1,986 cases to the end of September.

Figure 2.19: Confirmed cases of COVID-19 among people living in residential aged care facilities, NSW, Vic, Qld and Tas, 2020

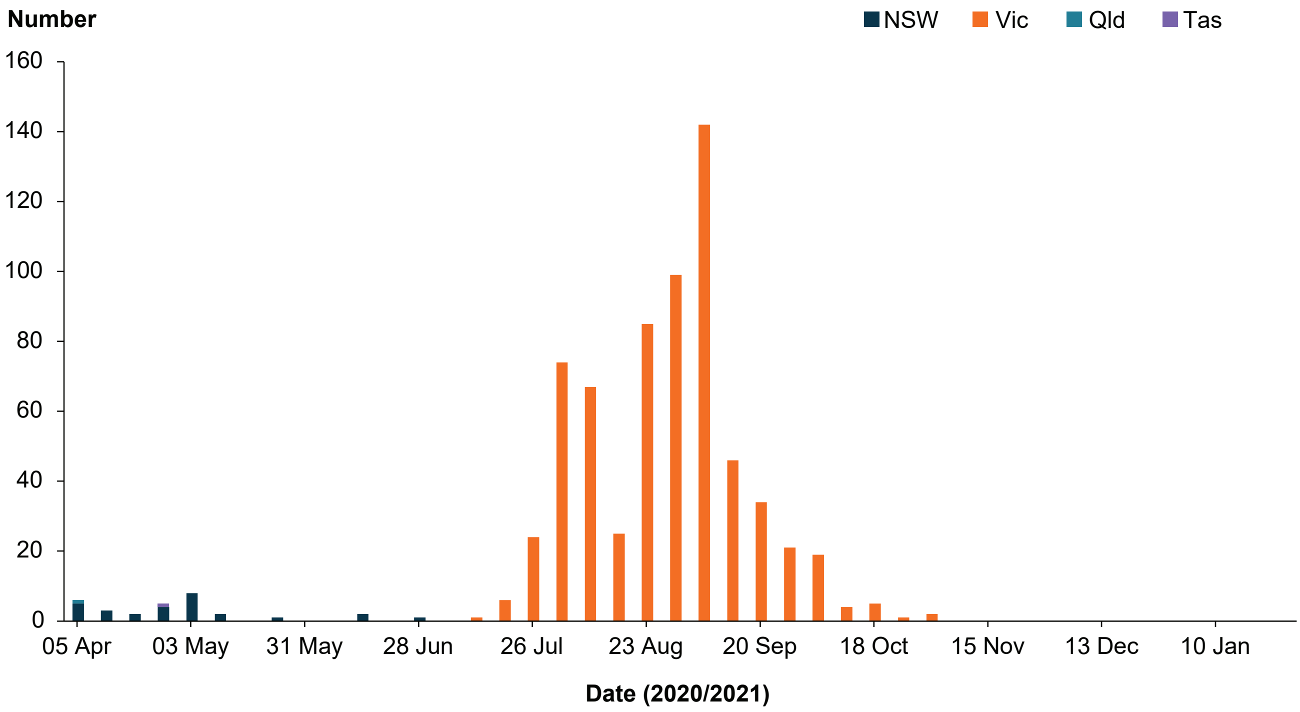


Source: Department of Health 2021f.

Deaths from these outbreaks were substantial (Figure 2.20). There were nearly 30 deaths from the earlier outbreaks in New South Wales, and over 650 in Victoria in 2020 (Department of Health 2021f). The corresponding case-fatality rates for these outbreaks in aged care were 46% and 33% (AIHW unpublished analysis). For deaths from COVID-19 to the end of November 2020 (which covers the period of all COVID-19 deaths among residents of aged care in 2020), an estimated 304 occurred in a residential aged care facility (ABS 2021a). This is around 45% of the 678 deaths among aged care residents who died from COVID-19 in 2020. Additional information on how many aged care residents with COVID-19 were hospitalised or admitted to ICU, as well as detailed demographic information (such as age and sex) on those who were affected was not available at the time of writing this report.

Similar to Australia, in Canada, a high proportion (69%) of COVID-19 deaths also occurred among residents of long-term care facilities or retirement homes (CIHI 2021). In the UK, 40% of COVID-19 related deaths up to 12 June 2020 were in residents of care homes (ONS 2020b, 2020c). The high proportion of deaths reflects the increased risk of death among the frail, elderly if they contract COVID-19.

Figure 2.20: Deaths from COVID-19 among people living in residential aged care facilities, NSW, Vic, Qld and Tas, 2020



Source: Department of Health 2021f.

In the early stages of the pandemic, the Australian and state and territory governments applied restrictions to protect Australians living in residential aged care, including limiting the number of visitors (Department of Health 2020f). In March 2020, the CDNA released the National Guidelines for the Prevention, Control and Public Health Management of COVID-19 Outbreaks in Residential Care Facilities in Australia (CDNA 2020).

The National Guidelines recognised the increased risk of transmission within aged care facilities, and more severe disease in this group of residents. It also became clear that when there was sustained community transmission of the COVID-19 virus, there was a substantial risk that staff would bring the virus into the facility, as was the case during the second wave in Victoria (Gilbert & Lilly 2020). There was increased risk of this happening when the staffing level was lower, staff worked across multiple facilities or were not fully trained in infection control procedures (Crotty et al. 2020).

The enforced isolation of people living in residential aged care had potential and realised effects on their mental health and cognition (Holt et al. 2020; Manca et al. 2020; Suárez-González 2021 [preprint]). This can increase symptoms of anxiety and depression. Both people with and without dementia are at risk of cognitive decline due to the social isolation.

As well as the tragic impact of contracting this disease on residents and their families and the impact of restricting visitors, the infection control requirements introduced challenges in providing routine care (for example, exercise, provision of healthy food). This became even more difficult when large numbers of staff tested positive and therefore were not able to attend work (Aged Care Quality and Safety Commission 2020). The long-term isolation from other residents, and particularly from family, had the potential to substantially increase loneliness and reduce general wellbeing of residents (Holt et al. 2020) and it was noted that there was a large increase in depression, anxiety and confusion among residents during this time (Royal Commission into Aged Care Quality and Safety 2020).

Health and aged care workers

Members of the health care workforce, including those in the aged care system, are at higher risk of catching COVID-19 as they may be in close contact with people with the disease while providing them with care (Chou et al. 2020). Health care workers can include clinical workers who provide direct care to patients or clients, such as nurses and doctors, as well as non-clinical workers in health and aged care settings who do not provide direct clinical care and include cleaners, caterers and administrative staff.

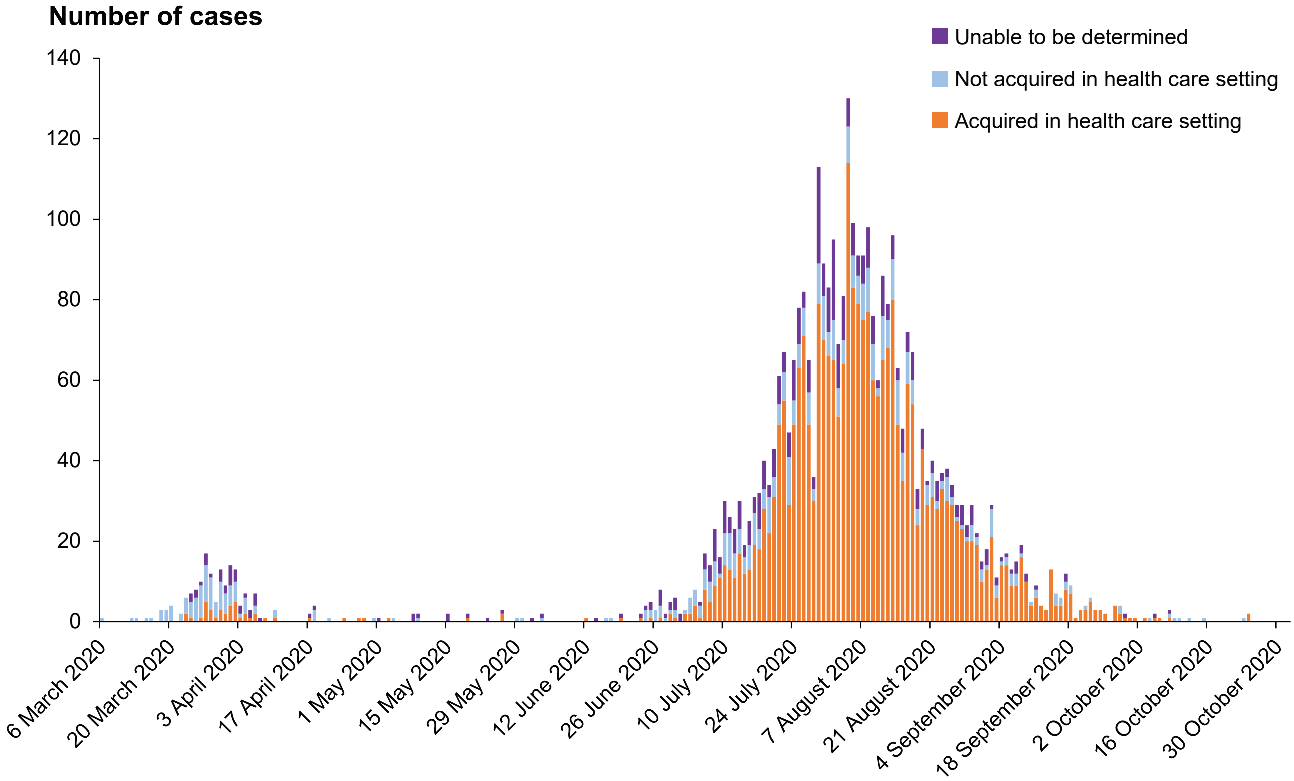
A prospective, observational cohort study in the United Kingdom and the United States of the general community and including front-line health care workers found that they had at least a threefold increased risk of contracting COVID-19. Compared with front-line health care workers who reported adequate availability of Personal Protective Equipment (PPE), those with inadequate PPE had an increase in risk (Nguyen et al. 2020), demonstrating the importance of PPE in protecting the health care workforce from infection.

Outbreaks in hospitals in Melbourne and Tasmania in late March 2020 showed how quickly the virus could spread through hospitals to infect patients, health care workers and their families (COVID-19 NIRST 2020a). When outbreaks occur the impact on the health care system can also be considerable, as large numbers of health care workers may need to quarantine to limit further spread of the virus and this can result in substantial reduction in services.

At the time of writing there is no ongoing national public reporting of COVID-19 cases in health care workers in Australia. A study by Quigley and others (2021) collated publically available data on health care worker infections in Australia between 25 January and 8 July 2020 and identified 36 hospital outbreaks and estimated at least 536 health care worker infections in that time. Health care workers were 2.69 times as likely to contract COVID-19 as the general community (Quigley et al. 2021).

During the second wave of COVID-19 cases Victoria saw an increase in the number of confirmed COVID-19 cases in health care workers and the Department of Health and Human Services undertook a review of cases in response. It showed that in the first wave 22% of health care workers who acquired COVID-19 acquired it at work (Figure 2.21), while in the second wave at least 69% of all health care worker cases likely acquired it in the workplace (DHHS Victoria 2020).

Figure 2.21: COVID-19 cases in health care workers in Victoria, 1 March to 1 November 2020



Source: DHHS Victoria 2021.

Four actions were outlined in this review to protect health care workers in Victoria:

1. Sharing of data
2. Support for infection prevention control
3. Improving COVIDSafe workplaces
4. Promotion of financial incentives to limit worker mobility.

As of 20 January 2021, Victoria had recorded more than 3,500 health care worker infections. Of the clinical health care workers who acquired COVID-19 in a health care setting, 50% were aged care or disability workers, 40% were nurses or midwives, 4.8% were medical practitioners and 3.2% were health care workers in other occupations. A total of 609 non-clinical workers in health care settings had a positive test for COVID-19, with 72% of cases acquired in aged care settings (DHHS Victoria 2021).

Front-line health care workers and aged care and disability care staff were included in the first phase (Phase 1a) of the national vaccine rollout strategy and prioritised to receive the Pfizer vaccine through specific hubs in urban and rural locations (Department of Health 2021b). Phase 1a of the rollout began on 22 February 2021. Other health care workers were included in Phase 1b which began on 22 March 2021. Early real world data from the vaccination of health care workers in a medical centre in the United States showed that the percentage of employees becoming infected was significantly lower in fully vaccinated staff, and reported a dramatic preservation of the workforce with a 90% decrease in the number of employees in either isolation or quarantine (Daniel et al. 2021).

Aboriginal and Torres Strait Islander people and communities

Aboriginal and Torres Strait Islander people and their communities are at high risk of COVID-19 outbreaks and severe outcomes due to health and socioeconomic inequalities including reduced access to services, barriers to treatment, a lack of culturally safe health care and high rates of chronic disease (AIHW 2020c; Yashadhana et al. 2020).

As of 25 April 2021, there have been 153 confirmed COVID-19 cases in Aboriginal and Torres Strait Islander people since the start of the pandemic. Note that nearly 6.9% of all cases did not have Indigenous status recorded in their record. Overall, Aboriginal and Torres Strait Islander people represent about 0.5% of all confirmed COVID-19 cases. The majority of locally acquired cases in Aboriginal and Torres Strait Islander people (79%) have been reported in major cities of Australia (COVID-19 NIRST 2021b). During 2020 there had been no deaths among Aboriginal and Torres Strait Islander people and no outbreaks recorded in remote communities.

In order to protect remote Aboriginal and Torres Strait Islander communities the Australian Government, at the request of Indigenous leaders, enacted relevant biosecurity legislation to restrict the entry into designated remote communities in March 2020 (Maclean & Brennan 2020). These restrictions were successful in reducing the spread of COVID-19 within communities. Remote travel restrictions were lifted in July 2020, however jurisdictions have arrangements under their own emergency management and/or public health laws to manage the impact of COVID-19, including in remote communities (NSW Health 2020).

The extremely successful response during the first year of the pandemic has been led by the National Aboriginal Community Controlled Health Organisation and has involved Indigenous people and communities to ensure that the priorities and solutions are safe and culturally appropriate for communities (Crooks et al. 2020). In early March 2020, The Aboriginal and Torres Strait Islander Advisory Group on COVID-19 was established to provide culturally appropriate advice to the Department of Health including for Aboriginal and Torres Strait Islander health services and communities about COVID-19 (Department of Health 2020a).

The worsening outbreak in Papua New Guinea in March 2021 increased the risk of cross-border transmission via the Torres Strait Islands and the rollout of vaccines to the Torres Strait islands was fast-tracked by the Queensland Government and began on 15 March 2021 (Queensland Health 2021). The Australian Government agreed to assist and partner with Papua New Guinea on a comprehensive support package to assist with the crisis. This included supplying 8,000 doses of vaccine to enable the vaccination of frontline health care workers and deploying a forward team of 3 Australian Medical Assistance Teams health specialists to Port Moresby (Prime Minister of Australia 2021).

Aboriginal and Torres Strait Islander people aged over 55 became eligible for the COVID-19 vaccine in Phase 1b as part of the national rollout strategy and vaccinations began on 22 March 2021 (Department of Health 2021h). As the pandemic progresses it will be important to ensure that the vaccine is efficiently and effectively rolled out to the Indigenous population, vaccination rates are high and that Aboriginal and Torres Strait Islander people are protected from the indirect impacts of the COVID-19 pandemic (Follent et al. 2021). Again, Aboriginal Community Controlled Health Organisations have become vaccination centres for their populations.

Socioeconomic groups

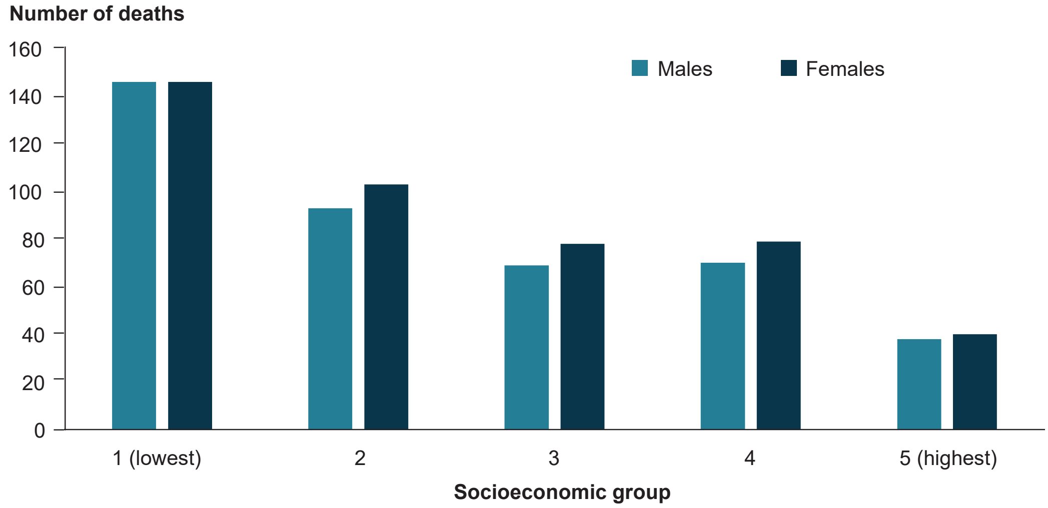
Evidence from other countries has shown the increased risk of developing COVID-19 and dying from it for those in lower socioeconomic groups (Drefahl et al. 2020; Mena et al. 2021). There could be a number of reasons relevant to Australia for this social gradient including: higher population density housing, reduced capacity to work from home (for example, people with lower incomes may be more likely to be employed in occupations that require work onsite), lower levels of income and education, and lack of private transport to access health care, as well as more need to use public transport which may increase a person's likelihood of contracting COVID-19.

Deaths by socioeconomic group

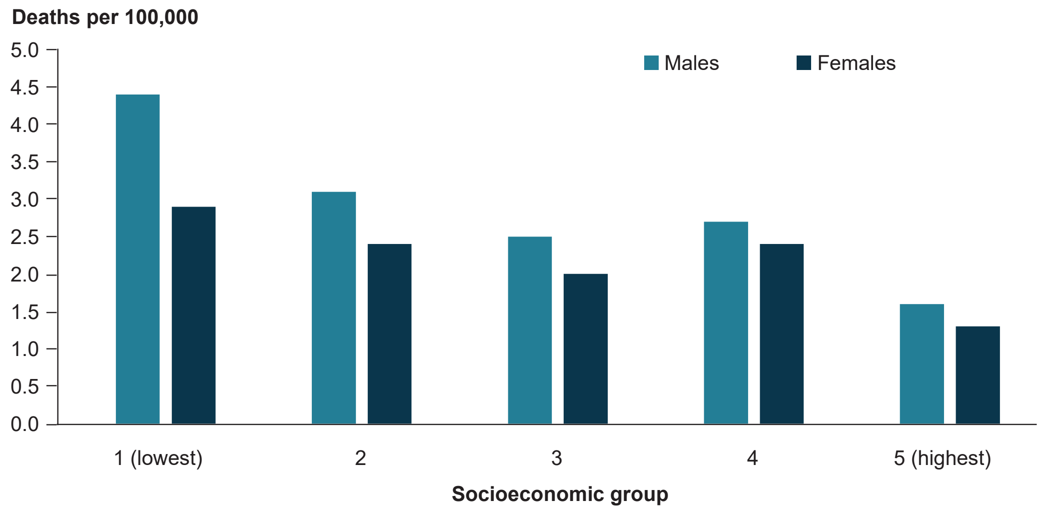
COVID-19 deaths sourced from ABS provisional mortality statistics were analysed by socioeconomic group based on population-based quintiles (using the ABS's Index of Relative Socio-Economic Disadvantage) which have equal-sized populations. This shows there was a clear gradient of decreasing COVID-19 deaths and age-standardised mortality rates by increasing socioeconomic position. There were almost 4 times as many deaths due to COVID-19 registered for people in the lowest socioeconomic group compared with the highest socioeconomic group, and age-standardised mortality rates were 2.6 times as high. This gradient was evident for both males and females (Figure 2.22).

Figure 2.22: Number (a) and age-standardised rate per 100,000 (b) of COVID-19 deaths in Australia, by socioeconomic group and sex, 2020

(a) Number



(b) Age-standardised mortality rate



Note: Socioeconomic groups were classified according to population-based fifths using the Index of Relative Socio-economic Disadvantage (IRSD) based on Statistical Area level 2 of current residence.

Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

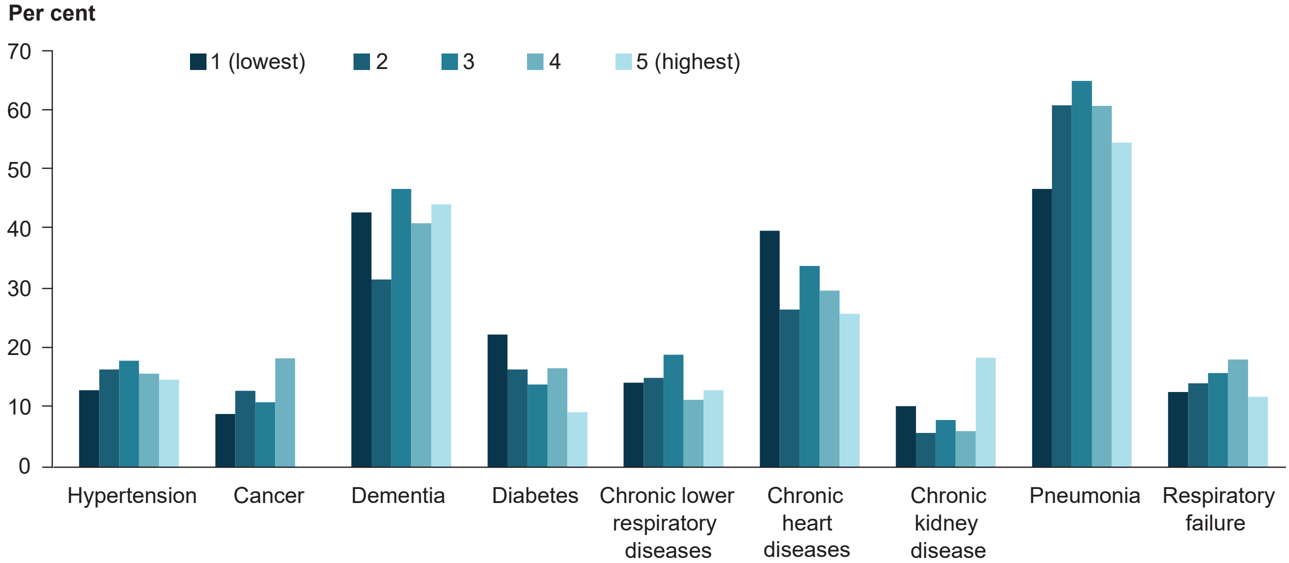
These findings are consistent with studies from other countries such as the United States and the United Kingdom which reported socioeconomic inequalities during the spread of the COVID-19 pandemic. For example, data from the United Kingdom Office for National Statistics indicate that COVID-19 mortality rates in the most deprived areas of England were more than double those in the least deprived areas and this disparity was larger than that seen for all-cause mortality (ONS 2020a). In Canada, research on COVID-19 has shown that people from poorer, more racially diverse areas have been more likely to die from COVID-19 (Public Health Ontario 2020). A number of studies from the United States and United Kingdom have reported people from socioeconomically disadvantaged groups have a higher risk of infection, and are more frequently hospitalised and receive intensive care than people from socioeconomically more privileged groups (Wachtler et al. 2020). A national study in Scotland of patients with COVID-19 admitted to critical care units reported that around one-quarter of admissions were from the lowest socioeconomic quintile compared with 13 per cent from the highest quintile, and that death rates after 30 days were significantly higher in patients from the most disadvantaged areas, after accounting for factors such as age and sex (Lone et al. 2020). A recent global study of 144 countries during the first 6 months of the pandemic (to August 2020) found that income inequality and not poverty was associated with higher death rates in relation to COVID-19 (Davies 2021).

A Guardian analysis of Department of Health data published on COVID-19 deaths of residents of residential aged care facilities shows, of the 10 nursing homes with the most deaths in Australia, 4 were in suburbs in the lowest (bottom 20%) socioeconomic areas, and 8 were in the bottom 50%. Of the 550 deaths attributed to specific Victorian homes at 18 September 2020, 41% occurred in facilities located in suburbs considered in the bottom 30% of socioeconomic disadvantage (The Guardian 2020; Department of Health 2021g).

Comorbidities by socioeconomic group

There was no clear pattern in the proportion of COVID-19 deaths with comorbidities by socio-economic group for most acute and chronic comorbid conditions. This is in contrast to all deaths due to most of these conditions which show a clear gradient by socioeconomic position. The exceptions were COVID-19 deaths with comorbidities of diabetes and chronic heart diseases (higher in the lowest socioeconomic group) and chronic kidney disease (higher in the highest socioeconomic group) (Figure 2.23). These social gradients were evident for both males and females. It is possible that there may be differences by age but the numbers of deaths by age and socioeconomic group for most diseases are too small to examine this extra detail.

Figure 2.23: Proportion of COVID-19 deaths with selected acute and chronic comorbidities, by socioeconomic group, 2020



Notes:

1. Socioeconomic groups were classified according to population-based fifths using the Index of Relative Socio-economic Disadvantage (IRSD) based on Statistical Area level 2 of current residence.
2. Data is not published for cancer in the highest socio-economic group due to small numbers.

Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

Comparison with other countries

As the COVID-19 pandemic affected countries around the world, some countries were able to contain the crisis more than others. During the first year, Australia and some other countries in the Asia-Pacific region including New Zealand, Taiwan, Vietnam and Thailand were able to manage the spread of disease fairly well compared with many other countries. Recent surges in cases in a number of these countries has demonstrated the continuing risk of major outbreaks, even in countries with robust systems in place. This is particularly the case with the new variants of the virus in circulation worldwide.

This section presents international data to provide broad comparisons of Australia's experience with selected other countries. This descriptive analysis is not able to account for all factors affecting individual country experiences; rather, it aims to make use of currently available data to start to explore differences between countries.

It is not possible to determine the reasons why some countries have managed to contain the virus more than others. However, it is likely that countries that had a strong response across a number of relevant areas had the highest chance of containing the virus. This type of response minimises the chances of outbreaks in the first place, but also provides the capability to bring them under control when they do occur. Some of the factors that may have influenced the magnitude of the epidemic within countries over the first year include the timing and strictness of population health interventions to minimise the importation and transmission of the virus (Department of Health 2021d, Lewis 2020, Tran et al. 2020); level of testing and genomic sequencing (Geoghegan et al. 2020, Rockett et al. 2020); strength of the public health system; clarity and consistency of communication by governments; how much public health responses were based on scientific evidence (Hyland-Wood et al. 2021, Pak et al. 2021); and pandemic preparedness and lessons learnt from previous pandemics (CDNA 2021a, Chua et al. 2021, Department of Health 2020b).

Data compiled by the WHO on cases and deaths are used in this section. These data were used because they contain consistently collected and reported information on cases and deaths, were updated daily, and made available in an easily accessible format for analysis. It is important to note that obtaining comparable international data can be challenging at any time, and particularly during emergency situations like a pandemic. There are a number of limitations in comparing cross-country COVID-19 cases and deaths data (Box 2.1). Data are affected by countries' capacity to detect COVID-19 infections, which was particularly limited in many countries at the onset of the crisis. There may be some under-reporting of cases and deaths by some countries, particularly when infection rates are very high (Lau et al. 2020). Country-level data may also mask differences at a regional level.

Box 2.1 Limitations of cross-country comparability of COVID-19 cases and deaths data

- Differences in testing capacity across countries and over time, with many countries having faced severe constraints in testing capacities early in the pandemic.
- Whether COVID-19 deaths occurring outside of hospitals (for example at home or aged care facilities) are fully recorded.
- Coding differences, especially whether suspected cases are counted alongside those confirmed by tests.

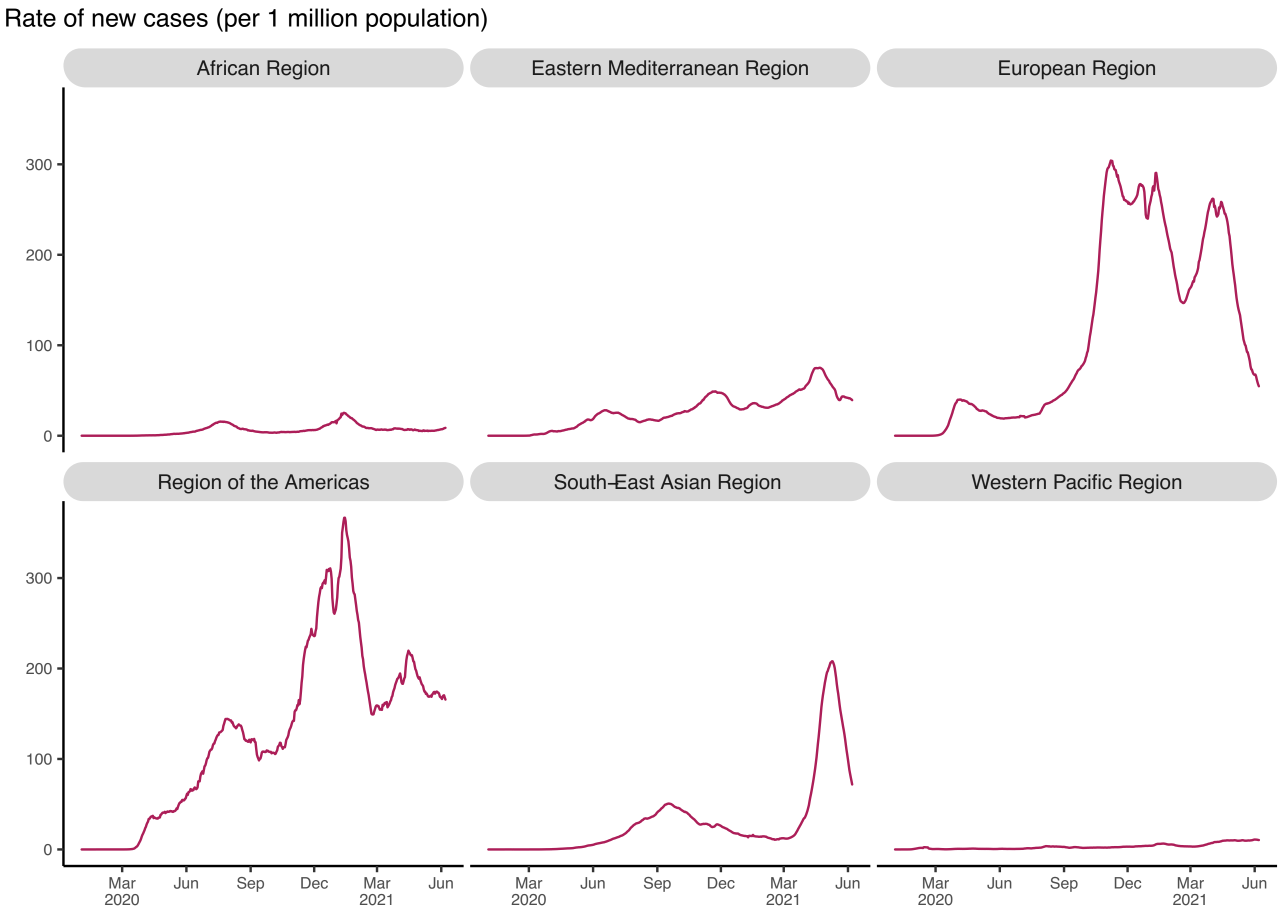
As a result of these differences, COVID-19 cases and deaths are likely to be under-detected and under-reported in some countries and it is likely that the actual number of cases and deaths worldwide is much higher than reported by the WHO (WHO 2021e). A modelling study conducted in May 2021 by the Institute for Health Metrics and Evaluation estimated that COVID-19 may have caused more than double the number of deaths officially reported globally. This analysis found that the largest number of unreported deaths occurred in countries that had the largest epidemics to date (IHME 2021).

Rates per 1 million population are presented to adjust for population size and allow for comparison between countries. Seven-day moving averages are used to reduce the volatility of the data over time and make the underlying trends clearer. Moving averages are also useful when numbers/rates are small in some countries because small numbers often result in greater volatility in the data.

Global cases and deaths

At the global region level there was a dramatic difference in the reported COVID-19 rates by WHO region, with the European Region (which includes the United Kingdom) and the Region of the Americas having much higher rates than the other regions. The Western Pacific Region, which includes Australia, had the lowest rates (Figure 2.24).

Figure 2.24: Rate of reported new cases of COVID-19: WHO region



Sources: WHO for case data and the World Bank for population data.

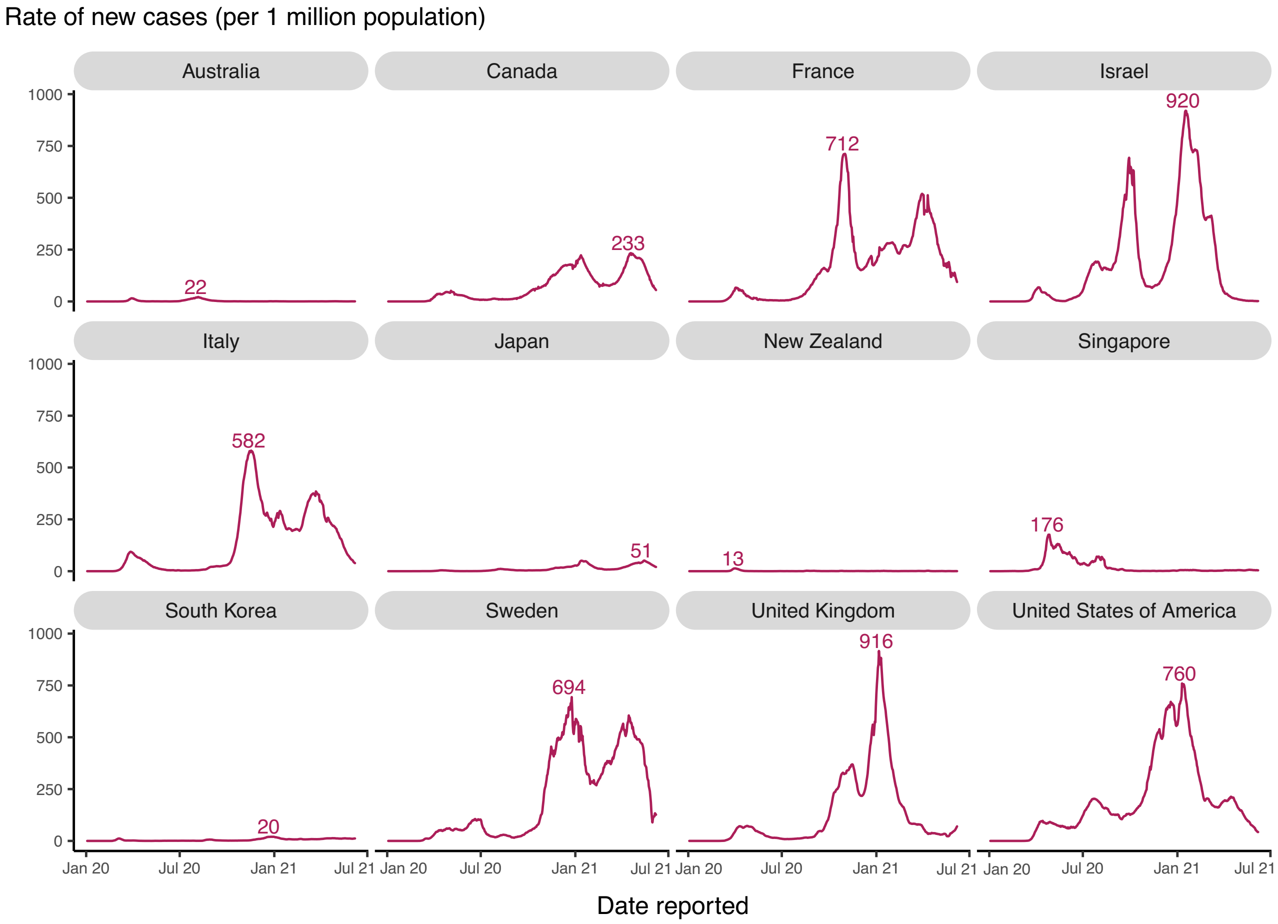
The list of countries included in each of the WHO regions in this analysis can be found in Appendix C. Some of the differences could be due to different testing rates by the countries in these regions, however a similar pattern could be seen in the deaths data (not shown). Other potential differences between countries in COVID-19 cases and deaths can be found in Box 2.1.

The countries included in the following comparison with Australia are a selection of OECD and other high-income countries. These countries are more likely to have better quality COVID-19 data than low-income countries.

Rate of cases: selected countries

During 2020 Australia kept the reported rate of new cases of COVID-19 very low in comparison to many other countries. Across the countries compared here, those with the lowest rates of new cases were Australia, Japan, New Zealand, South Korea and Singapore (Figure 2.25).

Figure 2.25: Rate of reported new cases of COVID-19: Australia and selected countries



Note: A 7-day rolling average is shown.

Sources: WHO for case data and the World Bank for population data.

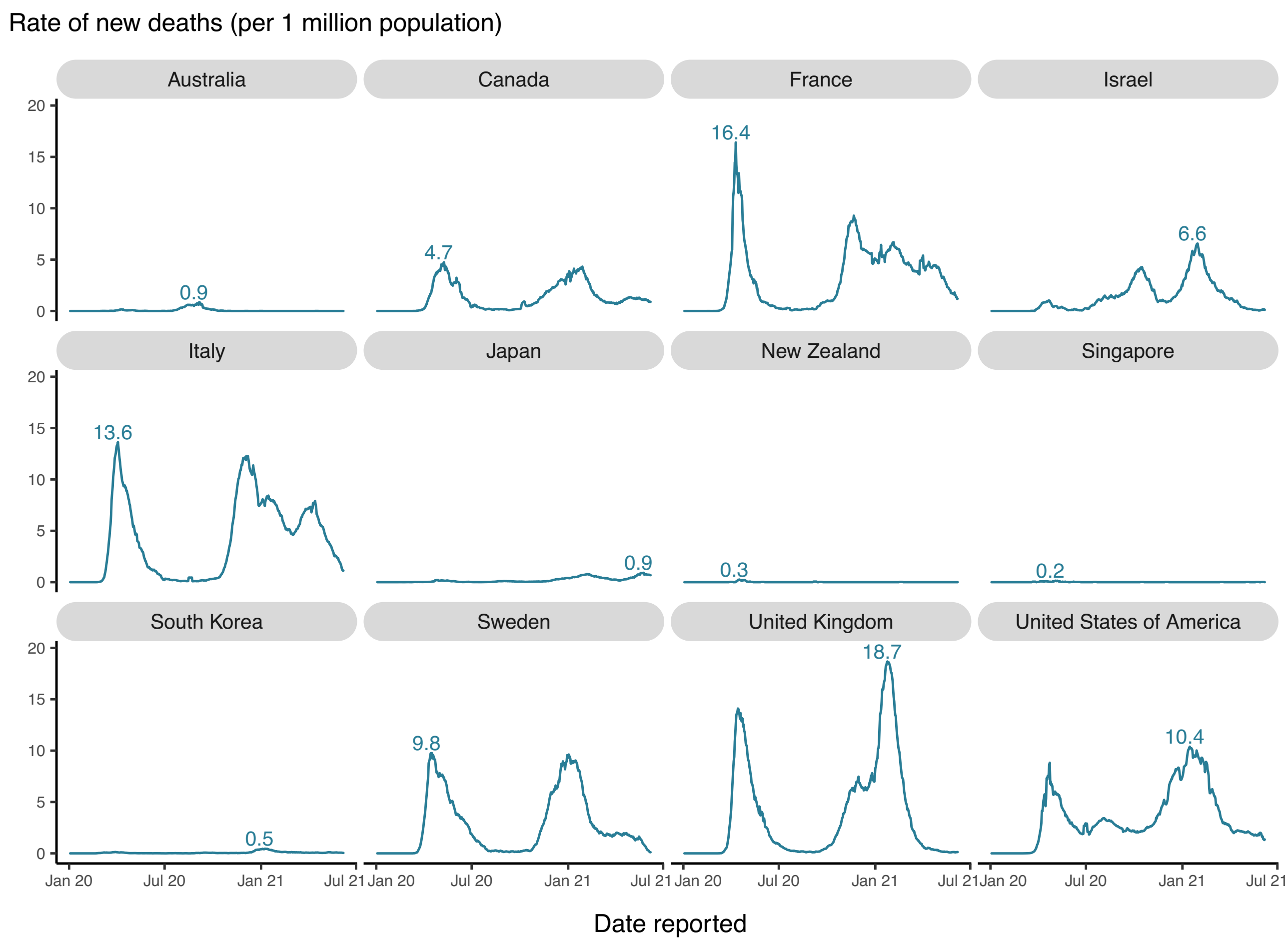
Countries with much higher reported rates among those presented here were France, Canada, Israel, Italy, Sweden, the United Kingdom and the United States. Some of these countries had multiple spikes in case rates, the spikes corresponding to the winter months being much higher. The emergence of more transmissible variants of the virus, such as the Alpha (B.1.1.7) variant, may have played a role in these waves (Galloway et al. 2021).

It is important to acknowledge that the rate of testing for SARS-CoV-2 in each country can affect the number of reported COVID-19 cases, and testing rates can vary substantially between countries and over time (Lau et al. 2020). Therefore, care should be taken when comparing the rate of cases between countries.

Rate of deaths: selected countries

Similar issues with under-reporting of cases across countries apply to deaths data, but it is still useful to compare the rates of COVID-19-associated deaths across countries, and the rate of deaths can be a better indicator of the size of the epidemic in countries where testing was low. Figure 2.26 shows the rate of deaths for Australia and selected countries. Australia and Japan had very low death rates during the year and were able to maintain those rates. The rates for New Zealand, South Korea and Singapore were even lower.

Figure 2.26: Rate of reported new deaths due to COVID-19: Australia and selected countries



Note: A 7-day rolling average is shown.
Sources: WHO for deaths data and the World Bank for population data.

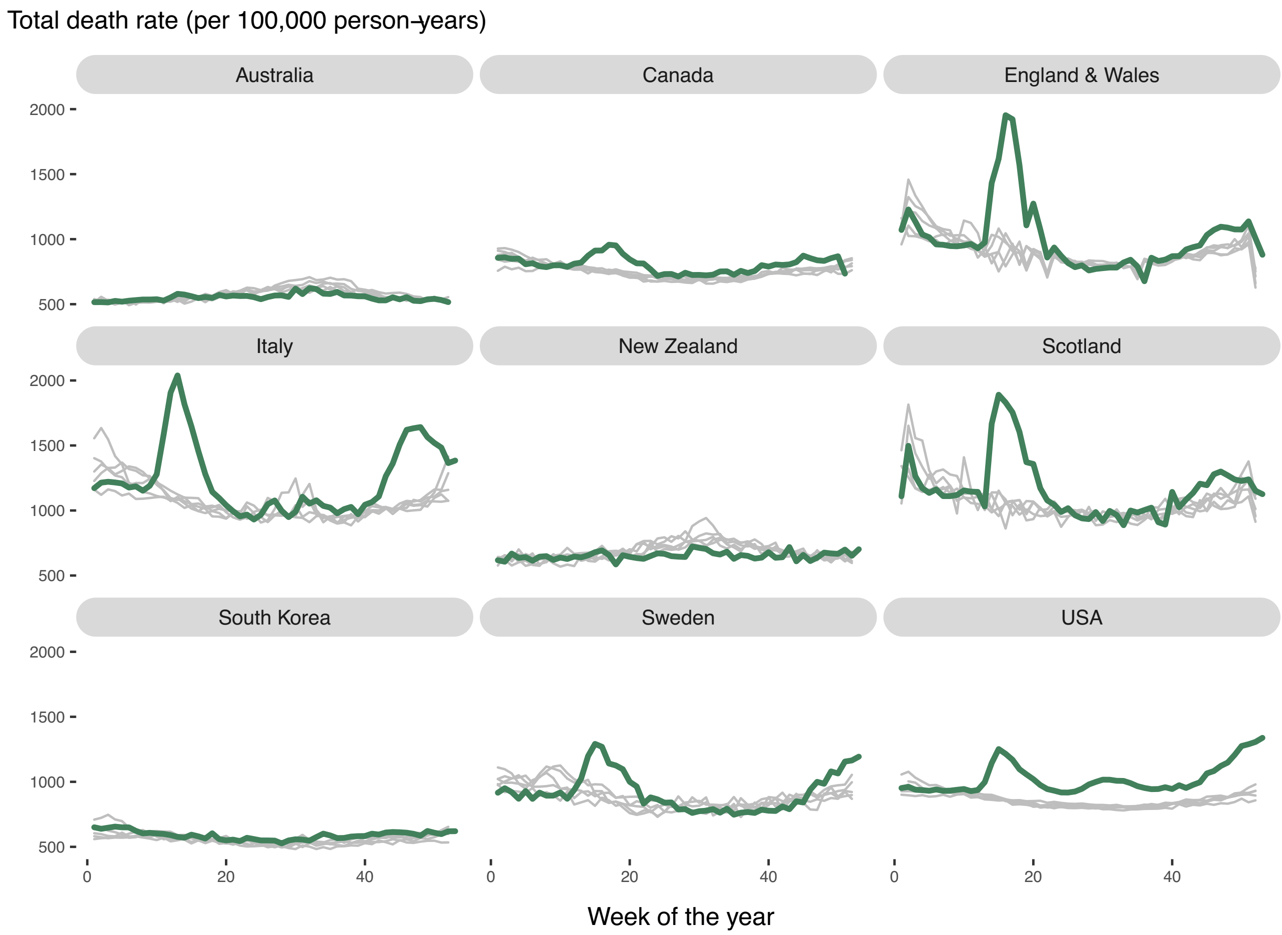
Countries that had higher reported death rates among those presented here included France, Canada, Israel, Italy, Sweden, the United Kingdom and the United States. These countries had 2–3 spikes in their rates over the course of the year corresponding to the waves of cases shown in Figure 2.25.

Excess deaths

The analysis of excess deaths due to all causes in different countries can be used as an indicator of both the direct and indirect effects of COVID-19 and can allow for comparison between countries. There are, however, some limitations in comparing excess deaths across countries which should be taken into account when examining the data included in this section. For example, differences in timing of the onset of COVID-19 and differences in delays in reporting deaths can affect cross-country comparisons of excess deaths (Morgan et al. 2020).

The data in this section are sourced from the Human Mortality Database and are available only for some countries (those publically reporting weekly death counts) and only a subset of these countries is presented here (Figure 2.27). This analysis compares the rate of all deaths observed in the country with the expected rate based on patterns from the previous 5 years.

Figure 2.27: Excess deaths during 2020: selected countries



Note: Data for Australia includes deaths certified by a doctor only.
Source: Human Mortality Database Short-term Mortality Fluctuations (STMF) data series.

The countries that kept cases and deaths low over time, such as Australia, New Zealand and South Korea, had low levels of excess deaths in 2020. Like Australia, New Zealand had lower total death rates in 2020 than in the previous 5 years, likely to be due to fewer deaths from influenza and potentially road traffic accidents; occupational causes; air pollution; and post-surgical complications (Kung et al. 2021). Note that further detail on excess deaths in Australia is presented in the 'Deaths from other diseases' section below. Countries that had high numbers of COVID-19 cases, including

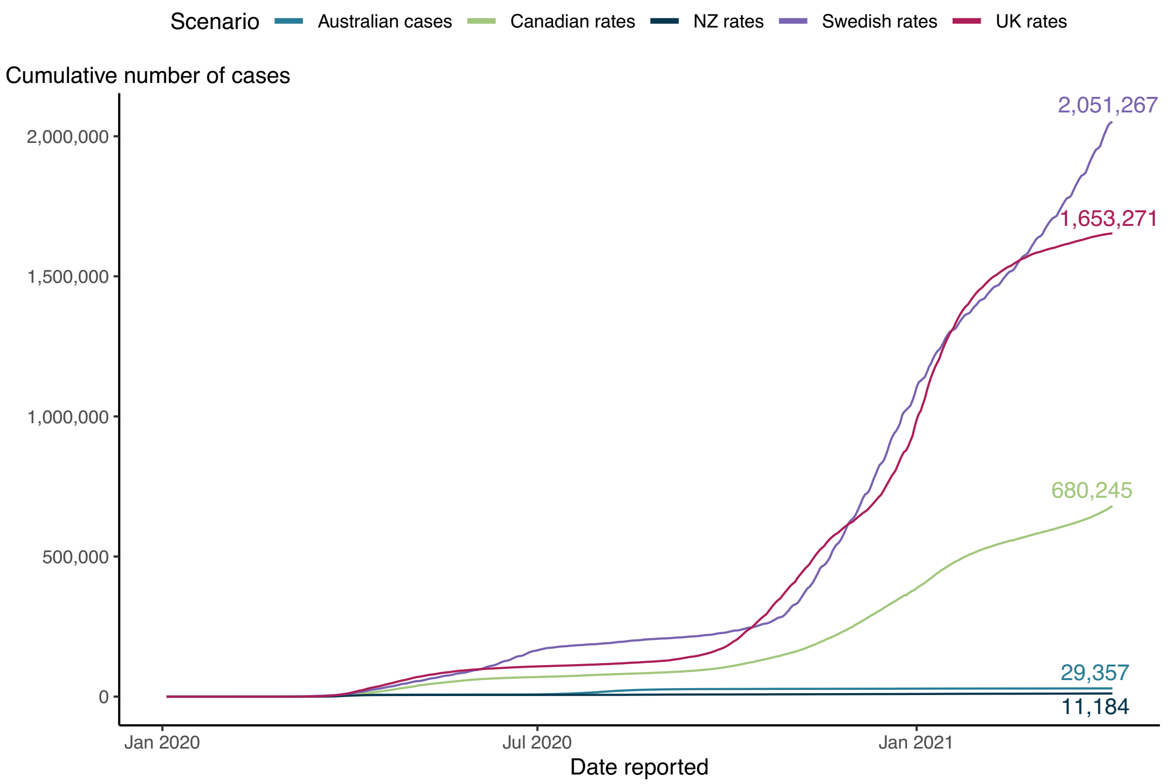
England and Wales, Scotland, Italy, Sweden and the United States, had multiple peaks in total death rates corresponding to the waves of infection during the year (Figure 2.25). Monitoring of excess all-cause deaths allows for the assessment of the total mortality impact of the pandemic in different places and avoids the issue of whether the deaths were attributable to COVID-19 (Islam et al. 2021; Leon et al. 2020; Morgan et al. 2020; Vestergaard & Molbak 2020).

How would Australia have fared if rates were the same as Canada, Sweden, the United Kingdom or New Zealand?

This section examines the scenarios if Australia had experienced the same crude case and death rates as 4 comparable countries: Canada, Sweden, the United Kingdom and New Zealand. These 4 countries were chosen for comparison because they are comparable to Australia in ways relevant to the analysis: they have similar proportions of people over 65 (which will partly account for different population age structures); similar population health as summarised by life expectancy at birth; and similar health systems and expenditure on health care (AIHW 2020g). These countries did apply some level of travel bans, physical distancing and other control measures, though to varying degrees. However, the estimates provided here are not an analysis of the impact of these interventions—a much more detailed analysis would be required for that.

Figure 2.28 shows the cumulative cases for Australia if the rates in these countries had applied. If the rates in Canada had applied then by early April 2021 Australia would have had 680,245 cases, and if the rates in the United Kingdom and Sweden had applied there would have been more than 1.6 to 2 million cases. In contrast, if the rates in New Zealand had applied there would have been around 18,000 fewer cases in Australia.

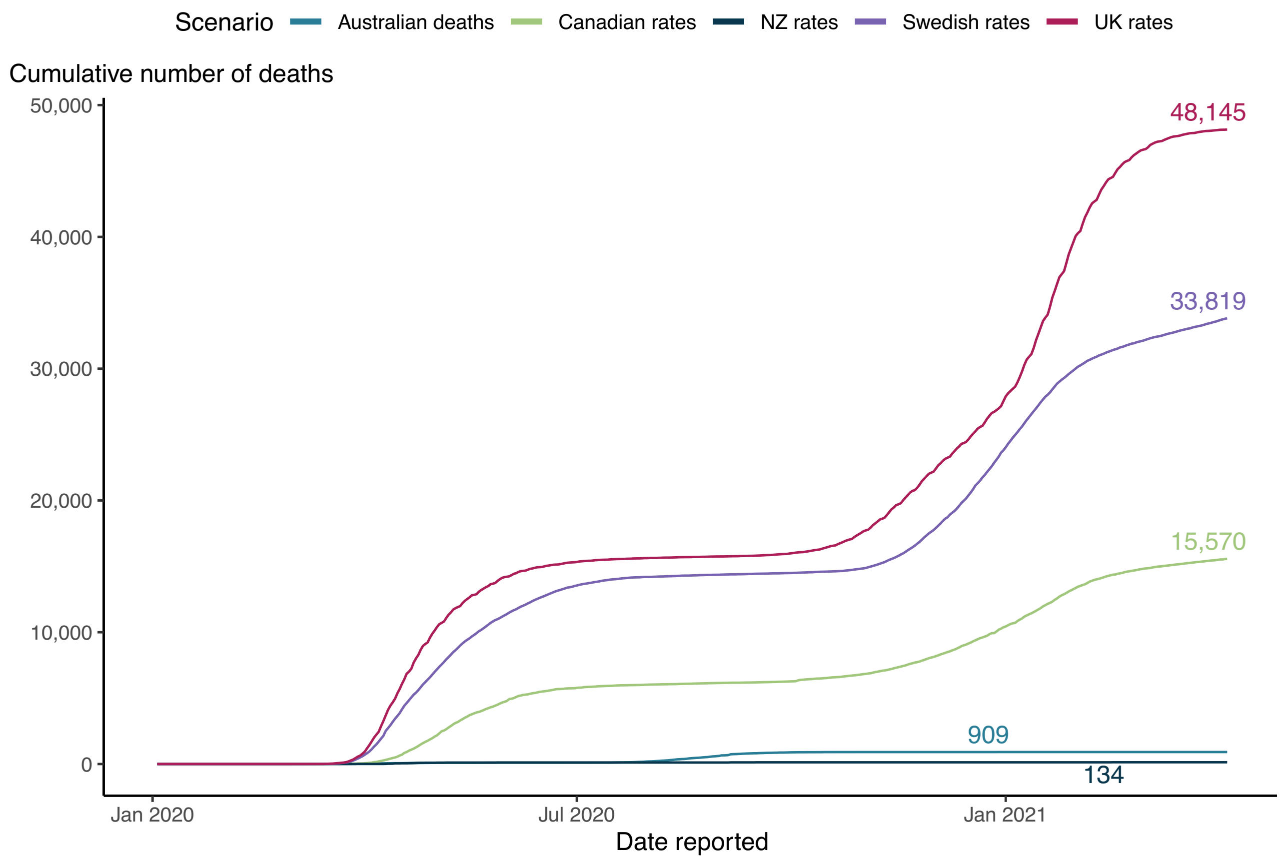
Figure 2.28: Number of cases of COVID-19: scenarios in Australia if the rates in Canada, New Zealand (NZ), Sweden and the UK applied



Sources: WHO for case data and the World Bank for population data.

The high numbers of cases would have put Australia's health system under extreme pressure and the number of deaths would have been much higher as a result. In the scenarios shown here Australia would have had between 15 and 46 times the number of deaths (Figure 2.29). With New Zealand rates applying there would have been many fewer deaths.

Figure 2.29: Number of deaths due to COVID-19: scenarios in Australia if the rates in Canada, New Zealand (NZ), Sweden and the UK applied



Sources: WHO for case data and the World Bank for population data.

3

Indirect health effects

The AIHW acknowledges the devastating effects suicide and self-harm can have on people, their families, friends and communities.

If this report raises any issues for you, these services can help:

- **Lifeline** 13 11 14
- **Suicide Call Back Service** 1300 659 467
- **Kids Helpline** 1800 55 1800
- **MensLine Australia** 1300 78 99 78
- **Beyond Blue** 1300 22 4636.

Crisis support services can be reached 24 hours a day.

Summary: 3 Indirect health effects

Deaths from other diseases

- In 2020, Australia recorded lower than expected total mortality compared with age-standardised death rates for the previous 5 years, with decreases in the winter months being statistically significant (however it should be noted that this does not include coroner-certified deaths). This is in contrast to many other countries where excess mortality (higher than expected deaths) was observed.
- Age-standardised death rates for influenza and pneumonia and chronic lower respiratory infections were lower in 2020 than age-standardised rates seen over the same period in previous years (2015–19), being particularly low during the winter months.

Impact on other communicable diseases and injuries

- In 2020, rates of laboratory-confirmed influenza were substantially lower from April onwards suggesting that measures introduced to control COVID-19, such as promotion of hand-hygiene, restrictions on international travel and movement within the country, may have had a positive impact on the circulation of the virus.
- The restrictions also appear to have caused a reduction in injuries due to falls and road traffic accidents, particularly during the first shutdown in March/April 2020:
  - Presentations to hospital emergency departments for trauma were lower than in the same period in previous years.
  - Data on national road deaths showed 5.1% and 25.3% fewer road deaths during March and April 2020 than the average over the previous 5 years.

Mental health

- The initial impacts of the pandemic in Australia appear to have increased levels of psychological distress (painful psychological symptoms associated with fluctuations in mood), particularly for younger people (adults aged 18–44).
- There were fluctuations throughout the remainder of the year but with a general improvement. By April 2021 the level of psychological distress across the whole population had essentially returned to pre-pandemic levels, however continued to be higher for young people.
- The proportion of people experiencing severe psychological distress also continued to be higher in April 2021 (9.7%) than prior to the pandemic (8.4% in February 2017).

Suicide

- The number of deaths by suicide in New South Wales, Victoria and Queensland have remained at similar levels to previous years.

Changes in health behaviours

Information is available on changes in key health behaviours during the early months of the pandemic (April to June 2020):

- 25% of people had increased consumption of snack foods and 36% decreased consumption of take-away or delivered meals compared with before the pandemic.
- 58% had increased their personal screen time compared with before the COVID-19 pandemic, and 41% had increased household chores and projects. These had decreased to 44% and 25% two months later.
- Similar proportions of people had increased as had decreased exercise and other physical activity.
- Of those adults who usually drank alcohol, 20% had increased their consumption compared with before COVID-19 restrictions. Data sources showed that between 13% and 27% had decreased it.
- Of those who usually smoked, 18% smoked more than before COVID-19 restrictions and 9.7% smoked less.
- Of those who used illicit drugs, 26% had decreased their consumption and 18% had increased it.

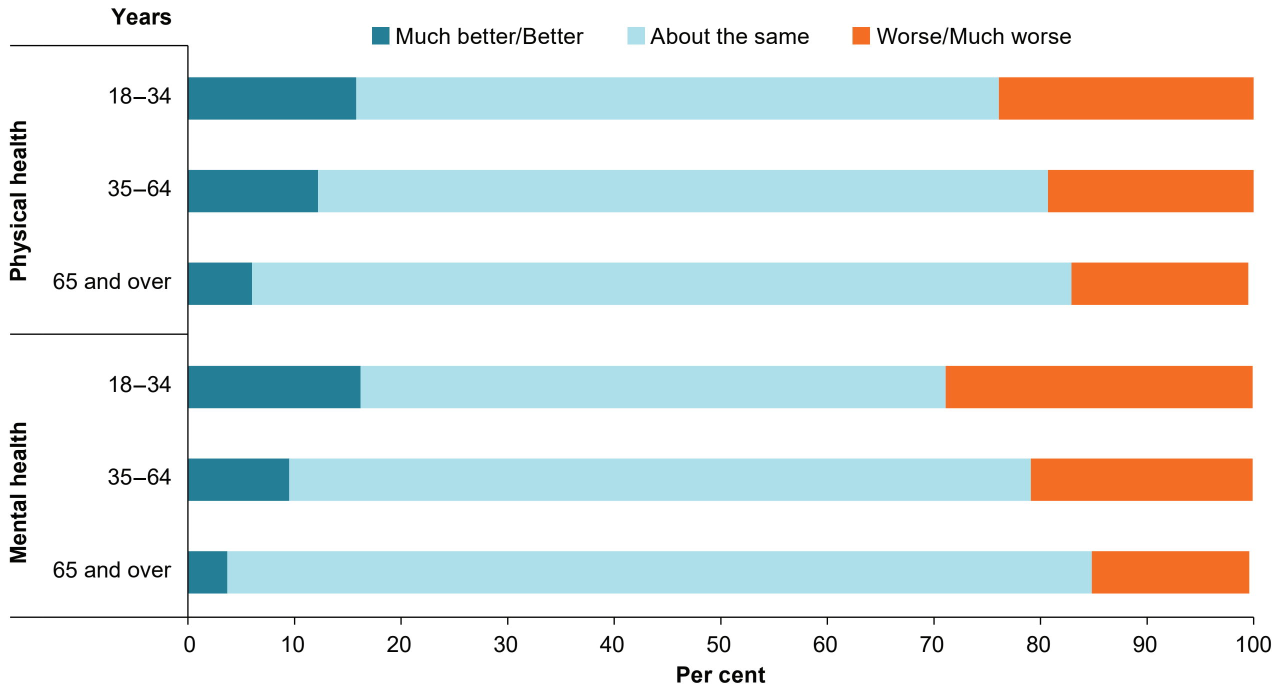
The information in Chapter 2 on the epidemic so far in Australia covers the direct, short-term effects of COVID-19. However, there are a number of potential indirect health effects from changes within the health system and changes in wider society due to interventions put in place (Douglas et al. 2020). This chapter covers some of these key health effects, where data are available.

The changes to society during the epidemic may have some positive and negative health effects, and this chapter has examples of both. The potential negative effects have received attention and action, with the aim of reducing their impact; for example, income and mental health support. The potential positive effects have perhaps received less attention but were known before and in the early stages of the pandemic to be possibilities (Chen et al. 2020; Shilling & Waetjen 2020; Toffolutti & Suhrcke 2014). It is complex to weigh the positive and negative effects against each other (Holden & Preston 2020).

As part of the ABS Household Impacts of COVID-19 survey of adults aged 18 and over, in January 2021 participants were asked whether their physical and mental health was better or worse than before the pandemic (ABS 2021d). Overall, 12% said their physical health was better or much better, and 20% said it was worse or much worse. However, there was a large difference in these assessments across age groups, with a higher proportion of younger groups reporting changes, particularly changes for the worse (Figure 3.1).

In terms of mental health, 11% said it was better or much better, while 22% said it was worse or much worse. The differences across age groups were even more pronounced than for physical health (Figure 3.1). Nearly half of those aged 18–34 reported changes (for the better or worse). This age group also had more changes than the oldest age group (65 years and over): 16% of the younger age group had positive changes compared with 4% of the oldest age group, and 29% had negative impacts compared with 15% in the oldest age group.

Figure 3.1: Perception of whether physical and mental health changed during COVID-19 pandemic, persons aged 18 and over, by age group, January 2021



Source: ABS 2021d.

Deaths from other diseases

Since the emergence of COVID-19, the number of deaths has been monitored closely in Australia and around the world to provide estimates of excess mortality that may be related to the pandemic. Excess mortality is typically defined as the difference between the observed number of deaths in a specified time period and the expected numbers of deaths in that time period. Measures of excess mortality can account for deaths due to COVID-19; potentially misclassified or undiagnosed COVID-19 deaths; and other mortality that may be indirectly related to the pandemic (for example, relating to social isolation or changed access to health care) (See Box 3.1 for more information).

Box 3.1: Measuring and interpreting excess deaths

Excess mortality is a term used to describe additional mortality during a given period of time (such as during a pandemic), relative to what would have been expected based on modelling historical deaths data (ABS 2020h). Estimates of excess deaths can provide information about the burden of mortality potentially related to the COVID-19 pandemic, including deaths that are directly or indirectly attributed to COVID-19.

Different methodologies are available to measure excess deaths.

- Regression modelling techniques can be used. For example, the ABS has adopted aspects of a methodology used by New South Wales Health in some of its reporting on excess deaths. It applies a cyclical linear regression with a robust estimation procedure to produce an expected number of deaths for 2020 for all cause and cause-specific mortality to identify statistically significant changes in patterns of mortality over time.
- Counts of deaths for 2020 compared to an average number of deaths recorded over the previous 5 years (2015–2019) can serve as a proxy for the expected number of deaths, so comparisons against baseline counts can provide an indication of excess mortality. The minimum and maximum counts from 2015–19 are also included to provide an indication of the range of previous counts.
- A comparison of age-standardised rates of deaths in 2020 compared to previous years (average of 2015–2019) which account for the impact of population growth and ageing on trends in mortality can also be used as an approximation of the short-term effects of the pandemic on mortality, but does not aim to directly estimate excess mortality during the pandemic.

Comparisons of counts of deaths and age-standardised rates have limitations, particularly for conditions that have experienced increasing or decreasing rates over time, and should be interpreted with caution.

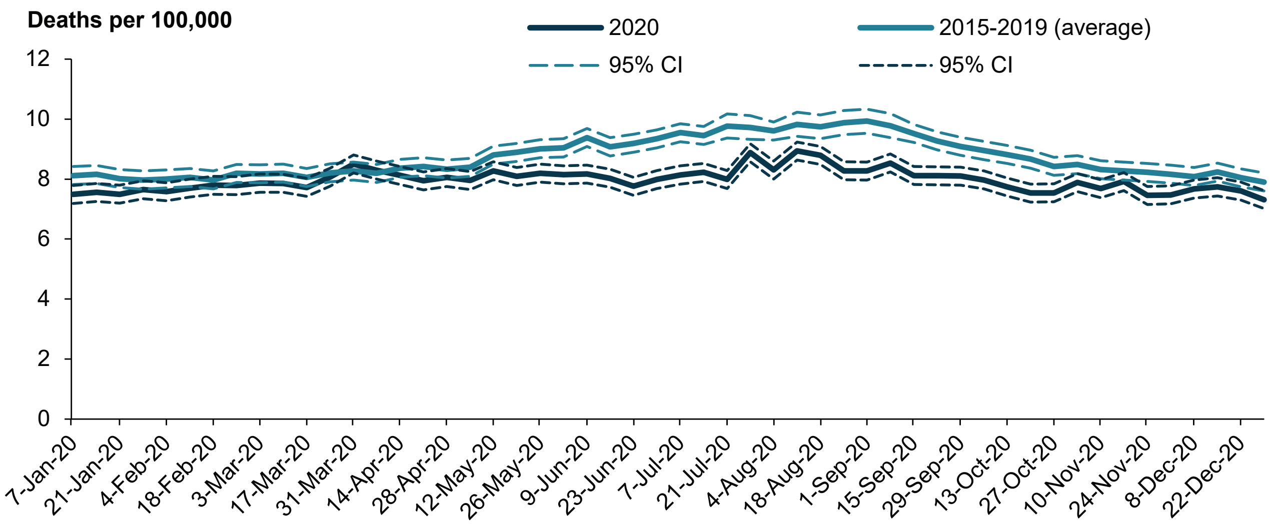
When **interpreting excess deaths** as a result of the pandemic, it is important to see if any other causes of death have increased above levels expected, and if so to determine whether this increase could be due to factors other than COVID-19. If any causes have decreased, reasons could include: the underlying trend has been decreasing; there has been social, environmental and behavioural changes as a result of the lockdowns and social distancing (for example, road traffic injury, infections); and whether some people who may usually have died from this cause of death died from COVID-19 instead.

Further information on measuring excess mortality during the COVID-19 pandemic can be found in the Australian Bureau of Statistics report (ABS 2021f) Measuring excess mortality in Australia during the COVID-19 pandemic.

All-cause mortality

ABS provisional mortality data (which includes GP-certified deaths only) show that from January to December 2020, Australia recorded lower than expected total mortality compared to age-standardised death rates for the previous 5 years (Figure 3.2). Regression modelling for the period January to November 2020 indicates that the decreases evident in the winter months are statistically significant (ABS 2021f). This is in contrast to many other countries where excess deaths have been recorded during the pandemic (see 'Comparison with other countries' in Chapter 2).

Figure 3.2: Comparison of all-cause age-standardised death rates per 100,000 in 2020 and average deaths during 2015–2019



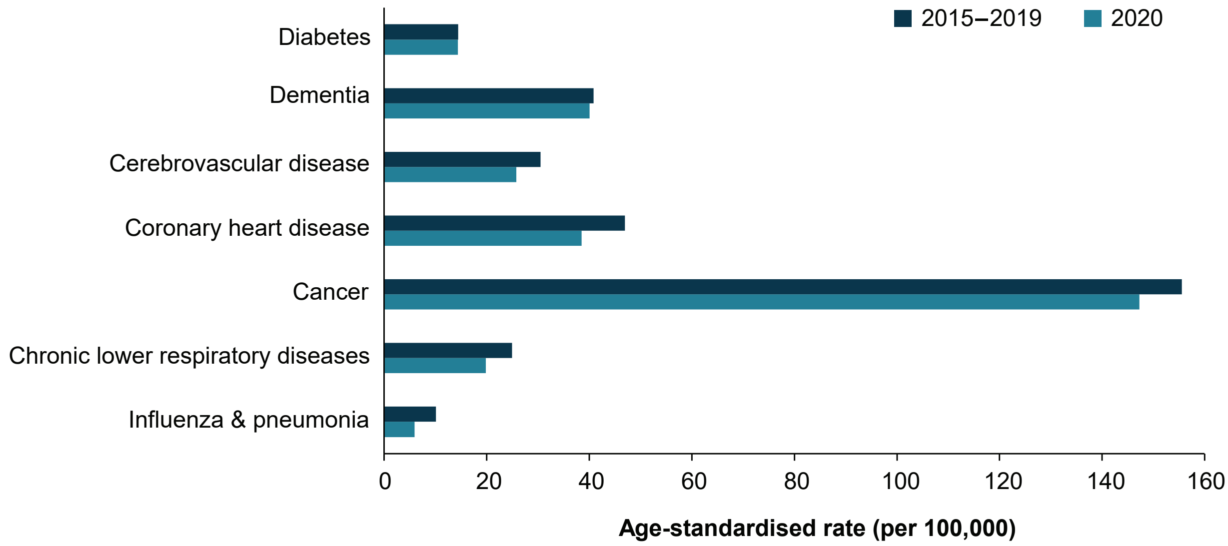
Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

Cause-specific mortality

While all-cause mortality provides a picture of the overall pattern of mortality during the pandemic it is important to look at cause-specific mortality to provide insights into how individual causes have changed. Specific causes may experience significant changes which can be masked at the all-cause level. The following section focuses on selected causes of death certified by a doctor in 2020 (it does not include coroner-certified deaths). Deaths are analysed by underlying cause of death only.

Age-standardised death rates in 2020 suggest that the COVID-19 pandemic in Australia did not lead to an increase in mortality for major causes of death compared with previous years (although it should be noted that these deaths do not include coroner-certified deaths). The age-standardised death rates for influenza and pneumonia, chronic lower respiratory diseases, cancer, CHD, cerebrovascular disease and dementia were all lower in 2020 than the average age-standardised rate for 2015–19. For diabetes, age-standardised death rates were similar in 2020 and 2015–19 (Figure 3.3). It should be noted that for cancer, CHD and cerebrovascular diseases, age-standardised death rates have been declining over time and thus a lower rate in 2020 would be expected compared to previous years. For dementia and diabetes, mortality rates (based on the underlying cause of death) have been increasing.

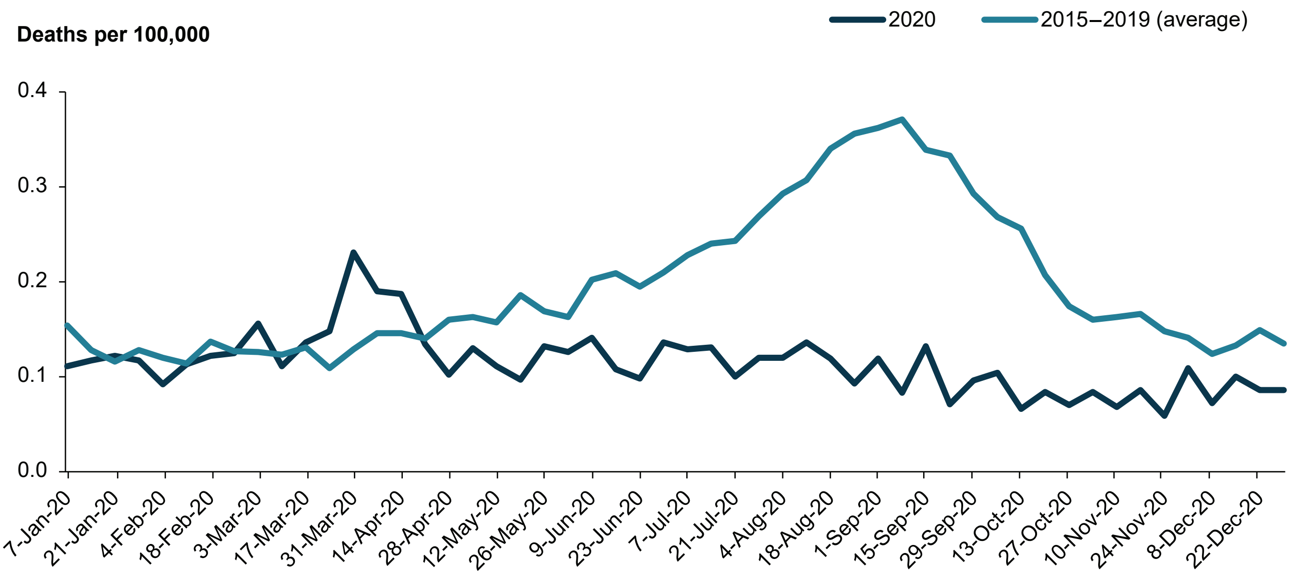
Figure 3.3: Comparison of age-standardised death rates for selected causes of death in 2020 and average deaths 2015–2019



Source: AIHW analyses of ABS Provisional Mortality Statistics: Customised Report.

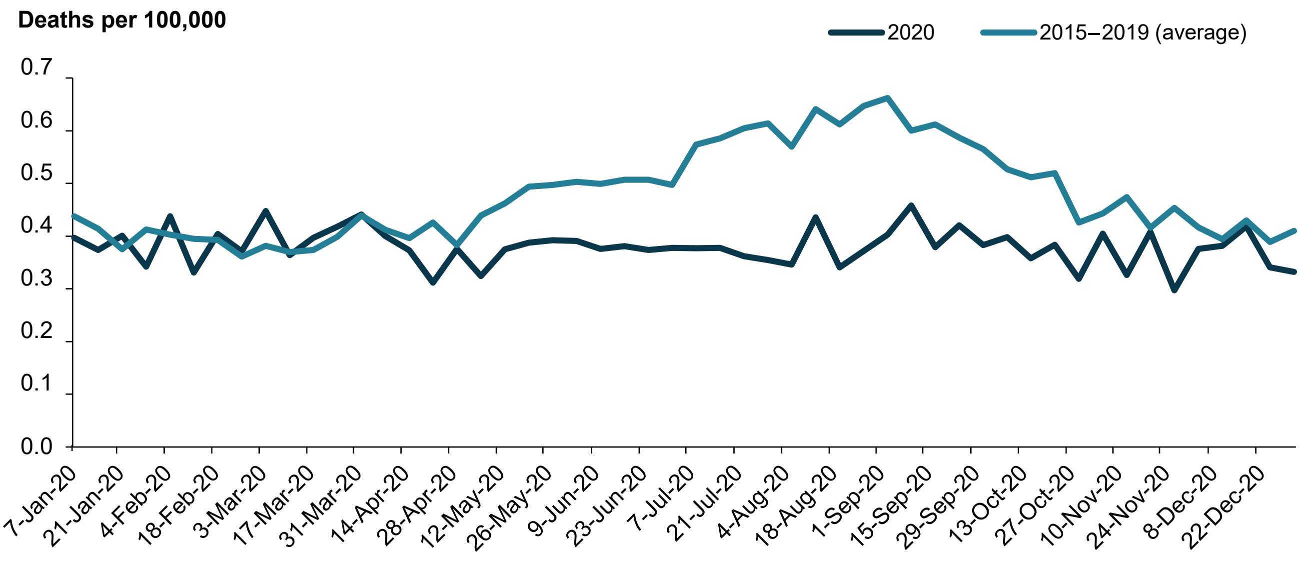
The age-standardised mortality rates in 2020 for influenza and pneumonia and chronic lower respiratory diseases were particularly low during the winter months compared to previous years (figures 3.4, 3.5). This supports the findings of other studies, which conclude that in Australia, infection control measures in response to the pandemic, Australians' adherence to these measures, and the increased uptake in influenza vaccinations have reduced transmission of these diseases and subsequent mortality (Department of Health 2020e; ABS 2021f).

Figure 3.4: Comparison of age-standardised death rates for influenza and pneumonia in 2020 and average deaths 2015–2019



Source: AIHW analyses of ABS Provisional Mortality Statistics (ABS 2021g).

Figure 3.5: Comparison of age-standardised death rates for chronic lower respiratory diseases in 2020 and average deaths 2015–2019



Source: AIHW analyses of ABS Provisional Mortality Statistics (ABS 2021g).

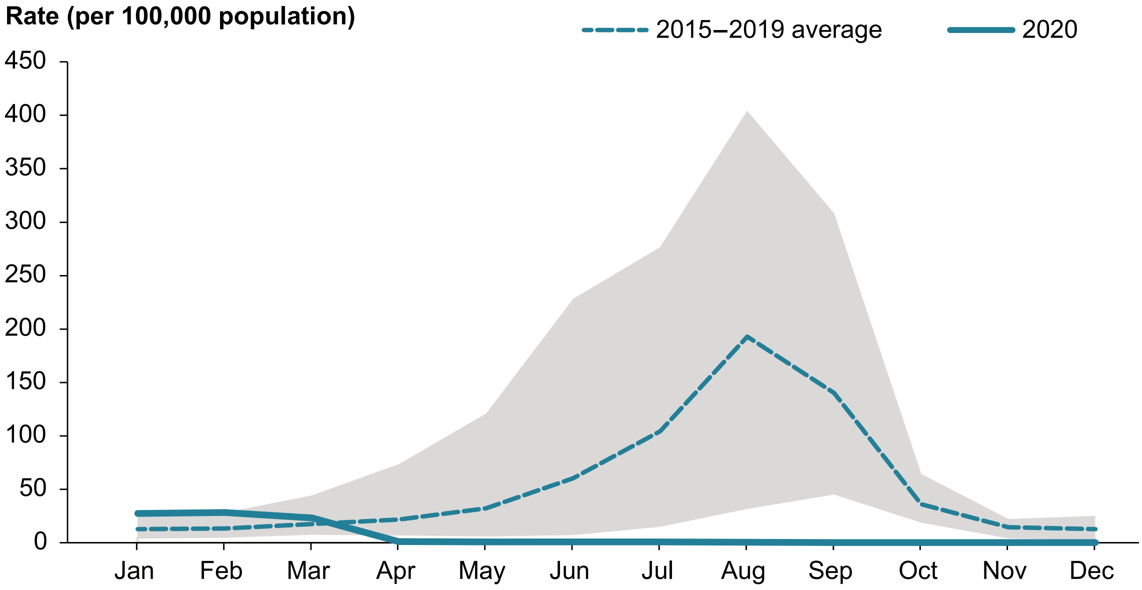
While the above analyses use age-standardised rates to look at changes in the pattern of mortality during the COVID-19 pandemic compared to previous years, the ABS has also used regression methods to estimate an expected number of deaths for 2020 for all-cause and cause-specific mortality. This analysis takes into account factors such as historical patterns in causes of death and seasonality to identify statistically significant changes in patterns of mortality over time. Counts of deaths that are above the upper bound of the confidence interval (threshold) are considered to be 'excess'. These estimates have been published for total Australia at the cause level to end of August (ABS 2020h), for total Australia all-cause mortality to the end of November (ABS 2021f) and for Victorian deaths at the cause-level to the end of November (ABS 2021f). They show findings consistent with those reported here based on age-standardised rates in terms of there being no excess mortality for the major causes of death examined for most weeks in 2020.

Both the AIHW analysis above and published ABS analysis on excess deaths use the underlying cause of death only. For some chronic conditions where it is common for the condition to be recorded as an associated cause of death on the death certificate (such as dementia, diabetes and chronic kidney disease), it is important to also take into account changes in the pattern of mortality in the associated causes. A recent report published by the AIHW examining dementia deaths during the COVID-19 pandemic includes analysis of people who died with dementia recorded as both the underlying and associated cause of death during the pandemic. It found that the age-standardised death rate for Australians with dementia recorded on their death certificates fell during the first 10 months of 2020, probably as a result of measures designed to prevent COVID-19 infections also limiting the spread of other infectious respiratory diseases (AIHW 2021e). This is in sharp contrast to the experience of other developed countries such as the United Kingdom, which has documented increased mortality among people with dementia during the pandemic, even when not due to COVID-19 (Alzheimer's UK 2020). The AIHW report also found that fatal COVID-19 outbreaks involved many people with dementia—257 (30%) of the 858 people who died due to COVID-19 during the period examined had dementia recorded as either an underlying or associated cause on their death certificate (AIHW 2021e).

Incidence of other communicable diseases

Early in the epidemic in Australia there were indications that the public health interventions may have been having a positive impact on the number of cases of other respiratory viruses, particularly influenza. During 2020, the notification rates for laboratory-confirmed influenza were substantially lower from April onwards (Figure 3.6), despite extensive testing, suggesting that measures introduced to control COVID-19 such as promotion of hand-hygiene, restrictions on international travel and movement within the country may have had a positive impact on the circulation of influenza (Bright et al. 2020; Sullivan et al. 2020). Similar patterns were seen in other countries, including New Zealand and the United States (Huang, Wood et al. 2021; Olsen et al. 2020).

Figure 3.6: Laboratory-confirmed influenza notification rates by month of diagnosis, Australia, 2020



Note: The minimum and maximum ranges for the 2015–2019 period is shown in grey.
Source: AIHW analysis of NNDSS data.

The spread of other communicable diseases may also have been reduced during the response to COVID-19. Preliminary analysis of nationally notifiable diseases in Australia in the first half of 2020 showed that the number of notifications for invasive pneumococcal disease, rotavirus, measles and dengue were lower than expected (Bright et al. 2020).

Injuries

The strict public health measures introduced to limit the spread of COVID-19 also appear to have caused a reduction in injuries due to falls and road traffic accidents, particularly during the first shutdown in March–April 2020. The number of presentations to hospital emergency departments (EDs) for trauma were lower than in the same period in previous years during the first lockdown in a number of hospitals across the country (Harris et al. 2020; Jacob et al. 2020; Kam et al. 2020;

Way et al. 2021). At the Westmead Hospital in Sydney the decrease in trauma admissions in March/April 2020 was due to a decrease in presentations where road traffic collisions and falls were the mechanism of injury (Jacob et al. 2020). The decrease in road traffic accidents is an expected consequence of the shutdown and data on national road deaths showed 5.1% and 25.3% fewer road deaths than the average over the previous 5 years during March and April 2020, respectively (BITRE 2020a, 2020b).

Data from the Victorian Injury Surveillance Unit for April 2020 showed similar patterns: the number of motor vehicle driver presentations to the ED was 52% lower than in April 2019. However, there was a 31% increase in the number of ED presentations for do-it-yourself (DIY) injuries (that is, open wounds, foreign bodies and burns) over the same period (VISU 2020). So it is possible that the reductions in road traffic injuries as a result of the strict shutdown may have been offset by increases in unintentional home injuries due to people spending more time in their homes.

There was also a decline in overall injury hospitalisation in the early months of the epidemic, reflected in the 2.5% decline in injury hospitalisations for the whole of 2019–20 compared with 2018–19 (AIHW 2020i; AIHW 2021a). This is in contrast with generally increasing numbers over the last 5 years.

Mental health

For some Australians, the COVID-19 pandemic and associated restrictions appear to have had a negative effect on mental health, while for others there were positive effects. Negative effects can include concerns about the virus itself, and some of the measures that were needed to contain the spread of the virus also had the potential for negative effects (NMHC 2020). Importantly, the need for as many people to stay at home as much as possible to increase physical distancing meant that many people were isolated from family, friends and other support networks. Flow-on effects such as sudden loss of employment and pressures involved in adapting to remote work and schooling were also part of the picture. For some people any resulting reductions in mental health may be short-term, while for others, there is potential for the pandemic and associated restrictions to exacerbate long-term mental health problems such as depression and substance abuse (WHO 2020g).

The potential for negative impacts on mental health was recognised early in the pandemic (Brooks et al. 2020; NHMC 2020). Aiming to reduce these effects, a number of support measures were put in place—see ‘Focus on mental health services’ in Chapter 4 for further details.

Loneliness

Loneliness is a risk factor for mental ill health, as well as being distressing in its own right (AIHW 2019d). The restrictions put in place to control the spread of the COVID-19 virus had an obvious side effect of increasing levels of loneliness in the community (Varga et al. 2021).

By mid-April 2020, based on self-reported information in the ABS Household Impact of COVID-19 survey, one-third of Australian adults had reduced the frequency of contact with family and friends since the start of the COVID-19 epidemic (ABS 2020b). The most commonly reported personal stressor in April 2020 was loneliness—reported by 22% of people, with females having higher rates than males (ABS 2020c). By the end of June 2020, this had reduced to 9% (ABS 2020e).

The longitudinal ANUPoll showed that, in April 2020, 41% of male and 50% of female respondents felt lonely at some time, but those percentages decreased to 31% and 40% respectively in May (Biddle et al. 2020d). The loneliness levels again increased in August but this rise occurred only in Victoria (Biddle et al. 2020e). Further, those who experienced loneliness had higher rates of psychological distress.

Psychological distress

Psychological distress reflects painful psychological symptoms associated with fluctuations in mood (APA 2021). There is a correlation between high levels of psychological distress and common mental health disorders. Psychological distress is commonly measured using the Kessler Psychological Distress Scale—10 items (K10). The questionnaire covers things like the individual's level of nervousness, agitation, psychological fatigue and depression in the past 4 weeks. The Kessler 6 scale is an abbreviated form of the K10. Much of the data for this section are drawn from the ANUPoll (Box 3.2).

Box 3.2: The ANUPoll

A panel survey—ANUPoll—has been used in a number of places in this report. The AIHW collaborated with the Centre for Social Research and Methods at the Australian National University to include questions on loneliness and the level of psychological distress using the Life in AustraliaTM Panel, managed by the Social Research Centre (Social Research Centre 2021).

This representative panel of adults living in Australia exclusively uses random probability-based sampling methods and covers both online and offline populations (that is, people who do and do not have access to the internet). In addition, as a panel it is possible to obtain longitudinal data including from the same respondents prior to the spread of COVID-19 which provides richer information than a series of cross-sectional snapshots, especially with regards to changes through time.

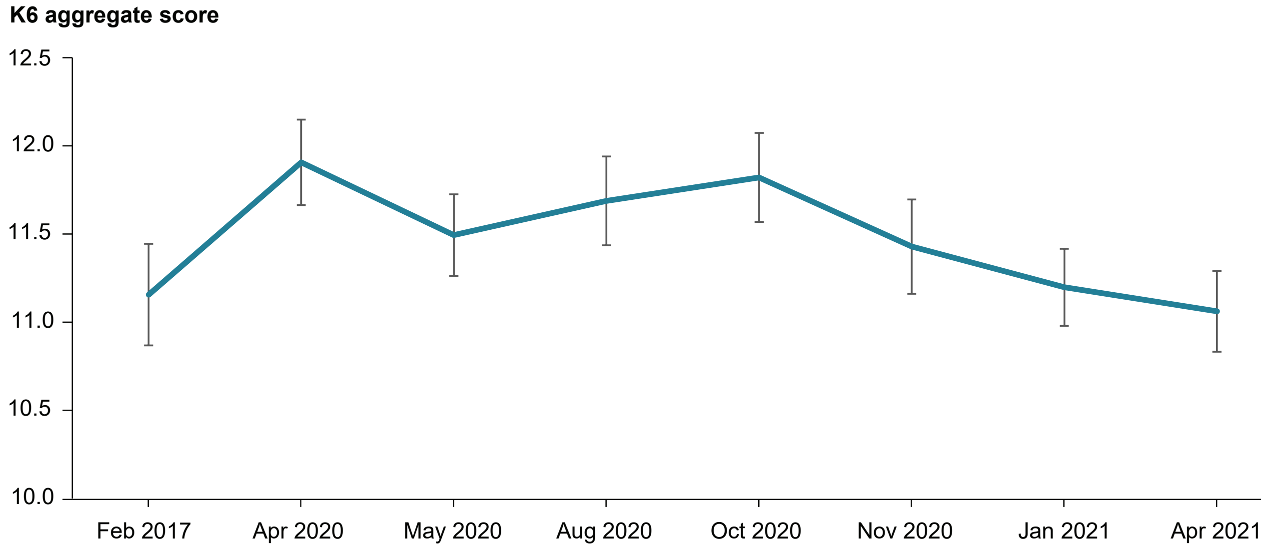
The survey is based on almost 3,500 respondents in the most recent survey. A high proportion (86%) of respondents have been included in earlier iterations of this survey, and new participants are added to replace others who have stopped participating. It includes self-reported data on a number of important topical issues and has been conducted up to monthly during the pandemic. In addition to the loneliness and psychological distress questions, other recent topics related to COVID-19 include income, labour market participation and education.

The ABS National Health Survey regularly collects data on psychological distress using the K10. Prior to the COVID-19 pandemic, there were no clear trends in these data for the period 2004–05 to 2017–18. The data do show that women aged 18–24 consistently have higher levels of psychological distress than other groups.

The initial impacts of COVID-19 in Australia appear to have increased levels of psychological distress. This was particularly the case for younger people. For adults aged 18–44, where there were statistically significant increases in levels of distress using the Kessler (K6) scale when comparing April 2020 estimates with those from February 2017 (data from the ANUPoll longitudinal survey; Biddle et al. 2020e). For people aged 45–54, levels of psychological distress remained steady during this period, and for those over 55 there was a slight improvement.

There were fluctuations in levels of psychological distress throughout the remainder of 2020. By April 2021, the average level of psychological distress had returned to pre-pandemic levels—the K6 aggregate score for all Australians increased from 11.2 in February 2017 to 11.9 in April 2020, then fell to 11.1 in April 2021 (Figure 3.7). However, it continued to be higher for young people. The proportion of people experiencing severe psychological distress also continued to be higher in April 2021 (9.7%) than in February 2017 (8.4%) (Biddle & Gray 2021; Biddle et al. 2020e).

Figure 3.7: K6 measure of psychological distress for February 2017, April, May, August, October and November 2020, January and April 2021, all ages, Australia



Note: The error bars on the chart indicate the 95 per cent confidence intervals for the estimates.
Source: Life in Australia, February 2017; ANUPoll, April, May, August, October and November 2020; January and April 2021 (Biddle & Gray 2021).

The data cited here are from a longitudinal survey, following the same individuals in each survey. From these data, a number of predictors of worsening psychological distress can be ascertained (Biddle et al. 2020e): worsening stress, increased loneliness, job loss and living in a capital city. In addition, people who had higher scores in February 2017 were more likely to have even higher scores by May 2020, showing that those already experiencing psychological challenges were particularly vulnerable.

Suicide

Given the potential for negative impacts on mental health, it is important to monitor suicide levels during the pandemic, however it is acknowledged that not all deaths by suicide are related to mental health issues. Data are available from suicide registers in the largest 3 Australian states, all showing very similar rates of suspected suicide in 2020 to 2019:

- New South Wales: in 2020 there were 896 suspected suicides, compared with 943 in the same period in 2019 (NSW Health 2021b)
- Victoria: in 2020 there were 713 suspected suicides, similar to the 718 over the same period in 2019 (Coroners Court of Victoria 2021)
- Queensland: between 1 January and 31 July 2020 there were 454 suspected suicides, which is similar to the 445 in the same period in 2019 (Leske et al. 2020).

Despite the negative impact on mental health, at this stage there appears to have been no increase in suicide rates. However, this will continue to be monitored into the future.

Changes in health behaviours

The primary aim of public health interventions to manage the spread of COVID-19 is to try to stop or reduce transmission of the virus and lessen the broader health and societal impacts. In the second half of March 2020, Australia's response to the COVID-19 pandemic escalated to national action and transitioned to a full shut-down (Duckett & Stobart 2020). These population-wide changes may also have had indirect effects on health-related behaviours such as changes to what people eat, whether or for how long they can exercise, how much alcohol they consume and the amount they smoke or use illicit drugs. For example, at various stages of the COVID-19 pandemic, there were restrictions on accessing non-essential services such as gyms or sporting facilities; limits on the amount of time allowed for exercising outside; and a decrease in incidental physical activity that people may do while commuting to work. This may have led to more sedentary behaviours and reduced physical activity, which in the longer term can indirectly contribute to morbidity and mortality.

This section explores the changes in health behaviours and factors influencing these changes during the COVID-19 pandemic in 2020. It draws from the different data sources and time periods described in Box 3.3, that reflect the varying levels of restrictions imposed.

Box 3.3: Data sources for health behaviours during the COVID-19-related restrictions in 2020

Data for this section draws on the following data sources:

- The Australian Bureau of Statistics Household Impacts of COVID-19 Survey is a longitudinal survey of around 1,000 people aged 18 and over in private dwellings. It collects information fortnightly via telephone on different topics related to the impacts of the COVID-19 pandemic. The third cycle (collected 29 April to 4 May 2020) (n=1,022) and seventh cycle (collected 24 to 29 June) (n=990), subsequently referred to as April and June surveys, collected information on lifestyle changes including food consumption, alcohol consumption, smoking and physical activity due to COVID-19. The panel selection was not strictly random sampling although it covered all Australian geographies (excluding very remote areas) and sampling weights by age, sex and geographic variables were used to calculate consistent full population estimates.
- The Australian National University's May 2020 ANUPoll collected information from 3,219 people aged 18 and over across all states and territories in Australia. It collected information primarily online and some via telephone between 12 and 24 May 2020 about alcohol consumption, smoking and illicit substance use. It is weighted across key demographic and geographic variables to have a similar distribution to the Australian population.
- The VicHealth Coronavirus Victorian Wellbeing Impact Study collected information from the first wave (defined as February 2020) and second wave (September 2020) of the pandemic for Victorian residents aged 18 and over. Respondents were asked about their health behaviours such as physical activity, diet, alcohol consumption and smoking. The first survey had 2,000 people and the second survey had 1,008 of the first survey's participants and 992 new participants. The participants were recruited from a non-probability panel (not a random sample). The survey was weighted by age, sex and geographic variables to provide a representative sample of the Victorian population.

(continued)

Box 3.3 (continued): Data sources for health behaviours during the COVID-19-related restrictions in 2020

- The Australian Longitudinal Study on Women's Health (ALSWH) conducted fortnightly surveys online from April 2020 until October 2020. The participants were women from three ALSWH cohorts born 1946–51, 1973–78 and 1989–95. Surveys six (n=7,003), seven (n=7,569), eight (n=7,391) and nine (n=7,491) focused on different health behaviour topics including alcohol consumption, diet, physical activity, and smoking changes compared with before the COVID-19 pandemic.

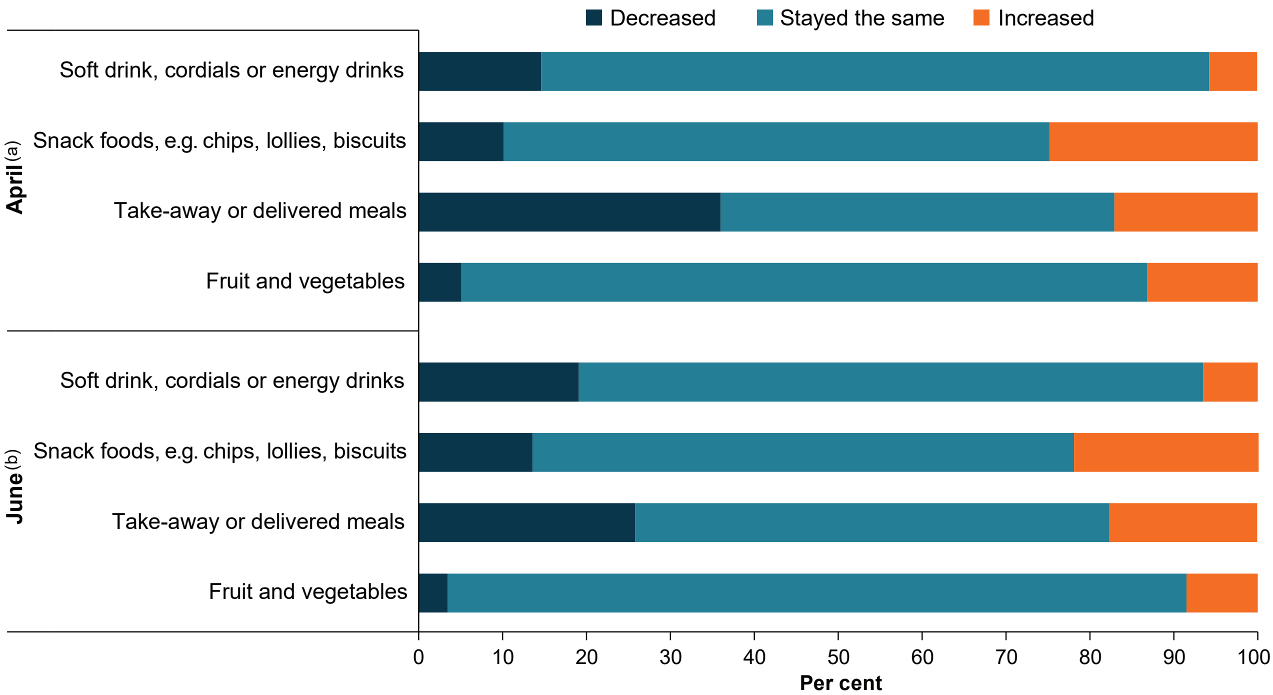
There are key differences in the data sources, which limit the ability for direct comparisons, including differences in sampling, demographics of the cohort, differing survey periods, and questions asked.

Diet

A healthy diet helps to prevent and manage health risk factors such as overweight and obesity and high blood pressure, as well as associated chronic conditions including type 2 diabetes. Food and beverages provide energy, nutrients and other components that if consumed in insufficient or excess amounts can result in ill health. A range of factors may influence changes due to a person's diet during the COVID-19 pandemic. For example, opportunity-induced eating and coping with negative emotions (such as stress) have been associated with unhealthy snacking behaviour (Verhoeven et al. 2015).

Data from the ABS Household Impacts of COVID-19 Survey showed that in April 2020 about 1 in 4 people (25%) reported increased consumption of snack foods and more than 1 in 3 (36%) reported decreased consumption of take-away or delivered meals compared with before the pandemic (Figure 3.8).

Figure 3.8: Changes in diet compared to before COVID-19, persons aged 18 and over, April and June 2020

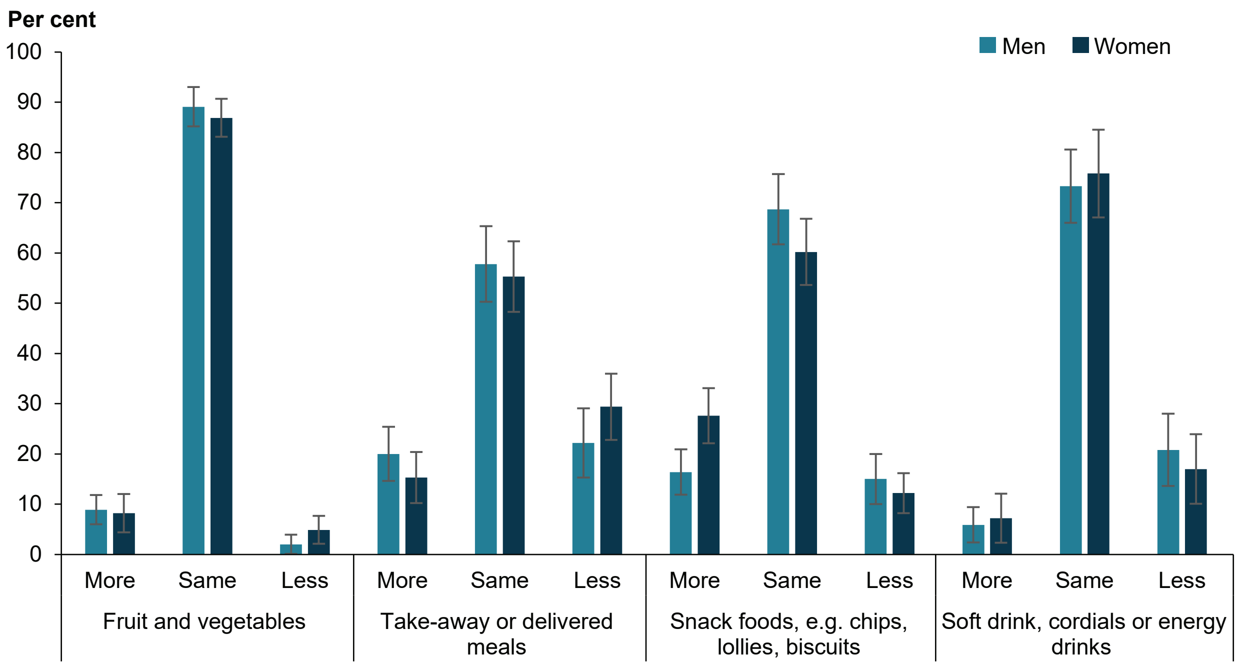


(a) Consumption in the last 4 weeks compared with before the COVID-19 pandemic.
(b) Consumption in the last 2 weeks compared with before the COVID-19 pandemic.
Note: Denominator excludes persons who did not usually consume or 'don't know' responses.
Source: ABS 2020c, 2020e.

Differences by sex and age

Increases in snack food consumption differed by sex, with a higher proportion of women reporting increased snack food consumption (28% of women compared with 16% of men) (Figure 3.9) (ABS 2020e).

Figure 3.9: Changes in diet compared to before COVID-19, persons aged 18 and over, by sex, June[(a)] 2020



(a) Changes in the last 2 weeks compared with before the COVID-19 pandemic.

Note: Denominator excludes persons who did not usually consume or 'don't know' responses.

Source: ABS 2020e.

In late July 2020, based on self-reported information in the ALSWH, more than 1 in 3 women (37%) reported eating more discretionary foods (for example pastries, chips, biscuits, ice cream, cakes or confectionary) compared with before the COVID-19 pandemic (Loxton et al. 2020a).

What are the reasons for changes in diet?

The VicHealth survey asked respondents their main reason for reduced take-away consumption during current COVID-19 restrictions in the second wave (September 2020). Of those respondents who decreased their take-away consumption (36%), the 2 most common reasons reported were 'They're not good for my health' (41%) and 'I have more time to cook meals' (37%) (VicHealth 2020). The April ABS survey also found that 38% of people reported increases in cooking or baking (of those who usually cook or bake) (ABS 2020c).

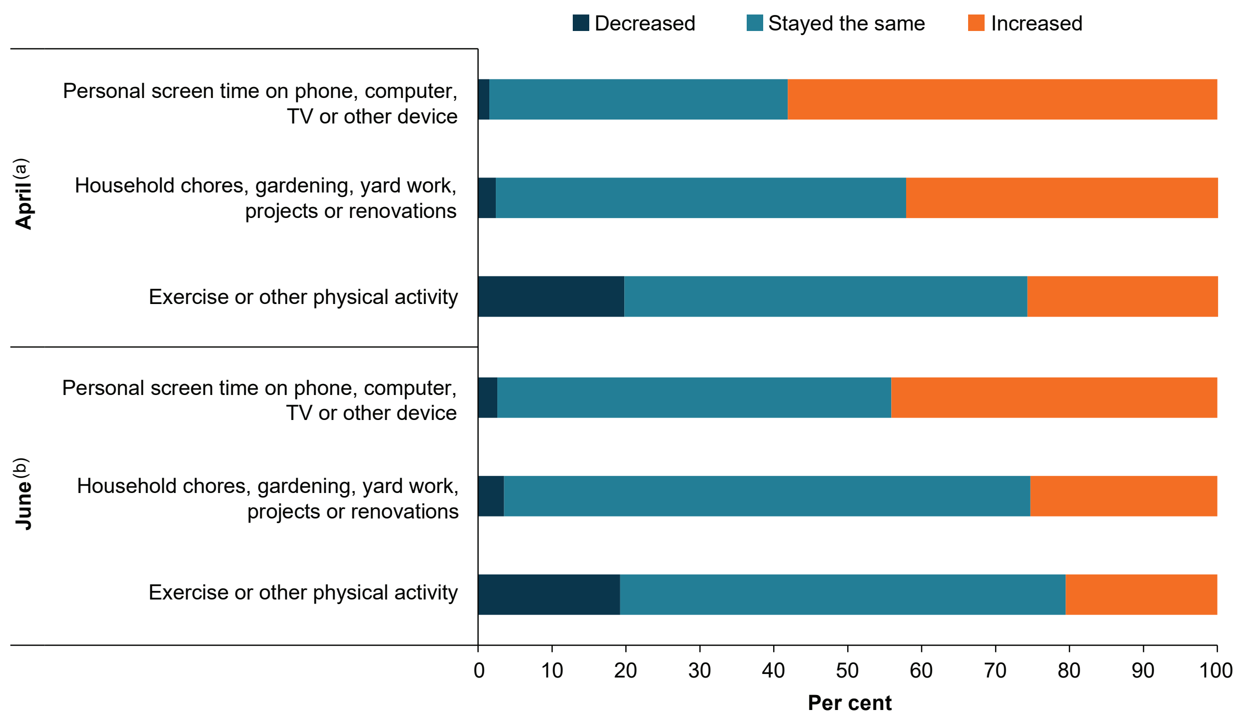
Physical activity and sedentary behaviour

Physical activity can include sport and leisure activities, as well as incidental activities such as household chores or gardening. Low levels of physical activity and high levels of sedentary behaviour (such as excessive screen time) are a major risk factor for chronic conditions. Reaching optimal levels of physical activity can reduce other risk factors such as overweight and obesity, high blood pressure and high cholesterol (AIHW 2017).

The majority of people increased personal screen time

In April 2020, the ABS Household Impacts of COVID-19 Survey found that around 3 in 5 (58%) people reported increases in their personal screen time on their phone, computer, TV or other device compared with before the COVID-19 pandemic (ABS 2020c). Around 2 in 5 (41%) reported an increase in household chores, gardening, yard work, projects or renovations. For the June period, 1 in 4 (25%) people reported increasing household chores, gardening, yard work, projects or renovations and almost half (44%) reported increasing personal screen time. Similar proportions of people reported increasing and decreasing exercise and other physical activity (ABS 2020e) (Figure 3.10).

Figure 3.10: Physical activity changes compared to before the COVID-19 pandemic, persons aged 18 and over, April and June 2020



(a) Consumption in the last 4 weeks compared with before the COVID-19 pandemic.

(b) Consumption in the last 2 weeks compared with before the COVID-19 pandemic.

Note: Denominator excludes persons who did not usually consume or 'don't know' responses.

Source: ABS 2020c, 2020e.

Differences by age

Increases in certain activities differed by age, with a larger proportion of people aged 18–64 reporting more personal screen time compared with those aged 65 and over (48% compared with 31%) in June (ABS 2020e). The ALSWH found that perceived changes to physical activity varied with age in women, with a higher proportion of younger age groups reporting changes (increases or decreases) to physical activity compared with older age groups (Loxton et al. 2020c).

What are the reasons for changes in physical activity?

During the second wave of the Australian COVID-19 pandemic in Victoria (September 2020) the VicHealth survey asked respondents about their main reason for increasing or decreasing their physical activity. Of those who reported an increase in physical activity (20%), getting out of the house (38%) and wanting to improve their health (38%) were the 2 most commonly reported reasons (VicHealth 2020). Of those people who reported decreases in physical activity (46%), over half reported low motivation (51%) and having to wear a mask (34%) were the 2 most common reasons for decreasing physical activity.

Alcohol use

The consumption of alcohol is a major cause of preventable disease and illness in Australia and has adverse social and economic impacts. Most Australians drink alcohol at levels that cause few harmful effects. Alcohol consumption throughout the COVID-19 pandemic in Australia may have increased or decreased depending on different factors. For example, the restrictions imposed throughout the pandemic saw the closing of non-essential services such as restaurants, pubs and clubs, which may have resulted in decreases in alcohol consumption for some.

In April 2020, self-reported information from the ABS Household Impacts of COVID-19 Survey showed that of those adults who usually drank alcohol, 20% reported increasing their consumption of alcohol and 13% reported decreasing their consumption in the previous 4 weeks compared with before COVID-19 restrictions (Table 3.1). In June 2020, a similar proportion of people reported that they increased or decreased their alcohol consumption compared with before the COVID-19 pandemic.

Table 3.1: Alcohol consumption changes compared to before the COVID-19 pandemic, persons aged 18 and over, April and June 2020

Month	Increased	Decreased	Stayed the same
April [a]	20.3%	13.4%	66.3%
June [b]	13.9%	14.7%	71.5%

(a) Consumption in the last 4 weeks compared with before the COVID-19 pandemic.
(b) Consumption in the last 2 weeks compared with before the COVID-19 pandemic.
Note: Denominator excludes persons who did not usually consume or 'don't know' responses.
Source: ABS 2020c, 2020e.

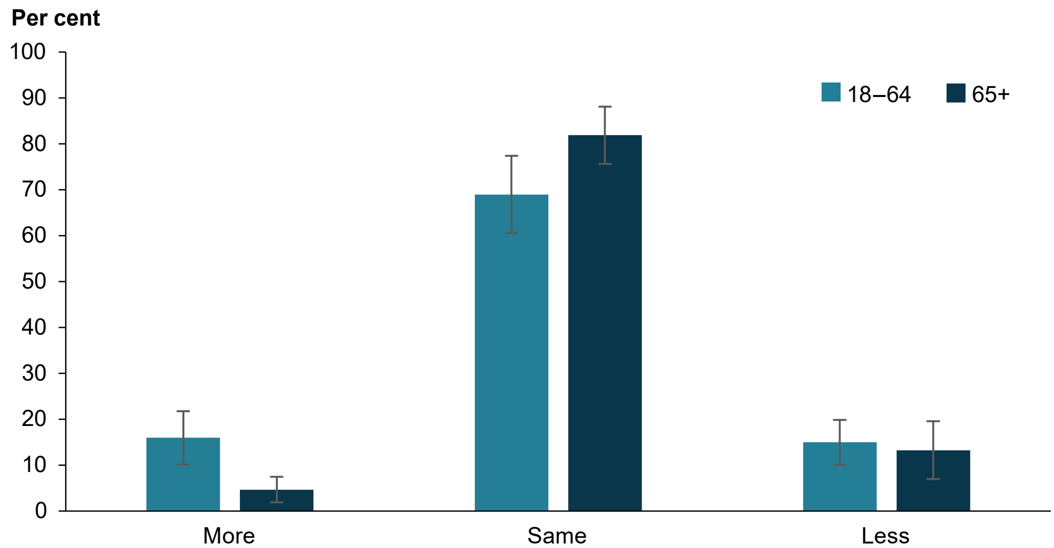
The May 2020 ANUPoll asked respondents about their changes to alcohol consumption since the spread of COVID-19 in Australia. Of those who reported drinking, 20% reported that their alcohol consumption had increased and 27% reported that their consumption decreased (Biddle et al. 2020a). The adverse effects of alcohol on health depend on factors such as the amount of alcohol consumed and frequency of consumption. Of those who reported an increase in alcohol consumption (20%), almost half (46%) said that the increase was 1–2 standard drinks per week and more than a quarter (28%) reported an increase of 3–4 standard drinks (Biddle et al. 2020a).

Differences by sex and age—younger women were more likely to report increasing alcohol consumption than men

In the April 2020 ABS survey, a higher proportion of women reported consuming more alcohol (27%) than men did (14%). These trends were similar in the May 2020 ANUPoll which found that 23% of women reported an increase in consumption compared with 18% of men. These proportions were consistent with those reported in the June 2020 ABS survey.

Changes in consumption of alcohol differed by age in the June 2020 ABS survey with a higher proportion of people aged 18–64 reporting increased consumption of alcohol (16%) compared with those aged 65 and over (4.7%) (Figure 3.11). Similar trends were reported in the April period although with higher estimates (23% for those aged 18–64, 7.5% for those aged 65 and over). The May 2020 ANUPoll also found differences in alcohol consumption by age with the highest proportions reporting an increased consumption in women aged 35–44, and men aged 25–34, declining in subsequent age groups. The ALSWH had cohorts aged 25–31, 42–47 and 69–74, and found similar trends with a higher proportion of women in younger age cohorts reporting an increase in alcohol consumption compared with the older cohorts.

Figure 3.11: Changes in alcohol consumption[(a)] compared with before COVID-19 restrictions, persons aged 18 and over, by age group, June 2020[(b)]



(a) For those who reported usually consuming alcohol.
(b) Consumption in the last 2 weeks compared with before the COVID-19 pandemic.
Source: ABS 2020e

What are the reasons for changes in alcohol consumption?

During the second wave of the Australian COVID-19 pandemic in Victoria (September 2020) the VicHealth survey asked respondents about their main reason for changes in their alcohol consumption. For those people who decreased consumption, not being in social situations that encourage drinking (44%), closure of drinking establishments (33%) and a general desire to improve health (31%) were the most common reasons reported for drinking less alcohol. The most common reasons for those who increased consumption were boredom (46%), being anxious or stressed (43%) and having more time in general (32%). The May 2020 ANUPoll also asked respondents about the reasons for increased alcohol consumption for those who reported an increase. The most common reason reported was that the person was spending more time at home (67% for men and 64% for women). The next most common response for men was 'Boredom, nothing else to do' (49%, 38% for women) while for women it was 'Increased stress' (42%, 29% for men) (Biddle et al. 2020a).

For more information, see Impacts of COVID-19 on alcohol and other drug use.

Smoking and illicit drug use

Smoking

Tobacco smoking is the leading cause of preventable diseases and death in Australia. According to the April 2020 ABS household survey, almost 9 in 10 (88%) people did not usually smoke. Of those who usually smoked (cigarettes, cigars, e-cigarettes or other tobacco products):

- 18% reported smoking more in the last 4 weeks compared with before COVID-19 restrictions (2.2% of all respondents)
- 9.7% reported smoking less (1.2% of the total).

Data from the ALSWH found that of women who reported smoking, 76% reported no changes in smoking habits and 5% reported changes in smoking (20% did not respond to the question). Of this 5%:

- 36% reported smoking less
- 64% reported smoking more since the beginning of the COVID-19 pandemic.

Of the women who were smoking more since the COVID-19 crisis began, 36% started or re-started smoking (Loxton et al. 2020b).

Data from the May 2020 ANUPoll found that there was little change in the proportion of current smokers—11.8% of the respondents were current smokers compared with 12.2% who were current smokers when they were recruited to the panel.

What are the reasons for changes in smoking?

The VicHealth survey reported that during the second wave of COVID-19 for people who reported smoking more, boredom (67%), stress or anxiety (67%) and having more free time (52%) were the most common reasons. For those who reported smoking less, improving general health (74%) and having fewer opportunities to smoke at home (26%) were the most common reasons.

Illicit drug use

In the May 2020 ANUPoll the majority of people reported never using illicit substances (89%). For respondents who used illicit drugs, around one-quarter (26%) reported a decrease in their consumption, while around 1 in 6 (18%) reported an increase (Biddle et al. 2020a).

Which illicit drugs changed in use?

According to the 2019 National Drug Strategy Household Survey, an estimated 3.4 million people nationally (16.4%) had used an illicit drug in the previous 12 months (AIHW 2020h). The Australians' Drug Use: Adapting to Pandemic Threats (ADAPT) study asked Australians who had used illicit drugs at least once a month in 2019 about their drug use during the COVID-19 restrictions (from March 2020) as compared to before. The highest reported increase in use was for cannabis (56% increase in Wave 1, 44% increase in Wave 2). MDMA (methylenedioxymethamphetamine—also known as ecstasy) and cocaine had the highest decreases across Wave 1 (49% decrease in MDMA use and 39% decrease in cocaine use) and Wave 2 (47% decrease in MDMA use and 42% decrease in cocaine use) (Sutherland et al. 2020).

Of those who reported an increased use of cannabis at Wave 1, 58% also reported an increase at Wave 2; the remaining 42% reported their use of cannabis had decreased or returned to pre-COVID levels. Of those who reported a decrease in MDMA and cocaine use at Wave 1, over two-thirds reported their use remained lower at Wave 2 (68% for MDMA and 59% for cocaine) (Sutherland et al. 2020).

The ADAPT study is not considered representative of all persons who use drugs. The sample of persons, aged 18–67, mostly comprised young people with high levels of education who lived in capital cities. As representative data for illicit drug use can be difficult to obtain there may be other data sources which assist in providing the full picture of changes to illicit drug use.

The National Wastewater Drug Monitoring Program measures the presence of substances in sewerage treatment plants across Australia. Report 11 covers 56% of the population (around 13 million people) in capital cities and regional areas (ACIC 2020).

Nationally, the population-weighted average consumption levels reached record, or near- record, low levels for capital city consumption of oxycodone and regional consumption of fentanyl in April 2020. Conversely, record high levels of consumption were reported for capital city consumption of nicotine, cocaine and cannabis in June 2020 and regional methylamphetamine and heroin consumption in April 2020.

There are limitations to using wastewater analysis for illicit drug use monitoring. For example, the specific marker for cannabis consumption, tetrahydrocannabinol (commonly known as THC), is excreted in extremely small amounts and detection is affected by surface adsorption. Wastewater analysis also cannot differentiate between the medical and non-medical use of pharmaceutical drugs such as oxycodone and fentanyl and cannot distinguish between nicotine intake from tobacco or e-cigarettes and nicotine replacement products (such as gums and patches).

For more information, see Impacts of COVID-19 on alcohol and other drug use.

4

Health services throughout the pandemic

Summary: 4 Health services throughout the pandemic

Emergency department use

- The number of emergency department presentations in public hospitals fell during the early months of the epidemic in Australia—presentations fell 38% over the last 3 weeks of March 2020.
- For the whole 2019–20 financial year, there was a 1.4% decrease in presentations compared with the previous financial year.
- Presentations for injuries decreased in March 2020, and the fall in emergency presentations generally affected the less urgent categories of patients.

Elective surgery

- Non-urgent elective surgery was suspended for 1 month at the end of March 2020.
- Before the pandemic, elective admissions involving surgery in public hospitals had been increasing steadily each year. In contrast, in 2019–20 the number decreased 9.3%.
- Due to the nature of the restrictions, reductions were in the less urgent groups. Between 2018–19 and 2019–20 there was a 9.2% decline in semi-urgent procedures and an 18.2% decline in non-urgent ones.
- Similar patterns were seen for operations for private patients subsidised through Medicare (in private as well as public hospitals). There was a 34% decrease in operations in April and May 2020 compared with the same period in 2019.

Services in the community

- In 2020, there was a small increase in visits to GPs that continued the pattern over recent years—a 3.4% increase in Medicare-subsidised GP visits compared with 2019.
- This reflects the net effect of a number of different drivers during this period, including changes to how services were delivered and changes to health-seeking behaviours of different groups in the population.
- This maintenance of consultation levels was supported by uptake of new telemedicine provisions introduced to enable some care to be undertaken remotely. By April 2020, 36% of GP consultations were delivered by phone or video, a level that continued to August 2020 but then decreased towards the end of the year.
- Telehealth was also important for other parts of the health system in 2020.
- Medicare-subsidised visits to specialists maintained pre-pandemic levels due to high use (19% to 37%) of telemedicine provisions in each month between April and August.
- Allied health attendance increased 20% between 2019 and 2020, again supported by use of the telemedicine provisions.
- Some services, particularly optometry and pathology, had considerable reductions in April 2020.
- By the end of August 2020, optometry services had returned to the usual level, though had not compensated for services not conducted earlier. This led to an overall 8.1% fall in the number of services in 2020 compared with 2019.
- The number of pathology services increased to above pre-pandemic levels after the initial decline. A substantial increase from June 2020 onwards resulted in an overall 2.9% increase in pathology services in 2020 compared with 2019.

Supply of medicines

- There was a sharp rise in prescriptions filled in March (a 23% increase compared with March 2019), suggesting people filled prescriptions earlier than usual in case there was a disruption during the shutdown period.
- There were then declines in April (8.8%) and May (11%) compared with 2019, followed by a return to pre-pandemic levels in June.
- Overall, there was a 0.9% increase in prescriptions in 2020 compared with 2019.
- The largest increase was for medicines used to treat respiratory conditions.

Chronic disease management

- Of particular interest was whether people with chronic conditions received the care they needed during the disruption caused by the pandemic.
- Medicare-subsidised GP services for 3 types of chronic disease management items all showed similar patterns—falls in services at the start of the pandemic, followed by recovery to somewhat above previous levels of use.
- This resulted in between 4.1% and 6.6% higher use in 2020 overall compared with 2019. Telehealth services made a large contribution to maintaining these levels.

Mental health services

- Potentially reflecting both the increased need for and increased availability of services, usage increased for a range a mental health services after late March 2020.
- Between mid-March and mid-December 2020, there was a steady rise in the number of services subsidised by Medicare, followed by some plateauing. The number of services for the 4 week period 31 August to 27 September 2020 was 14.5% higher than for the 4 weeks from 2–29 September 2019.
- Telehealth services accounted for about 1 in 3 services during this period.
- The number of mental health-related prescriptions dispensed under the PBS also displayed some novel patterns during 2020, most notably a spike in volume during March, corresponding to the first wave of the pandemic and exceeding March 2019 levels by roughly one-fifth.

Cancer screening

- Breast screening services through BreastScreen Australia were suspended from late March to late April/early May 2020. This resulted in a large decline in screening mammograms, from 70,000 in March 2020 to just over 1,100 in April. Mammograms then increased as restrictions were eased.
- From January to June 2020 there were 145,000 fewer mammograms compared with the same period in 2018. From July to September 2020 there were 12,000 more mammograms than in the same period in 2018.
- Changes to the Cervical Screening Program in recent years meant that the number of screening tests conducted in 2020 was expected to be lower than in 2019.
- There were fewer tests in 2020 than in 2019 but the impact of COVID-19 cannot be quantified without further years of data (as 2020 is the first year affected by the transition to 5-yearly screening).
- Background fluctuations in bowel screening tests, due to factors such as how many kits are sent out and recent increases in the frequency of testing, make it difficult to disentangle any effects of COVID-19.
- The number of tests returned in 2020 did vary month to month, being both lower and higher than the numbers in 2019. The timing of these fluctuations does not appear to be related to the pandemic.

Health services have been affected in a number of ways during the COVID-19 pandemic. Substantial changes in health services have been needed to respond to the direct effects of the virus and disease, including the public health measures outlined in Chapter 1 and the need to meet the health requirements of people who develop COVID-19. There are also indirect effects, such as some services being restricted at various times (for example, elective surgery); increases in the need for particular services (for example, mental health); decreases in the need for others (for example, injuries); and people changing their health-seeking behaviour to reduce their chance of contracting the virus.

There are key areas where data would be useful to determine the impact of these various effects—some have data available at this stage, and some do not:

- COVID-19-specific services: there is limited national data on this aspect at this stage, apart from the hospital services data presented in Chapter 2. Note that some of the data below may include COVID-19-specific services, though they cannot be separated from other services.
- Hospital services: **emergency department use** (data available to the end of June 2020); **admitted patient services** (data available to the end of June 2020); **elective surgery** (some data to the end of June 2020, and some to the end of 2020).
- Services in the community (out of hospital): **GP services** (data available to the end of 2020); **other service**s (data available to the end of 2020); **chronic conditions management** (data available to end of 2020); **mental health services** (data available to the end of 2020); and use of medicines (data on **supply of medicines** to end of 2020).
- Prevention and early detection: **screening for particular cancers** (data available to September 2020).

The main focus of this chapter is on national data, with some data split by state to show the impact of various subnational outbreaks. Data for the components in bold are presented below.

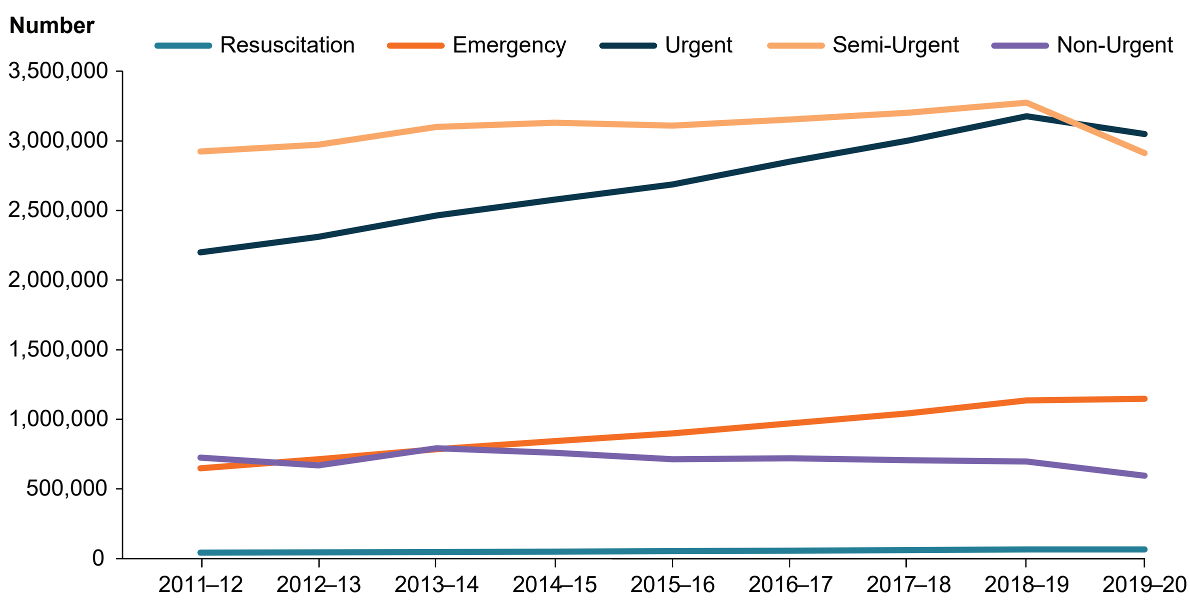
Emergency department use

The number of emergency department presentations in public hospitals fell during the early months of the epidemic in Australia, likely due to the COVID-19 restrictions and changes made to the health system (AIHW 2020e). For the whole 2019–20 financial year, there was a 1.4% decrease in presentations compared with the previous financial year. When looking at the period coinciding with the epidemic, the effect on emergency department use is very clear. Between the weeks starting 9 March and 30 March 2020, presentations fell 38%. Over subsequent weeks the number of presentations slowly increased, though they remained lower than in the same period in 2019. For the week beginning 22 June 2020, presentations were 8.4% lower than for the same period in 2019.

One clear pattern in the types of presentations was for injuries, for which presentations decreased from 5,800 in the week beginning 24 February 2020, to 3,400 in the week beginning 30 March (AIHW 2020e). This period coincided with the restriction on travel, sporting activities and other public gatherings.

The fall in emergency presentations generally affected the less urgent categories of patients more than the most urgent cases (Figure 4.1). The largest percentage declines between 2018–19 and 2019–20 were for the non-urgent (14%) and semi-urgent (11%) groups. In terms of the number of presentations, the largest falls between the 2 years were for the semi-urgent (362,700 fewer patients), urgent (127,700 fewer) and non-urgent (99,900) groups.

Figure 4.1: Emergency department presentations by urgency status

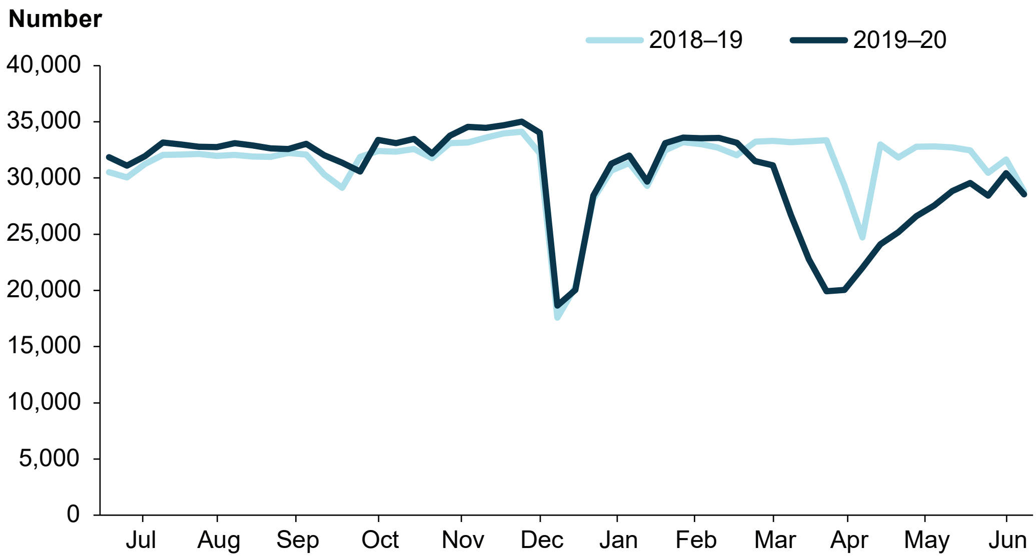


Source: AIHW 2020f.

Hospitalisations

The number of patients admitted to hospital in Australia during the early months of the pandemic declined substantially for a number of weeks (Figure 4.2). This led to an overall 2.8% decline in hospitalisations in 2019–20 compared with 2018–19, reversing the trend over the last 5 years of increases of 3.3% on average (AIHW 2021a). Falls in elective admissions accounted for the largest proportion of the decline. The decline in 2019–20 compared with the previous year was larger for private hospitals (4.5%) than public hospitals (1.7%).

Figure 4.2: Average daily completed hospitalisations by week of admission, 2018–19 and 2019–20



Note: As completed hospitalisations are counted here, hospitalisations with a date of admission near the end of the financial year period are under-represented here.

Source: AIHW 2021a.

Elective surgery

At the beginning of the COVID-19 pandemic in Australia, non-urgent elective surgery was suspended for 1 month, from 26 March to 27 April 2020. During this time, only Category 1 (the most urgent) and exceptional Category 2 procedures could be undertaken. These restrictions then started to be eased, initially allowing all Category 2 and some Category 3 procedures to resume. The long-term health effects of cancelling or postponing non-urgent elective surgeries are not yet known.

Elective surgery occurs in both public and private hospitals, with around two-thirds of elective admissions involving surgery being performed in private hospitals (AHIW 2019c). Elective surgery waiting list data in public hospitals are currently available for the complete 2019–20 financial year. No similar waiting list data for elective surgery in private hospitals are available, though some data on Medicare-subsidised operations occurring in hospital are provided below (which may also include some non-elective operations). It is important to note that there is some overlap between these Medicare data and the public hospital data—procedures for private patients in public hospitals are included in both data sets.

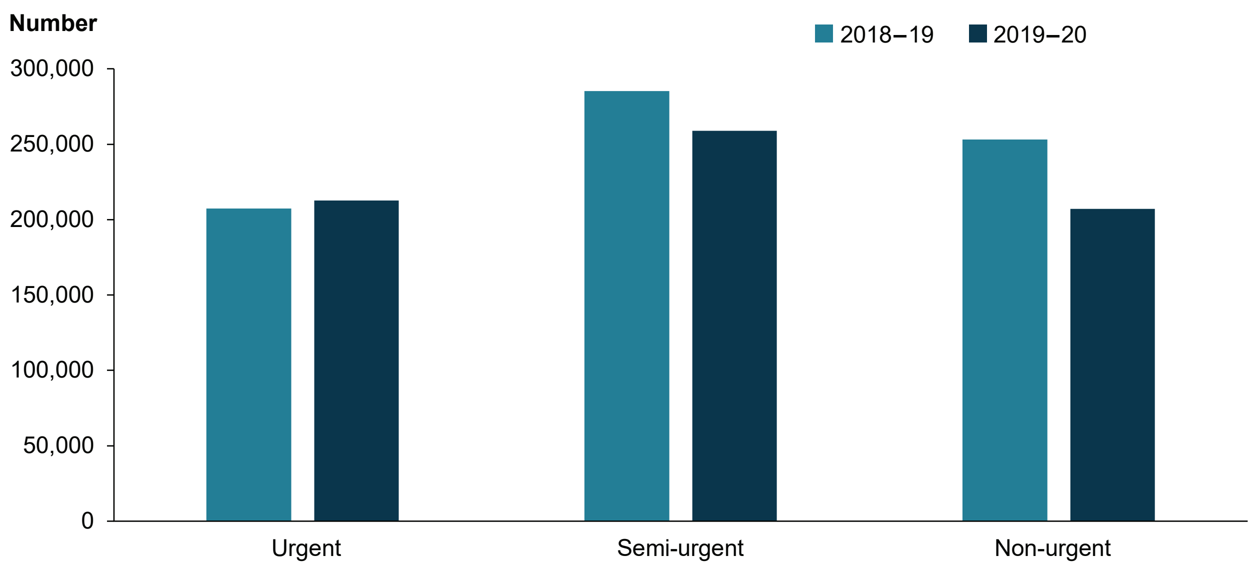
Public hospitals

Elective admissions involving surgery in public hospitals are prioritised by clinical urgency from elective surgery waiting lists. During the period leading up to the COVID-19 pandemic, elective admissions involving surgery in public hospitals had been increasing steadily each year (from 720,400 in 2015–16 to 753,600 in 2018–19). But in 2019–20 the number decreased by 9.3% to 683,600 (AIHW 2020d).

The smallest number of procedures was in April 2020, with admissions increasing again to expected levels by the end of June 2020. In the week beginning 16 March 2020, there were 15,300 elective surgeries, but by the week beginning 13 April, there were only 4,800. By the week beginning 22 June, the number had increased to 14,200.

As expected due to the structure of the imposed restrictions outlined above, the reductions were in the less-urgent categories (Figure 4.3). Between 2018–19 and 2019–20 there was a small increase in urgent procedures, but a 9.2% decline in semi-urgent procedures and a 18.2% decline in non-urgent ones.

Figure 4.3: Elective admissions in public hospitals by urgency category

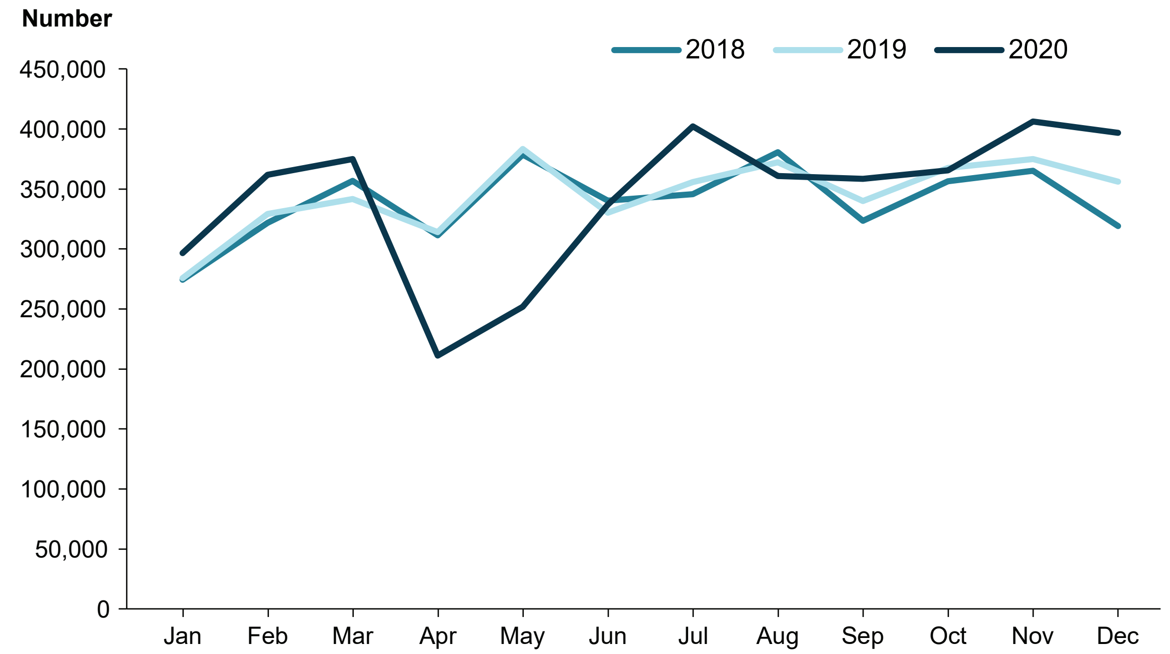


Source: AIHW 2020d.

Private patients (in public and private hospitals)

The patterns seen above for procedures in public hospitals are also apparent in the data on operations for private patients (in private as well as public hospitals). For this group, there had been slightly higher numbers of procedures in the period leading up to the COVID-19 epidemic—a 9% increase between January and March 2020 compared with the same period 12 months earlier (Figure 4.4). Due to the large fall in the number of operations in April and May of 2020, there was a 34% decrease in those 2 months compared with the same period in 2019.

Figure 4.4: Medicare-subsidised operations in hospital for private patients, 2018 to 2020



Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

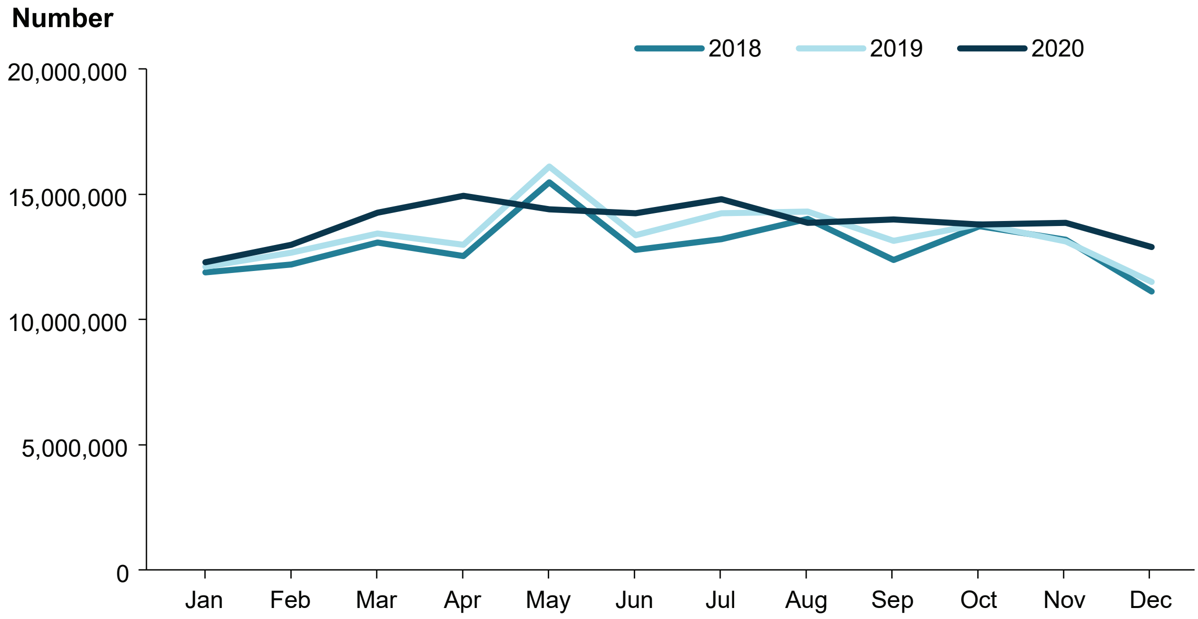
Services in the community

GP services

During the early period of the COVID-19 epidemic in Australia, there was concern that people may not receive the care they needed for other medical issues. As GPs provide the majority of primary care in Australia, it was important to track service provision by this group.

Until the end of 2020, the number of visits to GPs had a similar pattern to that from the previous 2 years, though with fewer peaks (Figure 4.5). There was also a small increase in overall visits that continued the pattern over recent years: in 2020, there was a 3.4% increase in Medicare-subsidised GP visits compared with 2019, following a very similar rise the year before. This increase reflects the net effect of a number of different drivers during this period, including changes to how services were delivered and changes to health-seeking behaviours of different groups in the population.

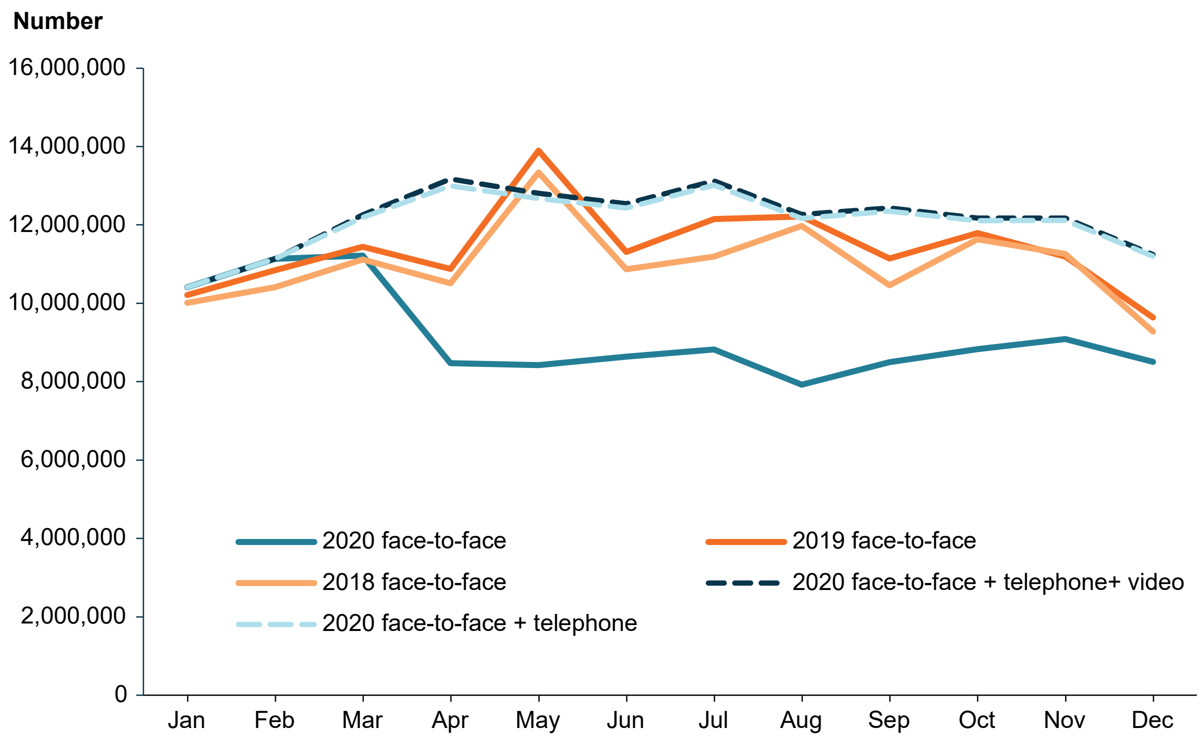
Figure 4.5: Medicare-subsidised non-referred visits to general practitioners, 2018 to 2020



Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

This maintenance of a similar number of visits was supported by the uptake of the new telemedicine provisions introduced to enable some care to be undertaken remotely during the epidemic. These temporary provisions were introduced in March 2020 and have been extended until the end of June 2021. By April 2020, just over one third (36%) of GP consultations were delivered by phone or video, a pattern that continued to August 2020 but then decreased somewhat towards the end of the year (Figure 4.6).

Figure 4.6: Medicare-subsidised GP visits by mode of delivery, 2018 to 2020

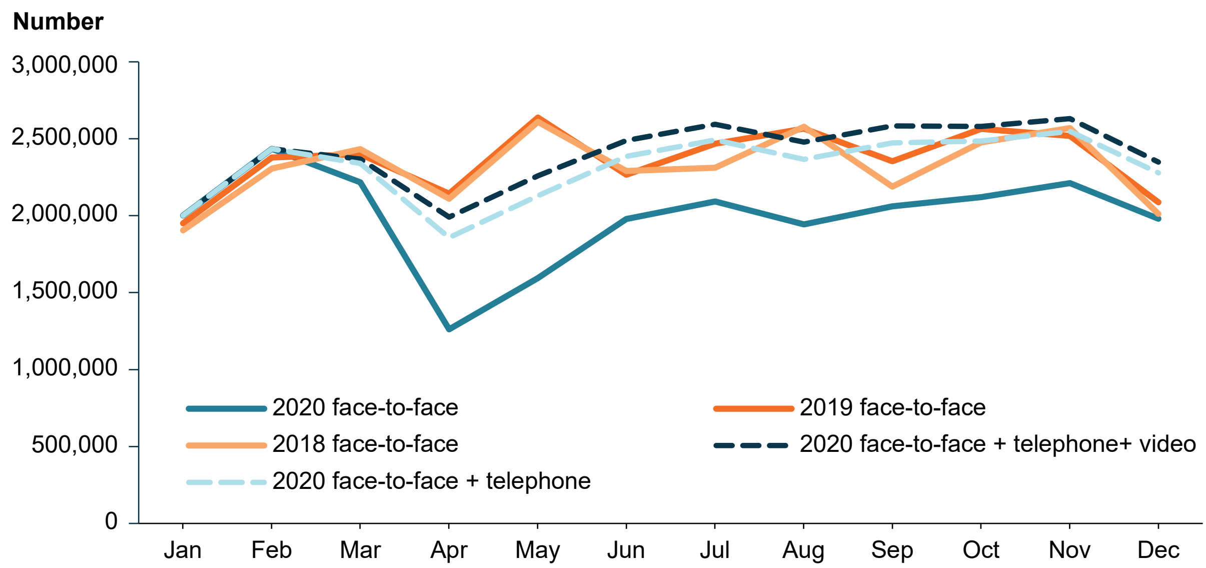


Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

Other services

Telehealth was also important for other parts of the health system. Visits to specialists subsidised through Medicare also maintained pre-pandemic levels due to at least 19% but up to 37% use of telemedicine provisions in each month between April and August 2020 (Figure 4.7). Note that these figures do not include specialist services provided through the public system, such as at outpatient clinics in public hospitals.

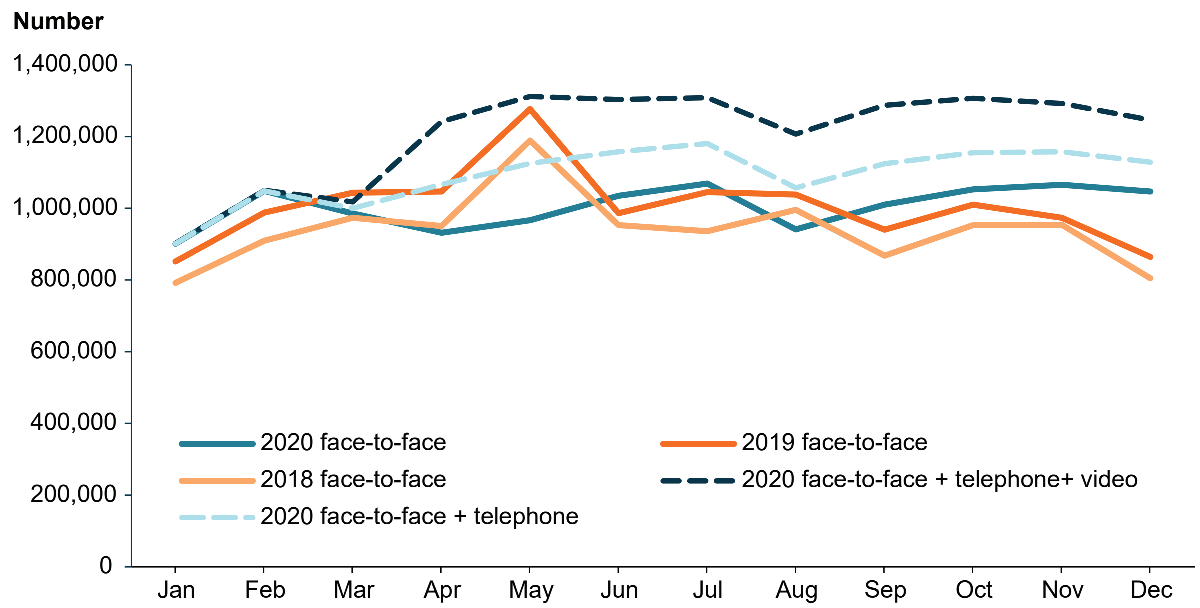
Figure 4.7: Medicare-subsidised visits to specialists, 2018 to 2020



Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

Allied health attendance increased during the pandemic period, resulting in a 19% increase between 2019 and 2020. This was again supported by use of the telemedicine provisions, both phone and video (Figure 4.8). It is likely that some of the increase in services was due to the particular focus on mental health support during the pandemic (Hunt 2020).

Figure 4.8: Medicare-subsidised allied health attendances, 2018 to 2020

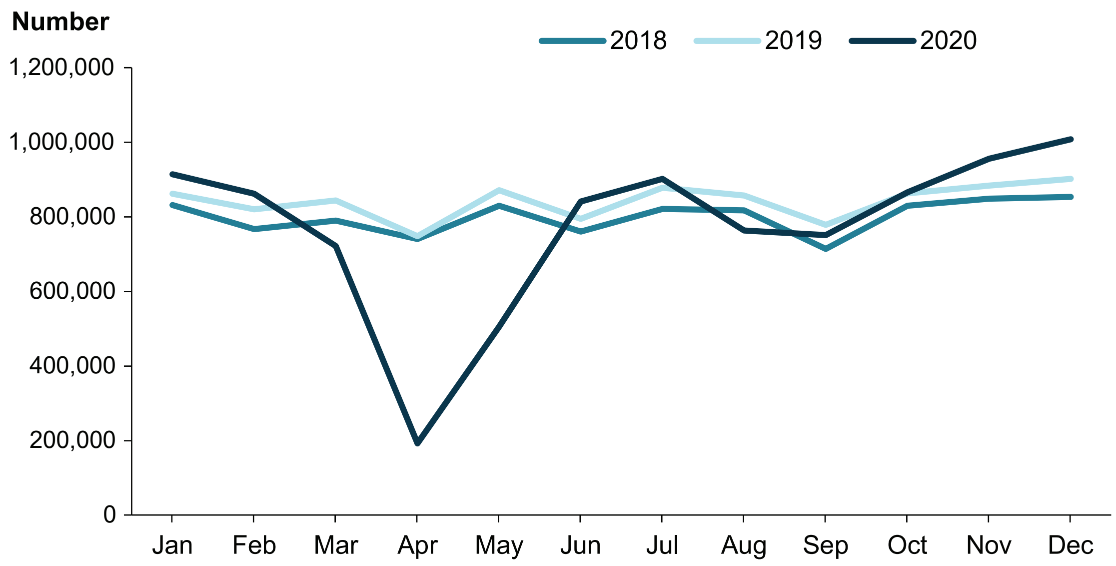


Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

Two components of the out-of-hospital health system that experienced considerable reduction in services in the early period of the epidemic in Australia were optometry services (Figure 4.9) and pathology services (Figure 4.10)—both with major falls in April 2020. By the end of August 2020, optometry services had returned to the usual level of service provision, though had not yet compensated for services not conducted in the earlier months. This led to an overall 8.1% fall in the number of services in 2020 compared with 2019.

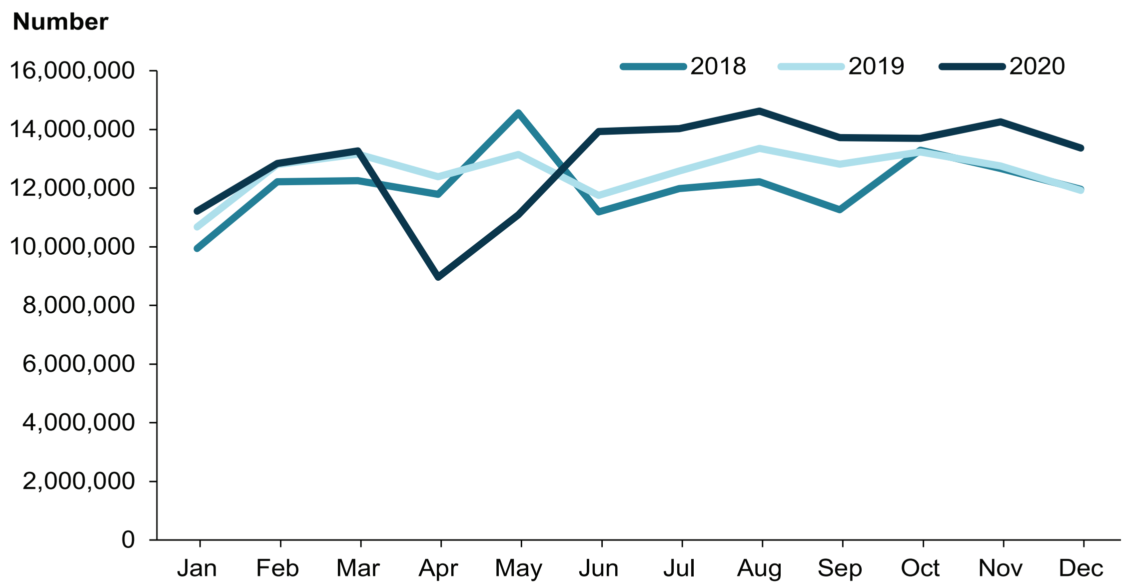
In contrast, the number of pathology services increased to above pre-pandemic levels after the initial decline—this may be due to the increased services for COVID-19 testing as well as some 'catch-up' for services not provided in the earlier months. The substantial increase from June 2020 onwards resulted in an overall 2.9% increase in pathology services in 2020 compared with 2019.

Figure 4.9: Medicare-subsidised optometry services, 2018 to 2020



Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

Figure 4.10: Medicare-subsidised pathology services, 2018 to 2020



Source: AIHW analysis of MBS data maintained by the Australian Government Department of Health.

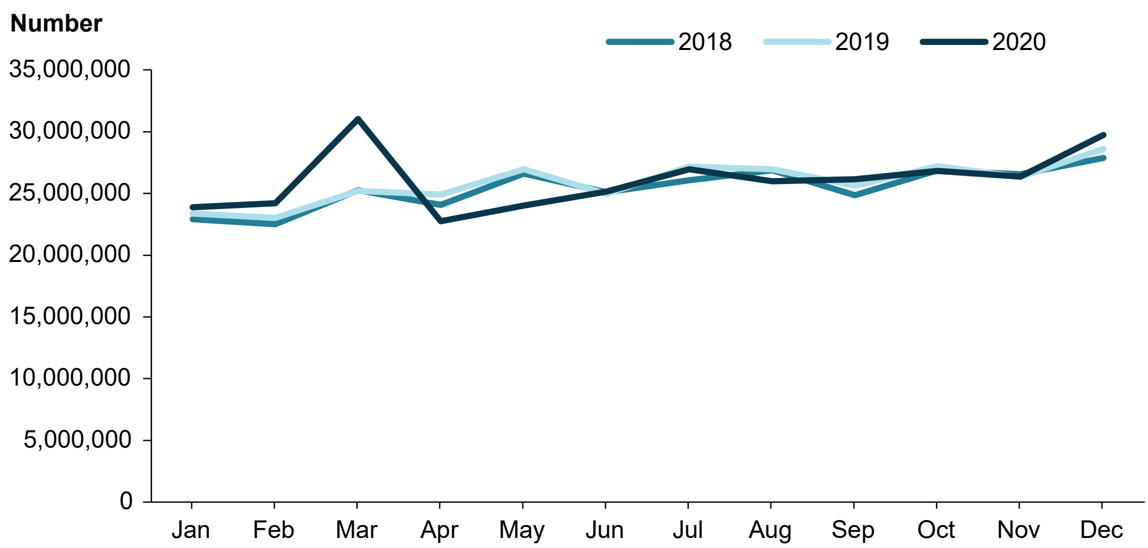
Supply of medicines

The majority of prescription medications used by Australians are provided under the Pharmaceutical Benefits Scheme (PBS). Data collected as part of the PBS correspond to prescriptions filled and dispensed under the scheme. Therefore, they provide information on the supply of medicines rather than use.

A range of measures were introduced at the start of the COVID-19 epidemic, aiming to ensure that patients could access the medications they needed. These included the temporary COVID-19 Home Medicines Service (delivery of medicines), more flexibility in the way doctors and pharmacies could prescribe and dispense medications, and measures to minimise stockpiling by patients.

Early in the epidemic in Australia, there was a sharp rise in prescriptions filled in March, followed by a decrease and then a return to pre-pandemic levels in June (Figure 4.11). This suggests people filled prescriptions earlier than they normally would in case there was a disruption during the shutdown period. In March 2020 the spike in the number of prescriptions filled resulted in a 23% increase compared with March 2019. The dips in April and May represented 8.7% and 11% decreases compared with 2019. Over the whole of 2020, there was a 0.9% increase in prescriptions compared with 2019.

Figure 4.11: Prescriptions dispensed through the PBS, 2018 to 2020

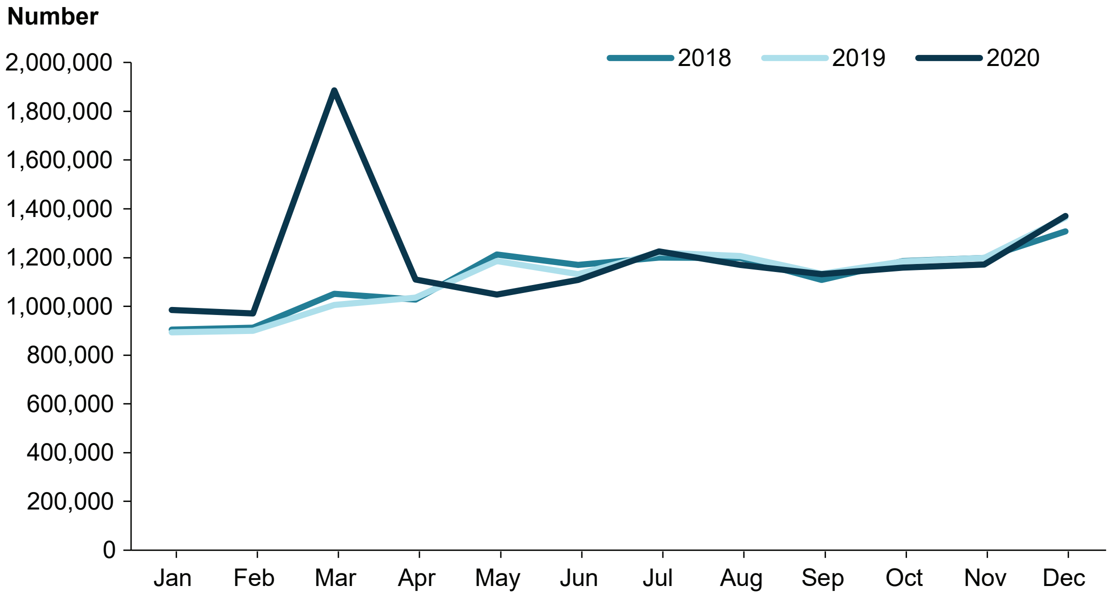


Source: AIHW analysis of PBS data maintained by the Australian Government Department of Health.

The group of medicines with the largest increase was those used to treat respiratory conditions, such as asthma and chronic obstructive pulmonary disease (Figure 4.12). The rise in March 2020 was 87% on the March 2019 level. In contrast to the situation for all prescriptions described above, the increase in medications for respiratory conditions resulted in an overall 92% increase for January–March 2020 compared with 13% in 2019 (AIHW analysis 2021). There was a similar rise in respiratory-related prescriptions after the spread of bushfire smoke during the 2019–20 bushfires (AIHW 2020a). Note that over-the-counter medications are not included in these figures.

Note that the pattern of prescriptions for mental health medications is described in the mental health section below.

Figure 4.12: Prescriptions dispensed through the PBS for respiratory medications, 2018 to 2020



Source: AIHW analysis of PBS data maintained by the Australian Government Department of Health.

Focus on chronic disease management

Of particular interest was whether people with chronic conditions received the care they needed during the disruption caused by the COVID-19 pandemic. People with chronic conditions are at greater risk of severe disease if they contract the COVID-19 virus (Department of Health 2021e; Ssentongo et al. 2020), making it more important that their conditions are well managed during this time. It is also possible that, because of this risk, people with chronic conditions may have avoided face-to-face medical care during the pandemic.

Medicare-subsidised GP services for chronic conditions management provide some information on this topic (see Box 4.1 for more information). While these specific services are not the only way people with chronic conditions access care, any adverse changes in the use of these services would be cause for concern.

Box 4.1: Medicare chronic conditions items

Chronic Disease Management (CDM) items are GP services on the Medicare Benefits Schedule (MBS) and are available to people with a chronic or terminal medical condition. Under these items, a chronic medical condition is defined as one that has been or is likely to be present for 6 months or longer (Department of Health 2014a).

CDM items cover the coordination, creation and review of several care planning tools.

General Practitioner Management Plan (GPMP)

A GP Management Plan (GPMP) can help people with chronic medical conditions by providing an organised approach to care (Department of Health 2014b). It is a plan of action agreed between a patient and their GP, and identifies the patient's health and care needs, sets out the services to be provided by the GP, and lists the actions the patient can take to help manage their condition.

Team Care Arrangements (TCAs)

Patients with complex care needs requiring multidisciplinary care are eligible for Team Care Arrangements (TCAs). These aim to more effectively coordinate the care needed from a patient's GP and other health or care providers.

TCAs provide Medicare-subsidised care from selected allied health care providers for individual treatment services, such as physiotherapy, podiatry, dietetics, mental health services and occupational therapy.

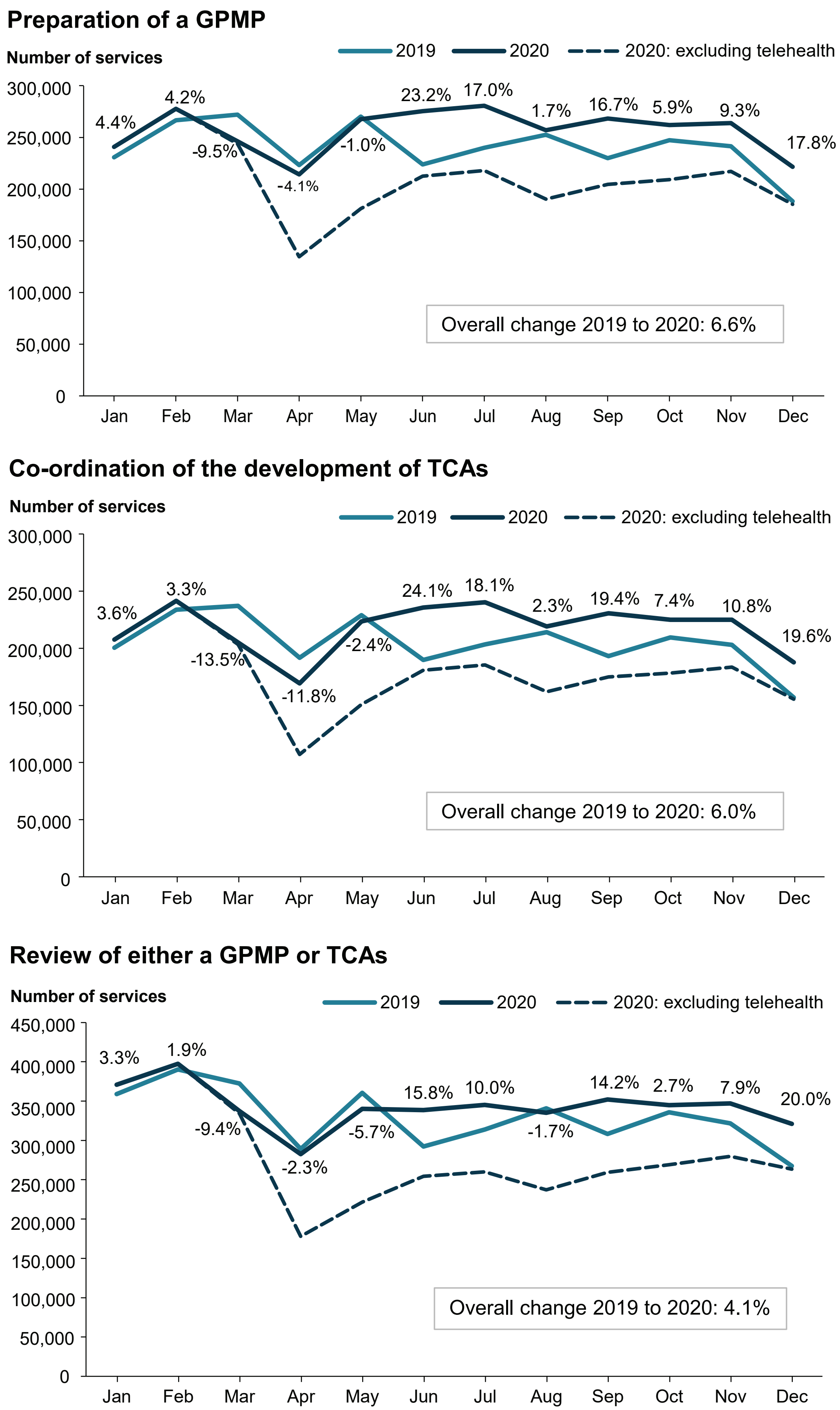
Review of GPMPs and TCAs

It is recommended that plans be regularly reviewed by the GP and patient. A review involves checking that a patient's goals are being met through the plan, and provides an opportunity to make any adjustments needed.

Data for 3 types of chronic disease management all showed similar patterns—some falls in services at the start of the pandemic in 2020, followed by recovery to somewhat above expected levels of use, resulting in higher use in 2020 overall compared with 2019 (Figure 4.13):

- As the baseline, they all had higher numbers of claims in the early months of 2020 compared with the same months in 2019: from around 2% to 6% higher. These increases could reflect aspects such as increases in the size of the population at risk of chronic conditions and more comprehensive care.
- Falls in the number of claims occurred in March and April 2020. In March 2020, the number of claims was 9.5% lower for the preparation of a GP management plan, 14% lower for coordination of the development of Team Care Arrangements, and 9.4% lower for review of either of these.
- Following this, there was a return to more usual levels for these items, with higher than expected use for preparation of a GP management plan and coordination of the development of Team Care Arrangements from June to December 2020.
- Overall, these Medicare items had higher use in 2020 than in 2019—between 4.1% and 6.6% higher.
- Telehealth services made a large contribution to maintaining the levels of care for people with chronic conditions (Figure 4.13). For example without telehealth, services for review of care arrangements would have been 16% lower in 2020 compared with 2019.

Figure 4.13: Medicare-subsidised services for chronic disease management, 2019 and 2020



Notes: GPMP: general practice management plan; TCA: team care arrangement. MBS item numbers included: 721, 229, 723, 230, 732, 233, 92024, 92068, 92025, 92069, 92028, 92072.

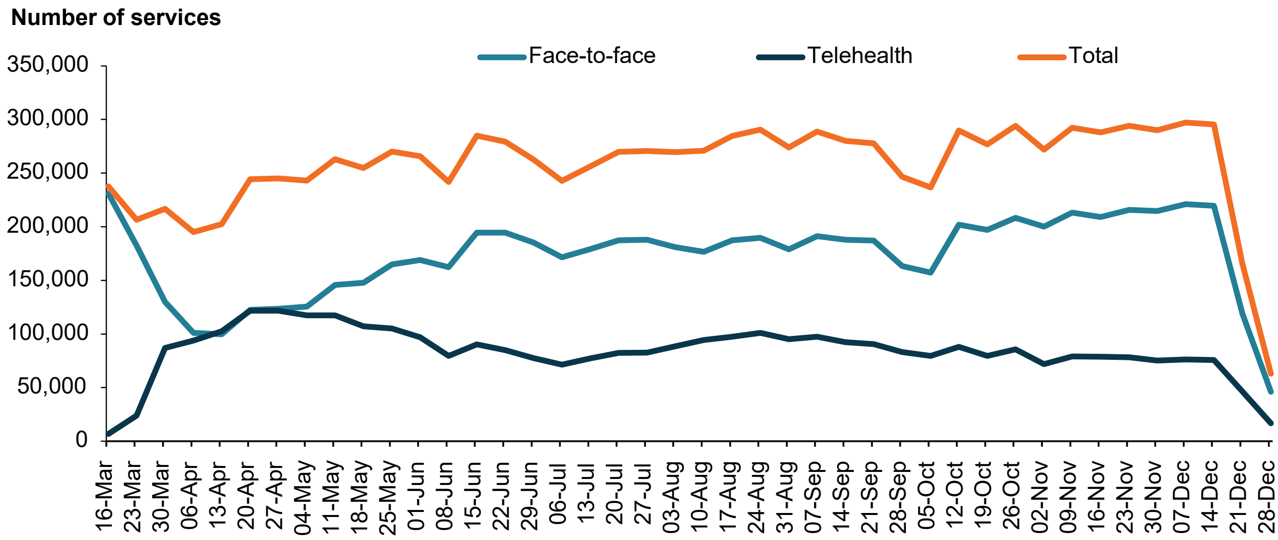
Source: MBS online data at Services Australia.

Focus on mental health services

As mentioned in the 'Mental health' section in Chapter 3, the COVID-19 pandemic has had negative effects on mental health for some Australians, particularly young people. Because potential negative effects on mental health were foreshadowed as a risk of the shutdowns needed to control the spread of the virus, Australian governments introduced a range of specific mental health measures (AIHW 2021f). These included additional service capacity (for example, helpline funding) and additional Medicare-subsidised psychological therapy sessions. The telehealth measures introduced in March 2020 described above were also important for mental health services.

Potentially reflecting both the increased need for and increased availability of services, usage has increased for a range a mental health services since late March 2020 when the restrictions started to be introduced. Between March and mid-December 2020, there was a steady increase in the number of Medicare-subsidised mental health-specific services processed (Figure 4.14). For example, the number of services for the 4 week period 31 August to 27 September 2020 was 14.5% higher than for the 4 weeks from 2–29 September 2019. There was substantial use of telehealth services, accounting for about 1 in 3 services between mid-March and mid-December 2020, with a peak of nearly 51% of services in the week beginning 13 April 2020.

Figure 4.14: Number of MBS mental health services processed by mode of delivery

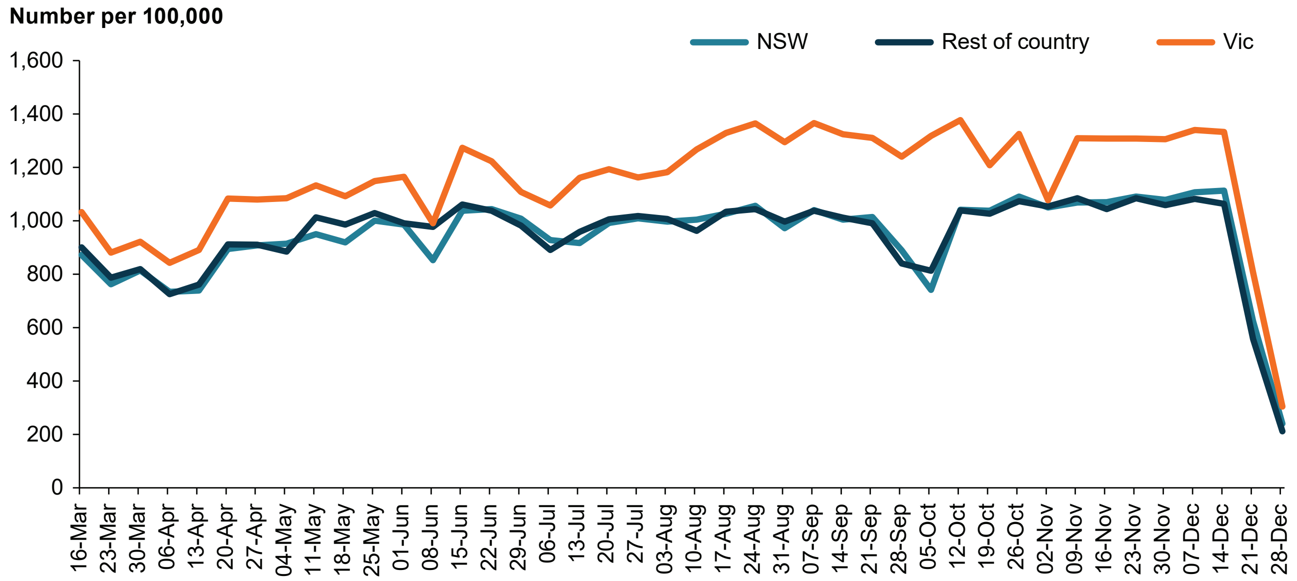


Note: The drop in service numbers in late December 2020 is similar to that observed for the same time period in previous years and reflects less service use during the Christmas holiday period.

Source: Medicare Benefits Schedule data.

Victoria had higher population rates of MBS-subsidised mental health services than NSW and the (combined) rest of the country prior to and for the whole period from March to December 2020 (Figure 4.15). Victoria's rate also increased notably through July and August while the rates in the rest of the country remained relatively stable—likely reflecting the continued restrictions in Victoria during the second wave there.

Figure 4.15: Number of MBS mental health services processed per 100,000 population, by jurisdiction



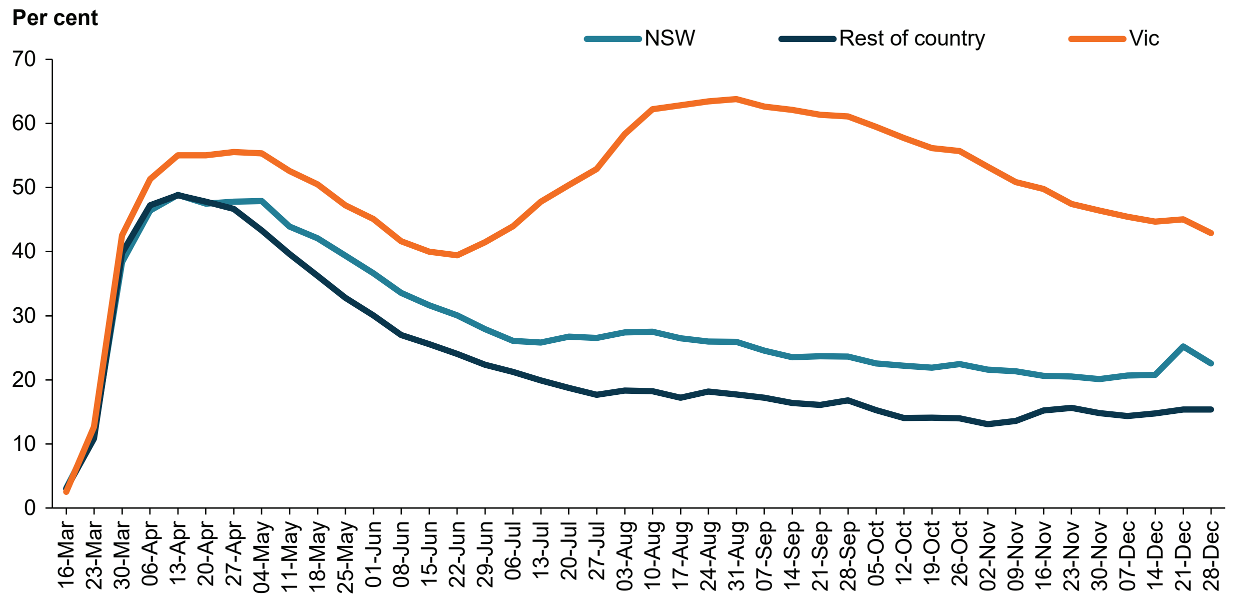
Notes

1. Rest of country refers to MBS services identified as having been delivered for people usually residing in Qld, WA, SA, Tas, ACT and NT.
2. Rates are based on estimated resident populations as at 30 June 2020.

Source: Medicare Benefits Schedule data.

The use of telehealth services also followed a different pattern in Victoria from in the rest of the country (Figure 4.16). Victoria's initial increase in the proportion of services being delivered via telehealth reached a higher peak than in NSW and the rest of the country. There was also another period of increase in Victoria, with a higher peak, corresponding to its second wave. During August and September 2020 the proportion in Victoria reached over 60% before falling to around 40% by the end of the year, substantially higher than in NSW (at a little over 20%). The spike for NSW in December 2020 corresponds to the period of restrictions in the Northern Beaches in Sydney.

Figure 4.16: Proportion (per cent) of MBS mental health services provided via telehealth by jurisdiction

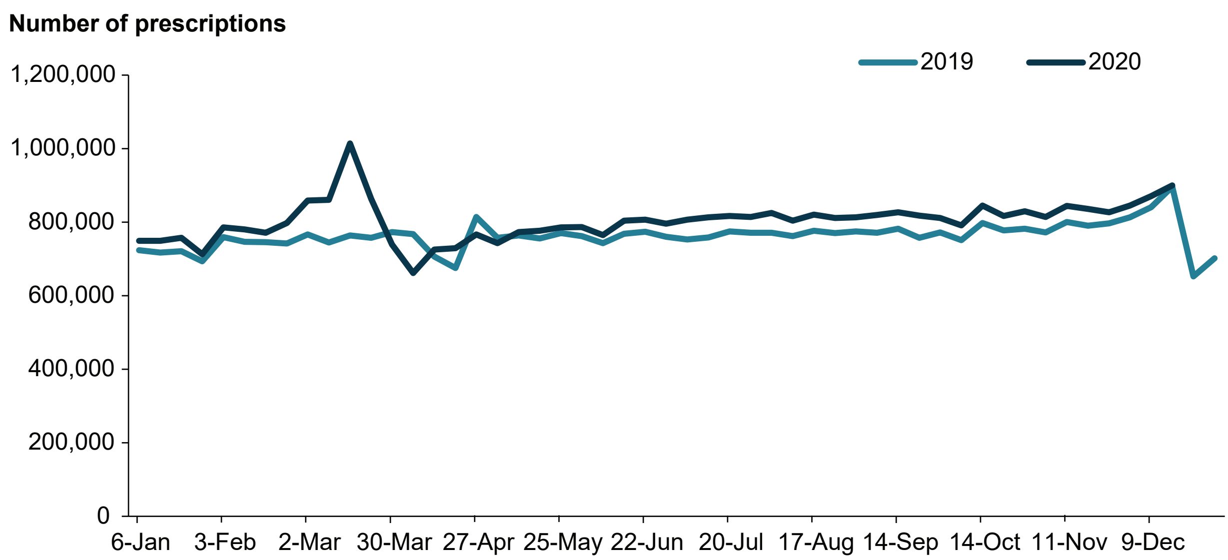


Note: Rest of country refers to MBS services identified as having been delivered for people usually residing in Qld, WA, SA, Tas, ACT and NT.

Source: Medicare Benefits Schedule data.

The number of mental health-related prescriptions dispensed under the PBS was also higher than expected during the pandemic compared to previous years. Similar to overall number of PBS prescriptions filled described earlier in this chapter, there was a spike in mental health prescriptions in March 2020—roughly one-fifth more than in March 2019—followed by a drop in the number. By May the number had increased again to above 2019 levels, and remained there until mid-December 2020 (Figure 4.17).

Figure 4.17: Number of PBS mental health-related prescriptions dispensed



Note: Mental health-related prescriptions include medications labelled as antidepressants; antipsychotics; anxiolytics; hypnotics and sedatives; and psychostimulants, agents used for ADHD and nootropics.

Source: PBS/RPBS data maintained by the Department of Health and sourced from Services Australia.

Focus on cancer screening

Screening for cancer aims to detect cancers early, either by detecting precancerous signs (to stop the cancer developing in the first place) or by detecting cancers when they are small (increasing treatment options and improving survival prospects). There are 3 national cancer screening programs (breast, cervical and bowel), and people diagnosed through these programs generally have better survival outcomes than those diagnosed when their cancers become symptomatic (AIHW 2018).

This section presents data on patterns of screening under the 3 national programs (AIHW 2020b, 2021b). Breast cancer screening was the only one of these programs that was temporarily suspended during the early days of the pandemic in Australia—from late March 2020—with resumption in late April/early May for many BreastScreen services. Box 4.2 provides some further background on these programs and the measures put in place during 2020.

Box 4.2: Australia's 3 national cancer screening programs and operational changes during 2020

BreastScreen Australia provides screening mammograms delivered in specialised facilities involving close contact between clients and health workers. Services were suspended from late March to late April/early May 2020 to protect clients and staff from the COVID-19 virus. BreastScreen services remained open during Victoria's second wave.

The **National Cervical Screening Program** involves a test usually carried out by a person's GP. While there was no suspension of the National Cervical Screening Program, and GP services continued during the pandemic, cervical screening does require in-person consultation.

The National Bowel Cancer Screening Program involves free home test kits, sent to eligible participants. There was no suspension of the National Bowel Cancer Screening Program. People do not need to leave their homes to complete the test, or to get their results, but do need to mail their completed test kit to the pathology laboratory.

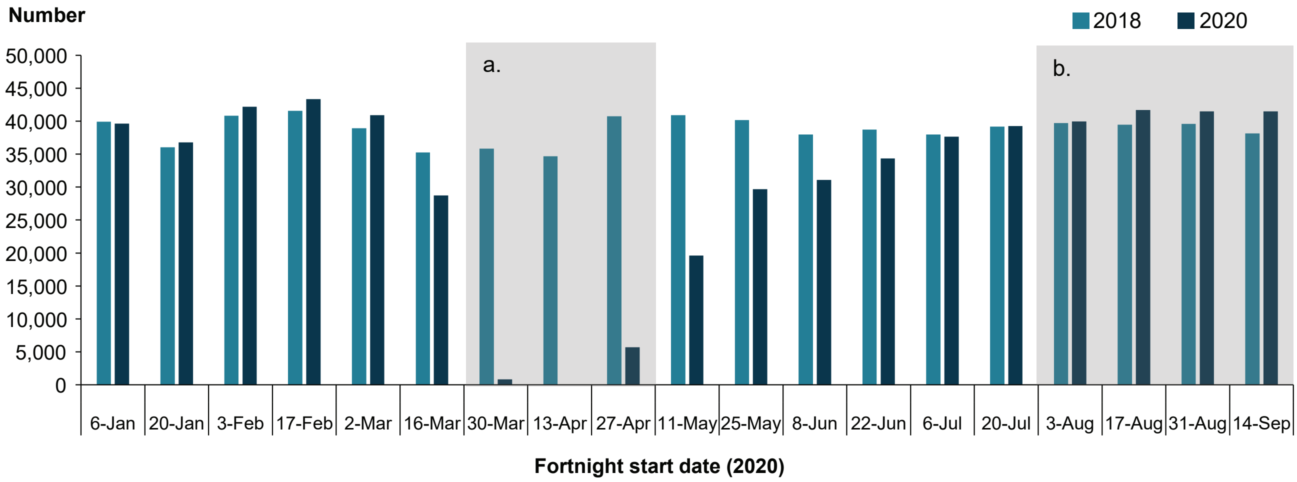
The long-term effects of any reduction in screening will not be known for some time, and thus it is important to continue to monitor the effects of the changing situation.

Breast screening

There was a large decline in the number of screening mammograms conducted through BreastScreen Australia during the tighter restrictions that included a suspension of all BreastScreen services, from 70,000 in March 2020 to just over 1,100 in April for women aged 50–74. From January to June 2020 there were 145,000 fewer screening mammograms than in the same period in 2018 (2018 was chosen as the comparison year as this is a 2-yearly program) (Figure 4.18). The number of screening mammograms increased as restrictions were eased (which was done in stages and varied somewhat due to different jurisdictional physical distancing and infection control measures). During the 3 months from July to September 2020 there were 12,000 more mammograms preformed than in the same period in 2018.

Over the period January to June 2020, Medicare-subsidised services for breast cancer investigations and surgeries showed a similar pattern to that for screening mammograms (Cancer Australia 2020).

Figure 4.18: Number of screening mammograms through BreastScreen Australia



Notes

1. As screening through BreastScreen is biennial, 2020 data are compared to 2018 data (not 2019 data).
2. Data show the number of screening mammograms performed in each fortnight. Date on x axis corresponds to the first date of the fortnight in 2020.
3. Shading labelled 'a.' refers to the period of tightened restrictions during Australia's 'first wave'; shading labelled 'b.' refers to the period of tightened restrictions in Victoria during the 'second wave'.
4. Data were extracted from state and territory BreastScreen registers and provided to the AIHW in November 2020. Data in this report are considered preliminary, and may differ from data sourced at a different time.

Source: Australian Institute of Health and Welfare analysis of state and territory BreastScreen register data; AIHW2020b.

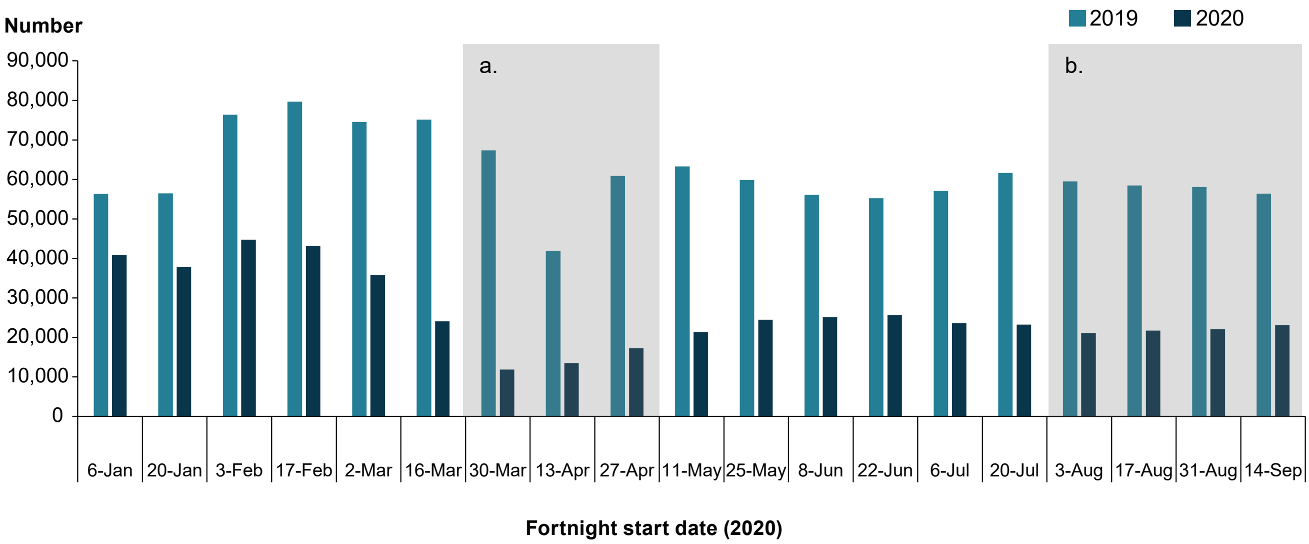
Unlike during the first wave when services were suspended, screening mammograms were available through BreastScreen services during Victoria's second wave. Analysis of the number of screening mammograms in Victoria during this time shows that there appeared to be only a minimal effect, if any, of the second wave on the number of screening mammograms performed in Victoria (AIHW 2020b, 2021b).

Cervical screening

Due to changes to the National Cervical Screening Program, the number of new Cervical Screening Tests conducted was expected to be lower in 2020 than in 2019, irrespective of the COVID-19 pandemic and subsequent restrictions. This is largely due to the program changing from 2-yearly Pap tests to 5-yearly Cervical Screening Tests (as modelled in Smith et al. 2016). This makes it inappropriate to compare directly 2020 data and 2019 data, although 2019 data are useful to show the changing pattern across the year (for example, fewer tests around Easter).

As expected, there were fewer cervical screening tests in 2020 than in 2019 (Figure 4.19). There was a reduction in the number of cervical screening tests in the second half of March 2020; the number then increased again in May and June, and had largely levelled off in July to September. The impact of COVID-19 cannot be quantified without further years of data (as 2020 is the first year affected by the transition to 5-yearly screening) (AIHW 2020b; AIHW 2021b).

Figure 4.19: Number of cervical screening tests



Notes

1. The number of tests conducted was expected to be lower in 2020 than in 2019 irrespective of the COVID-19 pandemic and subsequent restrictions due to a change from 2-yearly to 5-yearly screens.
2. Data show the number of cervical screening tests performed in each fortnight. Date on x axis corresponds to the first date of the fortnight in 2020.
3. Shading labelled 'a.' refers to the period of tightened restrictions during Australia's first wave; shading labelled 'b.' refers to the period of tightened restrictions in Victoria during the second wave.
4. Data were extracted from the National Cancer Screening Register in November 2020. Data in this report are considered preliminary, and may differ from data sourced at a different time.

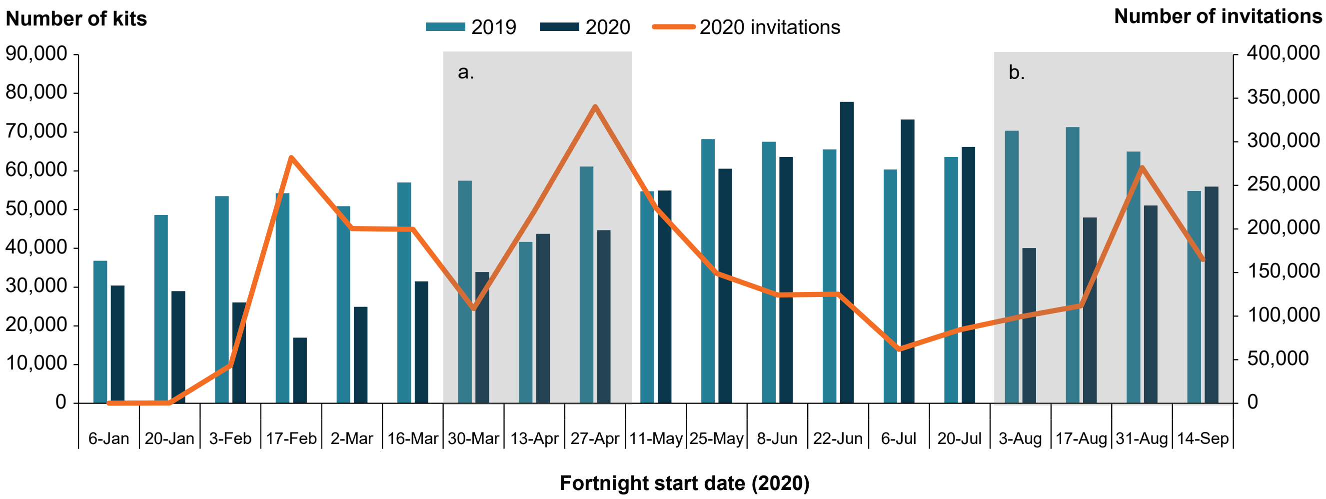
Source: Australian Institute of Health and Welfare analysis of National Cancer Screening Register data; AIHW2020b.

Bowel cancer screening

People are invited to take a free bowel screening test every 2 years if they are in the target age range of 50 to 74. However, there are fluctuations in how many kits are sent at different times of the year, due to factors such as transport times and weather (which can affect the quality of the sample sent in for testing). This subsequently affects the number of kits returned each month. The National Bowel Cancer Screening Program has also broadened its target age groups in recent years, and in early 2020 finalised the process of increasing the frequency of screening. These factors make it difficult to disentangle any effects of COVID-19.

No clear patterns directly correlating with the COVID-19 pandemic can be seen from these data (Figure 4.20). The number of screening tests returned was, at times, lower in 2020 than in 2019, but there may have been other factors behind this.

Figure 4.20: Number of bowel screening tests



Notes

1. Data show the number of iFOBT kits performed in each fortnight (vertical bars) and the number of invitations sent each fortnight (line). Date on x axis corresponds to the first date of the fortnight in 2020.
2. Shading labelled 'a.' refers to the period of tightened restrictions during Australia's first wave; shading labelled 'b.' refers to the period of tightened restrictions in Victoria during the second wave.
3. Data were extracted from the National Cancer Screening Register in November 2020. Data in this report are considered preliminary, and may differ from data sourced at a different time.

Source: Australian Institute of Health and Welfare analysis of National Cancer Screening Register data; AIHW 2020b.

Colonoscopy and sigmoidoscopy procedures subsidised through Medicare declined markedly in April and May 2020; however, colorectal surgeries remained at similar levels to those of 2019 (Cancer Australia 2020).

5

COVID-19 impact on social determinants of health

Summary: 5 COVID-19 impact on social determinants of health

Income and employment

- For the 12 months to February 2021, 21% of people surveyed said their household finances had worsened; 16% said they had improved.
- Average after-tax household income fell 9.1% between February and April 2020, followed by little further change until August 2020. By November 2020 it had increased and was almost back to the February 2020 level. These increases did not continue and by April 2021, average household income was still 7.2% lower than February 2020 levels.
- In April 2020, 20% of people in the labour force were either unemployed or underemployed (those working who wanted more hours). After this, the underutilisation rate declined and by June 2021 it was 12.8%, lower than late 2019 levels.
- Unemployment increased from 5.1% in February 2020 to a peak of 7.5% in July 2020. It returned to pre-pandemic levels by May 2021, and by June 2021 it was lower (4.9%).
- By June 2021, employment was higher than before the pandemic (1.2% higher than March 2020).
- A number of government support programs were put in place during this period—notably, the JobKeeper subsidy and the Coronavirus Supplement paid to recipients of JobSeeker (unemployment benefit) and a number of other government allowances.
- These payments contributed to reductions in poverty for some groups, such as single parent families (from 20% in February 2020 to 8% in June 2020), but many people did have falls in income. Almost two-thirds (64%) of JobKeeper recipients reported they had reductions in their income.
- The levels of support from these programs is reducing and JobKeeper and the Coronavirus Supplement ended at the end of March 2021.

Education and child care

- In May 2020, 76% of adults with children had kept them home from child care or school due to COVID-19. In September 2020, 35% of households still kept them at home, largely due to the situation in Victoria.
- In November 2020, around half of parents were concerned about their child's learning due to the disruptions from COVID-19, though the vast majority were satisfied with the way their child's education institution handled the COVID-19 situation.

Family and domestic violence

- The potential for increases in family and domestic violence were considered early in the pandemic, due to the widespread social restrictions and resulting economic challenges. These restrictions may also have made it more difficult for people to report incidents or leave the violent situation.
- There is a lack of national data on domestic violence during the COVID-19 pandemic, though several data sources suggest that it has been a growing problem.
- An online survey of 15,000 women found that 5% experienced physical or sexual violence from a current or former cohabiting partner between February and May 2020. For 65% of these women, it was the first time the violence had occurred, or the violence had increased in frequency or severity.

- Data on support services showed increases: a 75% increase in Google searches for domestic violence help during the early months of the epidemic compared with previous years; and a 26% increase in calls to MensLine compared with the previous year.

Child protection

- The pandemic has potentially limited opportunities for child abuse and neglect to be detected and reported, and the added challenges due to the pandemic may have made some children more vulnerable to child abuse and neglect. Data on child protection services provide an insight into patterns and trends of child abuse and neglect.
- From March to September 2020, notifications commonly dropped during the shutdowns in various states and territories, and increased once restrictions eased. Similar falls and increases have previously been observed around school holiday periods, suggesting that the reduced opportunities for schools to report suspected child abuse also occurred during the shutdowns.
- An increase in notifications from schools after April 2020 in 7 jurisdictions with data available was larger than in previous years, suggesting the COVID-19 restrictions may have had an added effect.

Housing

- Between April and May 2020, there was a doubling in the percentage of Australians experiencing housing stress (when housing costs are too high for a household's income), from 7% to 15%.
- A number of temporary initiatives were put in place to assist households in need with their housing costs.
- Around May 2020, lower payments were negotiated by 16% of mortgage holders and 11% of renters, while another 8% and 2% of these groups negotiated a freeze on payments.
- In December 2020, 3% of mortgage holders had the payments reduced and 2% had them frozen in the previous 4 weeks.
- The number of clients using specialist homelessness services remained steady between January and June 2020.
- A number of support policies were implemented by governments during this time, and not all were delivered through specialised homelessness services. It could be that the service data may not indicate the full impact of the epidemic on homelessness.

Indirectly, the various restrictions put in place to control the spread of the virus have had a number of flow-on effects, both health effects (see Chapter 2) and other effects on broader wellbeing. The broader effects include changes in income, employment and education; potential safety issues related to family violence and child abuse; and changes in housing situations. These are collectively termed 'social determinants of health', and are known to influence longer-term health outcomes (AIHW 2020j). Negative social impacts occurring now have highlighted and potentially exacerbated existing inequalities, and have the potential to adversely affect population health in the future.

Income and employment

Income changes

There have been substantial changes in income for many people during the pandemic. Over the 12 months to February 2021, 21% said their household finances had worsened during that period, 16% said they had improved and the remainder said they were unchanged (ABS 2021c). Groups with higher proportions saying their household finances had worsened included people without a job, with a disability or having a long-term health condition.

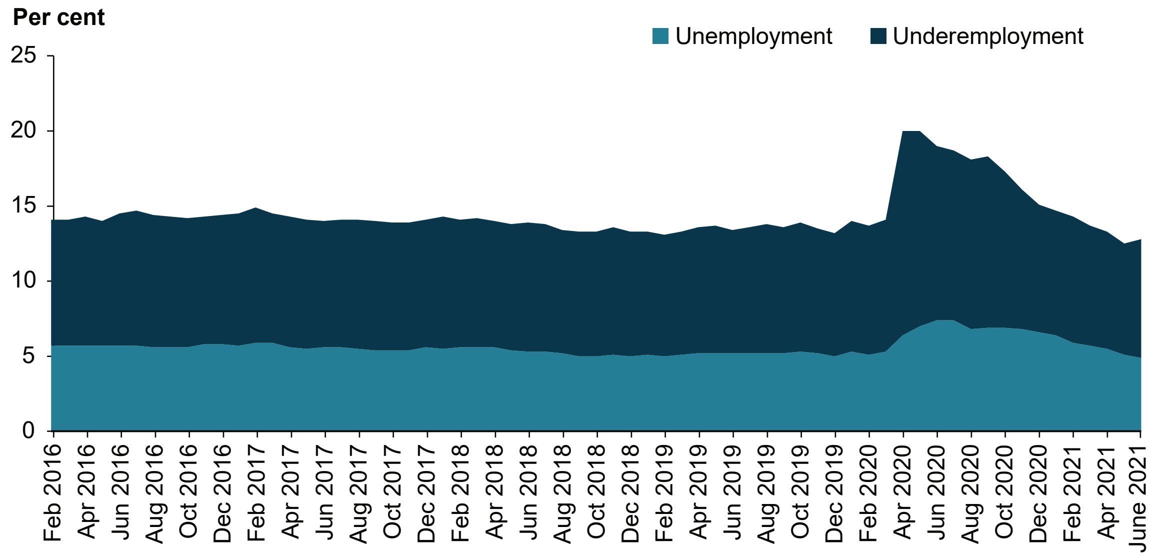
Based on data from the ANUPoll (see Box 3.2), average after-tax household income fell sharply (by 9.1%) between February and April 2020, followed by little further change until August 2020 (Biddle et al. 2020e). However, by November 2020 average household income had increased, and was almost back to the February 2020 levels (Biddle et al. 2020f). These increases did not continue in 2021 and by April 2021, average household income was still 7.2% lower than February 2020 levels (Biddle & Gray 2021).

Labour market changes

There have also been substantial changes to the labour market during the pandemic, largely from the shutdown of non-essential industries. This led to large increases in unemployment and underemployment (those who were working but wanted to work more hours). In addition, many people have had significant changes to their work environment, including large numbers working from home (and supervising schooling at home), and those working in essential services (including health and aged care) having had substantial changes directly due to the virus.

In April and May 2020, 1 in 5 people in the labour force (20%) were either unemployed or underemployed (Figure 5.1), by far the peak underutilisation figure over the period since February 2016. The previous peak was around 15% in February 2017. The underutilisation rate declined after May 2020 and then stabilised by the end of September 2020 at around 18%. By April 2021 it had further declined to 13.3%, similar to the pre-pandemic levels from late 2019, and by June 2021 it was lower than pre-pandemic levels (12.8%). Unemployment increased from 5.1% in February 2020 to a peak of 7.5% in July 2020. By May 2021 it had decreased to the same rate as in February 2020 (5.1%), and by June 2021 it was lower (4.9%). In June 2021, underemployment was also lower than pre-pandemic levels, and employment was higher (1.2% higher than March 2020) (ABS 2021e).

Figure 5.1: Underutilisation rate, February 2016–June 2021



Source: ABS 2021e.

Support programs

To help mitigate the substantial impact on the labour market and resulting incomes, a number of government support programs were put in place, notably the JobKeeper subsidy and the Coronavirus Supplement paid to recipients of JobSeeker (unemployment benefit), and a number of other government payments. The Coronavirus Supplement effectively doubled the total payment made to people receiving unemployment benefits (Whiteford 2020). These schemes concluded at the end of March 2021.

The JobKeeper scheme was, in effect, a wage subsidy for employees of eligible businesses and a support mechanism for the self-employed. In April 2020, the first month of the JobKeeper Payment, around 3.4 million employees received the payment. By July 2020, the number of people in receipt of the payment reached a peak of 3.7 million (AIHW analysis of unpublished data by the ATO). Note that recipients were classified as employed in ABS labour force regardless of the hours they worked (e.g. even if they were stood down).

The number of people receiving JobSeeker Payment doubled between February and May 2020, from 720,000 to 1.46 million. Note that from 20 March 2020, JobSeeker Payment replaced Newstart Allowance as the main income support payment for recipients aged between 22 years to Age Pension qualification age who have capacity to work. Existing Newstart Allowance recipients at this date were transitioned to JobSeeker Payment.

Youth Allowance unemployment recipients also increased, from 86,000 in February 2020 to 171,000 in May 2020. Numbers have fallen in most months since then to May 2021, but are still higher than prior to the COVID-19 pandemic. In May 2021, there were 1.1 million recipients of unemployment payments (JobSeeker Payment and Youth Allowance (other) combined), which is just under 246,300 or 28% higher than in March 2020 (886,200) (DSS 2021). Note that, for most of this period, a number of requirements to receive these payments were waived (such as the assets tests and obligation to actively seek work).

The increase in government support payments, including the introduction of the Coronavirus Supplement and the JobKeeper Payment, contributed to reductions in estimated poverty for some groups, notably single parent families (from 20% in February 2020 to 8% in June 2020) (Phillips et al. 2020). However, a significant proportion of recipients did experience a fall in income: 64% of JobKeeper recipients reported they had reductions in their income (ABS 2020f). The levels of support from these programs is reducing and JobKeeper and the Coronavirus Supplement ended at the end of March 2021; it is expected that there will be increases again in poverty rates.

Education and child care

As noted above, many children were not able to attend child care or school during the various waves of the pandemic. This meant that many parents took on additional child care responsibilities or supervising school work, often while also working at home. Broader economic impacts from the pandemic, such as parent or guardians' job loss; decrease in hours worked; or a shift to remote working may have affected the need or capacity to enrol or send children to a preschool program provider.

In May 2020, 76% of adults with children had kept them home from child care or school due to COVID-19 (ABS 2020d). In September 2020, 35% of households still kept their children at home due to COVD-19 (ABS 2020g). This was largely due to the situation in Victoria, with many child care centres and schools closed and 83% of households keeping their children at home. In New South Wales, the figure was 21%.

Earlier in the pandemic (in May 2020), over half of parents with school-aged children at home said their children were having difficulties concentrating while learning from home (ABS 2020d). This is reinforced by survey data from November 2020: around half of parents were concerned about their child's learning due to the disruptions from COVID-19 (13% very concerned and 37% somewhat concerned (Biddle et al. 2020c). However, the vast majority were satisfied with the way their child's education institution handled the COVID-19 situation (48% very satisfied and 40% somewhat satisfied). These satisfaction levels are higher than in the United States where the same questions were asked (25% very satisfied; 44% somewhat satisfied (Biddle et al. 2020c).

Family and domestic violence

Since early in the pandemic, the potential for increases in family and domestic violence were considered, due to the widespread social restrictions and resulting economic challenges. These restrictions may also have made it more difficult for people experiencing violence to report the incidents or leave the violent situation.

It is challenging to obtain comprehensive data on the extent of family, domestic and sexual violence. There are inherent challenges in measurement—the incidents frequently occur behind closed doors, and can be concealed or denied by perpetrators and sometimes by the victims. Data sources can include only incidents that have been disclosed by individuals or recorded by relevant authorities (ABS 2017).

Despite the lack of national data on domestic violence during the COVID-19 pandemic, several data sources suggest that it has been a growing problem. An online survey of 15,000 women found that 4.6% experienced physical or sexual violence from a current or former cohabiting partner between February and May 2020 (Boxall et al. 2020). For 65% of these women, it was the first time the violence had occurred, or the violence had increased in frequency or severity since February. From the same survey, 5.8% of all women were subject to coercive control (experiencing 3 or more forms of emotionally abusive, harassing and controlling behaviours), and in 55% of cases it was first-time abuse or it had worsened since February. Over a third (37%) of women who experienced physical/sexual violence or coercive control wanted to seek help but did not on at least 1 occasion (due to safety concerns). More than half (58%) who experienced both physical/sexual violence and coercive control wanted to seek help but did not on at least 1 occasion (Boxall et al. 2020).

Data on support services also show an increase in demand, though a mix of factors may be driving these patterns, including increased availability and awareness of services and/or a potential increase in incidents. There was a:

- 75% increase in Google searches for family and domestic violence help during the very early months of the epidemic compared with the average over the previous 5 years (Prime Minister of Australia 2020; ABC News 2020a)
- 26% increase in calls to MensLine compared with the previous year (ABC News 2020a).

Lastly, domestic violence support services in New South Wales, Victoria and Queensland have reported increases in client numbers; the frequency and severity of violence; first-time violence; and the complexity of client needs (Carrington et al. 2021, Pfitzner et al. 2020; Women's Legal Service Queensland 2020; Women's Safety NSW 2020). There were also reports of abusers using COVID-19 as a reason for violence, including limiting contact with others, and anger due to income or job losses. These reports of changes in demand come from a range of sources, however patterns of service use are likely to vary across sectors and geographical areas. There is also some evidence from specialist service workers in New South Wales that demand did not diminish after restrictions eased (Foster et al. 2020).

Child protection

Child protection services aim to protect children from abuse and neglect in family settings. As is the case for family and domestic violence, it is difficult to collect comprehensive data on the prevalence of child abuse and neglect in the community. Data on child protection services provide an insight into patterns and trends of notified child abuse and neglect. Suspicions about child abuse or neglect are often reported by schools, child care centres, and other people or services children regularly come into contact with. These reports are known as 'notifications' of suspected child abuse and neglect. The COVID-19 pandemic has potentially limited opportunities for child abuse and neglect to be detected and reported. In addition, the added challenges due to the pandemic may have made some children more vulnerable to child abuse and neglect and previous crises have shown higher child abuse reports during those times (Curtis et al. 2000; Meadows et al. 2015; Risso-Gill & Finnegan 2015).

Data for March to September 2020 (covering the first wave of restrictions in Australia and part of the second wave in Victoria) showed that notifications commonly dropped during the COVID-19 shutdowns, and increased once restrictions eased (AIHW 2021d). However, the number of notifications varied considerably across the period, both month to month and across states and territories.

A commonly observed pattern is for notifications to fall during school holidays and rise again once school resumes as school personnel are a common source of notifications—the second highest (19%) in 2019–20 after police (22%) (AIHW 2021c). The increase in notifications from schools after April 2020 in all 7 jurisdictions with data available was larger than in previous years, suggesting the COVID-19 restrictions may have had an added effect (AIHW 2021d). The remote learning implemented in many jurisdictions meant that children may have been less visible to school staff for longer periods than usual. There was also a second drop in notifications in Victoria between July and September 2020, coinciding with school closures there. Similar patterns have been found in other parts of the world, such as in New York City (Rapoport et al. 2020).

The total number of notifications from March to August 2020 was higher in some jurisdictions (New South Wales, Queensland, South Australia, Northern Territory) compared with the same period in 2019, lower in others (Western Australia and the Australian Capital Territory) and similar in Victoria (AIHW 2021d). However, some increases follow a pattern of increasing numbers over recent years (such as in New South Wales), thought to be related to increased awareness of child protection issues and improvements in reporting processes.

Housing

For many Australians, housing costs such as mortgage or rent payments are one of the largest components of household spending. As such, many of those households whose income was affected during the COVID-19 pandemic experienced increased difficulty in making these regular payments.

Between April and May 2020, there was a doubling in the percentage of Australians who were not able to pay their rent or mortgage on time, from 7% to 15% (Biddle et al. 2020b). This was higher among renters (27%) than mortgage holders (17%). And among renters, it was higher among low-income renters (40%) than those on higher incomes (10%).

A number of initiatives were put in place to assist households in need with their housing costs. In the early stages of the pandemic (around May 2020), lower payments were negotiated by 16% of mortgage holders and 11% of renters, while another 8% and 2% of these groups negotiated a freeze on payments (Biddle et al. 2020b). These initiatives were temporary, and many people would have returned to normal payments. In December 2020, 3% of mortgage holders had the payments reduced and 2% had them frozen in the previous 4 weeks (ABS 2021b). For renters, 2% had their payments reduced and 2% had them deferred or they were in arrears, in the last 4 weeks.

The number of clients using specialist homelessness services remained steady between January and June 2020, and this was the case for particular client groups including children under 18 and clients who have experienced family and domestic violence (AIHW 2020k). Client numbers were similar to the same period in 2019. While the numbers were steady, a number of support policies were implemented by governments during this time. As not all of these were delivered through specialised homelessness services, it could be that the homelessness service data may not indicate the full extent of the epidemic on homelessness.

6

Data development

6 Data development

Data are playing an essential part in the response to the COVID-19 pandemic and have been collected and used in new ways as countries try to contain the spread of the SARS-CoV-2 virus. This chapter outlines innovative ways data are being collected and used in Australia, including viral genomic sequence data to identify links between cases, wastewater testing to identify potential undetected sites of transmission and the use of digital technology to assist with contact tracing to prevent ongoing transmission. As the pandemic progresses it is also important to collect, analyse and report on data from COVID-19 cases to monitor their long-term health outcomes, and health service use. Large data sets will also be needed to monitor the rollout of COVID-19 vaccines to the Australian population.

Innovative use of data during the pandemic

Genomic sequencing data

Genomic sequencing of pathogens such as viruses has increasingly become an important part of the effective investigation of infectious disease outbreaks (Armstrong et al. 2019). The sequencing of the SARS-CoV-2 virus during the pandemic has been an important tool in the public health response in Australia, allowing clusters of cases to be identified and identifying links between cases that had no known epidemiological links (Rockett et al. 2020; Seemann et al. 2020). Other countries, such as New Zealand, have used information from genomic sequencing to inform their public health response and assist with minimising the transmission of the virus in the community (Geoghegan et al. 2020).

As the COVID-19 pandemic has progressed genomic sequencing of the virus has been essential to track changes in the virus and identify variants of interest/concern—described in the 'Disease characteristics' section in Chapter 1. As the global rollout of vaccines takes place, data on the SARS-CoV-2 genomic sequence will continue to be vital for monitoring changes to the virus that could decrease the effectiveness of the currently available vaccines.

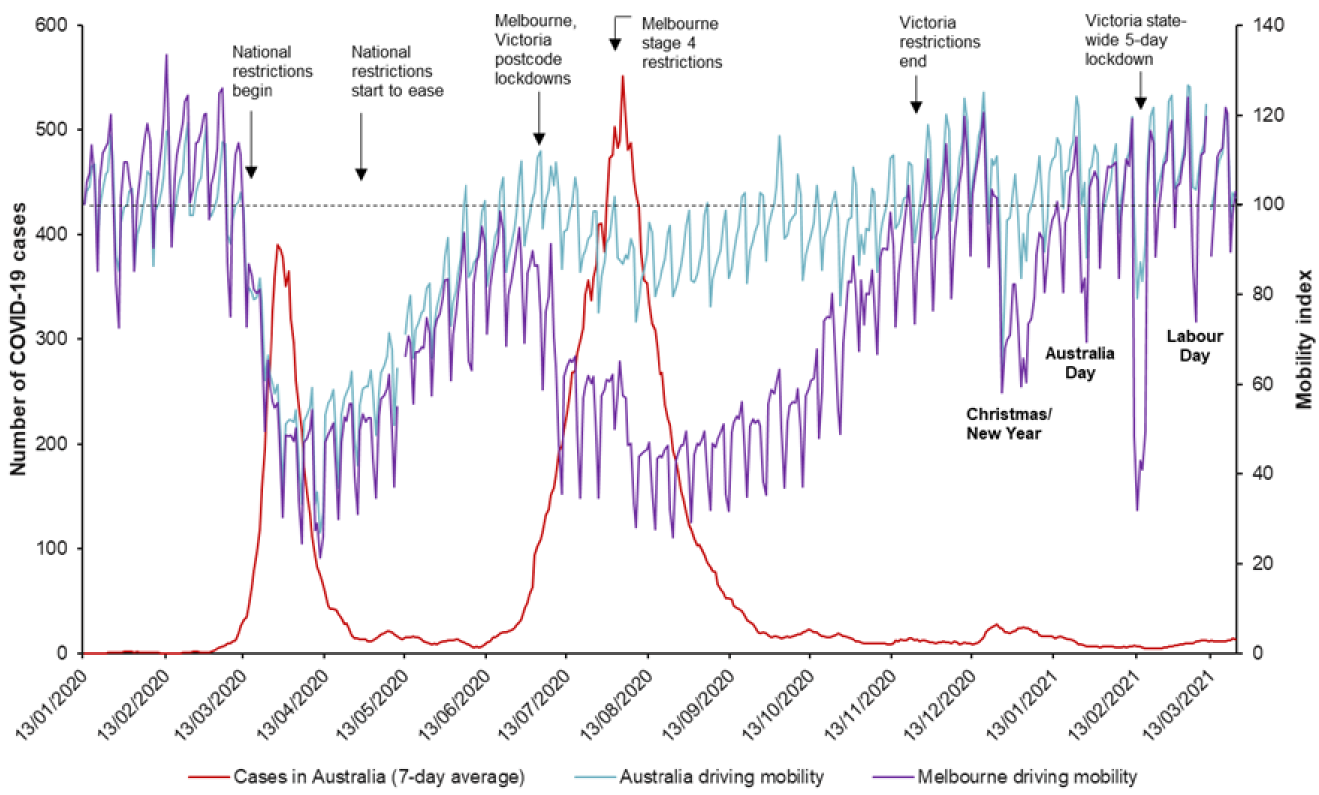
Wastewater testing data

Detection of pathogens in wastewater (sewage) can be a useful tool for the surveillance of infectious diseases in the community and has been used in the past to detect diseases such as polio. Early in the pandemic, it was established that the SARS-CoV-2 virus could be detected in faecal samples from patients, indicating that detection of the virus in wastewater could be a useful way of monitoring for COVID-19 cases in the community (Larsen & Wigginton 2020). A number of jurisdictions in Australia monitor wastewater samples for the virus and use it as an early warning surveillance system for potential cases in the community (Premier of Victoria 2020). Water Research Australia has established the Collaboration on Sewage Surveillance of SARS-CoV-2 Project to integrate reliable results of sewage testing for the SARS-CoV-2 virus with health data for COVID-19 at the national level (Water Research Australia 2021). Wastewater surveillance can be used in conjunction with other public health interventions and messaging to encourage people to remain alert for symptoms and present for testing to minimise undetected community transmission (Farkas et al. 2020).

Mobile phone data

Data from mobile phones has continued to be used throughout the pandemic to monitor the movement of populations and track how they respond and recover from public health interventions, such as movement restrictions and lockdowns (Adams et al. 2020). Figure 6.1 shows the number of COVID-19 cases in Australia overlaid with mobility data for driving for both Australia and Melbourne. During the national restrictions in March/April 2020, the mobility index for driving declined substantially in both Melbourne and Australia, before recovering towards the baseline in June. During the second wave of cases in 2020, the driving mobility index declined more for Melbourne than Australia as a whole as strict public health restrictions were implemented in Victoria to reduce COVID-19 transmission in the community. There was an additional decline in driving mobility in Melbourne in February 2021 when a 5-day shutdown was introduced in Victoria following community spread of cases after transmission of the virus in hotel quarantine.

Figure 6.1: Number of COVID-19 cases in Australia and Apple mobility index for driving in Australia and Melbourne, 13 January 2020 to 21 March 2021



Note: The mobility data represent daily changes in requests for directions in Apple Maps by transportation type (driving), compared to a baseline volume on 13 January 2020. The baseline is shown as a dotted line at 100. No data were available for 11 and 12 May 2020.

Sources: Apple Mobility Trends https://www.apple.com/covid19/mobility; WHO.

Aggregated mobility data can be a useful tool to monitor public health interventions in response to COVID-19 outbreaks (Zachreson et al. 2021).

Some governments have also developed and introduced mobile phone applications to enable people to record their movements, which can help with contact tracing when there are COVID-19 cases in the community (Lewis 2020; O'Connell & O'Keeffe 2021). In Australia, each state and territory has developed a check-in application which records the location and date/time the person was at the location. The information is stored for a short period to assist with contact tracing if required. When integrated with contact tracing systems these tools can improve the contact tracing process and make it easier to identify contacts and cases (Grantz et al. 2020).

COVID-19 register

This report highlights the substantial individual, health system and broader social and economic impacts of COVID-19 in Australia. Emerging evidence of longer-term effects of COVID-19 presents the need for ongoing monitoring of health outcomes and health system use by people who have had a diagnosis of COVID-19.

Collection of data on specific populations, such as those with 'long COVID' (see section on post-COVID-19 syndrome in Chapter 2 for more detail), or those with pre-existing conditions, is vital to informing the community about potential risk factors, and enabling health systems to manage these cases. There is also a need to monitor the COVID-19 vaccines being provided to the Australian population, in terms of effectiveness against disease, in particular, severe impacts leading to hospitalisation or death, effectiveness against different COVID-19 strains, and monitoring the health outcomes of people who contract COVID-19 despite being vaccinated. An efficient way to measure these outcomes, and answer other COVID-19-related questions at the population level, is to use the information contained in large-scale health data sets.

Disease registers

Disease registers collect information about specific diseases, which can aid population health through increased knowledge about disease patterns. Other important purposes include providing information to enhance patient care and advance scientific and clinical knowledge (Rankin & Best 2014). Disease registers contain records at the person level, are population-based (thus contain records of all individuals within the defined scope, in contrast to other data sources which may contain a subset), and are ongoing (AIHW 2001).

Internationally, a number of disease-specific registers have been set up to collect information on COVID-19. Examples include CAPACITY-COVID—a European-based register for investigating the role of cardiovascular disease in COVID-19 (Linschoten & Asselbergs 2020), and the American Heart Association COVID-19 Cardiovascular Disease Registry (American Heart Association 2021). Denmark has established the Danish COVID-19 Cohort, of all Danish residents who have, or have had, a COVID-19 test (with a positive or negative result) (Pottegard et al. 2020). Linkage of the cohort to the existing administrative and health care data (such as primary care and hospital usage, prescribing patterns, and employment as a health care professional) provides a comprehensive range of information for epidemiological purposes, with complete national coverage.

Towards an Australian COVID-19 Register and linked data set

People in Australia who are eligible for Medicare are able to access government-funded health care, including hospital care, primary care, allied health care, and pharmaceuticals. The data generated by individuals' interactions with the health care system, through Medicare, and other data, such as records of deaths and private hospital interactions, are collected by the Australian Government and states and territories, and provide a rich source of information on people's access to and use of services. To capitalise on these existing data, the AIHW is working with the CDNA and states and territories to develop a national person-based register and research linked data set of all people who have tested positive for COVID-19 (along with a control group) in Australia since the start of the pandemic.

The COVID-19 Register and linked data set will enable linkage at the national level to administrative data, including MBS, PBS, immunisation, hospitals and aged care data.

The aim of this project is to support current data needs arising from the COVID-19 pandemic, by providing an evidence base for research into the medium and long-term effects of COVID-19. Broad areas of research include:

- epidemiological and statistical research
- service and medication dispensing and patient journeys
- identifying groups or cohorts of interest
- monitoring, evaluation and data quality improvement.

The project also aims to effectively and efficiently fill existing gaps in national surveillance reporting for COVID-19.

Appendix A:
COVID-19 mortality methods

Appendix A: COVID-19 mortality methods

Definition and coding of COVID-19 deaths

A death directly due to COVID-19 is defined by the World Health Organization (WHO) as a death resulting from a clinically compatible illness, in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID disease (for example, trauma). There should be no period of complete recovery from COVID-19 between illness and death (WHO 2020e). In response to the emergence of COVID-19, the WHO issued new emergency codes to be included in the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) and used when coding causes of death due to COVID-19: U07.1 COVID-19 virus identified is used when COVID-19 is confirmed by laboratory testing and U07.2 COVID-19 virus not identified is used for suspected or clinical diagnoses of COVID-19 where testing is not completed or inconclusive. About 99% of COVID-19 deaths in Australia have been confirmed by laboratory testing (ABS 2020a).

Due to the public health importance of COVID-19, the WHO have directed that the new coronavirus strain be recorded as the underlying cause of death, that is, the disease or condition that initiated the train of morbid events, when it is recorded as having caused or contributed to death (WHO 2020e). This means that unlike other causes of death such as dementia and chronic kidney disease, in Australia it is rare for COVID-19 to be coded as an associated cause of death (ABS 2020a).

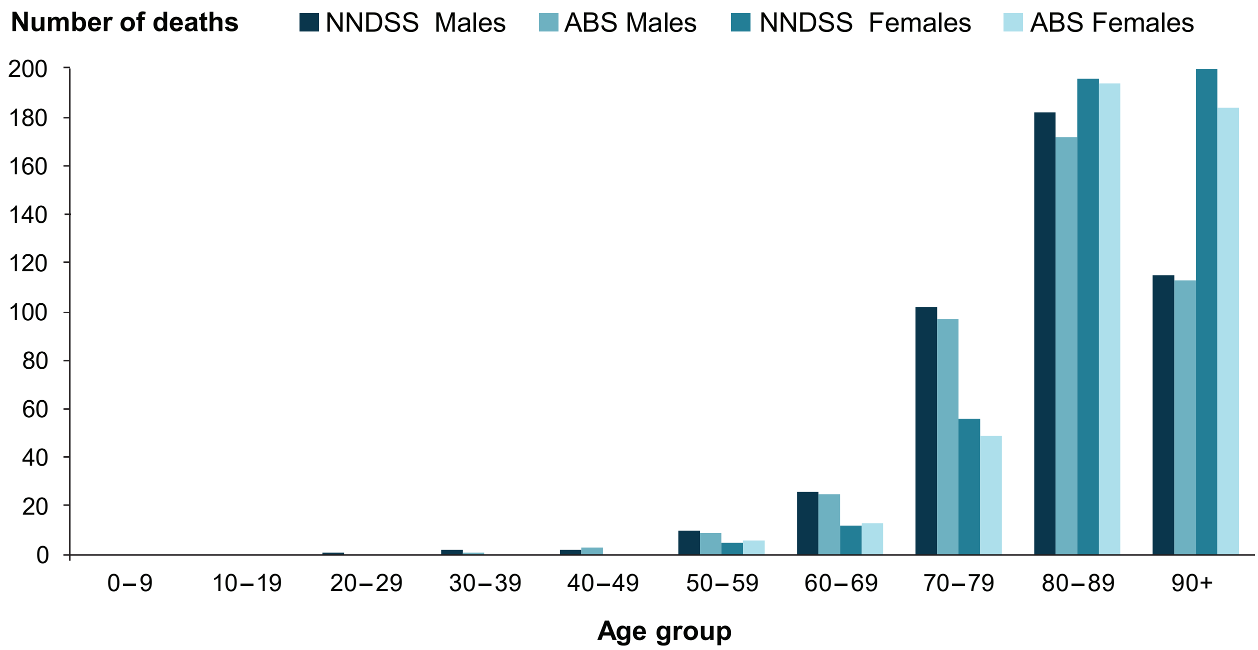
Comparison of COVID-19 deaths data from NNDSS and ABS death registrations

In Australia, information on deaths from COVID-19 is available from two sources. Firstly, it is collected through the National Notifiable Disease Surveillance System (NNDSS) which receives data from the states and territories and provides information on both infections and mortality, and includes basic demographic information about the decedent (for example, age, sex). Secondly it is compiled by the Australian Bureau of Statistics (ABS) based on death registrations processed by the state and territory Registrars of Births, Deaths and Marriages, and information on the cause of death sourced from a Medical Certificate of Cause of Death completed by a certifying practitioner. Death registrations is the official source used for reporting on all deaths in Australia. Mortality data collected from the disease surveillance system and the registration system are not directly comparable.

Both the NNDSS and ABS data sources use the WHO definition of a COVID-19 death. The main differences between them are that it takes longer to get the information from the registration-based system than the surveillance system, and the ABS collection includes additional information on deaths from COVID-19 including more detailed demographic information and associated causes of death; and uses the same methods as for other causes of death and thus are comparable. For deaths reported through state and territory surveillance systems to the NNDSS, it is not possible to differentiate between dying of, or dying with, COVID-19. It is also important to note that in some states and territories such as Tasmania, there is no legislative requirement for hospitals or residential aged care facilities to report COVID-19 deaths to public health authorities. As such, COVID-19 deaths that are reported to the NNDSS should not be considered an official death count.

During 2020 a total of 866 deaths were registered in Australia as due to COVID-19. This was lower than the number of deaths collected through the NNDSS for the same period (909 deaths). NNDSS death numbers were higher than ABS death registration numbers for both males and females and for most age groups (Figure A1). This may be due to a number of reasons. Firstly, it takes longer to get data from the deaths registration system than the NNDSS (registration delays are on average 20–25 days after the death occurs and data are reported to the ABS on average 40–50 days after death), and some deaths take longer to be registered than others. Secondly, a small number of coroner-referred deaths involving COVID-19 may not yet be finalised and provided to the ABS for inclusion in current death registration numbers. Lastly, a small proportion (estimated to be around 2.6%; ABS 2020a) of all deaths involving COVID-19 have the death recorded as an associated cause of death rather than an underlying cause of death, and thus will not be counted in the ABS death registration numbers, but may be included in the NNDSS numbers.

Figure A1: Comparison of number of COVID-19 deaths in Australia, NNDSS notifications data and ABS death registrations data, 2020



Source: Department of Health 2020d and AIHW analysis of ABS Provisional Mortality Statistics: Customised Report.

Associated causes of death

Death registration statistics in Australia are usually reported using the underlying cause of death which refers to the condition or circumstances that initiated the morbid events leading to death. However information is also collected on associated causes of death which are defined as causes that contributed to the death and can be either conditions listed in the causal sequence (the chain of events leading to death), risk factors or pre-existing chronic conditions.

Doctors record the sequence of events leading to death in Part I of the Medical Certificate of Cause of Death (death certificate), specifying at least an underlying cause and where relevant, intermediate causes and the immediate (direct) cause of death. All other significant diseases or conditions that contributed to the death but were not in the direct causal pathway are recorded in Part II. These can include, for example, comorbid chronic diseases, risk factors, and previous history of cancer or other conditions that prevented recovery or overcoming the morbid process leading to death (ABS 2008).

The selection of the underlying cause for doctor-certified deaths is automated (using Iris software since 2013 and Medical Mortality Data System for earlier years) (ABS 2019). The causal sequence reported in Part I of the death certificate is the primary focus of the standardised ICD-10 coding guidelines for selecting the underlying cause of death. The guidelines validate the reported sequence of events leading to death and identifying 1 cause as the underlying cause. Where the sequence is implausible, or a more specified condition is certified in Part II, all conditions on the death certificate (including from Part I and Part II) are re-examined to identify a single underlying cause.

All causes contributing to deaths are processed in accordance with WHO guidelines of the ICD-10.

Data included in this report on associated causes of death for COVID-19 deaths are sourced from ABS provisional mortality statistics which, for COVID-19 deaths, include both GP-certified and coroner-certified deaths.

Appendix B: COVID-19 burden of disease methods

Appendix B: COVID-19 burden of disease methods

Background

The Australian Burden of Disease Study (ABDS) is based at the Australian Institute of Health and Welfare, and is funded by the Australian Government Department of Health. The most recent published estimates are for the reference year 2015, providing estimates for 216 diseases/injuries and 38 risk factors in Australia, at the national level and for various population groups (AIHW 2019a). Details on the methods used to calculate burden of disease in the Australian study are in the AIHW report Australian Burden of Disease Study: methods and supplementary material 2015 (AIHW 2019b). Work is under way to produce burden of disease estimates for 2018.

It is important to note that only the direct effects of the COVID-19 pandemic are included in this analysis. Any indirect effects (such as the effects of shutdowns and job losses) can be viewed as a risk factor for ill health, and could potentially be analysed as risk factors in future burden of disease analysis.

Methods for constructing COVID-19 burden of disease estimates have been produced by international experts, and these are used as the starting point for the Australian estimates, largely drawing on the development work produced by the European Burden of Disease Network (EBDN) (EBDN 2020; Wyper et al. 2021), but also taking into account information available on methods used in the Korean Burden of Disease Study and the Global Burden of Disease Study.

Data on COVID-19 are improving over time and, while the best data available at the time of analysis have been used, the data are expected to continue to improve in the future (such as through the use of data linkage).

This is a single disease (for COVID-19 only) burden of disease analysis, in contrast to the full ABDS which provides estimates for essentially all diseases. As such, the usual technical comorbidity adjustment applied in the ABDS is not used in these initial COVID-19 estimates. The methods used here to estimate the burden of COVID-19 are intended to be incorporated into future ABDS studies that cover years from 2020 onwards.

Case definition

A person is classed as having had COVID-19 (and therefore in scope of this analysis) if they tested positive for the SARS-CoV-2 virus using Australian-approved testing methods (laboratory definitive evidence most commonly from a PCR test of a nasopharyngeal swab). This essentially matches the requirements to be in scope of the proposed data collections listed below as data sources for this analysis.

Fatal burden

The methods for calculating the fatal burden are straightforward, as they use the usual methods in the ABDS. The Global Burden of Disease (GBD) 2010 reference life table for the remaining life expectancy is used to calculate the years lost due to dying from COVID-19. Some secondary calculations using the current Australian life table are also made.

The input data required for this component of the analysis is the number of COVID-19 deaths, by sex and broad age group. These data are sourced from ABS provisional death registrations data. These data do not contain cases referred for coroner investigation (see Appendix A for further information). Only deaths with an underlying cause of COVID-19 are included to match the standard approach for burden of disease studies.

Non-fatal burden

Conceptual model

The conceptual model for COVID-19 is shown in Figure 2.15, which is the consensus model being used by the European Burden of Disease Network. This model defines the severity categories used to calculate the non-fatal burden. Important components for our analysis include:

- Asymptomatic cases: given Australia's high testing rates, and the inclusion of some proportion of asymptomatic cases in the official case counts (for example, if someone is tested as part of contact tracing), an estimate of the proportion of cases that were asymptomatic is needed. The model currently uses figures from a meta-analysis (Byambasuren et al. 2020) which showed that 17% of cases were truly asymptomatic (for example, excludes pre-symptomatic cases). Australian-specific data could not be found.
- Mild/moderate cases: these cases correspond to those not requiring hospitalisation to treat their disease. It is noted that some cases in Australia were hospitalised to maintain strict isolation rather than because of the severity of their disease, but it is likely that this proportion was low during the main outbreaks making the overall proportion small; however the actual proportion could not be estimated for this analysis.
- Severe cases: these correspond to those hospitalised to treat their disease, but not requiring admission to Intensive Care Units (ICUs).
- Critical cases: these correspond to people who were treated in ICUs.
- Post-acute consequences: these correspond to cases with post COVID-19 syndrome (which includes 'long COVID-19'). While evidence is still emerging on this, estimates have been made based on the United Kingdom survey run by the Office for National Statistics (ONS 2021) which is described in the 'Severity' section in Chapter 2 of this report.
- The permanent functional impairment component has not been incorporated due to lack of evidence at this stage (more elapsed time is needed to understand these potential consequences).
- The death component is covered above in the 'Fatal burden' section.

We are largely able to measure the number of people in each category directly (detailed below).

Model parameters: disability weights and disease durations

The 'disability weights' reflect the severity of the disease, and correspond to a 'health state' that describes the average experience for people in that severity level. As is the usual approach in the ABDS, the use of GBD disability weights has been prioritised. However, 1 extra disability weight (for critical cases) has also been included, sourced from the European disability weight survey (Haagsma et al. 2015), as no corresponding disability weight is available from the GBD study. The disability weights that have been used are outlined in Table B1, drawn from EBDN 2020. Note that is the usual practice in burden of disease analysis for asymptomatic cases not to receive a disability weight.

Table B1: Proposed health states and corresponding disability weights for COVID-19 analysis

Health state type	Severity level	Health state	Disability weight
Acute infectious disease	Asymptomatic	Has infection but experiences no symptoms	Nil
	Mild/moderate	Has a fever and aches, and feels weak, which causes some difficulty with daily activities	0.051
	Severe	Has a high fever and pain, and feels very weak, which causes great difficulty with daily activities	0.133
	Critical	Intensive care unit admission	0.655
Chronic infectious disease	Post-acute consequences	Is always tired and easily upset, the person feels pain all over the body and is depressed.	0.219

Source: EBDN 2020.

The average duration parameter for mild/moderate cases used by the Robert Koch Institute in Germany is used: 14 days (Rommel et al. 2021).

The duration parameters for severe and critical cases are based on empirical data on average length of stay from the National Hospital Morbidity Database. Median length of stay data by age group and sex were smoothed, with the resulting estimates used in the analysis shown in Table B2. Hospitalisations without an ICU admission are used for severe cases, and those with ICU admission for critical cases. As hospitalisation usually occurs later in the illness, the 14-day duration for mild/moderate cases was added to these lengths of stay in hospital to produce the durations used in the model. These compare with overall durations from the German study of 21 and 32 days for the severe and critical groups, respectively.

The average duration parameter used for post-acute consequences is 91 days, corresponding to a quarter of a year. This is a broad assumption as data are not yet available on the full trajectory for people with long COVID.

Table B2: Smoothed median length of stay in hospital (days), January–June 2020

	Hospitalisation without ICU admission		Hospitalisation with ICU admission	
Age group	Males	Females	Males	Females
0–9	3.5	3.8	0.0	0.7
10–19	7.4	7.2	2.2	2.4
20–29	8.0	7.9	5.3	3.3
30–39	8.0	7.9	9.5	6.6
40–49	8.4	7.8	14.0	11.8
50–59	8.8	7.8	17.6	16.7
60–69	8.8	7.9	19.4	18.1
70–79	8.8	8.9	18.3	14.5
80–89	11.3	12.9	13.4	6.5
90+	19.5	21.5	5.4	0.2

Source: AIHW analysis of NHMD data.

Data sources

Broadly, the number of incident cases in each severity category is required for the model. National data have been used in most cases.

The data need to reflect the full coverage of cases, adjusted for any under-ascertainment. Given Australia's very high testing rates and comprehensive contact tracing/testing, it is likely that case numbers are close to complete, unlike the situation in many other countries (Wyper et al. 2021). Further, it is also assumed that there would be virtually no under-ascertainment among the severe and critical groups as it is unlikely that people requiring hospitalisation do not receive that care in Australia. Those admitted to hospital would almost certainly have been tested for SARS-CoV-2 if there was any chance they had contracted it. There is the possibility that some under-ascertainment occurred in the mild/moderate group, but it is thought to be relatively low in Australia. Given the lower severity (and hence lower contribution per case to the disease burden) in the mild/moderate group, and the likely small number of missed cases, no adjustment for under-ascertainment has been made.

Asymptomatic cases

We attempted to source Australian data on the number of asymptomatic cases, but none could be found. We have therefore used the figure from the meta-analysis mentioned above (Byambasuren et al. 2020) to define this proportion. While it is expected that Australia's thorough testing and contact tracing would have found many asymptomatic cases, it is possible that in some periods of the pandemic, some asymptomatic cases were missed.

Mild/moderate cases

This is calculated as the total number of cases, notified in the daily reports from the states and territories to the Australian Government described below, minus asymptomatic cases and minus cases admitted to hospital. It was not possible to incorporate an adjustment to reflect hospital admissions that were for isolation rather than treatment of more severe disease. However, these numbers were not very large compared with the number admitted for treatment.

Severe cases

This is calculated as the number of cases admitted to hospital minus those admitted to ICU. These data have been sourced from the AIHW National Hospital Morbidity Database (NHMD) for the period January–June 2020 (described further in the Hospitalised cases section in Chapter 2). The NHMD contains data on all hospitalisations in Australia. Adjustments were required to adjust the episode-based data to reflect the total proportion of COVID-19 cases admitted to hospital in Australia in 2020, which is estimated to be 12.5% (COVID-19 NIRST 2021b), and then the age/sex specific proportions for January–June 2020 were applied to data for the whole year.

Critical cases

Similarly to severe cases, data have been sourced from the AIHW NHMD on the number of hospitalisations for COVID-19 involving an ICU admission for the period January–June 2020 . The corresponding age/sex specific proportion of cases were then applied to the case numbers for the whole year. An adjustment was also required to account for deaths in older ages that were not recorded as being admitted to ICU even though they died. This could have been because they received end-of-life care in general hospital wards or in nursing homes, rather than in ICUs. For 70–79 year age group, the critical case number was taken to be the number of deaths, and the balance was removed from the severe category. For the 80–89 and 90+ age groups, the critical case number was taken to be the number of deaths, and 50% of the balance was removed from the severe category and 50% from the mild/moderate group. This is a conservative approach, as there were also a number of people in these age groups admitted to ICU who did not die.

Post-acute consequences (long COVID)

Assumptions on the number of people with long COVID use data from the ONS survey in England/Wales (see 'Severity' section in Chapter 2). This had an overall prevalence of 13.7%. Available figures by age group were smoothed to provide data for the age groups used in this analysis. The prevalence proportions were then adjusted down to include only the 60.6% of people with some limitation to their daily activities due to their symptoms.

Appendix C: WHO region analysis

Appendix C: WHO region analysis

Table C1: Countries included in the WHO region analysis in Figure 2.24

European Region	African Region	Region of the Americas	Western Pacific Region	Eastern Mediterranean Region	South-East Asian Region
Albania	Algeria	Antigua and Barbuda	American Samoa	Afghanistan	Bangladesh
Andorra	Angola	Argentina	Australia	Bahrain	Bhutan
Armenia	Benin	Aruba	Brunei Darussalam	Djibouti	India
Austria	Botswana	Bahamas, The	Cambodia	Egypt, Arab Rep.	Indonesia
Azerbaijan	Burkina Faso	Barbados	China	Iran, Islamic Rep.	Maldives
Belarus	Burundi	Belize	Fiji	Iraq	Myanmar
Belgium	Cabo Verde	Bermuda	French Polynesia	Jordan	Nepal
Bosnia and Herzegovina	Cameroon	Bolivia	Guam	Kuwait	Sri Lanka
Bulgaria	Central African Republic	Brazil	Japan	Lebanon	Thailand
Croatia	Chad	British Virgin Islands	Kiribati	Libya	Timor-Leste
Cyprus	Comoros	Canada	Korea, Rep.	Morocco	
Czech Republic	Congo, Dem. Rep.	Cayman Islands	Lao PDR	Oman	
Denmark	Congo, Rep.	Chile	Malaysia	Pakistan	
Estonia	Cote d'Ivoire	Colombia	Marshall Islands	Qatar	
Faroe Islands	Equatorial Guinea	Costa Rica	Mongolia	Saudi Arabia	
Finland	Eswatini	Cuba	Nauru	Somalia	
France	Ethiopia	Curacao	New Caledonia	Sudan	
Georgia	Gabon	Dominica	New Zealand	Syrian Arab Republic	
Germany	Gambia, The	Dominican Republic	Palau	Tunisia	
Gibraltar	Ghana	Ecuador	Papua New Guinea	United Arab Emirates	
Greece	Guinea	El Salvador	Philippines	Yemen, Rep.	
Greenland	Guinea-Bissau	Grenada	Samoa		
Hungary	Kenya	Guatemala	Singapore		
Iceland	Lesotho	Guyana	Solomon Islands		
Ireland	Liberia	Haiti	Tonga		
Isle of Man	Madagascar	Honduras	Tuvalu		
Israel	Malawi	Jamaica	Vanuatu		
Italy	Mali	Mexico	Vietnam		
Kazakhstan	Mauritania	Nicaragua			
Kosovo	Mauritius	Panama			
Kyrgyz Republic	Mozambique	Paraguay			

European Region	African Region	Region of the Americas	Western Pacific Region	Eastern Mediterranean Region	South-East Asian Region
Latvia	Namibia	Peru			
Liechtenstein	Niger	Puerto Rico			
Lithuania	Nigeria	Suriname			
Luxembourg	Rwanda	Trinidad and Tobago			
Malta	Sao Tome and Principe	Turks and Caicos Islands			
Moldova	Senegal	United States			
Monaco	Seychelles	Uruguay			
Montenegro	Sierra Leone	Venezuela, RB			
Netherlands	South Africa				
North Macedonia	South Sudan				
Norway	Tanzania				
Poland	Togo				
Portugal	Uganda				
Romania	Zambia				
Russian Federation	Zimbabwe				
San Marino					
Serbia					
Slovak Republic					
Slovenia					
Spain					
Sweden					
Switzerland					
Tajikistan					
Turkey					
Turkmenistan					
Ukraine					
United Kingdom					
Uzbekistan					

Note: Countries excluded include Anguilla, Bonaire, Cook Islands, Democratic People's Republic of Korea, Eritrea, Falkland Islands (Malvinas), French Guiana, Guadeloupe, Guernsey, Holy See, Jersey, Martinique, Mayotte, Micronesia (Federated States of), Montserrat, Niue, Northern Mariana Islands (Commonwealth of the), Pitcairn Islands, Réunion, Saba, Saint Barthélemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Sint Eustatius, Sint Maarten, Tokelau, United States Virgin Islands, Wallis and Futuna, occupied Palestinian territory, including east Jerusalem.

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Abbreviations

ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ALSWH	Australian Longitudinal Study on Women's Health
AUSMAT	Australian Medical Assistance Teams
ATAGI	Australian Technical Advisory Group on Immunisation
CDM	Chronic Disease Management
CDNA	Communicable Diseases Network Australia
CHD	Coronary heart disease
COVAX	COVID-19 Vaccines Global Access facility
COVID-19	Coronavirus disease 2019
DALY	Disability-adjusted life year
EBDN	European Burden of Disease Network
GBD	Global Burden of Disease Study
GP	General practice
GPMP	GP Management Plan
HIV	Human Immunodeficiency virus
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10th Revision
ICU	Intensive Care Unit
IRSD	Index of Relative Socio-economic Disadvantage
LE	Life expectancy
MBS	Medicare Benefits Schedule
MERS	Middle East Respiratory Syndrome
mRNA	Messenger Ribonucleic Acid
NHMD	National Hospital Morbidity Database
NNDSS	National Notifiable Diseases Surveillance System
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economic Co-operation and Development
PBS	Pharmaceutical Benefits Scheme

PHLN	Public Health Laboratories Network
PPE	Personal Protective Equipment
Qld	Queensland
SA	South Australia
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus-2
Tas	Tasmania
TCA	Team Care Arrangements
TGA	Therapeutic Goods Administration
Vic	Victoria
VITT	Vaccine-induced thrombotic thrombocytopenia
WA	Western Australia
WHO	World Health Organization
YLD	Years lived with disability
YLL	Years of life lost

Glossary

antibodies: Protein components of the immune system that circulate in the blood, recognising foreign substances like bacteria and viruses, and neutralising them.

asymptomatic: Showing no symptoms of a particular disease.

coronary heart disease: A disease due to blockages in the heart's own (coronary) arteries, expressed as angina or a heart attack. Also known as ischaemic heart disease.

general practitioner (GP): A medical practitioner who provides primary comprehensive and continuing care to patients and their families in the community.

herd immunity: The indirect protection from an **infectious disease** that happens when a population is immune either through **vaccination** or immunity developed through previous infection.

human immunodeficiency virus (HIV): A virus that damages the immune system and makes it harder for a person to fight infection. There is no cure for HIV but there are treatments available to stop its progression.

immunisation: A procedure designed to induce immunity against infection by using an antigen to stimulate the body to produce its own **antibodies**.

infectious disease: Disease or illness caused by infectious organisms or their toxic products. The disease may be passed directly or indirectly to humans through contact with other humans, animals or other environments where the organism is found. Also referred to as a communicable disease.

influenza (flu): An acute contagious viral respiratory infection marked by fever, fatigue, cough, muscle aches, headache and sore throat.

immunisation: A procedure designed to induce immunity against infection by using an antigen to stimulate the body to produce its own antibodies. See also **vaccination**.

immunity: The ability of an organism to resist a particular infection or toxin by the action of specific **antibodies** or sensitised white blood cells.

isolation: Separation of sick people with an **infectious disease** from people who are not sick.

notifiable disease: A group of communicable diseases that are reported to state and territory health departments, as required by legislation. The information enables public health responses and the monitoring of disease activity.

platelets: Small cells in the blood that form clots to stop bleeding.

presenteeism: People coming to work when they are unwell.

quarantine: Separation and restriction of the movement of people who were exposed to an infectious disease to see if they become sick.

telehealth: Health services delivered using information and communication technologies, such as videoconferencing.

transmission: Transmission of infectious agents. Any mechanism by which an infectious agent is spread from a source or reservoir to another person.

vaccine: A product that stimulates a person's immune system to produce **immunity** to a specific disease, protecting the person from that disease.

vaccine effectiveness: Measures how well a vaccine works when given to people in the community outside of clinical trials.

vaccination: The process of administering a vaccine to a person to produce **immunity** against infection. See also **immunisation**.

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Related publications

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This report looks at the direct and indirect health effects of COVID-19 in Australia. It includes information on case numbers, deaths and burden of disease as well as the impact on other diseases, health services, changes in health behaviours and social determinants. By 20 June 2021, there had been just over 30,000 cases and 910 deaths from COVID-19 in Australia. Some groups in the population were more affected than others.

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