Australian Bureau of Statistics

AUSTRALIAN BUREAU OF STATISTICS SUBMISSION

To the Senate Committee on Community Affairs References: Inquiry into Excess Mortality

May 2024

Introduction

The Australian Bureau of Statistics (ABS) welcomes the opportunity to make a submission to the Senate Community Affairs References Committee inquiry into Excess Mortality.

The ABS is Australia's national statistical agency. The ABS' purpose is to inform Australia's important decisions by delivering relevant, trusted, and objective data, statistics and insights.

The ABS produces official mortality statistics. This includes reporting excess mortality estimates and information on deaths due to COVID-19. The ABS publishes:

- *Deaths, Australia* (annually)
- *Causes of Death, Australia* (annually)
- Information on Life Expectancy and Estimated Resident Population (published in *National, State and Territory Population* quarterly)
- Reports designed to provide timely information on deaths since the start of the pandemic, including the Provisional Mortality Series (covered in this submission).

ABS data on deaths is based on death registrations reported by the Registries of Births, Deaths and Marriages (RBDMs) in each state and territory. There are other, separate, systems which also report on deaths including the National Notifiable Disease Surveillance System (NNDSS). The NNDSS is administered by the Australian Government Department of Health and Aged Care. Every day the state and territory health authorities advise the department of new cases of notifiable diseases. The NNDSS was used for daily counts of deaths from COVID-19 during earlier stages of the pandemic.

ABS reporting of mortality during the pandemic

This section will address the Inquiry terms of reference part (a)(i), 'Australian Bureau of Statistics (ABS) data showing excess deaths in recent years, with particular reference to all-cause provisional mortality data reported by the states and territories to the ABS.'

Prior to the pandemic, the key sources of mortality information were the ABS' annual Deaths and Causes of Death, Australia publications. These reports include detailed demographic information (e.g. age, sex) and cause of death for all deaths registered during a calendar year. While very comprehensive, the annual reports did not meet the need for timely insights into patterns of mortality during the pandemic or provide numbers of excess deaths.

The ABS started publishing monthly provisional mortality data in June 2020 to address data gaps in the early stages of the pandemic. These publications were initially part of a suite of reporting changes the ABS implemented to provide more up-to-date information to the community and support the government's response to the pandemic. From 2021-22, the Department of Health and Aged Care provided funding to the ABS to continue provisional mortality reporting in recognition of the importance of this data in monitoring the impacts of the pandemic. In these provisional reports, the ABS publishes death registration data soon after receiving information from the RBDMs. These reports aim to provide early indications of patterns of mortality, rather than fully complete counts of deaths.

The ABS receives about 95% of registrations within three months of a death. With each monthly report, additional deaths may be registered that occurred in a previously reported week or month, increasing counts of deaths. While the ABS does most of its quality

assurance work before publishing provisional data, it may make revisions to some previously reported demographic details or causes of death as part of its ongoing quality assurance.

Provisional mortality data informs the following ABS publications:

1. Provisional Mortality Statistics reports. These provide timely summary mortality data by week and month of death. The ABS publishes information by age, sex, jurisdiction and selected causes of death.

   The monthly Provisional Mortality Statistics publications should not be used as a source of official excess mortality estimates. For publications reporting on data up to the end of 2023, the ABS included analysis comparing the most recently occurring deaths to an average number of deaths occurring previously, referred to as the baseline average. The baseline average is calculated as the average number of deaths occurring in a week over a five-year period. For example, for the first two years of the pandemic, the baseline average was calculated from the weekly number of deaths occurring over 2015-2019. The purpose of the baseline average was to provide a simple picture of how current mortality compared to mortality in recent years.

   At times the monthly provisional data has been mistakenly used as a source of official excess mortality estimates. The ABS publishes the following advice in its Provisional Mortality Statistics reports:

   "While this publication can provide an indication of where counts of deaths are above or below expectations, it does not provide official estimates of excess mortality. Using the number of deaths from the previous years as the predictor for the expected number of deaths does not take into account changes in population size and age-structures of that population, as well as expected improvements in mortality rates over time."

2. COVID-19 Mortality in Australia reports. These include information on COVID-19 associated deaths received up to one month prior to reporting. COVID-19 associated deaths are as recorded on the medical certificate as cause of death. They include deaths caused directly by the virus (deaths 'from' COVID-19) and deaths where a person died 'with' COVID-19 (the person died from a cause other than COVID-19 such as cancer but had COVID-19 certified as a contributing factor). Reports include detailed information on COVID-19 associated deaths in Australia, including whether the virus caused the death or contributed to death, detailed demographic breakdowns (age, sex, country of birth, socio-economic indicators) and details of associated causes of death.

3. Measuring Australia's excess mortality during the COVID-19 pandemic reports. These provide official estimates of excess mortality every six months. The methodology used to produce these excess mortality estimates applies a cyclical linear regression to historical data to produce an expected number of deaths. These estimates account for age-structure, change over time within a population and historical trends. **This publication should be used when reporting on ABS figures of excess mortality.** All excess mortality figures in this submission come from this report.

Defining excess mortality

Excess mortality is the difference between the observed number of deaths in a specified time-period and the expected number of deaths in that period. Historically, excess mortality has been used in a wide range of studies, for example to measure the effects of diseases (e.g. influenza) and natural disasters.

During the COVID-19 pandemic it was recognised internationally that excess mortality estimates could provide a more complete picture of mortality than focusing on deaths due to COVID-19 alone. This is because mortality at the all-cause level can account not only for deaths identified as being due to the virus, but also potentially misclassified or undiagnosed COVID-19 deaths and mortality that may be indirectly related to the pandemic (e.g. relating to social isolation or changed access to health care).

What have the ABS' excess mortality reports during the COVID-19 pandemic been measuring?

A clear understanding of the policy or research question is important to selecting the right statistical tools including the most appropriate data inputs. During the pandemic, the ABS has been answering this question: *'How does the number of deaths which has occurred during the COVID-19 pandemic (2020-2023) compare to the number of deaths expected had the pandemic not occurred?*'. The ABS' excess mortality figures represent the response to this question.

How does the ABS measure excess mortality?

Estimating excess mortality is complex. The estimate of excess mortality is dependent on the expected number of deaths. The expected number of deaths is an estimate, forecast from historical deaths data. The premise is that patterns of mortality in recent years provide an appropriate baseline of what future mortality may look like.

To obtain a robust estimated number of expected deaths, several methodological decisions must be made on the mortality trend (referred to as the baseline), and to account for both the age-structure and size of a population. The ABS made the following methodological decisions:

- Pandemic years were intentionally excluded from the baseline. For example, the low mortality rate recorded in 2020 is likely an indirect effect of the pandemic (given the health measures that were in place) and using this year would mean that the estimated excess deaths would not represent "mortality expected in the absence of a pandemic". The ABS uses data from 2013 to 2019 in its baseline.
- Age-specific rates rather than raw numbers of deaths were modelled to measure expected mortality figures. Australia has an ageing population which means that the number of deaths per year should increase over time. An age-specific rate accounts for the base population as well as the age structure of that population.
- Allowance was made for the trend in decreasing mortality rates over time in Australia due to improvements in health care and interventions. This means while the number of deaths overall increases over time (due to an ageing population), there is a decrease in the age-standardised mortality rate (due to reductions in mortality, particularly in younger to middle-age groups).

- Expected mortality and subsequent excess mortality estimates for Australia and the states and territories were all modelled separately. This meant that the mortality patterns for each jurisdiction could be considered independently, and appropriate adjustments made. For example, many jurisdictions experienced a severe influenza season in 2017 which caused some excess mortality. This excess mortality required some adjustment in the baseline when extrapolating expected mortality for those jurisdictions. These adjustments were not necessary for jurisdictions where no excess mortality was recorded in 2017.

ABS excess mortality estimates

The ABS has produced four reports on excess mortality, with methods being improved over time. The last two reports used the methodology described in the previous section. The most recent report was released in December 2023 and provided excess mortality estimates for 2020, 2021, 2022 and to the end of August 2023. Estimates showed that excess mortality was recorded for 2021 (1.6%), 2022 (11.7%) and 2023 (6.1% until the end of August), with mortality lower than expected for 2020 (-3.1%).

Table 1: Excess mortality by year, Australia, 2020-2023

	Expected deaths (no.)	Observed deaths (no.)	Excess deaths (no.)	Excess deaths (%)	COVID-19 associated deaths(a) (no.)
2020	170,045	164,795	-5,250	-3.1	916
2021	169,048	171,799	2,751	1.6	1,448
2022	170,911	190,856	19,945	11.7	13,287
2023(b)	**112,714**	**119,619**	**6,905**	**6.1**	**4,444**

Source: ABS, *Measuring Australia's excess mortality during the COVID-19 pandemic until the end of August 2023*.

a. COVID-19 associated deaths are as recorded on the medical certificate of cause of death. They include deaths caused directly by the virus and deaths where a person died with COVID-19.
b. Data for 2023 includes deaths that occurred by 27 August and were registered by 31 October 2023.

The ABS produces excess mortality estimates at both the national and state/territory level (see Table 2 below). Estimates for jurisdictions with small numbers of deaths such as the Northern Territory are volatile so care should be taken when using these estimates. The ABS outlines these issues in the commentary and methodology of *Measuring Excess Mortality in Australia During the COVID-19 Pandemic*.

Table 2: Excess mortality as a percentage above expectation by jurisdiction, 2020-2023

	2020	2021	2022	2023(a)
New South Wales	-4.1	0.3	11.5	4.8
Victoria	-0.9	3.7	14.0	7.6
Queensland	-4.3	1.0	10.6	5.9
South Australia	-3.1	0.5	9.9	6.2
Western Australia	-3.9	0.9	7.1	5.5
Tasmania	-3.6	5.6	13.2	12.6
Northern Territory(b)	1.6	6.6	18.4	-2.9
Australian Capital Territory	-4.3	-4.0	10.4	-1.0
Australia	**-3.1**	**1.6**	**11.7**	**6.1**

Source: ABS, *Measuring Australia's excess mortality during the COVID-19 pandemic until the end of August 2023*.

a. Data for 2023 includes deaths that occurred by 27 August and registered by 31 October 2023.
b. Data for the Northern Territory includes deaths occurring by 28 May and registered by 31 October 2023.

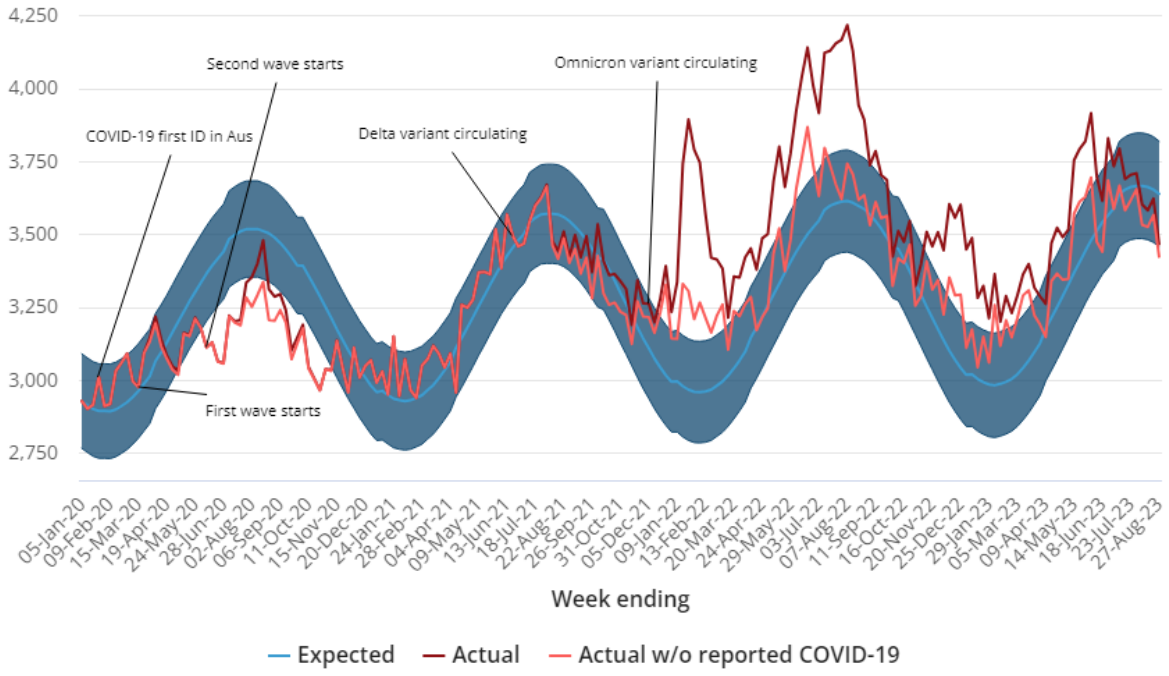
Excess mortality in 2020-2023

This section will address the Inquiry terms of reference part (a)(ii), 'Excess mortality with particular reference to Australian Bureau of Statistics (ABS) data showing excess deaths in recent years, with particular reference to the difference between all-cause provisional mortality data for 2021, 2022 and 2023 and the preceding years of 2015 to 2020 (inclusive).'

The ABS has produced excess mortality estimates for the years 2020-2023 only. This is because the excess mortality figures are addressing the question *'How does the number of deaths which has occurred during the COVID-19 pandemic (2020-2023) compare to the number of deaths expected had the pandemic not occurred?*'. Pre-pandemic years are used as the baseline to forecast the expected number of deaths only. As 2020 is considered a pandemic year, the ABS recommends that it is not included with pre-pandemic years when considering excess mortality.

The graph below shows weekly expected mortality, actual mortality (with and without COVID-19 deaths included) and upper and lower bounds against key events in the COVID-19 pandemic. This graph is in the ABS publication: *Measuring Australia's excess mortality during the COVID-19 pandemic until the end of August 2023* published in December 2023.

Graph 1: Comparison of all-cause baseline and COVID-19 period deaths against regression, Australia, December 2019 – August 2023 (a)(b)(c)(d)



a. Data is provisional and subject to change.
b. Years are based on a sum of ISO weeks derived from the weekly modelling. There are 53 weeks in 2020. There are 52 weeks in 2021 and 2022. Excess mortality has been estimated for the first 34 weeks of 2023.
c. Reported deaths 'from' or 'with' COVID-19 are as recorded on the death certificate.
d. Deaths in 2023 are deaths that occurred by 27 August and were registered and received by the ABS by 31 October 2023.

2020

The ABS excess mortality estimates indicate there was lower than expected mortality in 2020, particularly over winter. Data from the *Causes of death, Australia* publication shows deaths from respiratory diseases (especially influenza and pneumonia) were the lowest on record in that year. Deaths from diseases and conditions such as dementia, which can increase a person's risk of death from acute respiratory disease, were also lower than expected.

The number of deaths due to COVID-19 was very low in Australia during 2020 with COVID-19 ranked as the 38th leading cause of death. Most of those deaths occurred in Victoria where COVID-19 was the 15th ranked cause. While the ABS does not analyse the causal effect of social factors and their relationship to mortality, the period of lower than expected mortality in 2020 coincided with the time when public health measures such as social distancing were in place.

2021-2023

Positive excess mortality was recorded in each of the years from 2021 to 2023.

2021

In 2021 excess mortality was estimated to be 1.6%. Most excess mortality occurred late in 2021 (December), coinciding with the Omicron wave. *Causes of Death, Australia* showed that deaths from respiratory diseases remained low in 2021 (with the second lowest mortality rate on record), with only two deaths found to be from influenza. COVID-19 was the 34th leading cause of death in 2021.

2022

Excess mortality was estimated to be 11.7% in 2022. This coincided with large numbers of deaths associated with COVID-19 during Omicron waves. In this year, COVID-19 became the third leading cause of death, the first time an infectious disease had been in the top five leading causes since the late 1960s.

A change in the seasonal pattern of mortality influenced the excess mortality estimate in 2022. In a typical year, mortality is higher during winter and lower in warmer months. During winter Australia typically records higher numbers of deaths due to acute respiratory diseases (e.g. influenza), as well as chronic diseases such as dementia, ischaemic heart diseases and diabetes, where people are more vulnerable to acute infectious respiratory diseases. While there was still a higher number of deaths in the winter of 2022, we also saw unusually high numbers of deaths in the summer months of 2022. Taking the summer month of January as an example, over the baseline period the average number of deaths occurring in a week in January was 2,800. Accounting for population change, this resulted in an estimated expected number of weekly deaths of around 3,000. In January 2022, over 3,200 deaths were recorded in each week, with one week in January recording close to 4,000 deaths. This increase (compared with the expected January average figure of 3,000 deaths per week) was largely due to a high number of deaths due to COVID-19. While not as marked as in the 2021-2022 summer period, the changed pattern in seasonal mortality (having some deaths due to COVID-19) has remained over the 2022-2023 and 2023-2024 summer periods.

2023

Excess mortality for the first eight months of 2023 is estimated to be 6.1%. The change in seasonal pattern of mortality seen in 2022 continued in 2023, with more deaths than expected occurring over the summer period early in the calendar year 2023. COVID-19 was still a significant cause of death during this period. Deaths were lower in 2023 compared to 2022 across most weeks.

The ABS expects to publish the full year estimate of excess mortality for 2023 by early June 2024.

State and territory data

Jurisdictional patterns of mortality are also important to consider over the pandemic period. In 2020, Victoria recorded much higher numbers of deaths from COVID-19 than other jurisdictions (805 deaths compared to 101 across all other jurisdictions combined). In 2022, Western Australia recorded a later peak of excess mortality (May) than other jurisdictions. COVID-19 infections peaked later in Western Australia, likely due to later re-opening of borders to travellers.

Contributors to excess mortality

This section will address part b of the terms of reference for the inquiry: 'factors contributing to excess mortality in 2021, 2022 and 2023.'

As part of compiling national mortality statistics, the ABS analyses and disseminates statistics on causes of deaths and demographics. The ABS sources this information from death registrations. Demographic information including age and sex comes from the death registration statement which is completed by the family with the assistance of a funeral director. The cause of death is sourced from the Medical Certificate of Cause of Death (MCCD) which is completed by a doctor or coroner. The ABS applies international coding standards to produce cause of death statistics.

COVID-19 as a contributor to excess mortality

COVID-19 associated deaths were the main contributor to excess mortality. A COVID-19 associated death is defined as someone who has died either directly due to the virus (the virus has caused complications leading directly to death) or has died "with" the virus (the person died from a cause other than COVID-19 such as cancer but had COVID-19 certified as a contributing factor).

Table 3 below shows the percentage of excess mortality where COVID-19 was associated with the death. In 2022, COVID-19 accounted for two-thirds of excess mortality. These are deaths where COVID-19 was listed on the MCCD by the certifying practitioner.

Table 3: Excess mortality by year, Australia, COVID-19 as a proportion of excess deaths

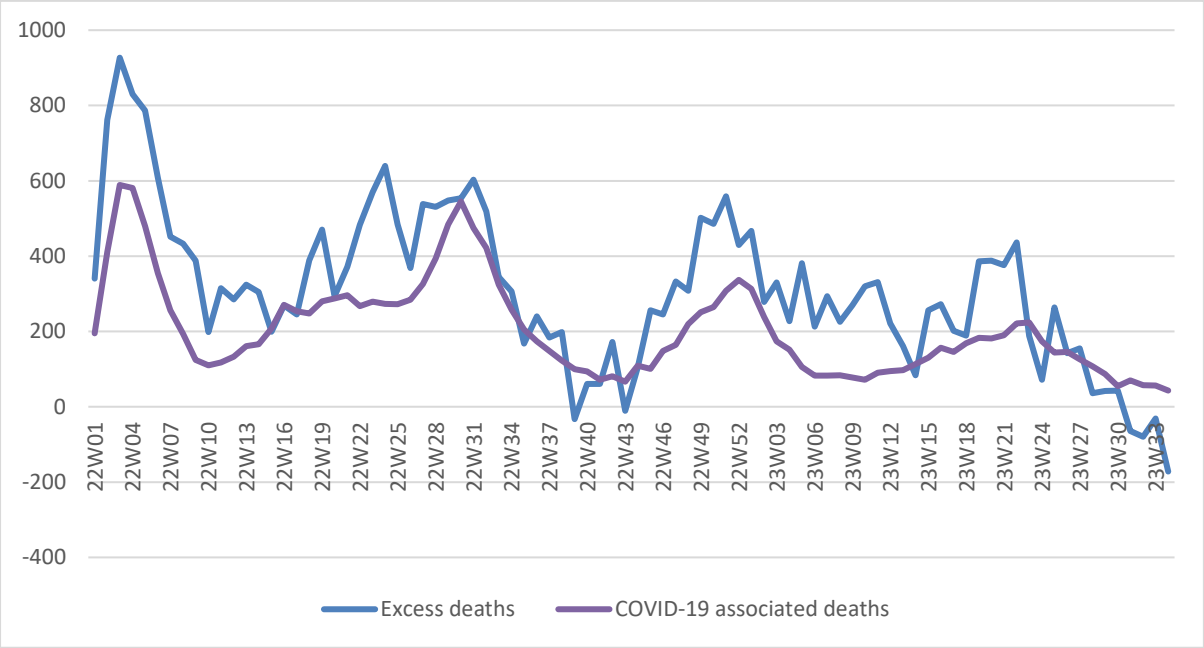
	Excess deaths (no.)	Excess deaths (%)	COVID-19 associated deaths (no.)	% of excess deaths accounted for by COVID-19(a)
2020	-5,250	-3.1	916	(c)n.a.
2021	2,751	1.6	1,448	52.6
2022	19,945	11.7	13,287	66.6
2023(b)	**6,905**	**6.1**	**4,444**	**64.4**

Source: This table is derived from data included in the ABS report: *Measuring Australia's excess mortality during the COVID-19 pandemic until the end of August 2023*.

a. COVID-19 associated deaths are as recorded on the medical certificate of cause of death. They include deaths caused directly by the virus and deaths where a person died with COVID-19.
b. Data for 2023 includes deaths that occurred by 27 August and registered by 31 October 2023.
c. Not applicable - no excess mortality was recorded in 2020.

The ABS statistics show that the number of excess deaths is higher in periods of high mortality from COVID-19. Graph 2 below shows the pattern of mortality for excess deaths and COVID-19 associated deaths across weeks in 2022 and 2023. These two years are presented due to higher estimates of excess mortality compared to 2021.

Graph 2: Number of estimated excess deaths and numbers of COVID-19 associated deaths, by week



Source: This graph is derived from data included in the ABS report "Measuring Australia's excess mortality during the COVID-19 pandemic until the end of August 2023".

Note: the labels on the x-axis of the graph refer to reference weeks. For example, 22W01 refers to the first week of 2022.

Demographic characteristics of people who die from COVID-19 associated deaths

People who die from or with COVID-19 are often from vulnerable populations. Key characteristics of people who have died from the virus over the course of the pandemic include:

- Their median age at death is 87.3 years.
- They were likely to have co-morbidities (i.e. they have two or more diseases or medical conditions), making them more susceptible to the effects of an acute respiratory infection.
- The most common pre-existing diseases among those who died from the virus were chronic cardiac conditions (including coronary heart disease) and dementia.
- People living in more disadvantaged areas were more than 2.5 times more likely to die from the virus. (This has changed over time – in 2021, people who died from the virus were over six times more likely to live in a most disadvantaged area, compared with 2.5 times over the course of the pandemic).
- Aboriginal and Torres Strait Islander people have a mortality rate from or with COVID-19 that is 1.6 times higher than non-Indigenous people.

Age profile of excess mortality

People over 65 years of age contributed most to excess mortality. The table below shows the numbers and proportions of estimated excess deaths by selected age groups for 2020 to 2023. While there is some excess mortality recorded for the younger groups across 2020-2022, there are small numbers of deaths in these age groups and a large amount of variability in the expected range. This means that the excess mortality percentages in these age groups may reflect natural variation in mortality patterns rather than statistically significant excess mortality. Table 4 shows COVID-19 as a proportion of excess deaths. In 2022 the virus accounted for over half of the estimated excess deaths in all age groups and over 95% of excess mortality in people aged under 35 years.

Table 4: Excess mortality by year, Australia, COVID-19 associated-deaths as a proportion of excess deaths by age group

	0-34	35-54	55-64	65-74	75-84	85-89	90-94	95+
Estimated excess deaths (no.) by age group								
2020	30	-377	-424	-596	-1,131	-1,292	-1,216	-248
2021	104	-364	-101	621	1,211	24	299	956
2022	116	433	1,005	2,727	5,831	3,390	3,572	2,870
2023(a)	-75	-157	121	909	2,756	1,180	1,035	1,134
% Excess (above expected) by age group								
2020	0.7	-3.5	-2.9	-2.2	-2.6	-4.5	-4.6	-1.8
2021	2.4	-3.5	-0.7	2.3	2..7	0.1	1.1	6.9
2022	2.6	4.1	7.0	10.2	12.8	11.7	13.7	20.4
2023(a)	-2.6	-2.3	1.3	5.2	9.0	6.1	6.1	12.1
COVID-19 Associated deaths (no.) by age group								
2020	3	6	33	87	253	220	210	103
2021	24	111	143	298	400	210	166	67
2022	111	365	573	1,652	3,622	2,727	2,634	1,577
2023	14	80	161	504	1,344	947	912	556
% Excess deaths accounted for by COVID-19(b)								
2020	10.0	(c)na	na	na	na	na	na	na
2021	23.1	na	na	48.0	33.0	(d)+100	55.5	7.0
2022	95.7	84.3	57.0	60.6	62.1	80.4	73.7	54.9
2023	**na**	**na**	**+100**	**55.4**	**48.8**	**80.3**	**88.1**	**49.0**

Source: This table is derived from data included in the ABS report “Measuring Australia’s excess mortality during the COVID-19 pandemic until the end of August 2023” published in December 2023.

a. Data for 2023 includes deaths that occurred by 27 August and were registered by 31 October 2023.
b. COVID-19 associated deaths are as recorded on the medical certificate of cause of death. They include deaths caused directly by the virus and deaths where a person died with COVID-19.
c. Not applicable because no excess mortality was recorded in 2020.
d. +100 Indicates there were more COVID-19 associated deaths than in the excess mortality estimate.

Deaths due to causes other than COVID-19

COVID-19 as reported on the medical certificate of cause of death does not account for the total estimated excess mortality. Considerations here include:

- There may be deaths where COVID-19 was a contributing factor, but it was not recorded on the death certificate (for example, the medical practitioner may be unaware of a present or past infection). If COVID-19 is not recorded on the death certificate it is not included in COVID-19 death tabulations presented by the ABS.
- Periods of excess mortality have coincided with periods of high COVID-19 associated mortality.
- Death rates for doctor-certified deaths for ischaemic heart diseases, diabetes and dementia have been higher during times of high mortality during the pandemic. These are all causes commonly recorded as co-morbidities among deaths associated with COVID-19.
- Mortality displacement is an epidemiological term for mortality occurring at an earlier time than otherwise expected. As Australia had lower than expected mortality in 2020, it is likely some reverse mortality displacement was experienced. This means deaths that may have occurred in 2020 had 2020 followed usual patterns of mortality, may have instead occurred in later years.

Other related matters

This section will address part d of the terms of reference for the inquiry: ‘other related matters’.

Producing data to meet policy needs

To date, the ABS has not included estimates of expected mortality with COVID-19 when calculating excess deaths. This is because it is not relevant for the question outlined earlier in this submission: *How does the number of deaths which has occurred during the COVID-19 pandemic (2020-2023) compare to the number of deaths expected had the pandemic not occurred?.* The ABS will need to produce estimates of expected mortality with COVID-19 included in the baseline for several reasons. Firstly, this will provide new insights into mortality expectations accounting for the virus and may be used for policy and planning purposes. The second reason is that the further we are from the start of the pandemic the more factors we have influencing our current mortality profile which should be considered. For example, influenza and other respiratory diseases are again circulating and contributing to deaths in Australia. Thirdly, the older the data used to model a current year of expected mortality, the less robust the estimate will be.

These considerations will alter the research question to “How does the number of deaths compare with expected numbers now that COVID-19 is an established factor influencing mortality?”. This will reduce the focus on COVID-19 and instead provide insights into other emerging factors influencing mortality, including those that are indirectly or unrelated to the disease itself. Answering this new research question will be challenging; mortality has largely not followed expected patterns during the pandemic and understanding what a “usual” mortality pattern now looks like requires consideration. The ABS has started to work through these questions.

As new patterns of mortality are established, the ABS is also re-focussing other reports to provide broader insights beyond COVID-19 mortality. In particular, the COVID-19 Mortality in Australia reports will change to focus on a range of respiratory diseases, including COVID-19, influenza and respiratory syncytial virus (RSV).

Additional mortality measures and analyses to use alongside excess mortality estimates

Estimates of excess mortality are a robust and reliable measure, but they cannot provide a complete picture of mortality during the pandemic on their own. There are many other ways in which the ABS reports mortality data which, when used alongside measures of excess mortality, provide more comprehensive insights.

For example, during the pandemic the ABS made changes to the coding of coroner-referred deaths (particularly suicide) to capture risk factors related to the pandemic (such as unemployment and social isolation) if they were mentioned in a coronial brief. This data is reported in *Causes of Death, Australia*.

Methods for calculating excess deaths

Across the world, health and statistical authorities have sought to measure excess mortality during the COVID-19 pandemic. Different methodologies have been applied, with the goal being to model an expected number of deaths for a given year. The choice of model, baseline and other methodological decisions can markedly affect estimates of expected (and therefore excess) mortality. Estimating the expected future seasonality for deaths can be a challenge in many models. The suitability of a model can depend on factors such as country context, data quality and collection methods and these factors should be considered when selecting a model to produce excess mortality outputs and when comparing outputs that have applied different methods.

The model applied by the ABS to produce excess mortality estimates is an adaptation of the Serfling model – a cyclical linear regression model that has been used extensively in the past (including in the Australian setting) to produce excess mortality estimates for influenza. The ABS worked closely with the New South Wales Ministry of Health to adapt aspects of this model to measure the impact of COVID-19. Several agencies, including jurisdictional health authorities, peer-reviewed the excess mortality estimates produced using the methodology described in this submission.

In Australia, excess mortality estimates are also produced independently by the Actuaries Institute Mortality Working Group (MWG). The MWG uses ABS provisional mortality data to produce these estimates for both all-cause mortality and cause-specific mortality, but applies different methods to model these estimates than the ABS. Despite differences in approach, the annual excess mortality estimates produced by the MWG are very similar to those produced by the ABS.

Deaths from COVID-19 vaccines

There has been interest in deaths from COVID-19 vaccines during the pandemic. Deaths that may be related to COVID-19 vaccines are investigated by the Therapeutic Goods Administration (TGA) with the TGA providing weekly vaccine safety reports up until late 2023. This process is separate from the ABS coding of causes of death.

The ABS has also published data on deaths from COVID-19 vaccines in its annual *Causes of Death, Australia* reports. The ABS accesses the national coronial information system and the medical certificate of cause of death to code causes of death in Australia. The ABS data has recorded 16 deaths as being due to the COVID-19 vaccine in the pandemic period. There have been nearly 71 million COVID-19 vaccine doses administered to date.

Deaths by vaccination status

ABS publications on deaths are based on death registrations reported to the ABS by the state and territory Registries of Births, Deaths and Marriages. Vaccination status is not reported with death registrations and therefore the ABS does not track deaths by vaccination status.

Vaccination status is available on the Australian Immunisation Register (AIR). The ABS administers the linkage of the AIR with other ABS and non-ABS datasets, which includes death registrations, in the Person Level Integrated Data Asset (PLIDA). The ABS provides access to the PLIDA for approved researchers for projects assessed as being in the public interest. The ABS does not produce mortality reports from the PLIDA.