Australian Government
Australian Institute of
Health and Welfare

How long can Australians live?

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Australian Institute of Health and Welfare
Canberra
Catalogue number PHE 324

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A complete list of the Institute's publications is available from the Institute's website www.aihw.gov.au.

ISBN 978-1-922802-99-6 (Online)
ISBN 978-1-923085-00-8 (Print)
DOI: 10.25816/b5ka-j371

Suggested citation

Australian Institute of Health and Welfare (2023) *How long can Australians live?*, catalogue number PHE 324, AIHW, Australian Government.

Any enquiries about or comments on this publication should be directed to:
Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Tel: (02) 6244 1000
Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare.

Please note that there is the potential for minor revisions of data in this report. Please check the online version at www.aihw.gov.au for any amendments.

Contents

Summary

On average, Australians are living longer than ever before. Life expectancy has been steadily increasing, and this is matched by increases in the proportion of deaths that occur at older ages and in the median age at death. However, the oldest age at death (often referred to as maximum age at death) has fluctuated from year to year and shown minimal increases over time. While improvements in life expectancy are resulting in an ageing population and growth in the population of centenarians, few Australians die at ages higher than 110. This suggests that mortality is being compressed into older ages and may be slowly converging towards a maximum age at death rather than a situation where maximum life span is increasing along with average life expectancy. There is ongoing debate on whether there is a biological limit to the human life span. In Australia, the oldest living person is believed to have died at age 114. Globally the oldest person is believed to have lived to 122 years (Jeune et al. 2010).

Why study longevity?

When looking at how long Australians live, the focus tends to be on average life expectancy. However, there are other measures of how long we live, and these add different nuances to our understanding of the health of Australians.

This report seeks to enhance our understanding of how long Australians are currently living and how this has changed over time. It looks at whether, with increasing life expectancy, other measures of longevity are also rising to provide insights into whether we can expect Australians to continue to live to increasingly older ages.

Sustained increases in some measures of longevity

Life expectancy in Australia has increased by 13.7 years for males and 11.2 years for females since the 1960s. People born in 2019–2021 can expect to live to more than 81 years (81.3 years for males and 85.4 for females).

The median age at death (the age by which half of all deaths have occurred) has also increased over time. Between 1964 and 2021, the median age at death increased by 11.5 years for males (from 68.1 to 79.6 years) and 10.9 years for females (from 74.0 to 84.9 years).

The modal age at death offers a further metric of longevity revealing the age at which the highest proportion of deaths occur. During the 1960s to the mid-1970s, deaths during infancy were the most common age at death. A higher concentration of deaths at older ages (74 and over) then became more commonplace. During the decade to 2021, the highest modal age at death was 87 for males and 91 years for females.

More Australians are dying beyond 100 years, but few past 110

The number of centenarian deaths (those aged 100 and over) has been rapidly increasing. In 2021, 1 in 72 deaths in Australia were of people aged 100 or more (2,247 deaths). This is an increase from 1 in 1,214 in 1964 (83 deaths). Over the period 1964–2021, most (94%) of these deaths occurred between the ages of 100 and 104 years. Over the same period, deaths at extreme old ages (110 years and above) remained rare.

Maximum age at death has not increased like other measures of longevity

While we have seen significant gains in life expectancy in Australia over time, this is not matched by changes in the maximum age at death. The average age of the 10 most elderly deaths in the 1960s ranged from 101.6 to 104.4 years for males and 103.5 to 105.8 years for females. In the most recent decade to 2021, the range was 104.7 to 107.3 years for males and 107.8 to 109.9 years for females. The single oldest age at death in Australia shows considerable year to year fluctuation, and is 114 years for females (occurring in 1983, 2002 and 2017) and 111 for males (occurring in 1991, 1997, 2002, 2003, 2020 and 2021).

Why are people living longer on average but there has been minimal improvement in the longest living individuals?

There are many reasons behind increased life expectancy in Australia, largely related to improved medical knowledge and technology, the widespread availability of antibiotics and vaccines, healthcare availability and access, improved living conditions and overall increasing wealth in Australia (AIHW 2022a). Better disease treatment, especially for infectious and parasitic diseases led to reductions in infant mortality. Improvements in sanitation, food quality and health education have contributed to lowering death rates and increasing life expectancy in people of all ages.

Improvements in life expectancy due to the above factors have resulted in an ageing population and a rising centenarian population (people aged 100 years or more). However, few people are living past 110 to become supercentenarians.

What more do we need to learn?

While centenarian deaths are increasing, these events are still relatively rare. The population of centenarians is growing but remains a very small portion of the overall population. Accurate and complete data on this group are vital to understanding mortality and population trajectories. More rigorous validation of deaths at extreme ages in Australia, coupled with linked births and deaths data, and more detailed population statistics, could enhance the precision of information on Australian longevity. This would enable more accurate assessment of the potential impacts of current trends in maximum life span on Australian society.

1 Introduction

About this report

Extreme longevity is of great interest to scientists and people in general. Stories about the longest lived lives leads us to wonder 'How long can we live?'. It is generally held that, alongside rising life expectancy, senescence, or the process of growing old, is being delayed until increasingly higher ages. This raises a fundamental question around whether there is a limit to the human life span.

Numerous studies support that mortality has been delayed to higher ages, however, there is no agreement on the exact limit of the human life span. Historical anecdotes of the most extreme life spans (to 200 years and even longer) are not possible to validate. Measuring human mortality at extreme ages requires adequate documentation that is free from age-ascertainment bias. Only since the 20th century has it become possible to authenticate the true age of very long-lived people, and even then, the availability of records is patchy, and validation requires meticulous investigation.

Nonetheless, available records show that, since at least the latter half of the 20th century, there has been unprecedented growth in the population of the number of centenarians, including semi-supercentenarians and supercentenarians (Box 1).

Australians too are on average living longer than before, and to very old ages. Sustained ageing of the Australian population has significant implications for people's health and wellbeing, as well as the planning of Australia's health, aged care and social security systems.

Box 1: Definitions

A **centenarian** is a person, living or deceased who has reached a minimum of 100 years of age.

A **semi-supercentenarian** is a person, living or deceased who has reached a minimum of 105 years.

A **supercentenarian** is a person, living or deceased who has reached a minimum of 110 years.

Life expectancy is the measure typically used to assess how long Australians can expect to live. However, other indicators of longevity are readily obtainable from data on death registrations. These can be assessed alongside life expectancy for a fuller picture of longevity in Australia.

This report aims to enhance our understanding of the maximum age to which Australians live and whether we can expect Australians to continue to reach increasingly older ages. Using Australian data about life expectancy, deaths and population, the broad objectives of this report are to:

- describe trends in life expectancy in Australia,
- examine trends in other measures of longevity in Australia including the maximum age at death, and
- present theories of whether there is a fixed or unlimited life span with the aim of understanding whether we can expect Australians to continue to live to increasingly older ages.

Measuring longevity

Three measures of central tendency can be used to describe the length of life in populations: life expectancy at birth, the median age at death and the modal age at death. A fourth measure, the maximum age at death reflects the oldest age at death. Comparing these measures provides a more comprehensive picture of longevity.

Life expectancy is the most used measure of longevity. It measures how long, on average a person could expect to live, given current mortality rates for their age and sex. Life expectancy at birth for example, describes the average expected number of years that babies could expect to live based on the assumption that the age- and sex-specific birth rates at the time they were born, prevail throughout their lifetime. The life expectancy at a specified age represents the number of remaining years a person can (on average) expect to live (based on the age- and sex-specific mortality rates for that age at the time) and is used here to indicate expected age at death, for example at age 65.

Life expectancy changes during the course of a person's life because as they survive the periods of birth, childhood and adolescence, their chance of reaching older age increases. Therefore the expected age at death of an 80 year-old today is usually higher than their life expectancy at birth 80 years ago.

As life expectancy is based on the cumulative number of years lived by a hypothetical cohort (encompassing deaths at all ages), life expectancy at birth reflects the average age at death (Canudas-Romo 2010).

The **median age at death** represents the age up to which half the population survives; that is, the age at which 50% of the deaths have occurred. If there are no changes in the level of mortality up to the median age (Canudo-Romos 2010), the median age does not change. However, if mortality decreases at earlier ages, the median age will increase due to there being more survivors. Changes in mortality at ages after which half the population has survived will not impact the median age at death. That is, the ages at which people die above the median age at death will not impact the median age at death.

The **modal age at death** refers to the age at which the highest proportion of deaths occur. Mortality in human populations typically shows a bimodal distribution of age at death, with a relatively high proportion of deaths in infancy (mode at age 0) and a second peak in late adulthood (sometimes referred to as late modal age (Canudas-Romo 2008; Canudas-Romo 2010)) that reflects the concentration of deaths at older ages. Though both modes are described in this report, the report focusses on the late modal age at death (which excludes infant deaths) as a measure of longevity.

The **maximum age at death** refers to the highest age at death in each year. In this report, maximum age was measured using the single maximum age and, to reduce annual fluctuation for measuring trends over time, the average maximum age (based on the average 10 oldest deaths each year).

These measures of longevity are readily available; life expectancy is reported annually by the Australian Bureau of Statistics (ABS), and the Australian Institute of Health and Welfare's (AIHW) National Mortality Database (NMD) can be used to assess the remaining measures. Additional validation is required on deaths occurring at extreme ages for analytical purposes.

More advanced measures of longevity include the probability of survival, which can be used to assess mortality trajectories at very old ages, and the ratio of centenarians to persons aged 60 forty years earlier to describe the proportion of the population that survives to very old age. However, these are difficult to apply as they require accurate detail on the

population at each age over 100 years. In Australia, population data available are capped at age 100 years (with people aged 100 and over combined together).

Fixed or unlimited life span?

The potential for increasing longevity is rigorously studied by demographers. Some experts argue that the maximal life span is unlimited, associated with ongoing gains in life expectancy from social and medical advances. Continuously rising life expectancies, with corresponding growth in centenarian populations in countries with low mortality support this notion. Oeppen and Vaupel (2002), for example, noted that in Japan, female life expectancy had been rising for 160 years at a steady pace of 3 months per year, without reaching a plateau. Also in Japan, in the decade to 2015, the centenarian population increased 146%, while the population of supercentenarians increased by 564% (from 22 to 146) (Saito et al. 2021). While the overall population in Japan is reducing, the centenarian population reached a record high in 2022 of 90,526 people (The Japan Times 2022). In Australia, the number of centenarians increased 27-fold from 226 in 1973 to 6,181 in 2022 (ABS 2022a). Moreover, long-term trends in the maximum age at death in Japan (1963–2015) and Quebec (1950–2010) each suggest consistent, linear increases (Beaudry-Godin et al. 2021; Saito et al. 2021). An assessment by Beaudry-Godin et al. (2021) showed that increasing levels of survival between the ages of 80 and 100 were a main contributor to the growth in the centenarian population, corresponding with major advances in medicine. With continuing advances in medicine, and management and treatment of diseases that were not previously survivable, there is reason to believe that more people will continue to live to older ages, such as 100 years or more.

While an increase in the maximum age at death is not a logical consequence of the population growth at advanced ages, recent research indicates various ways in which genetics, healthy diet, lifestyle and interventions affect human longevity (Longo 2022; Passarino et al. 2016). The extension of life span may be due to interventions that slow age-related chronic diseases, leading to extension of a healthy life span, that is, living more years in full health with no symptomatic disease or injury (Passarino et al. 2016).

In support of a fixed maximum age at death, some suggest there are biological limits of the human body, which inevitably decays over time. These include the shortening of DNA segments called telomeres (Jiang et al. 2007), the depletion of organ reserves which enable the body to maintain homeostasis (Fries 1980), and the accumulation of DNA mutations (Chatterji et al. 2015).

Some identified shortcomings in the fixed life span theory relate to methodology and biology. Life expectancy predictions are modelled with past data, which may overlook the size of the gains acquired through improved medical knowledge and technology (Boudoulas et al. 2017). If there is a limit to the human life span, then advances in survival would eventually slow down and ultimately cease. From the viewpoint of life expectancy, the rate of growth would be expected to slow; that is, the amount by which life expectancy increases each year, would become smaller and smaller. Until recently, life expectancy has continued to increase in most low mortality and high income countries. However, in the last decade we have started to see a slowing of improvements in life expectancy in some countries (Arias et al. 2022; Office of National Statistics 2021) and in Australia (Lopez and Adair 2019). See Box 2 for examples of changes in trends in life expectancy evident in some countries since the start of the COVID-19 pandemic.

If there is a limit to the life span, what is it? A previously proposed limit of 115 years (Dong et al. 2016), as well as being repudiated (Jdanov et al. 2021), has been surpassed by the longest lived humans to date.

Longest living humans over the past century

Historically, average life expectancy was low. While there are accounts of people living to around 100 in the 18th century, verificiation is difficult due to poor documentaiton (Jeune et al. 2010).

Demographers, by painstaking methods, have deemed the earliest validated supercentenarians to have died in the late 19th and early 20th centuries (Table 1). Geert Adriaans Boomgaard who died in 1899 and Margaret Ann Harvey Neve who died in 1903, both aged 110 years, were considered to be the first validated centenarians (Chambre et al. 2021; Jeune and Poulain 2021; Poulain et al. 2021; Young 2021). Since then there are many accounts of even longer lives. Validated records indicate that currently, the oldest person ever to have lived is Jeanne Calment, who died at age 122 in France in 1997. There has been debate over her true age within the scientific community (Zak 2019), but multiple researchers accept that her age at death was truly 122 (Robin-Champigneul et al. 2020; Robine et al. 2019). The oldest male person to have died was Jiroemon Kimura in Japan aged 116 years. According to validated records, Christina Cock was the longest-lived Australian female, dying in 2002 at the age of 114 years, and Dexter Kruger, who died 111 years in 2021 is considered the longest-lived Australian male (Gerontology Research Group 2015).

Table 1: First supercentenarians and oldest validated ages at death, globally and Australia

Name	Sex	Year born	Year died	Age at death	Country died
First centenarians					
Geert Adriaans Boomgaard	Male	1788	1899	110	Netherlands
Margaret Ann Harvey Neve	Female	1792	1903	110	Guernsey
Louisa Kirwan Thiers	Female	1814	1926	111	USA
Delina Filkins	Female	1815	1928	113	USA
Katherine Plunket	Female	1820	1932	111	Ireland
Oldest lived worldwide					
Jeanne Calment	Female	1875	1997	122	France
Sarah Knauss	Female	1880	1999	119	USA
Marie-Louise Meilleur	Female	1880	1998	117	Canada
Mikao Osawa	Female	1898	2015	117	Japan
Emma Morano	Female	1899	2017	117	Italy
Jiroemon Kimura	Male	1897	2013	116	Japan
Christian Mortensen	Male	1882	1998	115	USA
Israel Kristal	Male	1903	2017	113	Germany
Dexter Kruger	Male	1910	2021	111	Australia
Jack Lockett	Male	1891	2002	111	Australia

(Continued)

Table 1 (continued): First supercentenarians and oldest validated ages at death, globally and Australia

Name	Sex	Year born	Year died	Age at death	Country died
Oldest lived Australians					
Christina Cock	Female	1887	2002	114	Australia
Beatrice Mears	Female	1888	2001	113	Australia
Ethel Farrell	Female	1902	2015	113	Australia
Molly Yeomans	Female	1888	2001	112	Australia
Caroline Mockridge	Female	1874	1987	112	Australia
Dexter Kruger	Male	1910	2021	111	Australia
Jack Lockett	Male	1891	2002	111	Australia
John Campbell Ross	Male	1899	2009	110	Australia
Claude Choules	Male	1901	2011	110	Australia

Notes

1. Excludes people currently alive.
2. Other sources may produce dissimilar results based on different levels of validation.

Sources: Chambre et al. 2021; Gerontology Research Group 2015; Gerontology Wiki 2023; Jeune and Poulain 2021; McCormack 2010; Poulain et al. 2021; Young 2021.

2 Results

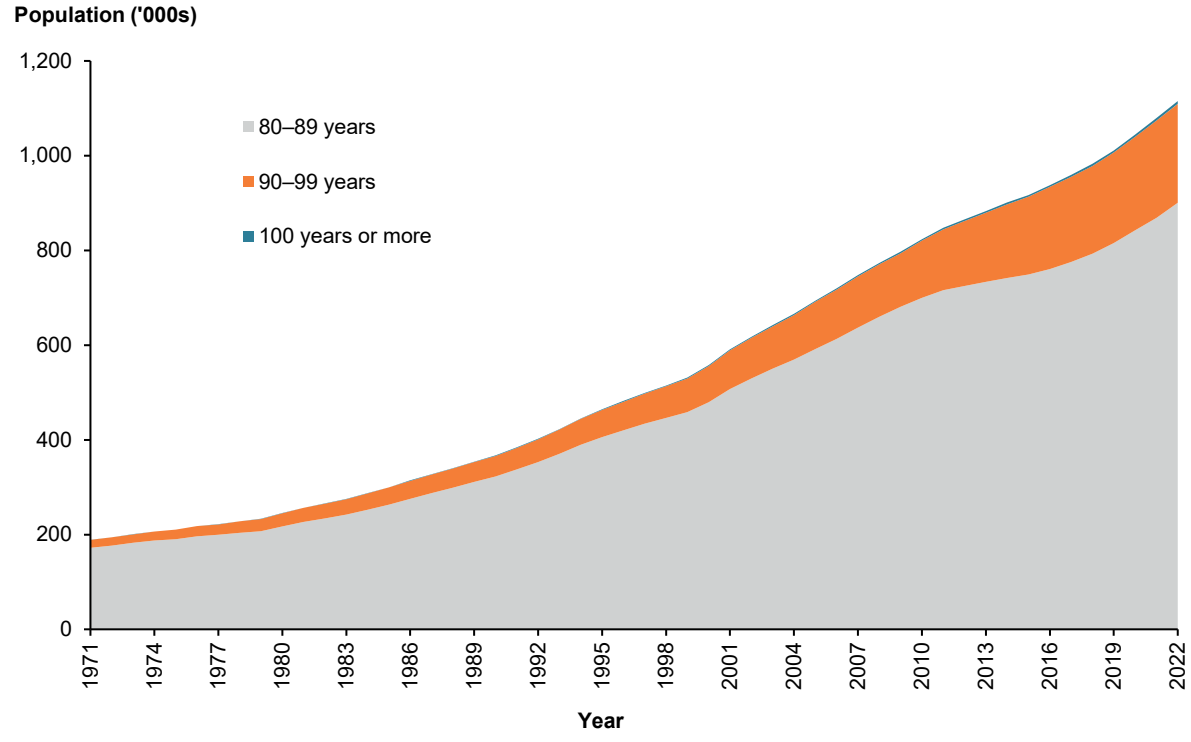
How has Australia's population aged?

Like other low mortality countries, Australia has an ageing population which is driven by low fertility and increasing life expectancy. In 1971 people aged 80 years or more made up 1.4% of the population and today (2022), they represent 4.3%. In numbers, this reflects a 6-fold increase from 188,819 in 1971 to 1,115,297 in 2022 (Figure 1).

The centenarian population has also grown. Analysis of population estimates (ABS 2022b) show that in 1971 there were 16 centenarians among every 1 million Australians, compared with 238 per million in 2022.

While life expectancy and the proportion of centenarians has increased over time, the proportion of supercentenarians has remained steady (Wilson and Terblanche 2018). The number and percentage of older Australians is expected to continue to grow. By 2066, it is projected that people over 65 in Australia will make up between 21% and 23% of the total population compared with 17% currently (2022) (ABS 2018a).

Figure 1: Elderly population by year and age group, Australia, 1971–2022



Note: Data for this figure are available in Supplementary Table S1.

Source: ABS 2022b.

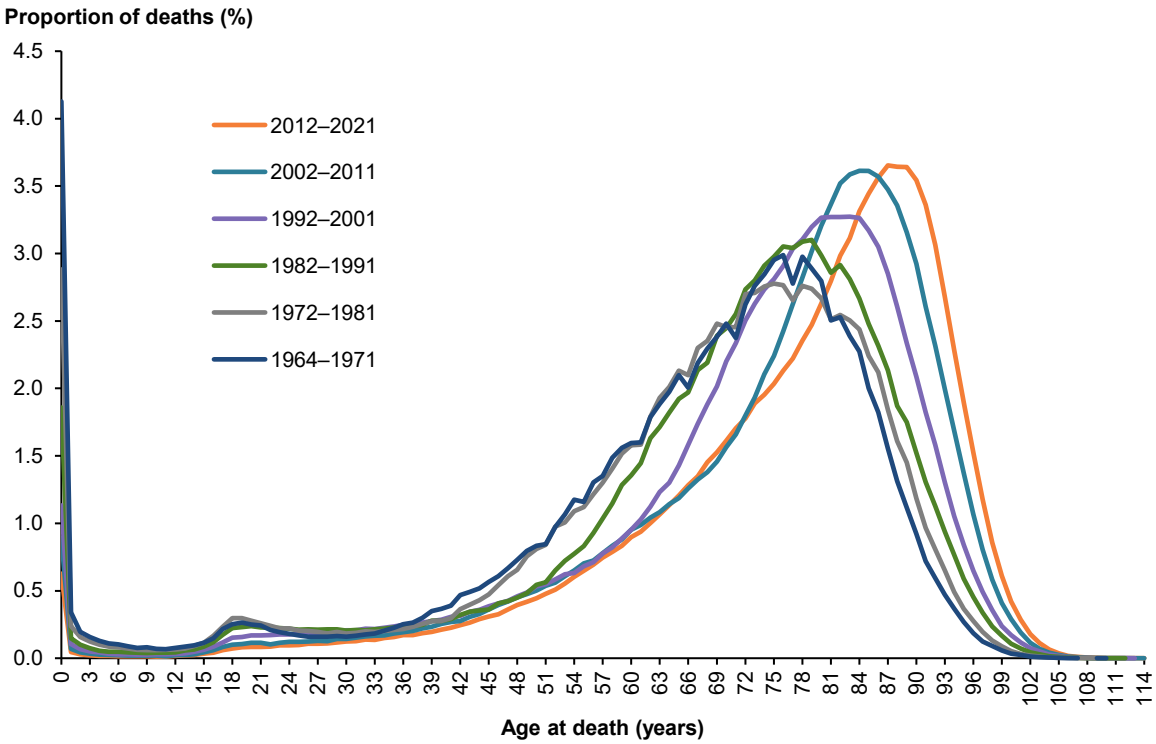
How has age at death changed over time?

The distribution of age at death in Australia for successive time periods is shown in Figure 2. The results illustrate a typically bimodal pattern of age at death, that is, with 2 modes or peaks reflecting the age at which most deaths occur. The mode at age 0 indicates the

relatively high proportion of infant deaths, and a later mode reflects the high proportion of deaths occurring at older ages.

In the earliest time periods (1964–1971 and 1972–1981), infant mortality (deaths before the first birthday) accounted for the highest proportion of deaths at any age; 4.1% and 2.9%, respectively. By 1982–1991, the age at which most (3.1%) deaths occurred was 79 years, with infant deaths accounting for 1.9% of deaths. Over the subsequent 30 years, the age at which most deaths occurred became increasingly higher (indicated by the shift of the peak of the curve to the right) with a greater concentration of deaths at older ages (indicated by the increasing peak of the curve). By 2012–2021, the highest proportion of deaths occurred at age 87 years accounting for 3.7% of deaths, with infant deaths accounting for 0.6%.

Figure 2: Proportion (%) of deaths by age at death and time period, Australia



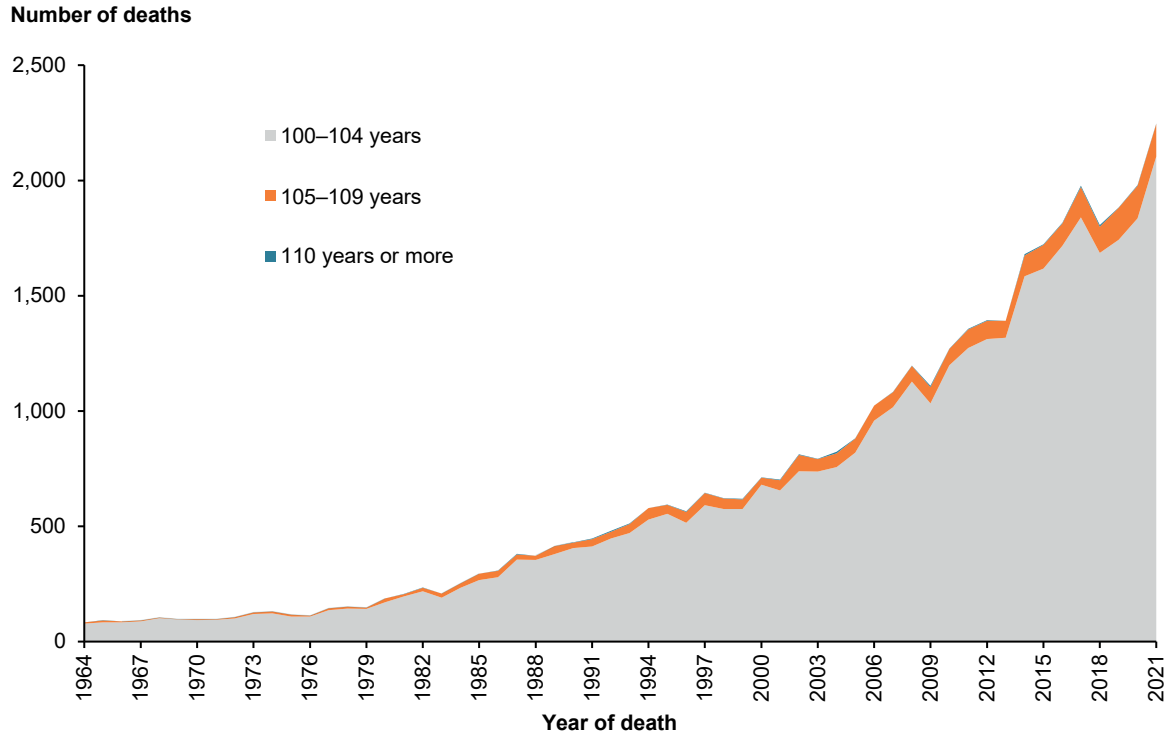
Notes

1. Deaths in 2021 include only those registered in 2021.
2. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
3. Data for this figure are available in Supplementary Table S2.

Source: AIHW National Mortality Database.

Corresponding to the increasing centenarian population over time, the number of centenarian deaths has risen from 83 in 1964 to 2,247 in 2021; an increase from 1 in 1,214 to 1 in 72 deaths (Figure 3). However, despite the rapidly increasing number of centenarian deaths, most deaths in this age group occur before 105 years (Figure 3). In the decades beginning 1964 and 2012, 94.8% and 93.6% of centenarian deaths, respectively, were at ages 100–104 years. Semi-supercentenarian deaths (those aged 105 and over) made up 5.2% and 6.4% of centenarian deaths in these decades, respectively. In the decade beginning 1964, there were 2 supercentenarian deaths (those aged 110 and over) compared with 31 in the decade beginning 2012.

Figure 3: Centenarian deaths by year of death and age group, Australia 1964–2021



Notes

1. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
2. Deaths in 2021 include only those registered in 2021.
3. Data for this figure are available in Supplementary Table S3.

Source: AIHW National Mortality Database.

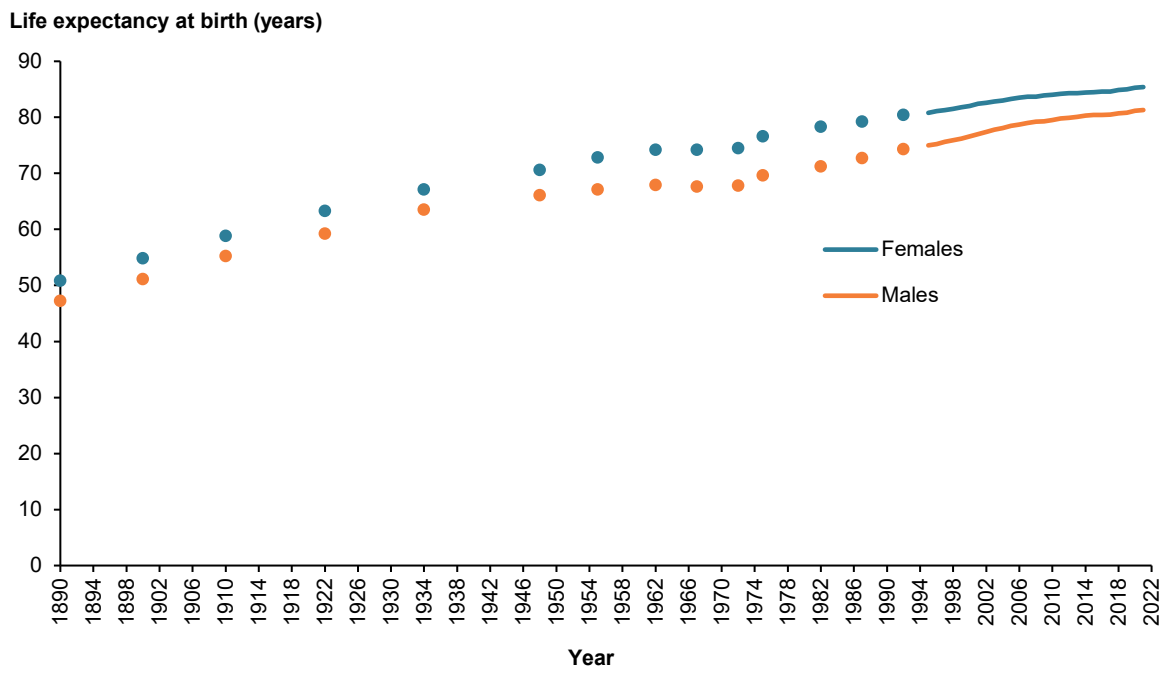
How long do Australians live?

Life expectancy

Life expectancy is the measure typically used to describe the longevity in a population. For more than a century, life expectancy in Australia increased without interruption (AIHW 2022b). For Australians born at the beginning of the 20th century, life expectancy was 51.1 years for males and 54.8 for females (Figure 4). By mid-century, males could expect to live on average to 67.1 years and females to 72.8 years. Current estimates (2019–2021) show that life expectancy at birth is 81.3 years for males and 85.4 years for females. Based on these figures, life expectancy at birth has increased on average by around 3 months each year since the turn of the 20th century.

Similarly, life expectancy at other ages has also increased. Based on historical life expectancy data (ABS 2014a), in 1960–1962 men aged 65 could expect to live, on average, a further 12.5 years, but by 2019–2021 men aged 65 could expect an additional 20.3 years, a gain of 7.8 years (ABS 2022c). Women aged 65 gained 7.3 years in life expectancy; from 15.7 in 1960–1962 to 23.0 in 2019–2021 (ABS 2014a; ABS 2022c). Once a person survives birth, childhood and adolescence, their life expectancy and chance of reaching a higher age increases.

Figure 4: Long-term trends in life expectancy at birth, by sex, Australia, 1890–2021



Note: Data for this figure are available in Supplementary Table S4.

Sources: ABS 2014a; ABS 2014b; ABS 2015; ABS 2016; ABS 2017; ABS 2018b; ABS 2019; ABS 2020; ABS 2021; ABS 2022c.

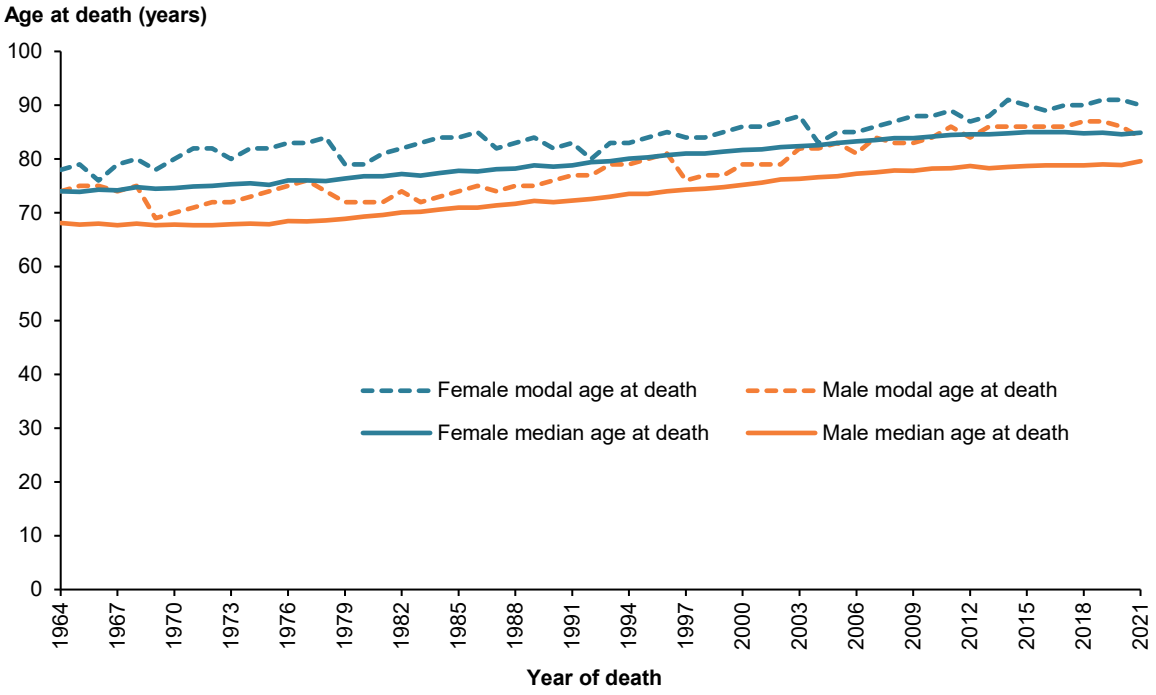
Median age and modal age at death

Two other measures of longevity are the median age and modal age at death for which trends are shown for males and females in Figure 5.

For both males and females, median age at death exhibits a sustained upward trend. During the 1960s and 1970s, the median age at death hovered around 68 years for males and 75 years for females, increasing to around 79 years and 85 years, respectively in the most recent decade to 2021.

The early modal age at death (infant mortality) is shown in Figure 2. Figure 5 presents the late modal age at death only to look at mortality trends after infancy. It suggests that while the modal age at death shows greater annual fluctuation than the median age at death, an upward trend is observable. During the 1960s, the late modal age at death for males ranged from 69 to 75 and from 84 to 87 years in the last decade to 2021. Female deaths displayed similar increases with a late modal age at death that ranged from 76 to 80 years in the 1960s compared with 87 to 91 years in the last decade.

Figure 5: Median and modal age at death, by sex, Australia, 1964–2021



Notes

1. Modal age at death excludes infant deaths.
2. Deaths in 2021 include only those registered in 2021.
3. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
4. Data for this figure are available in Supplementary Table S5

Source: AIHW National Mortality Database.

Maximum age at death

With the above 3 measures of longevity showing upward trends over time, albeit at different paces, does the maximum age at death show a similar pattern?

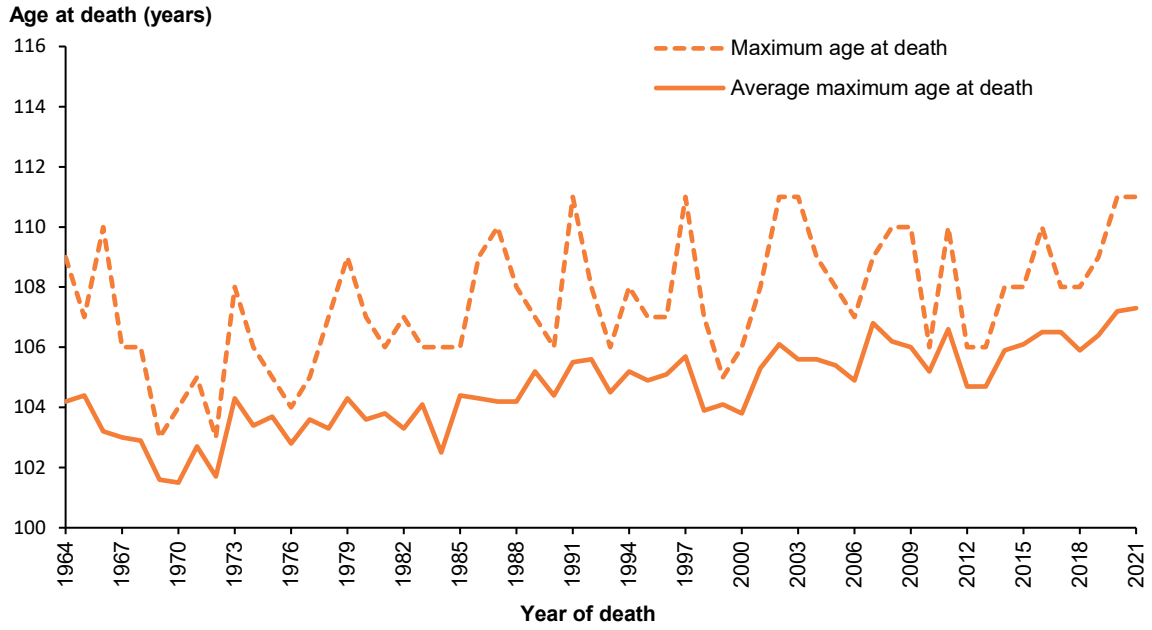
Deaths at extreme ages are rare events. Most centenarian deaths occurred between the ages of 100–104 years. However, the maximum ages reached were often higher than this. During the period 1964 to 2021, there were 2,643 semi-supercentenarian deaths; 348 males and 2,295 females. Of these, 84 were supercentenarians (12 males and 72 females).

Figure 6 shows the maximum age at death using 2 measures of the maximum age: the single maximum and average maximum (calculated as the average of the 10 oldest deaths in each year) based on validated deaths in Australia (see Appendix B) between 1964 and 2021. Both show considerable year-to-year fluctuation, but a very slight upward trend is visible. The maximum age at death was 111 years for males (with deaths at this age occurring in 1991, 1997, 2002, 2003, 2020 and 2021) and 114 years for females (occurring in 1983, 2002 and 2017) (Figure 6).

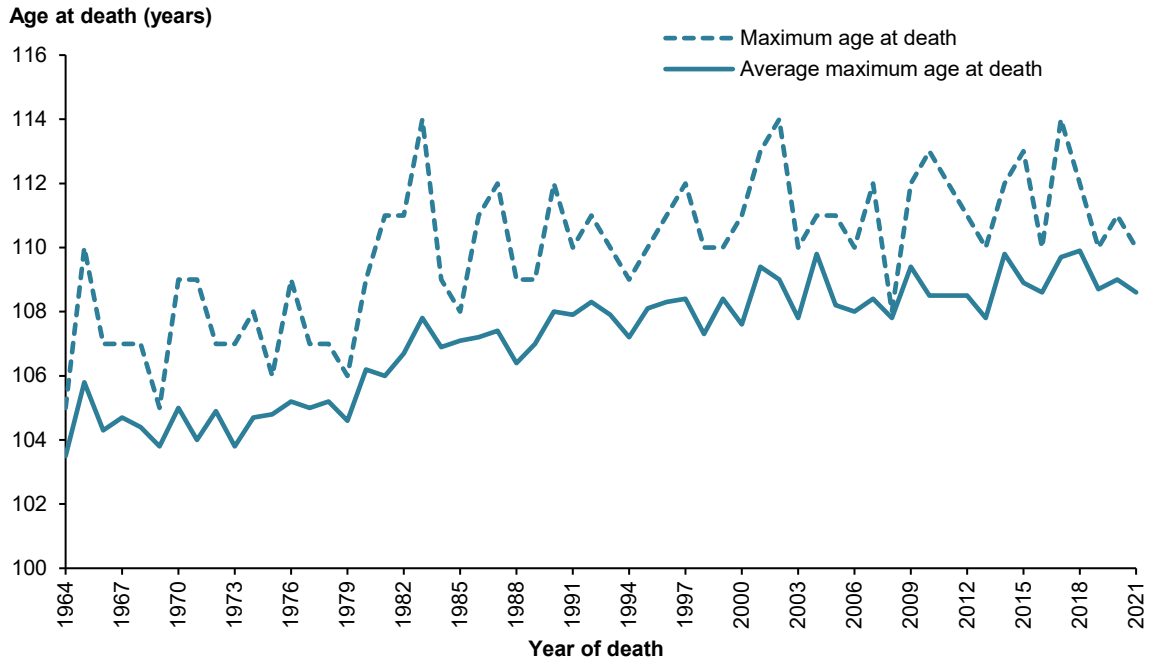
Considering the average maximum age at death, for males this ranged from 101.6 to 104.4 years in the 1960s to between 104.7 and 107.3 years in the most recent decade. The corresponding results for females show the range to be 103.5 to 105.8 years in the 1960s and from 107.8 to 109.9 years in the most recent decade.

Figure 6: Maximum and average maximum age at death, by males (a) and females (b), Australia, 1964–2021

(a) Males



(b) Females



Notes
1. Maximum age at death refers to the highest age at death in each year.
2. Average maximum age at death is the average of the 10 deaths with the highest ages in each year.
3. Deaths in 2021 include only those registered in 2021.
4. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
5. Data for this figure are available in Supplementary Table S6.

Source: AIHW National Mortality Database.

How do these measures of longevity compare?

Comparing trends for each of the longevity measures and assessing their pace of change may offer insight into the mortality trajectories of the ageing Australian population, and help to answer the question of whether we can expect Australians to continue to live to increasingly older ages.

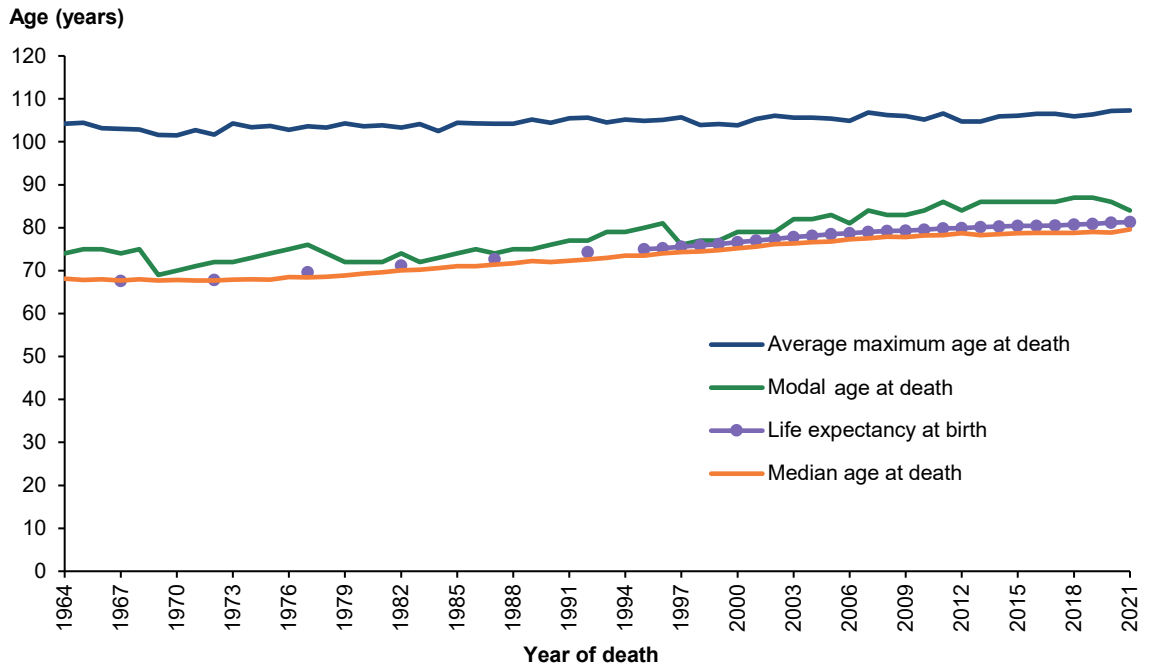
Figure 7 shows for males and females, trends in life expectancy at birth, the median age at death and the modal age at death (excluding infant deaths) together with the average maximum age at death. Considering the beginning and end points of the analysis period (1964 and 2021), there were considerable increases in life expectancy, the median age and the modal age at death.

Life expectancy at birth increased by 13.7 years for males and 11.2 years for females. The median age at death also increased over this period; by 11.5 years for males (from 68.1 to 79.6 years) and by 10.9 years for females (from 74.0 to 84.9 years). Considering the late modal age at death which excludes infant deaths, this increased by 10 years for males (from 74 to 84 years) and by 12 years for females (from 78 to 90 years). The average annual increases for life expectancy at birth, the median and the modal age at death were 3.0, 2.4 and 2.1 months per year for males and 2.5, 2.3 and 2.5 months per year for females, respectively.

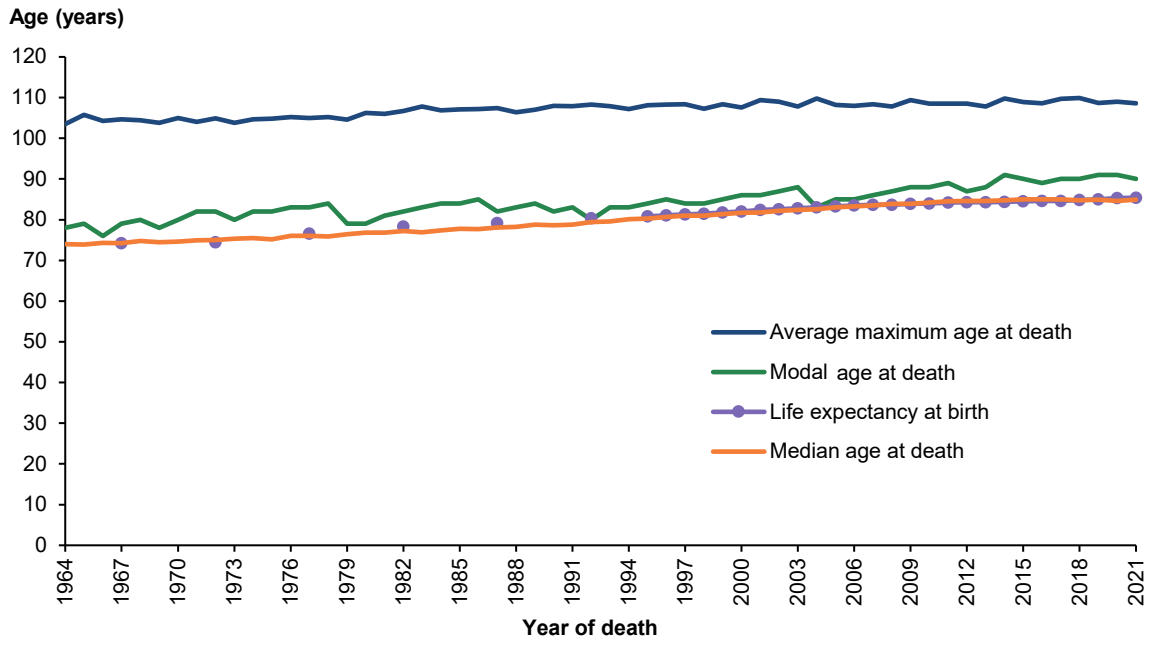
The maximum age at death increased at a slower rate than the above measures of longevity. For males, the average maximum age (average 10 oldest deaths each year) increased by 3.1 years (from 104.2 in 1964 to 107.3 years in 2021) and for females, it increased by 5.1 years (from 103.5 to 108.6), noting that there was some year to year fluctuations. If these differences are representative of the pace of change over the period examined, the average annual increase in maximum age over this period was 0.7 months per year for males and 1.1 months per year for females.

Figure 7: Indicators of longevity: life expectancy at birth, median age at death, modal age at death and maximum age at death, by males (a) and females (b), Australia, 1964–2021

(a) Males



(b) Females



Notes
1. Year refers to year of death for median, mode and average maximum age at death.
2. Average maximum age at death is the average of the 10 deaths with the highest ages in each year.
3. Modal age at death excludes infant deaths.
4. Deaths in 2021 include only those registered in 2021.
5. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
6. Data for this figure are available in Supplementary Table S7.

Sources: AIHW National Mortality Database; ABS 2014a; ABS 2014b; ABS 2015; ABS 2016; ABS 2017; ABS 2018b; ABS 2019; ABS 2020; ABS 2021; ABS 2022c.

Considering that life expectancy increases as people reach higher ages, Figure 8 shows the trends in life expectancy, based on the expected age at death for people aged 65, 75 and 85 years. This is compared to trends in the average maximum age at death.

The gain in life expectancy over the period 1967 to 2021 was highest among 65 years olds. Life expectancy at age 65 increased by 8.1 years for males (from 77.2 years to 85.3 years) and by 7.3 years for females (from 80.7 to 88.0). Life expectancy at age 75 increased by 5.3 years for males (from 82.3 in 1967 to 87.7 in 2021) and by 5.4 years for females (from 84.2 in 1967 to 89.6 in 2021). Increases in life expectancy at age 85 were the smallest, and lower, overall than the increases in the average maximum age at death over the period examined. Life expectancy at age 85 increased by 2.5 years for males (from 89.1 to 91.6 years) and by 2.8 years for females (from 89.9 to 92.7 years).

Figure 8: Average maximum age at death, average expected age at death at ages 65, 75 and 85, by males (a) and females (b), Australia, 1964–2021

(a) Males

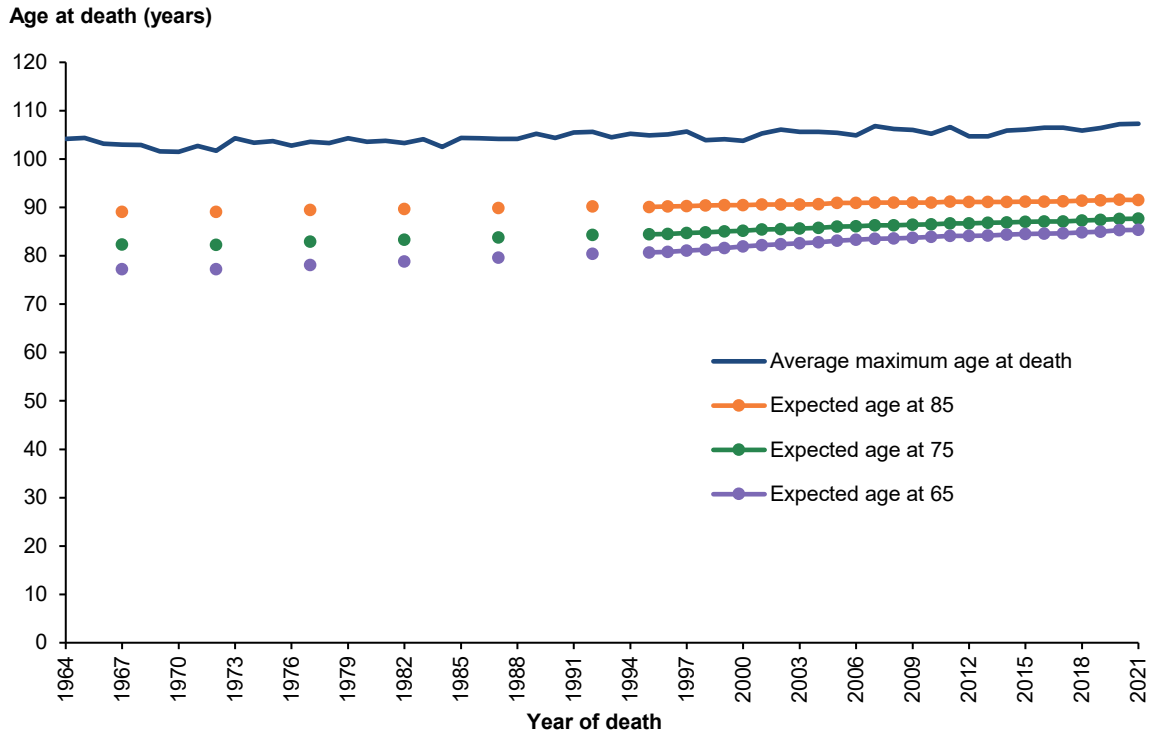
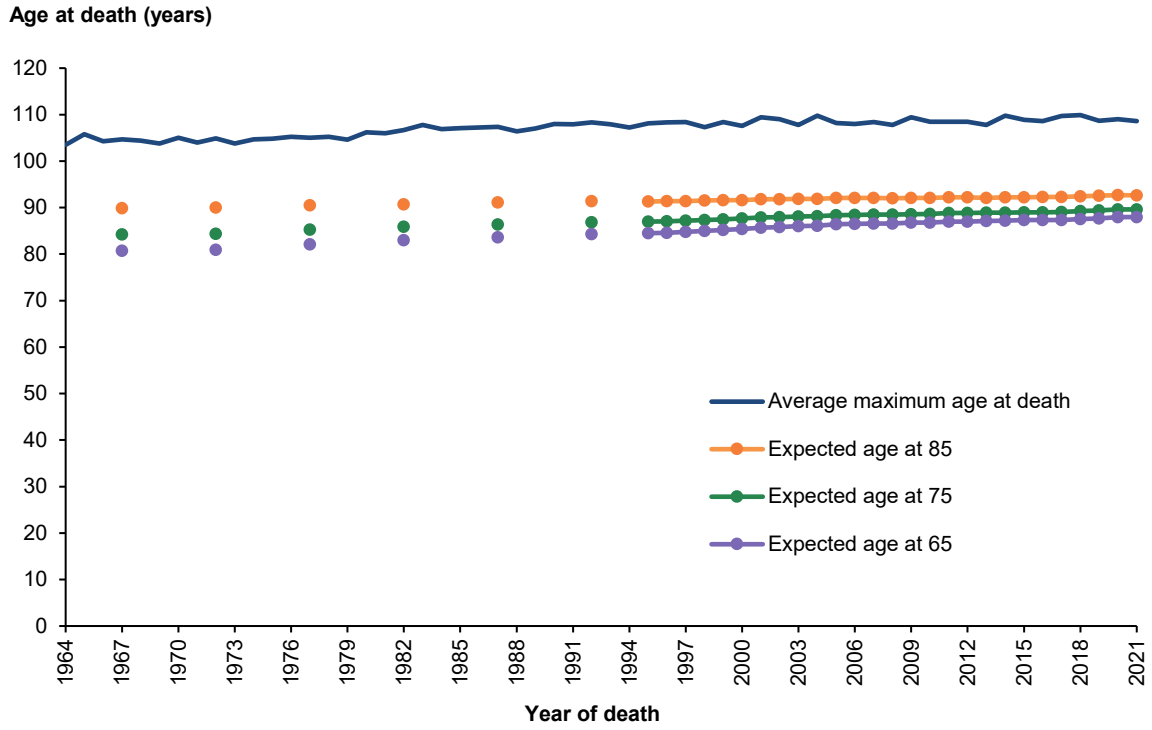


Figure 8 (continued): Average maximum age at death, average expected age at death at ages 65, 75 and 85, by males (a) and females (b), Australia, 1964–2021

(b) Females



Notes

1. Deaths in 2021 include only those registered in 2021.
2. Average maximum age at death is the average of the 10 deaths with the highest ages in each year.
3. Excludes 8 deaths that exceed the validated sex-specific age at death in Australia.
4. Expected age at death refers to the life expectancy at that age added to the age.
5. Data for this figure are available in Supplementary Table S8.

Sources: AIHW National Mortality Database; ABS 2014a; ABS 2014b; ABS 2015; ABS 2016; ABS 2017; ABS 2018b; ABS 2019; ABS 2020; ABS 2021; ABS 2022c.

These trends illustrate that while there has been a small improvement to maximum life span in Australia over time, the rate of increase is much slower than for the average life span (as measured by life expectancy at birth and median age at death). Further, the gains in longevity based on the average expected age for 85-year-olds are outpaced by the gains in maximum age at death. This suggests that mortality is being compressed into older ages and may be converging towards a maximum.

How can life expectancy be increasing faster than maximum life span?

In Australia, environmental improvements beginning in the 1900s extended the average life span dramatically with significant improvements in living conditions – such as better water supplies, sewerage systems, food quality and health education. This reduced exposure to infectious diseases. Advances in medical technology (such as mass immunisation and antibiotics), and promotion and prevention strategies related to public health (AIHW 2022a) further increased life expectancy at all ages in the second half of the 20th century.

The 21st century has seen even further increases in life expectancy – partially due to lower infant and child mortality (mainly the result of treatment of infection), fewer young people dying in motor vehicle accidents, and fewer older people dying from heart disease. The reduction in deaths from heart disease, the leading cause of death, has been linked to medical advances and behavioural changes, such as improvements in diet and less smoking (AIHW 2022a). In addition, improvements in health-care availability and access, better living conditions and overall increasing wealth in Australia have contributed to increased life expectancy (AIHW 2022a).

However, despite medical advancements and improvements from public health interventions that have resulted in large gains in life expectancy in Australia, maximum life span has shown minimal improvement. This is reflected in improvements in life expectancy resulting in an ageing population and growth in the population of centenarians, with corresponding growth in centenarian deaths but few people dying past the age of 110 years. Living to extreme ages is a rare event. The literature suggests there is no single basis for exceptional longevity. Rather its determinants are multifactorial, stemming from different combinations of genetics, environment and lifestyle, with the additional influence of social determinants and an element of chance (Pignolo 2018).

International comparisons

It is of interest to researchers, policymakers and the general public to see how Australian experiences compare on an international scale. Comparisons of life expectancy between countries can highlight the extent to which life expectancy in Australia could improve.

Table 2 shows the life expectancy at birth in 2021 of Australia within the top 16 countries from the Organisation for Economic Co-operation and Development (OECD). Australia enjoys one of the highest life expectancies in the world, at 83.2 years in 2021 for males and females at birth combined – ranking fifth among 38 OECD member countries.

Among OECD member countries, Japan has the highest life expectancy (84.7 years). Life expectancy in Switzerland, Korea and Spain also surpass Australia.

Table 2: Life expectancy (years) at birth, leading OECD member countries, 2021 (or latest available year)

Rank	Country	Life expectancy (years)
1	Japan	84.7
2	Switzerland	84.0
3	Korea	83.5
4	Spain	83.3
5	**Australia**	**83.2**
6	Iceland	83.2
7	Norway	83.2
8	Sweden	83.2
9	Italy	82.9
10	Luxembourg	82.8
11	Ireland	82.6
12	Israel	82.6
13	France	82.5
14	New Zealand	82.3
15	Finland	82.0
16	Belgium	81.9

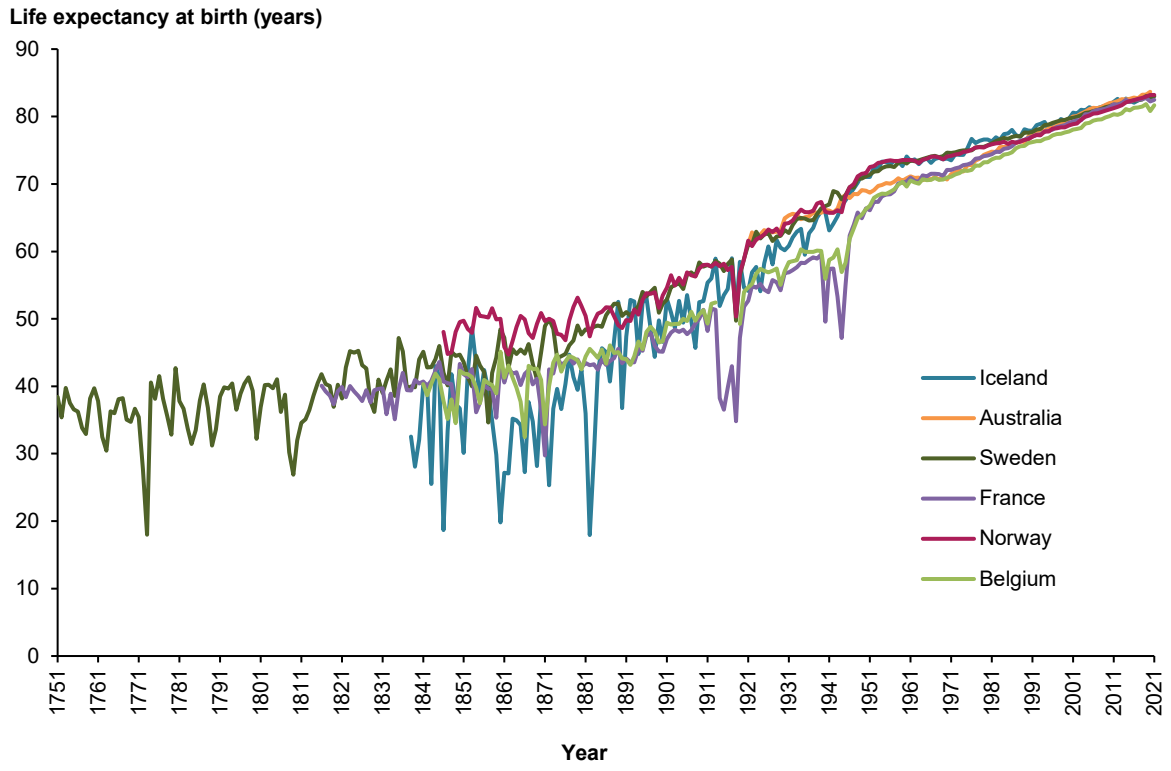
Notes

1. The OECD life expectancy data are for 2021 or the latest year available from each member country.
2. The life expectancy values for Japan, Korea, Australia, Ireland, New Zealand are for 2020; data for 2021 were not available for these countries at time of publication.

Source: OECD 2023.

Long-term trends in life expectancy at birth are shown in Figure 9. Availability of such historical data is limited to selected European countries from the Human Mortality Database. Data for Australia are available from 1921. Each country shows a general increasing trend over time, with distinct temporary falls during the periods of World War I and World War II, most notably in France and Belgium. Throughout the latter half of the 20th century, life expectancy at birth for Iceland, Sweden and Norway was similar to, or longer than, in Australia, France and Belgium. Since the 21st century, Australian life expectancy is in line with the group of Scandinavian countries for which data are available.

Figure 9: Historical life expectancy at birth in selected countries, 1751–2021

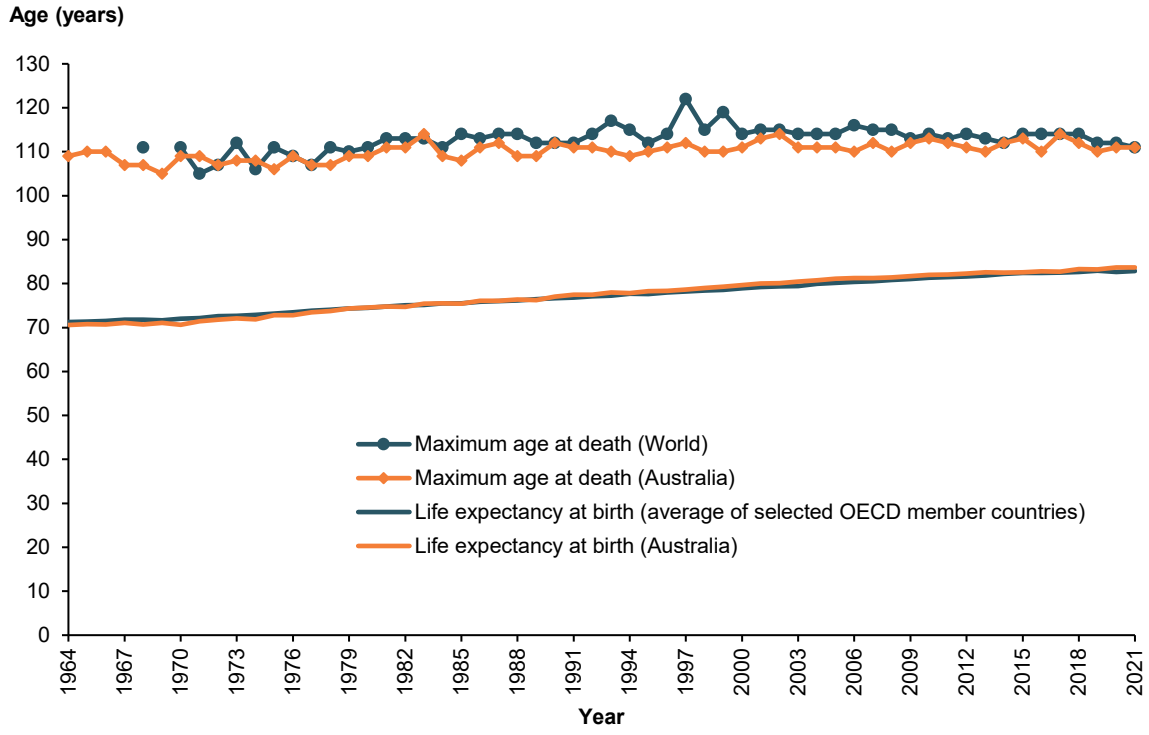


Note: Data for this figure are available in Supplementary Table S9.

Source: Human Mortality Database.

Figure 10 shows trends in life expectancy at birth in Australia and the average for the leading 15 OECD member countries combined, alongside the maximum age at death in Australia and the maximum age at death worldwide. Over the period 1964 to 2021, the life expectancy in Australia and for the OECD average have been similar. The world maximum age at death ranged between 105 and 111 in the late 1960s to 1970s and between 112 and 114 in the decade 2011 to 2021, peaking in 1997 at 122. The maximum age at death in Australia ranged between 105 and 109 in the late 1960s to 1970s, and between 110 and 114 in the most recent decade, peaking in 1983, 2002 and 2017 at 114.

Figure 10: Life expectancy at birth (Australia and average of selected OECD member countries), and maximum age at death (Australia and World), 1964–2021



Notes

1. Maximum age at death for World denotes the highest age at death reported in the International Database of Longevity. It was not reported prior to 1968 nor in 1969.
2. Maximum age at death for Australia is sourced from the AIHW National Mortality Database. It refers to the highest age at death each year.
3. Life expectancy at birth for Australia and selected OECD member countries are sourced from the Human Mortality Database. The estimates for Australia may differ slightly from those reported by the Australian Bureau of Statistics.
4. Average life expectancy at birth of selected OECD member countries is the average of life expectancy estimates for Japan, Switzerland, Korea, Spain, Iceland, Norway, Sweden, Italy, Luxembourg, Ireland, Israel, France, New Zealand, Finland and Belgium. These OECD member countries were reported as having leading life expectancy in 2021 (or nearest available year) (OECD 2023).
5. Data for this figure are available in Supplementary Table S10.

Sources: AIHW National Mortality Database; Human Mortality Database; International Database of Longevity; OECD 2023.

The data presented in this chapter focuses on long-term trends in life expectancy and includes deaths up to the first two years of the COVID-19 pandemic. Different patterns in mortality and life expectancy may be evident in some countries when looking at trends since the pandemic. Box 2 summaries current data and evidence around this, noting that more years of data are needed to fully assess the impact of COVID-19 on life expectancy and mortality.

Box 2: Life expectancy trends since COVID-19

Like Australia, other high-income countries have experienced sustained gains in life expectancy over recent decades. However, in some of these countries since the start of the COVID-19 pandemic, the pace at which life expectancy once grew has slowed, and even reversed; that is, life expectancy has declined.

Life expectancy at birth in the United Kingdom (UK) in 2018–2020 was 79.0 years for males and 82.9 years for females. Comparing these estimates to 2015–2017 showed that female life expectancy improved only slightly (by 0.5 weeks) whereas for males it was 7 weeks lower. These changes were largely attributed to the increase in the number of deaths during the COVID-19 pandemic (Office of National Statistics 2021).

Though generally rising in past decades, life expectancy in the United States (US) has recently shown dramatic declines. Prior to the COVID-19 pandemic, life expectancy had been declining in some population groups in the United States as a result of deaths due to drug overdoses, suicides and alcohol-related diseases, coined 'deaths of despair' (Tilstra et al 2021; Gold 2020). In 2019, life expectancy at birth in the US was around 79 years. However, in both 2020 and 2021, life expectancy at birth decreased, firstly by 2 years to 77.0 in 2020 and then by another 0.9 years to 76.1 in 2021. The latter decline has been primarily attributed to the COVID-19 pandemic in which COVID-19 deaths contributed 50% of the decrease in life expectancy and unintentional injuries contributed a further 16% to this decrease (Arias et al. 2022).

The latest official life expectancy estimates for Australia by the ABS are for the 3 years 2019–2021 combined. These estimates are based on mortality data which include a pre-pandemic year (2019), a year with unusually low mortality (2020), and a year with higher-than-expected mortality (2021). Such volatility in mortality during the pandemic period makes it difficult to assess further trends in life expectancy in Australia. A recent analysis by the Actuaries Institute COVID-19 Mortality Working Group indicates an excess all-cause mortality of around 12% in 2022; that is an excess of 20,200 deaths (Actuaries Digital 2023). According to Cutter et al. (2023), COVID-19 reduced life expectancy in Australia by around 1 year in 2022. The same report predicts it will be some time before mortality reaches a ‘new normal’ state.

3 What more do we need to learn?

While determining whether there is a biological limit to human longevity is out of scope for this report, the analyses presented suggest that the average life span in Australia (as measured by life expectancy at birth), the median age at death and the modal age at death are increasing faster than the change in the maximum age at death.

The analyses presented here are not without limitations. The measurement of human longevity requires rigorous statistical assessment which is made difficult by sparse, incomplete and imprecise data on some populations (Villavicencio et al. 2021).

The validation of extreme ages at death in Australian deaths data is not as rigorous as the approach applied by some demographers. To avoid overestimation of the maximum age at death in Australia in this report, a very small number of deaths (8 in total) were excluded if the reported age was older than a sex-specific validated age at death in Australia (namely, 111 years for males and 114 years for females) (See Appendix A for further information). There is a high degree of annual fluctuation in the single maximum age at death which is consistent with the rarity of deaths at extreme ages. Consequently, the time series for the single maximum age at death is sensitive to extreme ages. To further mitigate this variability and to better assess trends over time, we used the average maximum age at death indicator based on the average of the 10 deaths with the highest ages each year.

Other limitations relate to data gaps. More accurate measures of longevity in Australia require precise data on the living centenarian population and their specific age to facilitate measures of survival. Australian population data by single year of age are not currently available past age 100. Linked births and deaths data, and detailed population statistics could enhance the precision of information on Australian longevity and enable better assessment of the potential impacts of trends in maximum life span on Australian society. Some other possibilities to explore for identifying elderly populations include data for aged care services and the Medical Benefits Schedule.

This report explored longevity in Australia based on data from death registrations. Patterns in longevity would be further enhanced by understanding the health of people who live to extreme ages. While health-adjusted life expectancy provides an indication of how many years of life expectancy, on average, is spent in full health or ill health for the Australian population, it does not enable us to understand the extent to which living longer is compromised by poor health among those living to extreme ages. For this, accurate data on both morbidity and mortality for this population are required, ideally at the individual rather than population level.

Appendix A: Data sources

National Mortality Database

This report analysed data from the National Mortality Database (NMD) to explore trends in 4 measures of longevity: life expectancy, the median age at death, the modal age at death and the maximum age at death in Australia. The NMD holds records for deaths that were registered in Australia from 1964 to 2021. The database comprises information about causes of death and other characteristics of the person, such as sex, age at death, area of usual residence and Indigenous status. The cause of death data are sourced from the Registries of Births, Deaths and Marriages (RBDM) in each state and territory, the National Coronial Information System and compiled and coded by the ABS. Date of birth is partially available since 1994 and routinely collected since 1995.

In the NMD, both the year in which the death occurred and the year in which it was registered are provided. For the purposes of this report, deaths were enumerated using the year in which the death occurred. It is commonplace for approximately 4–7% of deaths to have a delayed registration; that is, some deaths that occur in a specific year are not registered until the following year. As a result, the death counts for 2021 will exclude the portion of the deaths that occurred in 2021 but were not registered until 2022. However, as more than 150,000 deaths occurred and were registered in 2021, and that the focus of this report is on deaths at very old ages, the potential omission of 4–7% delayed registrations on the analysis undertaken is minimal.

Records for deaths that occurred prior to 1964 (4,338 deaths), or with an unknown year of death (85 deaths) were excluded. Deaths with an unknown age were also excluded (890 deaths).

The variable age at death was used to ascertain the age (in complete years) at which the death occurred. This information is usually provided by the next of kin through the Death Notification Form completed by funeral directors. If the age at death is not provided, the ABS impute the age using the date of birth and date of death where available. The date of birth is available in the NMD for some jurisdictions since 1994 and for all jurisdictions since 1995.

While some validation of age at death is undertaken using information from a number of sources including the family, the RBDM and the ABS, there is no validation of age at death in Australia using the demographic method outlined in Appendix B. As such, a crude validation status was ascribed to the death records for the purposes of this report. We considered that all deaths aged 109 years or younger were true and valid (Table A1). At the time of reporting, the oldest validated (by another source) age at death was 114 for females and 111 years for males. We considered that deaths above these sex-specific ages occurring in any year in Australia were implausible. Death registrations in the NMD are de-identified; thus, an external validation of age at death cannot be directly aligned to a death record in the database.

As a result, based on this crude validation mechanism, we excluded 8 deaths registered on the NMD at reported extreme ages. This included 3 females with reported age between 115 and 118 years and 5 males with reported age between 112 and 115 years. For these deaths there was either no date of birth recorded or other information in these death records (such as year of migration) suggested an implausible age at death. In the years that these 8 deaths occurred (which ranged between 1982 and 2012, with most (6 out of the 8 deaths) occurring before 1997), there were no noted external validations of extreme ages at death. For the remaining deaths aged 110 and over, the record was assigned *plausible and validated age* if

there was external validation of a death at that age in that year, or *plausible but not validated* if there were no external sources of validation of a death at that age in that year.

Table A1: Validation status for age at death by sex, deaths occurring 1964–2021, Australia

Validation status	Males	Females	Persons
Age at death less than 110[(a)]	3,913,254	3,433,669	7,346,923
Plausible and validated age[(b)]	4	50	54
Plausible but not validated age[(c)]	8	22	30
Implausible age at death[(d)]	5	3	8
Total	**3,913,271**	**3,433,744**	**7,347,015**

(a) Age at death considered true and validated. Included in the analysis.

(b) Age at death is plausible based on the range and year of externally validated ages at death of Australians. Included in the analysis.

(c) Age at death is plausible but not validated according to the range and year of externally validated ages at death of Australians. Included in the analysis.

(d) Age at death is implausible according to the range of externally validated ages at death of Australians. Excluded from the analysis.

This report describes 2 measures of the maximum age at death: a single maximum reflecting the highest reported age by sex in each year; and the average maximum age at death which is calculated as the annual average of the 10 deaths with the highest ages in each year.

The data quality statements underpinning the NMD can be found on the following ABS web page: ABS quality declaration summary for Deaths, Australia.

For more information on the NMD see AIHW National Mortality Database.

Human Mortality Database

The Human Mortality Database (HMD) compiled and maintained by scientific researchers collates mortality and life expectancy data from statistics agencies of included countries. It is used to estimate mortality trajectories and populations of centenarians.

International Database of Longevity

The International Database of Longevity (IDL) contains verified data on nearly 20,000 individuals in 13 countries across the world who lived to age 105 or older. The demographic information includes sex, date of birth, date of death, age at death, place of birth and place of death when available. The database was last updated in 2021.

The ages of supercentenarians (persons living to age 110 or older) are validated on a case-by-case basis while those of semi-supercentenarians (persons living to ages 105 to 109) are validated through samples. Each contributing nation or region provides a list of individuals to be included in the IDL after validating their ages in accordance with a collectively adopted protocol. The data enable researchers to conduct longevity and mortality studies using enhanced measures and trajectories of mortality at extreme ages.

The IDL includes data from 13 countries: Austria, Belgium, Denmark, England and Wales, Finland, France, Germany, Japan, Norway, Spain, Sweden, and the United States, as well as from the province of Quebec, Canada.

Other data sources

Unofficial collations by researchers also exist, for example, the Gerontology Research Group, which compiles validations and data about the longest lived and living humans.

Appendix B: Validating age at death

Validating the age of very old people

There is limited reliable historical evidence of people living to extreme ages as poor documentation hinders the verification of the ages of purported centenarians (Jeune et al. 2010). Validation of long-lived individuals requires more than recorded dates of birth and death. To ensure accuracy of the earliest centenarians, demographers went to extreme lengths to reconstruct families and events, for example, to eliminate namesakes between siblings (that is, a sibling born at a later date having the name of a predeceased sibling). Age was determined using a series of chronological events, such as marriage, child-bearing and military service. In some cases, alleged accounts of very long lives have been disproven with the emergence of evidence that contradicts previous information. This could be as simple as misrecording the year of birth; for example, '1895' misrecorded as '1875' adds 20 years to an individual's life span.

More recent is the emergence of dependable evidence coupled with meticulous validation of very long-lived lives during the last century, and in some cases dating back to the 1800s. There are several and varied sources on people who died at very old ages that are used to evaluate extreme longevity in human populations. One such collection is the International Database on Longevity (IDL). This collection contains verified data on nearly 20,000 individuals in 13 coutnries who lived to 105 years or older and is considered to provide accurate and reliable data for the study of longevity. However, strict criteria around age validation permits inclusion of data from very few countries, not including Australia (Jdanov et al. 2021). The criteria for inclusion relate to completeness and age-validation. Complete data on deaths at high ages are necessary to avoid age-ascertainment bias that arises, for example, through notoriety. Deaths at very old ages are rare, thus errors in age ascertainment have a high impact on results. As well, the IDL includes a validation scale to describe the level of validation ascribed to each individual. It is expected that over time, these data will enable complete sets of mortality probabilities to directly observe mortality patterns among the very old.

Extreme longevity can also be explored using data collected by governments through civil registrations, for example, the RBDM in Australia. The NMD houses deaths registrations from the RBDM, however, the age at death in the NMD is not validated using the same rigorous approach as used by some demographers or the IDL. As well, civil registrations and censuses are used to estimate population sizes and mortality. Though, even in countries with adequate civil registrations, the sparseness of very elderly populations usually results in loss of information for this age group. As an example, there are an estimated 6,200 centenarians in Australia in 2022, however, there is no further information available about their exact age.

References

ABS (Australian Bureau of Statistics) (2014a) *Australian Historical Population Statistics, 2014*, ABS cat. no. 3105.0.65.001, ABS, Australian Government.

ABS (2014b) *Life Tables, States, Territories and Australia, 2011–2013*, ABS cat. no. 3302.0.55.001, ABS, Australian Government.

ABS (2015) *Life Tables, States, Territories and Australia, 2012–2014*, ABS cat. no. 3302.0.55.001, ABS, Australian Government.

ABS (2016) *Life tables, states, territories and Australia, 2013–2015*, ABS cat. no. 3302.0.55.001, ABS, Australian Government.

ABS (2017) *Life tables, states, territories and Australia, 2014–2016*, ABS cat. no. 3302.0.55.001, ABS, Australian Government.

ABS (2018a) *Population Projections, Australia, reference period 2017 (base) –2066*, ABS, Australian Government.

ABS (2018b) *Life tables, states, territories and Australia, 2015–2017*, ABS cat. no. 3302.0.55.001, ABS, Australian Government.

ABS (2019) *Life tables, 2016–2018*, ABS, Australian Government.

ABS (2020) *Life tables, 2017–2019*, ABS, Australian Government.

ABS (2021) *Life tables, 2018–2020*, ABS, Australian Government.

ABS (2022a) *National, state and territory population*, *reference period June 2022*, National, state and territory population tables. Table 6: Population, by age and sex–States and territories–at 30 June 2022, ABS, Australian Government, accessed 12 June 2023.

ABS (2022b) *National, state and territory population*, *reference period December 2022*, ABS, Australian Government, accessed 12 June 2023.

ABS (2022c) *Life tables, 2019–2021*, ABS, Australian Government.

AIHW (Australian Institute of Health and Welfare) (2022a) *Australia's health 2022: Chapter 4 Changing patterns of mortality in Australia since 1900*, AIHW, Australian Government, accessed 1 December 2022.

AIHW (2022b) *Deaths in Australia*, AIHW, Australian Government, accessed 06 May 2023.

AIHW (2020) *Australia's health 2020: data insights, Chapter 10 Longer lives, healthier lives?*, AIHW, Australian Government.

AIHW (2014) *Healthy life expectancy in Australia: patterns and trends 1998 to 2012*, AIHW, Australian Government.

Arias E, Tejada-Vera B, Kochanek KD and Ahmad FB (2022) 'Provisional life expectancy estimates for 2021', *Vital Statistics Rapid Release*, report no. 23, doi:https://dx.doi.org/10.15620/cdc:118999.

Beaudry-Godin M, Bourbeau R and Desjardins B (2021) 'Extreme longevity in Quebec: factors and characteristics', in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Boudoulas KD, Triposkiadis F, Stefanadis C and Boudoulas H (2017) 'The endlessness evolution of medicine, continuous increase in life expectancy and constant role of the

physician', *Hellenic Journal of Cardiology,* 58(5):322–330, https://doi.org/10.1016/j.hjc.2017.05.001.

Canudas-Romo V (2008) 'The modal age at death and the shifting mortality hypothesis', *Demographic Research*, 19:1179–1204, doi:10.4054/DemRes.2008.19.30.

Canudas-Romo V (2010) 'Three measures of longevity: time trends and record values', *Demography*, 47(2):299–312, https://doi.org/10.1353/dem.0.0098.

Chambre D, Jeune B and Poulain M (2021) 'Geert Adriaans Boomgaard, the first supercentenarian in history?', in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Chatterji S, Byles J, Cutler D, Seeman T and Verdes E (2015) 'Health, functioning, and disability in older adults – present status and future implications', *The Lancet*, 385(9967):563–575, https://doi.org/10.1016/s0140-6736(14)61462-8.

Cutter K, Lyon R and Lang J (2023) *Counting the toll of COVID*, Croakey Health Media, https://www.croakey.org/counting-the-toll-of-covid/, accessed 23 May 2023.

Dong X, Milholland B and Vijg J (2016) 'Evidence for a limit to human lifespan', *Nature Advance* online publication, https://doi.org/10.1038/nature19793.

Fries JF (1980) 'Aging, natural death, and the compression of morbidity. *New England Journal of Medicine*, 303(3):130–135, https://doi.org/10.1056/nejm198007173030304.

Gerontology Research Group (2015) *Supercentenarians lists and tables: Table A: Verified supercentenarians (listed chronologically by birth date),* GRS website, accessed 14 March 2023.

Gerontology Wiki (2023) *List of Australian supercentenarians*, Gerontology Wiki website, accessed 14 March 2023, https://gerontology.fandom.com/wiki/List_of_Australian_supercentenarians.

Gold MS (2020) 'The role of alcohol, drugs, and deaths of despair in the U.S.'s falling life Expectancy', *Missouri Medicine*, 117(2):99–101.

Human Mortality Database, *Human mortality database*, accessed November 2022.

Jdanov DA, Shkolnikov VM and Gellers-Barkmann S (2021) 'The International Database on Longevity: data resource profile', in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Jeune B, Robine JM, Young R, Desjardins B, Skytthe A and Vaupel JW (2010) 'Jeanne Calment and her successors. Biographical notes on the longest living humans', in: Maier H, Gampe J, Jeune B, Robine JM and Vaupel J (eds) *Supercentenarians*, Demographic Research Monographs, Springer, Berlin, Heidelberg, https://doi.org/10.1007/978-3-642-11520-2_16.

Jiang H, Ju Z and Rudolph KL (2007) 'Telomere shortening and ageing', *Zeitschrift Fur Gerontologie Und Geriatrie*, 40(5):314–324, https://doi.org/10.1007/s00391-007-0480-0.

Jeune B and Poulain M (2021) 'The First supercentenarians in history, and recent 115 + −year-old supercentenarians. An introduction to the following chapters', in Maier H, Jeune B, and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Longo V (2022) 'Nutrition, longevity and disease: from molecular mechanisms to interventions', *Cell,* 185(9):1455–1470, https://doi.org/10.1016/j.cell.2022.04.002.

Lopez AD and Adair T (2019) ‘Slower increase in life expectancy in Australia than in other high income countries: the contributions of age and cause of death’, *Medical Journal of Australia*, 210:403–409. https://doi.org/10.5694/mja2.50144

McCormack J (2010) ‘Being very old in a young country: centenarians and supercentenarians in Australia’, in: Maier H, Gampe J, Jeune B, Robine JM and Vaupel J (eds) *Supercentenarians*, Demographic Research Monographs, Springer, Berlin, Heidelberg, https://link.springer.com/chapter/10.1007/978-3-642-11520-2_6.

Office of National Statistics (2021) *National life tables – life expectancy in the UK: 2018 to 2020*, ONS website, accessed 24 May 2023.

OECD (Organisation of Economic Cooperation and Development) (2023) *OECD health statistics 2023*, OECD website, accessed 24 January 2023, https://data.oecd.org/healthstat/life-expectancy-at-birth.htm.

Oeppen J and Vaupel JW (2002) ‘Broken Limits to Life Expectancy’, *Science*, 296: 1029–1031. doi:10.1126/science.1069675

Passarino G, De Rango F and Montesanto A (2016) ‘Human longevity: genetics or lifestyle? It takes two to tango’, *Immunity and Ageing*, 13(12), https://doi.org/10.1186/s12979-016-0066-z.

Pignolo RJ (2018) ‘Exceptional human longevity’, *Mayo Clinic Proceedings*, 94(1):110–124., doi:10.1016/j.mayocp.2018.10.005.

Poulain M, Chambre D and Jeune B (2021) ‘Margaret Ann Harvey Neve – 110 years old in 1903. The first documented female supercentenarian’, in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Robin-Champigneul F (2020) ‘Jeanne Calment's unique 122-year life span: facts and factors; longevity history in her genealogical tree’, *Rejuvenation Research*, Feb 2020:19–47, http://doi.org/10.1089/rej.2019.2298.

Robine JM, Allard M, Herrmann FR and Jeune B (2019) ‘The real facts supporting Jeanne Calment as the oldest ever human’, *The Journals of Gerontology: Series A,* 74:S13–S20, https://doi.org/10.1093/gerona/glz198.

Saito Y, Ishii F and Robine JM (2021) ‘Centenarians and supercentenarians in Japan’, in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

The Japan Times (2022) *Centenarians in Japan top 90,000 for first time*, The Japan Times, https://www.japantimes.co.jp/news/2022/09/16/national/japan-record-centenarians/, accessed 12 June 2023

Tilstra AM, Simon DH and Masters RK (2021) ‘Trends in “Deaths of Despair” among working-aged white and black Americans, 1990–2017’, *American Journal of Epidemiology*, 190(9):1751–1759, https://doi.org/10.1093/aje/kwab088.

Villavicencio F and Aburto JM (2021) ‘Does the risk of death continue to rise among supercentenarians?’, in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Wilson T and Terblanche W (2018) ‘New estimates of Australia’s centenarian population’, *International Journal of Population Data Science*, 3(1):447, doi:10.23889/ijpds.v3i1.447.

Young RD (2021) ‘113 in 1928? Validation of Delina Filkins as the first “second-century teenager”’, in: Maier H, Jeune B and Vaupel JW (eds) *Exceptional lifespans*, Springer Link, Switzerland, doi:10.1007/978-3-030-49970-9.

Zak N (2019) ‘Evidence that Jeanne Calment died in 1934 – not 1997’, *Rejuvenation Research*, 22:3–12, http://doi.org/10.189/rej.2018.2167.

Acknowledgements

This report was produced by members of the Burden of Disease and Mortality Unit at the Australian Institute of Health and Welfare. The report was authored by Karen Bishop and Wendy Ho under the guidance of Michelle Gourley and Richard Juckes. Matilda Pulford undertook data checking for the report, and Oscar Yang provided statistical advice.

Valuable input was received from Lauren Moran from the Australian Bureau of Statistics. The authors would also like to thank the Centre for Population for reviewing this report.

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
COVID-19	Coronavirus disease 2019
HMD	Human Mortality Database
IDL	International Database on Longevity
NMD	National Mortality Database
OECD	Organisation for Economic Co-operation and Development
RBDM	Registries of Births, Deaths and Marriages
UK	United Kingdom
US	United States

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Related publications

This report, *How long can Australians live?*, and other AIHW publications can be downloaded from the AIHW website <https://www.aihw.gov.au/>. The AIHW website also includes information on ordering printed copies.

The following related AIHW publications might be of interest:

AIHW (2022b) *Deaths in Australia*, AIHW, Australian Government.

AIHW (2022a) *Australia's health 2022: Chapter 4 Changing patterns of mortality in Australia since 1900*, AIHW, Australian Government.

AIHW (2020) *Australia's health 2020: data insights, Chapter 10 Longer lives, healthier lives?*, AIHW, Australian Government.

AIHW (2014) *Healthy life expectancy in Australia: patterns and trends 1998 to 2012*, AIHW, Australian Government.

On average, Australians are living longer than ever before. Life expectancy has been steadily increasing, and this is matched by increases in the proportion of deaths that occur at older ages and in the median age at death. The result is an ageing population coupled with substantial growth in the population of centenarians (people aged 100 years or more). However, the oldest age at death has shown minimal increases over time. In Australia the oldest living person is believed to have died at age 114.

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