DemoGraphic

By what age do people experience familial death, and how has that changed over time?

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Introduction

At the beginning of the twentieth century, death was a familiar and frequent occurrence. Average period life expectancy at birth in Australia in 1901 was 54 years, and based on contemporary mortality rates (Smith 2007), less than three-quarters of the population survived to age 40, with 10% of babies dying before their first birthday, and another 10% before age 30. Consequently, it was common to experience the death of close family members from a young age.

In early twenty-first-century Australia, male and female life expectancy at birth are now both well above 80 years. Based on 2018–20 Australian life tables, more than 98% of people survive to their 40th birthday, and death is concentrated at very old ages, with more than half of deaths occurring over the age of 85 years (ABS 2021a). As noted by Jalland (2006 p. 4) "old age [has now] replaced infancy as the most likely time of death…Parents today expect their children to survive at least to adulthood, and many people do not experience death until their elderly parents die."

The ages at which people experience the death of family members has changed enormously over the past century. This study aims to quantify this experience by considering two 'average' Australians born 100 years apart, in 1901 and 2001, and employing relevant demographic measures to trace the ages by which they are likely to experience familial death, given their own survival. Here, 'familial death' (or, death of a family member) is defined as the death of a parent, sibling, partner, or child.

Data and methods

Basic demographic assumptions are set out in Table 1. For our average Australian born in 1901 (hereafter referred to as '1901'), their mother was born 30 years earlier in 1871 and their father three years before that in 1868 (based on likely age patterns of partnership and fertility). It is assumed that 1901's mother survived at least to their birth, and father at least to their conception (nine months before birth).

Australian wives born in 1871 who had children, and who survived their childbearing years, had an average of five children each (Knibbs 1911; Wickens 1921). If this average is assumed for 1901's

Table 1: Demographic assumptions for family members (self, parents, siblings, partner, children), average Australians born in 1901 and 2001

Family member	**Assumptions for 1901's family**	**Assumptions for 2001's family**	**Common assumptions**
Self	Born in 1901.	Born in 2001.	Assumed to survive well into old age. For the demography of partner and children, 1901 and 2001 are assumed to be female.
Mother	Born in 1871.	Born in 1971.	Survives at least to 1901/2001's birth. Subsequent partnerships/marriages are not accounted for.
Father	Born in 1868.	Born in 1969.	Survives at least to 1901/2001's conception. Subsequent partnerships/marriages are not accounted for.
Siblings	4 siblings born 1897, 1899, 1903, 1905.	1 sibling, born in either 1999 or 2003.	No multiple births. Birth intervals of 2 years. Each sibling is at risk of death from their birth. The birth of siblings after 1901/2001 is predicated on the survival of their mother to birth, and their father to conception. The sex ratio at birth for siblings (to calculate mortality) is assumed to be 1.05 males to 1 female.
Partner	Born in 1899. Partnership/ marriage in 1925.	Born in 1999. Partnership/ marriage in 2029.	Partner is male. Survives at least to partnership/marriage.
Children	3 children born in 1927, 1929 and 1931.	2 children born in 2031 and 2033.	The birth of children is predicated on the survival of their father to conception. Subsequent partnerships/marriages are not accounted for. The sex ratio at birth for children (to calculate mortality) is assumed to be 1.05 males to 1 female.
For parents, siblings, partner and children, annual age-sex-year-specific probabilities of dying are calculated from relevant Australian life tables, 1901–2019, and projected probabilities assuming that life expectancy at birth increases to 91 years for males and 93 years for females in 2101. Mortality in 1897–1900 is assumed to be the same as in 1901.			

mother, with no multiple births, birth intervals of two years, and 1901 being the middle child, then 1901's four siblings were born in 1897, 1899, 1903 and 1905. Each sibling is at risk of death from the time of birth.

It is further assumed that 1901 is female, and that she marries in 1925 when she is aged 24 years to a man two years older (based on marriage patterns in Carmichael 1988). Assuming she has children, she has three—the median for her cohort (ABS 2005; ABS 1999)—born in 1927, 1929 and 1931. 1901's husband is at risk of death from marriage, and her children, from birth.

The sex ratio at birth for 1901's siblings and children is assumed to be 105 males per 100 females. The birth of siblings after 1901 is predicated on survival of 1901's mother to each birth, and 1901's father to each conception. Second and subsequent marriages/partnerships are not accounted for.

A similar method is followed for the 'average Australian' born in 2001 (hereafter known as '2001'). Based on average ages at marriage and birth (Carmichael 1988; Kippen 2006; ABS 2021c), her mother was born in 1971, and her father in 1969, and she is one of two children. Future partnering and birth

rates by age are not known, but based on likely trends, 2001 is assumed to partner in 2029 with a man two years older than her, and have two children born in 2031 and 2033.

Both 1901 and 2001 are assumed to survive well into old age. Mortality rates for family members are assumed to be independent. Relevant national age-sex-year-specific mortality rates are applied to 1901 and 2001's parents, siblings, partner, and children, from the relevant starting point for each, for each year over time.

Annual period single-year-of-age life tables were available from 1901 to 2019 (Smith 2007; ABS 2021a; ABS 2021b). It was assumed that 1901 rates applied for the period 1897–99. For 2020 onwards, it was assumed that period life expectancy at birth will continue to increase to 91 years for males and 93 years for females in 2101, implying an average increase of around 1.2 years per decade for males, and 0.9 years per decade for females.

Projected male life expectancy is between the 'high' and 'low' male life expectancy assumptions made in the most recent Australian population projections (ABS 2018), and similar to projected Australian male life expectancy in the most recent United Nations population projections (United Nations 2019). Projected female life expectancy is in line with the 'high' Australian projection (ABS 2018), and slightly lower than the United Nations projection (United Nations 2019). Male and female life tables for the given life expectancies in 2101 were sourced from the United Nations extended model life tables, general pattern (United Nations 2011). Annual age-sex-specific mortality rates were interpolated between 2019 and 2101. Period rates by single year of age were rearranged into cohort rates by age to trace cohort survival.

All calculations were conducted using Microsoft Excel.

Key features

Figure 1 shows, for our typical Australian born in 1901, the probability across age of having experienced the death of a parent, sibling, partner, or child. Figure 2 shows the same results for our 2001-born Australian. The differences are striking.

By the age of 40, 1901 had a three-in-four chance that at least one parent was deceased—57% for her father, and 37% for her mother. She also had a 59% likelihood that a sibling had died, 5% for her husband, and 20% for a child. Assuming independence of outcomes, 1901 had a 92% probability that a family member (parent, sibling, spouse, child) died before her 40th birthday, and an 83% probability that such a death occurred when she was between the ages of 5 and 40. The early 'steps' evident in the probabilities of death for siblings and children are due to the high risk of infant mortality for 1901's siblings born in 1903 and 1905, and her children born in 1927, 1929 and 1931 (Figure 1).

In contrast, by age 40, 2001 has a three-in-four chance that both her parents are still alive. The likelihood that 2001's father dies before 2001 reaches age 40 is 17%, and her mother, 9%. By age 40, 2001 has only a 2% probability that her sibling dies, 1% for her partner, and less than 1% for a child. The risk is only around one-quarter that, before the age of 40 (or between 5 and 40), 2001 will suffer the death of a parent, sibling, spouse or child (Figure 2).

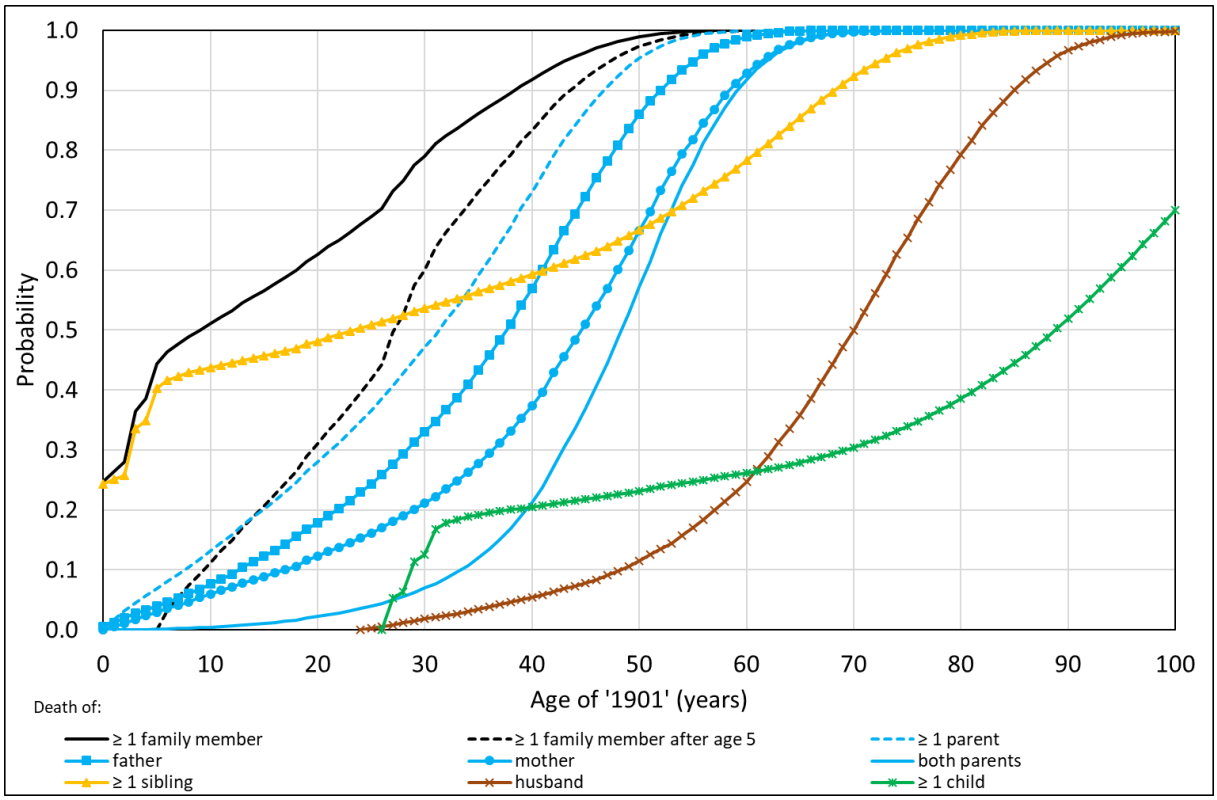

Figure 1: Cumulative probability of familial death (parent, sibling, partner, child) by age, average Australian born in 1901

Source: Cohort age-sex probabilities of death calculated from Smith (2007).

Notes: Mother born in 1871; father in 1868; 4 siblings in 1897, 1899, 1903 and 1905; husband in 1899; children in 1927, 1929 and 1931. ≥ 1 family member: death of at least 1 family member (father, mother, sibling, partner, child); ≥ 1 family member after age 5: death of at least 1 family member (father, mother, sibling, partner, child) after 1901 reaches age 5 years; ≥ 1 parent: death of at least 1 parent; ≥ 1 sibling: death of at least 1 sibling; ≥ 1 child: death of at least 1 child.

We can also consider the median ages by which 1901 and 2001 first experience the death of a family member; that is, the age at which the cumulative probability of death is 50%. On average, 1901 was almost 20 years younger than 2001 when she lost a parent (age 31 years versus 50 years) and her partner (70 years versus 88 years). The median age at which 1901 first lost a sibling was 23 years, compared to 93 years for 2001. 1901 could expect to experience the death of a child by age 88 years, whereas 2001's children will likely all outlive her, even if she survives to her 100th birthday (Figures 1–2).

By age 50, the probability that 1901 experienced the death of a family member is almost 100%, whereas the probability for 2001 is around 50% (Figures 1–2).

In line with Jalland's statement in the Introduction, this analysis indicates that the continuing postponement of death to older ages means that the majority of Australians born at the turn of the millennium will not suffer a familial death—parent, sibling, partner, or child—until they themselves are well into middle age. For the cohort born a century earlier, death of family members from a young age was a much more common experience.

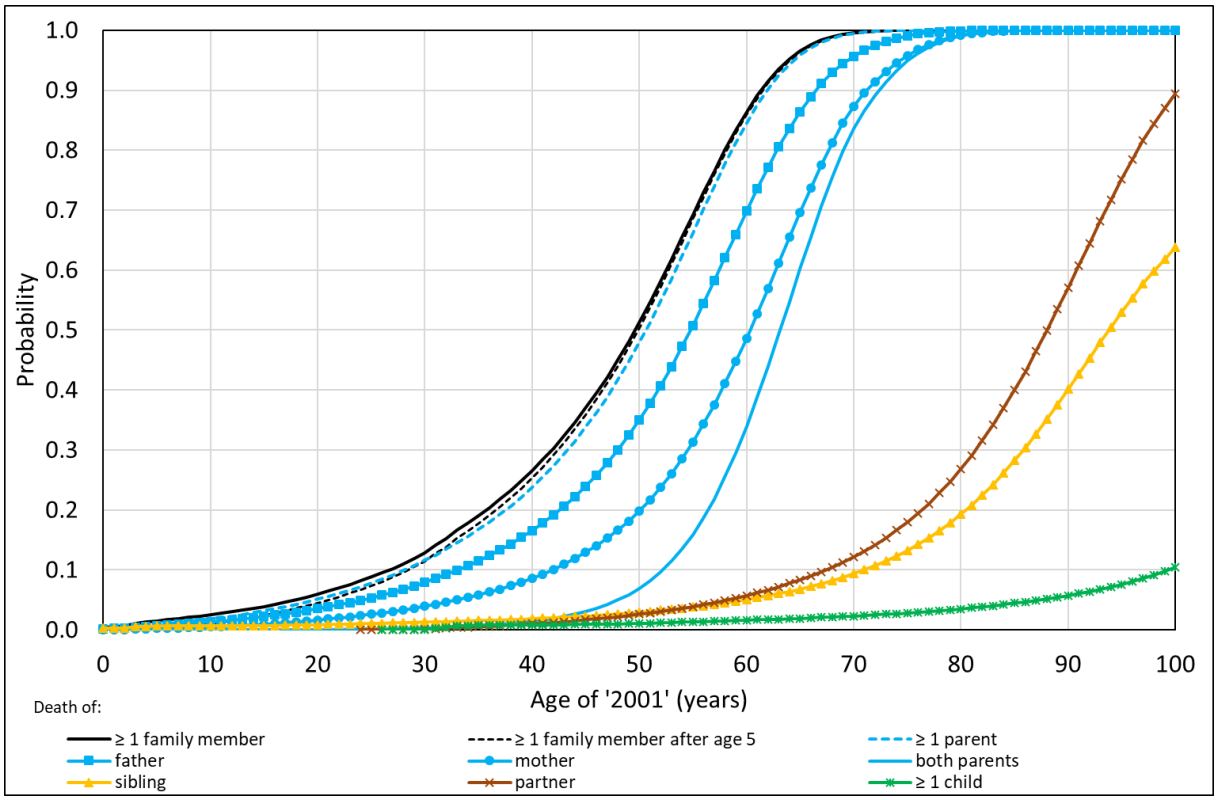

Figure 2: Cumulative probability of familial death (parent, sibling, partner, child) by age, average Australian born in 2001

Source: Cohort age-sex probabilities of death calculated from Smith (2007); ABS (2021a); ABS (2021b); United Nations (2011).

Notes: Mother born in 1971; father in 1969; 1 sibling in 1999 or 2003; partner in 1999; children in 2031 and 2033. ≥ 1 family member: death of at least 1 family member (father, mother, sibling, partner, child); ≥ 1 family member after age 5: death of at least 1 family member (father, mother, sibling, partner, child) after 2001 reaches age 5 years; ≥ 1 parent: death of at least 1 parent; ≥ 1 child: death of at least 1 child.

Limitations

Since single-year-of-age mortality rates by sex were only available annually for Australia from 1901 to 2019, it was assumed that 1901 rates applied for the period before 1901 (to 1901's siblings born in 1897 and 1899). Mortality rates after 2019 were projected assuming continuing decline. If the actual future mortality decline is not as great, or death rates increase in future, then 2001 will be more likely to experience the death of close family members at a younger age. The calculations assume independence of mortality risk, whereas mortality is likely to cluster within families and time periods. These scenarios are a national average only. The demography of different sub-populations (e.g., McCalman et al. 2009) is not accounted for.

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