

ABOUT MORTALITY DATA FOR AUSTRALIA

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GENERAL

Early population statistics for Australia stem from custom population enumerations known as musters. The musters served specific administrative purposes and targeted particular groups of populations, such as convicts. They were held irregularly over the first 40 years of settlement with a total count of musters that was no more than 30. People were not legally required to participate. As a result, such enumerations suffer from a great undercount (Camm, 1984).

Population statistics for Australia in the period covered by the HMD derive mainly from national censuses. The first modern census was conducted in 1828, but this only covered New South Wales and parts of Tasmania and Queensland. Since that time censuses were held more or less regularly every 5 or 10 years in the different colonies. Starting in 1911, following the establishment of the Federation of Colonies on 1 January 1901, censuses were conducted regularly by the successive governments of the Commonwealth of Australia. A list of Australian censuses is provided in Appendix Table I.

The first records of vital statistics are available from parish registers, established after colonization began in 1788. Official registration was first established in Tasmania in the year 1838 followed by Western Australia, South Australia, Victoria and New South Wales including Queensland in the years 1841, 1842, 1853, and 1856, respectively (Young, 1975). Before 1906, data on deaths are available from the annual State vital statistical reports; from 1907 to 1963, they are from the statistical reports of the Australian Bureau of Statistics (ABS) and its predecessor (Commonwealth Bureau of Census and Statistics 1905–1974). However, population estimates have been available for every calendar year starting in 1921 only, which explains why the HMD series starts then. The ABS now maintains an individual record database of deaths starting in 1964.

Source of Data

Population data used in the HMD for the years 1921 to 2018 originate from Australian official estimates produced by the ABS using intercensal methods. These data have either been purchased from the ABS or downloaded freely from the ABS website. Population data for years 1921-1970 were purchased from the ABS. The data are compilations from various statistical publications on population estimates. Population data for years 1971-2019 are official mid-year estimates from the ABS. Whenever possible, the latest population estimates are included.

Data on deaths for years 1921 to 1963 have been compiled by the HMD from annual official statistics reports. Special tabulations of death counts have been purchased from the ABS for years 1964 until 2017, and general tabulations by year of death, sex and age were downloaded from the ABS website for years 2012 to 2018 to be used in the interim.

Annual birth counts by sex have also been downloaded from the ABS website. Total birth counts by month have been compiled from annual statistical reports for years 1962-1974, taken from data collected by the Human Fertility Database (HFD) for years 1975-1999, and downloaded from the ABS website for years 2000-2011 and for 2017-2018. Births by year, sex, and month of occurrence for 2012-2017 have been received as part of a purchasing bundle from the ABS.

Additional information about the data sources is included in Appendix II. Complete information for each data value in the database is provided in the reference and note files, available in the input database.

TERRITORIAL COVERAGE

There has been no significant change in territorial coverage of Australian statistics in the period currently covered by the HMD series. The estimated resident population of Australia includes the population of “Other Territories” since June 1994, but it is not treated as a territorial change in this database. On December 31st of 2003 the population of Australia was estimated at 20,008,677

and the population of the “Other Territories” at 2,646, or 0.013% of the total.

Until 1967, the indigenous population was excluded from federal censuses and population estimates as stipulated in section 127 of the Constitution. ‘Aboriginal natives’ were defined as individuals with more than 50% Aboriginal ‘blood’. The Constitution Alteration (Aboriginals) Act of 1967 repealed this provision and since 10 August 1967 ‘full-blooded’ Aboriginals and Torres Strait Islander people are officially included in population statistics. Official population estimates were backdated to 1961 to include estimates of indigenous population, but Aboriginal births and deaths have only been included in Australia's vital statistics since 1966. This constitutes a universe change, but the HMD does not adjust the series at this time to account for this universe change, since the requisite data are either not available or of insufficient quality. The ABS estimates the aborigine population to have been approximately 80,000 persons at the time of the 1966 census, around 0.7-0.8% of the total population, but this estimate is not reliable or detailed enough to use to adjust the HMD mortality series properly. Instead we assume that the indigenous Australian population was small enough around the time of these statistical changes that the effect on national mortality estimates is trivial.

DEATH COUNT DATA

Coverage and Completeness

Due to the legal requirements of the death registration system established in the middle of the 19th century, data on deaths are considered to be complete and of a good quality though data collected after 1964 are considered to be of a better quality than historical data (personal communication with ABS). Deaths of overseas visitors are classified according to the State or Territory where the death was registered. Official death statistics disseminated by ABS are based on deaths tabulated by year of registration rather than year of occurrence. In recent years, about five percent of deaths are registered after the year of occurrence. This

percentage varies from year to year, and likely ranged from 5%-10% for the years included in the HMD series by year of registration (1921-1963). The effect of late registration is to smooth real annual variation in death counts, and to introduce unobserved variation due to annual changes in the proportion of deaths registered late. For the years in which we can compare results from using registered versus occurred deaths, 1964-2011, the effect of late registration would have been to introduce a random error in life expectancy on the order of +/- 0.1 year of life, but with no detectable bias. Most late-registered deaths are registered in the year following occurrence. The most recent year in the HMD series, 2018, incorporates deaths which occurred in 2018 but were registered in 2019, and is considered reasonably complete. Forthcoming updates will tend to lag behind preliminary data availability in this fashion.

Currently, death statistics come from the death certificates and the death information forms. Death certificates are filled by the attending medical officer and include information on the cause of death or the condition leading to death. A death information form is filled out by the deceased's next of kin or by the funeral director and includes administrative and demographic information. Death certificates are coded by ABS and added to the unit record level database. De-identified copies of computerized records are also provided to the Australian Institute of Health and Welfare (AIHW) which maintains its own mortality databases.

Specific Details

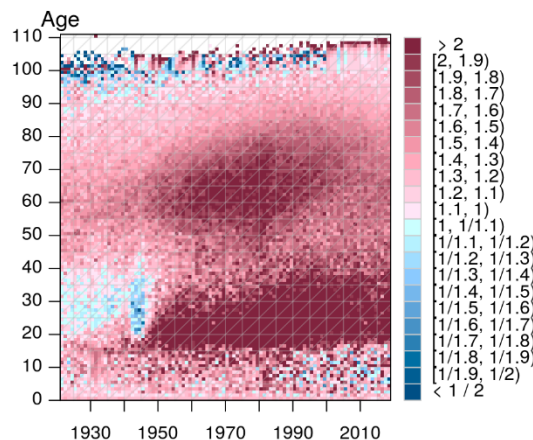
- Data for years 1921-1963 are by single years of age (up to the maximum age) and year of registration. These data have been compiled by the HMD from freely available pdf files on the ABS website.
- ABS follows a strict policy on releasing confidential data. For current tabulations, including the HMD data purchased for years 1990-2011, all cells containing a death count of 1 or 2 have been replaced by an asterisk,

Last Updated: March 27, 2020

and we do not know the true value. All such cases have been replaced with the expected value (given marginal distributions), and these lines are identified by a note in the Input Database.

- There is an observed underreporting of WWII wartime male death registrations in the civil register. It is worth noting the dip in mortality sex ratio observed in the plot of male-to-female mortality rate sex ratios for years 1939-1945. A relevant remark from the ABS 1945 Demography bulletin notes as follows: “*The deaths as recorded in Section V. exclude deaths of defence personnel in each of the years 1942, 1943, 1944 and 1945 but include such of those deaths as were registered with civil Registrars during the years 1940 and 1941. The figures shown in this section thus relate to the Australian resident civilian population.*” (Commonwealth Bureau of Census and Statistics 1947). This likely suggests that underreporting of military deaths over the course of the war led to the spot of reduced mortality sex ratio (in favor of females) in 1939-1945 for ages 18-40.

AUS, Male Mx / Female Mx, 1x1



- Death counts for years 1964 and forward are tabulated by year of occurrence. There is no obvious rupture in the series between 1963 and

1964, when the switch from year of registration to year of occurrence took place, and no special adjustment is made.

- For 1990-2016, deaths are mostly tabulated by Lexis triangles, but birth cohort is missing in some cases, especially in the 1990s. There are therefore many overlapping additive Lexis shapes (AP, APC, PC) in the Input Database for deaths, each of which is dealt with according to the HMD methods protocol.
- For 2017-2018, deaths by year of occurrence are tabulated by single year of age (not by Lexis triangle) from publicly available data (see below the section “Revision Notes” for more details).

POPULATION COUNT DATA

Coverage and Completeness

Prior to 1971, population estimates are based on *de facto* census counts. Starting in 1971, population estimates are based on *de jure* census counts adjusted for net undercount and to include Australians temporarily overseas. The HMD makes no adjustment for this universe change, but this may be considered in the future. Data are considered to be complete and of good quality.

Resident (*de jure*) population estimates are referred to as either *Preliminary*, *Revised* or *Final*. They are derived from the census date population estimates which are in turn *de jure* census counts adjusted for net undercount. The net census undercount is estimated by ABS from a Post-Enumeration Survey conducted 3 weeks after the census. The estimates are produced by the cohort component method using information on subsequent births, deaths and migration. Preliminary estimates are generally made available six months after the reference period. Revised estimates are generally published a year later (e.g. estimates for the 1997-98 financial year became available in September, 1999). Final population estimates are published for the previous intercensal period after each census. Estimates by single years of age and sex are published annually with a

June 30th reference date.

Specific Details

- Until 1967, the indigenous population was excluded from federal censuses. Population estimates were *a posteriori* adjusted back to 1961 by ABS to include estimates of the indigenous population.
- All estimates from 1921 to 2018 are official mid-year estimates based on final intercensal estimates by ABS.
- The estimates for the years 2012-2016 are the revised official estimates, based on intercensal estimation from the 2016 census.

BIRTH COUNT DATA

Coverage and Completeness

Due to the legal requirements of the birth registration system established in the middle of the 19th century, data on births are considered to be complete and of good quality. Annual births are included in the HMD series by year of registration and sex. The HMD birth series begins in 1860 rather than in 1921, since variations in the annual birth series are used to help split age-period tabulated death counts into Lexis triangles according to the Methods Protocol, and these early birth cohorts pass through the HMD mortality series. Some universe changes did happen in the early years of the birth series, but these territorial additions were sparsely populated areas and do not significantly alter the series, and so no adjustment is made. Specifically, birth statistics include the Northern Territories (NT) starting in 1902. No adjustment is made for this, since the proportion of births in the NT was very small in 1902 (0.00019). Birth statistics include the Australian Capital Territory (ACT) starting in 1911. No adjustment is made for this, since, again, the proportion of births in the ACT was very small in 1911 (.00029). We assume that variation by year of registration is a good enough approximation of true annual variation to be useful for this estimation procedure. Total births by

month of occurrence have been collected starting from 1962 and are not available for earlier years.

There is usually an interval between the occurrence and registration of a birth and, as a result, some births occurring in one year are not registered until the following year or later, especially those taking place at the very end of a calendar year. This can be caused by either a delay by the parent(s) in submitting a completed form to the registry, or a delay by the registry in processing the birth. (Australian Bureau of Statistics, 2016).

The difference between the two HMD series (births by month of occurrence and births by sex and year of registration) is at most 3%.

Specific Details

- Years 1860 to 1901 exclude births that occurred in the Northern Territory (NT). Births for years 1860 to 1910 exclude births that occurred in the Australian Capital Territory (ACT).
- Since 1966 Aboriginal births are included in vital statistics.
- Births by sex and year of occurrence are available for purchase from the ABS from 1975 forward, but these have not been acquired by the HMD at this time.

REVISION NOTES

Changes with the September 2014 revision:

Population counts: New official population estimates are used for the 1991-2001 intercensal period, due to a methods revision at the ABS. New official intercensal population estimates are used for years 2002-2011, which replace the previous postcensal series, and entail a reduction in the size of population denominators for most recent years.

Deaths: Deaths for years 1921-1963 were collected from pdfs of scanned copies

of annual vital statistics reports from ABS and its predecessors and replace the previous HMD input. Data from occurrence-years 1964 to 2011 were purchased from ABS and replace the previous series by year of registration.

Births: The annual birth series by sex and year of registration was extended backwards by adding years 1860 to 1920. Years 2005 to 2009 have been replaced with final counts from ABS. Births by month of occurrence were also compiled for years after 1962.

Changes with the December 2017 revision:

Life tables: All life tables have been recalculated using a modified methods protocol. The revised protocol (Version 6) includes two changes: 1) a more precise way to calculate a_0 , the mean age at death for children dying during the first year of life and 2) the use of birth-by-month data (where and when available) to more accurately estimate population exposures. These changes have been implemented simultaneously for ALL HMD series/countries. For more details about these changes, see the revised Methods Protocol (at <http://www.mortality.org/Public/Docs/MethodsProtocol.pdf>), particularly section 7.1 on Period life tables and section 6 and Appendix E, on death rates. The life tables calculated under the prior methods (Version 5) remain available at v5.mortality.org but they have not been, and will not be, updated.

Changes with the July 2018 revision:

Deaths: For 2012-2015, deaths by year of occurrence are tabulated by single years of age from data publicly available on the ABS website. Deaths counts cross-tabulated by year of occurrence and year of birth are not freely available and were not purchased by the HMD.

Last Updated: March 27, 2020

Population counts: New official population estimates are used for the 2012-2016 intercensal period, based on the 2016 census. This change had almost no effect on mortality estimates.

Changes with the March 2019 revision:

Deaths: Death tabulations for years 2012-2017 (2017 preliminary) by year, sex, age of death and by birth cohort (Lexis triangle) have been purchased from the ABS on January 28, 2019 and substituted to the previous data for 2012-2016 by single year of age (Lexis rectangle).

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APPENDIX I. POPULATION CENSUSES

1828, November — first modern census in New South Wales including parts of Queensland and Tasmania;

1833, September 2nd—census in New South Wales including all of Queensland and Tasmania;

1836, September 2nd—census in New South Wales including Victoria, Queensland and Tasmania;

1841, March 2nd—census in New South Wales including Victoria and Queensland; census in South Australia;

1842, 1843—census in Tasmania[according to AHPS census in Tasmania was 27 Sep 1841];

1844, February 26th—census in South Australia;

1846—census in New South Wales including Victoria and Queensland (March, 2nd); separate census in South Australia (February, 26th);

1847, December 31st—census in Tasmania;

1848, October 10th—census in Western Australia;

1851—census in New South Wales including Victoria and Queensland (March 1st); separate censuses in South Australia (January, 1st) and Tasmania (March, 1st);

1854—censuses in Victoria (April, 26th) and Western Australia (September, 30th);

1855, March 31st—census in South Australia;

1856, March 1st—census in New South Wales including Queensland;

1857—censuses in Victoria (March, 29th) and Tasmania (March, 31st);

1859, December 31st—census in Western Australia;

1861, April 7th—censuses in New South Wales, Victoria, Queensland, South Australia, Tasmania;

1864, January 1st—census in Queensland;

1866, March 26th—census in South Australia;

1868, March 2nd—census in Queensland;

1870—censuses in Western Australia (March, 31st) and Tasmania (February, 7th);

1871—censuses in New South Wales (April, 2nd), Victoria (April, 2nd), Queensland (September, 1st) and South Australia (April, 2nd);

1876—censuses in Queensland (May, 1st) and South Australia (March, 26th);

1881, April 3rd—census in all colonies (New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, Northern Territory);

1886, May 1st—census in Queensland;

1891, April 5th—census in all colonies;

1901, March 31st—census in all colonies;

Last Updated: March 27, 2020

1911, April 3rd—first census of Commonwealth of Australia. On 1 January 1911 The Australian Capital Territory was founded as a Federal Territory and Northern Territory was transferred to the Commonwealth;

1921, April 4th—census

1933, June 30th—census

1947, June 30th—census

1954, June 30th—census

1961, June 30th—census

1966, June 30th—census

1971, June 30th—census

1976, June 30th—census

1981, June 30th—census

1986, June 30th—census

1991, August 6th—census

1996, August 6th—census

2001, August 7th—census. This is the first census when the respondents had the option to have their census returns retained and made available to the public after 100 years. Census returns from previous censuses were destroyed after statistical extractions had been carried out.

2006, August 8th—census.

2011, August 9th—census.

2016, August 9th—census.

Additional information on the content of censuses from 1911 to 1996 can be found on the web site of the Australian Bureau of Statistics (www.abs.gov.au) (Trewin, 2000).

APPENDIX II - DESCRIPTION OF DATA USED FOR THE LEXIS DATABASE**DEATHS**

Period	Type of Data	Age Grouping	Comments	RefCode(s)
1921–1963	Annual death counts by year of registration, age, and sex.	0, 1,...maximum age attained		1921-1963 (RefCodes are separate for each year of data, and each RefCode matches the year to which data refer.)
1964-1989	Annual death counts by year of occurrence, age, and sex.	0, 1,...maximum age attained		43
1990-1999	Annual death counts by year of occurrence, age, and sex.	100, 101,...maximum age attained	Used to complement a later series that only has ages up to 100+.	43
1990-2011	Annual death counts by year of occurrence, age, birth cohort, and sex	0,1,...,99,100+		28
2012-2016	Annual death counts by year of occurrence, age, and sex.	0,1,...,99,100+		51
2012-2016	Annual death counts by year of occurrence, age, birth cohort, and sex	0,1,...,99,100+		54
2017-2018	Annual death counts by year of occurrence, age, and sex.	0,1,...,99,100+		59

POPULATION

Period	Type of Data	Age Grouping	Comments	RefCode(s)
1921–1970	Midyear official estimates	0,1,...,84, 85+		6
1971–2018	Midyear official estimates	0,1,...,99,100+		16, 29, 48, 52, 56

ANNUAL BIRTHS

Period	Type of Data	Comments	RefCode(s)
1860-1999	Birth counts by sex and year of registration.		32, 3
2000-2018	Birth counts by sex and year of registration.		26, 31, 46, 49, 53, 57

Last Updated: March 27, 2020

BIRTHS BY MONTH

Period	Type of Data	Comments	RefCode(s)
1962-2004	Birth counts by month and year of occurrence.		34, 35, 36, 37, 38, 39, 40, 41, 42, 33, 47
2005-2018	Birth counts by month and year of occurrence.		50, 55, 58