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Any enquiries about or comments on this publication should be directed to:
Communications, Media and Marketing Unit
Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Phone: (02) 6244 1032
Email: info@aihw.gov.au

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Summary

- Death rates for the Australian Indigenous population are much higher than the non-Indigenous population across all age groups and for all major causes of death. However, there is considerable uncertainty about the magnitude of this difference because Indigenous status has not been reported accurately on death registrations.
- A recent study by the Australian Bureau of Statistics (ABS) sought to estimate the true number of Indigenous deaths by probabilistically linking registered deaths with 2006 Census records. The study estimated Indigenous life expectancy for 2005–07 to be 67.2 years for males, which was 11.5 years lower than for non-Indigenous males, and 72.9 years for females, which was 9.7 years lower than for non-Indigenous females.
- Indigenous death rates are highest compared with non-Indigenous rates for ages 25–64 years.
- The causes of death with the largest contribution to excess male Indigenous mortality are circulatory diseases (26%), external causes (20%), neoplasms (10%), respiratory diseases (10%) and endocrine, metabolic and nutritional disorders (9%).
- The causes of death with the largest contribution to excess female Indigenous mortality are circulatory diseases (24%), endocrine, metabolic and nutritional disorders (18%), digestive diseases (10%), neoplasms (9%) and respiratory diseases (10%).
- For males aged 35–54 years, the ratio of Indigenous to non-Indigenous death rates is highest for diabetes (18.9), chronic lower respiratory disease (11.4), and diseases of the liver (7.2).
- For females aged 35–54 years, the ratio of Indigenous to non-Indigenous death rates is highest for diabetes (26.6), diseases of the liver (13.9) and ischaemic heart disease (10.6).
- From 1991–2008, Indigenous death rates declined significantly, but not more than falls in death rates for other Australians.
- There was also a decline in Indigenous death rates from circulatory diseases, and again this was matched by falls for other Australians.
- Previous research has revealed that a range of risk factors contribute to excess Indigenous mortality, including tobacco smoking, excessive alcohol consumption, high overweight/obesity, poor nutrition and lower utilisation of health services.

Introduction

The Australian population experiences death rates amongst the lowest in the world. However death rates for the Indigenous population are much higher than the non-Indigenous population across all age groups and for all major causes of death. The exact magnitude of this substantial difference is difficult to ascertain because Indigenous status has not been reported accurately on death registrations.

This paper examines the data on mortality of the Indigenous population. It details Indigenous mortality data availability and quality, and describes methods and results from a recent study to estimate Indigenous life expectancy. Next, the paper analyses all-cause and cause-specific mortality levels and trends. Finally, the findings and their limitations are discussed.

Mortality data and analyses

Indigenous status in mortality data

The measurement of Indigenous mortality rate is subject to the accuracy of reporting of Indigenous status at death. There is a standard question on the death certificate of each state and territory to elicit information on a person's Indigenous origin. Generally, this information is provided by a close relative. If the deceased is reported as being of Aboriginal or Torres Strait Islander origin, they are classified as 'Indigenous'. Where the deceased is reported as not being of Aboriginal or Torres Strait Islander origin, they are classified as 'non-Indigenous'.

Since 1998, there has been a category of Indigenous status of 'not stated'. Where a death is reported as 'not stated', it is not included in the category of 'non-Indigenous'. However, prior to 1998, where there was no category for 'not stated', the deceased cannot be classified in these categories of 'non-Indigenous' or 'not stated'. Therefore, for analyses of data prior to 1998, there is a category of 'other Australians' that includes deaths where the deceased was reported as either not of Indigenous origin or Indigenous status was not stated.

The information on Indigenous status of the deceased can be impacted by various factors, including personal and cultural aspects associated with identifying as Indigenous, the person that completes the question, and the perception of why such information is required (ABS 2009a).

Sources of life expectancy estimates and mortality data

The primary measures of Indigenous life expectancy in this paper are derived from the ABS Experimental Life Tables (ABS 2009a). The methods to compute the ABS Experimental Life Tables are based on adjustments to registered mortality data according to identification of Indigenous status. These adjustment methods are detailed in Box 1.

The measures of all-cause and cause-specific mortality in this paper are based on calculations using data from the AIHW National Mortality Database. The National Mortality Database is a national collection of de-identified information for all deaths in Australia and is maintained by the AIHW. Information on the characteristics and causes of death of the deceased is provided by the Registrars of Births, Deaths and Marriages and coded nationally by the ABS.

Information on the cause of death in the AIHW National Mortality Database is supplied by the medical practitioner certifying the death or by a coroner. Deaths from a particular calendar year of registration are added to the National Mortality Database once each year. Data on the cause of death presented in the paper is for the underlying cause of death, which is the disease or injury which initiated the train of morbid events leading directly to death (ABS 2009c).

Unlike estimates of life expectancy, the all-cause and cause-specific mortality data presented in this paper do not adjust deaths for the Indigenous identification rate. This is because the methods used to estimate life expectancy remain experimental, and are likely to be further developed. The paper presents mortality data by state/territory of usual residence rather than state/territory where death occurs or where the death was registered. Deaths are reported as according to year of registration.

Issues related to analysis of levels and trends of mortality

This paper analyses the level of all-cause and cause-specific mortality in recent years, as well as longer-term trends.

All-cause mortality

For the level of all-cause mortality, the years 2004–2008 combined are examined to reduce uncertainty from small numbers of deaths in individual years. For these years, the five jurisdictions of NSW, Queensland, Western Australia, South Australia and Northern Territory are analysed. The reporting of national Indigenous mortality rates from these five jurisdictions was recommended by the National Advisory Group on Aboriginal and Torres Strait Islander Health Information and Data (NAGATSIHID) and endorsed by the National Indigenous Reform Agreement Performance Information Management Group (NIRAPIMG) in August 2010. These five jurisdictions represent approximately 90% of the Indigenous population of Australia. Longer-term all-cause mortality trends are reported for single calendar years from 1991 to 2008.

Cause-specific mortality

The level of cause-specific mortality is presented for the period 2004–2008, where possible. Some cause-specific mortality tables could not be constructed for 2008, because data of required detail were not available. Trends in cause-specific mortality are presented for 1997 to 2008 because International Classification of Diseases version 10 (ICD-10) has been used to classify causes of death in Australia from 1997 onwards. Data prior to 1997 would be subject to potential misclassification error between ICD versions 9 and 10.

Box 1: Life expectancy estimates ABS Experimental Life Tables

Almost all deaths in Australia are registered, however Indigenous status is sometimes not recorded or is recorded incorrectly, resulting in inaccurate estimates of Indigenous mortality. The number of registered Indigenous deaths therefore needs to be corrected to provide more reliable life expectancy estimates.

The primary Indigenous life expectancy estimates reported in this paper are derived from the ABS Experimental Life Tables (ABS 2009a). The construction of ABS Experimental Life Tables was based upon an estimation of the identification rate of Indigenous status in registered deaths (ABS 2009a). In order to estimate the true number of Indigenous deaths, the Census Data Enhancement (CDE) Indigenous Mortality Quality Study probabilistically linked deaths registered between 9 August 2006 and 30 June 2007 with 2006 Census records[1] (ABS 2008). The expected number of Indigenous deaths in the Census was estimated by adjusting linked Indigenous deaths according to propensities of being Indigenous in the Post Enumeration Survey (PES) given Indigenous status in the Census. This adjustment was made to ensure consistency of the expected number of Indigenous deaths in the Census with Indigenous Census population data, which were also adjusted using the results of the PES.

Indigenous identification rates were computed by dividing the number of registered deaths reported as Indigenous by the expected number of Indigenous deaths in the Census. The resultant identification rates were used to derive factors for adjusting registered Indigenous deaths. The adjusted deaths were then used to compile Indigenous life tables. Identification rates were computed separately for NSW, Queensland, Western Australia and Northern Territory. An identification rate is provided for the Victoria, South Australia, Tasmania and ACT jurisdictions combined because of small numbers of Indigenous deaths in these jurisdictions. A separate identification rate was computed for all Australia.

Table 1 presents the identification rates for Australia and each state/territory. The identification rate for Australia is 0.92. The identification rate in Queensland is 0.94, NSW is 0.87, Western Australia 1.11 and Northern Territory 1.09. An identification rate in excess of 1.0 indicates that a higher number of persons identified as Indigenous at death registration compared with at the Census with PES adjustment. For Western Australia and Northern Territory, where this occurs, it should be noted that between 35% and 40% of deaths were not linked, which may suggest that linked deaths are not representative of all deaths (ABS 2009a). The adjustment to the number of registered Indigenous deaths to provide the number of expected Indigenous deaths can be represented by an adjustment factor, which is calculated as the reciprocal of the identification rate.

The level of the identification rate directly impacts the life expectancy. A higher identification rate represents a lower number of expected Indigenous deaths, and therefore a higher life expectancy. In contrast, a lower identification rate represents a higher number of expected Indigenous deaths, and therefore a lower life expectancy.

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[1] In Victoria, death records were only available to mid-March 2007.

Table 1: Indigenous deaths identification rates by state/territory, 2006–2007

State/Territory	Number of registered Indigenous deaths	Expected number of Indigenous deaths[(a)]	Identification rate	Adjustment factor[(b)]
NSW	372	427	0.87	1.15
Queensland	351	372	0.94	1.06
WA	254	228	1.11	0.90
NT	204	188	1.09	0.92
Vic/SA/Tas/ACT combined	146	226	0.65	1.55
Australia[(c)]	**1,327**	**1,441**	**0.92**	**1.09**

(a) In Census if weighted PES Indigenous propensities are used.

(b) The reciprocal of the identification rate.

(c) Includes all jurisdictions.

Source: ABS (2009a)

Trend data

Trend data for both all-cause and cause-specific mortality data are only presented for the jurisdictions of Western Australia, South Australia and Northern Territory, where data for this period are deemed to be of adequate quality (ABS & AIHW 2008). Data from these three jurisdictions therefore only provide partial information regarding trends in Indigenous mortality. Also, trend data are only presented for Indigenous and other Australians, because of the issues discussed above regarding the categories of Indigenous status prior to 1998.

Population data

Indigenous population data are required to compute mortality rates and therefore estimate life expectancy. The Indigenous population estimates used in this paper are the Indigenous estimated resident population (ERP) figures, based on the 2006 Census (ABS 2009b). The 2006 Census enumerated the Indigenous population from responses to a question on a person's Indigenous status. The Indigenous ERP for 2006 is computed using this enumerated Indigenous population from the Census, and adjusted for undercount based on results from the PES as well as for non-response to the Indigenous status question (ABS 2009b). Population numbers for other years are projected based on assumed future levels of fertility, mortality and migration (ABS 2009b).

The use of Indigenous ERP based on 2006 Census resulted in a mortality time series that was vastly different to that published in previous national reports such as the Aboriginal and Torres Strait Islander Health Performance Framework. The implications of using 2006 ERP are discussed in Box 2.

Box 2: Effect of 2001 and 2006 Census based Indigenous population on mortality

This paper uses ABS experimental estimates of the Indigenous resident population based on the 2006 Census (referred to as 2006 ERP) as the denominator for calculating mortality rates. Previously published mortality rates used a denominator based on the 2001 Census estimates (referred to as 2001 ERP).

Indigenous mortality rates show a greater decline over time when estimated using the 2006 ERP compared to the 2001 ERP, resulting in a significant closing of the gap in mortality between Indigenous and non-Indigenous Australians. However, the two sets of mortality rates are not comparable.

The main factor contributing to the change is the increase in the estimated Indigenous population between the 2001 and 2006 Census based ERPs, resulting in lower Indigenous mortality rates. The growth in Indigenous population between 2001 and 2006 is about 12 per cent, compared to about 6 per cent for the total Australian population. Some of this growth may be attributable to changes in Indigenous identification.

According to the ABS, by extending the Census post enumeration survey to more remote areas, the post 2006 Census adjustment provides a more accurate estimate of Indigenous population than previous estimates.

The ABS also used the findings from the 2006 Census and mortality data enhancement project to produce a revised backcast Indigenous population series. For backcast estimates, it was assumed that Indigenous male and female life expectancy at birth would increase by 0.2 years per year between 1986 and 2006 (this assumes Indigenous life expectancy at birth of 63.1 years for males and 68.8 years for females in 1986). This resulted in less Indigenous people between 1986 and 1999 and more people from 2000 to 2006.

Similar adjustments have not been made to the registered number of deaths which also affect the estimated mortality rates.

Indigenous life expectancy

Life expectancy at birth is a summary measure of mortality that estimates the number of years a child would live if it hypothetically experienced the age-specific death rates for the specified period throughout its life. The estimates produced below are based on the ABS Experimental Life Tables, described in Box 1, and are estimated using methods that are likely to undergo further development (ABS 2009a). Previous estimates of Indigenous life expectancy in Australia are described in Box 3.

Box 3: Previous estimates of Indigenous life expectancy

Previously, the completeness of Indigenous mortality registration has been estimated using methods that do not directly link registered deaths with another data source. Instead, these indirect methods measure underreporting by making a number of assumptions about the characteristics of the population. The ABS first used a method proposed by Preston and Hill (1980), which adjusts the counts of deaths recorded in the intercensal period. This method provided life expectancy estimates of 57 years for Indigenous males and 62 years for Indigenous females for the 1991–96 period, approximately 20 years below life expectancy for all Australian males and females. This method is only applicable for stable populations, where there is no net migration and didn't adjust for change in Indigenous identification. This method was therefore deemed inappropriate by the ABS for estimating Indigenous life expectancy.

The ABS next used an indirect method proposed by Bhat (2002) to estimate the incompleteness of Indigenous mortality reporting. This method allows for an adjustment for 'migration', which accounts for 'unexplained growth' of the Indigenous population caused by changing propensity to identify as Indigenous over time. The method however relies on an estimate of the natural increase of the population and so is experimental. The Bhat method produced life expectancy estimates of 59 years for Indigenous males and 65 years for Indigenous females, approximately 17 years below the respective estimates for all Australians. This method was used by the ABS in the 'Experimental Indigenous Abridged Life Tables, 1996–2001' publication (ABS 2004).

A more recent method that has been used is the Generalised Growth Balance method, which was applied by the University of Queensland in the report 'The Burden of Disease and Injury in Australians, 2003' (Vos et al. 2007). This method is similar to the Bhat method, but instead of estimating population increase it estimates change in Census coverage. The report estimated life expectancy at birth for Indigenous Australians as 64 years for males and 69 years for females, approximately 13 years lower than for all Australians.

An analysis of the indirect methods used by the ABS (2004) and Vos et al. (2007) to estimate Indigenous life expectancy in the NT revealed they are very sensitive to relatively minor variations in estimates of the age distribution of the Indigenous population of the NT (Barnes et al. 2008). A change in the population within an age group by 10% was found to change life expectancy estimates by up to 10 years. The authors concluded that their findings '…make a compelling argument against using either of the indirect methods for national estimates of Indigenous life expectancy' (Barnes et al. 2008: 5).

The difference in estimated life expectancy at birth between the Indigenous and non-Indigenous population in 2005–2007 is shown in Table 2. For Australia, estimated non-Indigenous male life expectancy (78.7 years) is 11.5 years higher than for the male Indigenous population (67.2 years). For females, estimated non-Indigenous life expectancy (82.6 years) is 9.7 years higher than for Indigenous (72.9 years). The difference in Indigenous and non-Indigenous life expectancy is lower than the previous estimates have shown. This does not suggest any trend, rather that methodological changes have produced different estimates.

This difference in estimated life expectancy by Indigenous status varies by state and territory. For both sexes, the difference is largest in both WA (males 14.0 years, females 12.5 years) and Northern Territory (males 14.2 years, females 11.9 years).

Male life expectancy in NT is clearly the lowest of all jurisdictions (61.5 years). The smallest difference in male life expectancy by Indigenous status is in NSW (8.8 years), where Indigenous life expectancy is highest (69.9 years).

Female Indigenous life expectancy is also highest in NSW (75.0 years), where the difference with non-Indigenous life expectancy is the lowest (7.5 years). The Northern Territory also has the lowest estimated life expectancy (69.2 years for females). Indigenous life expectancy was not computed for other jurisdictions because of low numbers of deaths.

Table 2: Life expectancy at birth by Indigenous status, 2005–2007

State/territory	Indigenous	Non-Indigenous	Total	Difference between non-Indigenous and Indigenous life expectancy at birth (years)
Males				
NSW	69.9	78.7	78.5	8.8
Queensland	68.3	78.6	78.4	10.4
WA	65.0	79.0	78.7	14.0
NT	61.5	75.7	72.0	14.2
Australia[(a)]	**67.2**	**78.7**	**78.5**	**11.5**
Females				
NSW	75.0	82.5	82.4	7.5
Queensland	73.6	82.5	82.3	8.9
WA	70.4	82.9	82.5	12.5
NT	69.2	81.2	77.6	11.9
Australia[(a)]	**72.9**	**82.6**	**82.4**	**9.7**

(a) Includes all jurisdictions.

Source: ABS (2009a)

A recent study commissioned by the AIHW (2010) has made estimates of Indigenous life expectancy by linking registered deaths in the National Mortality Database with Indigenous death records from alternative data sources. The three alternative sources are residential aged care data, hospital data and neonatal death data from the National Perinatal Data Collection (NPDC). The residential aged care and hospital data account for over 80% of registered deaths in Australia, while use of the neonatal death data from the NPDC will help overcome the considerable under-identification of Indigenous infant deaths in registration data (AIHW 2010). The deceased was classified as Indigenous if they were identified as such in any of the sources. The study estimated Indigenous life expectancy for the period 2001–06 as 66.8 years for males and 72.9 years for females. Compared with the 2005–07 estimates of the ABS (2009a) shown in Table 2, the AIHW male estimate is 0.4 years lower while the female estimate is the same.

The AIHW study also estimated life expectancy by including deaths that could not be linked due to poor identifying information, and assuming the same propensity for being *missed Indigenous records* as those that were linked. This adjustment resulted in a slightly lower estimated life expectancy of 66.6 years for males and 72.7 years for females.

It should be noted however, that as each of these three linked collections under-identify Indigenous persons for similar reasons, and as the proportion of Indigenous persons not identified as such in any of the collections is not known, the resultant estimates could overstate life expectancy.

All-cause mortality

Table 3 presents the proportion of total deaths and population that are Indigenous across different age groups in NSW, Queensland, WA, SA and NT for 2004–2008. At all age groups, the proportion of total deaths that are Indigenous exceeds the proportion of the population that is Indigenous. The difference is most substantial for the age group 25–64 years, where the Indigenous proportion of total deaths is between 3–5 times the Indigenous proportion of the total population. The smallest differential between the Indigenous proportion of deaths and population is at ages 65 and over. The Indigenous proportion of total deaths is lower than the Indigenous proportion of the total population. This is because the age pattern of Indigenous Australians is younger than for other Australians; younger people have a lower risk of dying than older people.

Table 3: Indigenous deaths and population by age, 2004–2008, NSW, Qld, WA, SA & NT combined

	Number of Indigenous deaths		Indigenous deaths as a proportion of total deaths (%)		Indigenous population as a proportion of total population (%)	
Age (years)	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
Less than 1	334	232	13.0	11.9	6.1	6.2
1–4	67	55	13.1	14.5	6.1	6.2
5–14	75	47	13.7	13.1	5.8	5.8
15–24	353	161	10.3	11.7	4.3	4.3
25–34	530	282	10.3	14.0	3.1	3.2
35–44	914	564	11.4	13.1	2.6	2.8
45–54	1,044	686	6.8	7.4	1.9	2.0
55–64	1,010	825	3.6	4.9	1.2	1.4
65 and over	1,718	1,931	0.9	1.0	0.7	0.8
Total[(a)]	**6,055**	**4,785**	**2.4**	**2.1**	**3.1**	**3.1**

(a) Includes deaths where age not stated.

Source: AIHW National Mortality Database

Table 4 shows the infant mortality rates by Indigenous status. The Indigenous infant mortality rate in the five jurisdictions is 9.6, over two times that of corresponding other Australians. The state/territory with the highest infant mortality rate is Northern Territory (14.9), which is over three times the corresponding figure for other Australians. The lowest Indigenous infant mortality rate is found in South Australia (6.9) and New South Wales (7.8). However in each of these states the Indigenous infant mortality rate is far higher than that for other Australians.

Table 4: Infant mortality rate[a], Indigenous and other Australians, 2004–2008, NSW, Qld, WA, SA & NT

State/territory	Indigenous	Other[b]
NSW	7.8	4.5
Queensland	9.2	4.8
SA	6.9	3.6
WA	10.6	3.3
NT	14.9	4.4
Total[c]	**9.6**	**4.3**

(a) Deaths at age less than 12 months per 1,000 live births.

(b) Other includes non-Indigenous and Indigenous status not reported.

(c) NSW, Qld, WA, SA & NT combined

Source: AIHW National Mortality Database

Table 5 shows the age-standardised death rates for the Indigenous and non-Indigenous population, as well as the ratio of the Indigenous to the non-Indigenous rate. The age-standardised death rate for Indigenous males (1,381 per 100,000 population) is 1.9 times as high as for non-Indigenous males (712). The ratio of the female Indigenous to non-Indigenous death rate is 2.0 (Indigenous 1,021, non-Indigenous 521).

Table 5: Age-specific death rates (per 100,000), by Indigenous status, 2004–2008, NSW, Qld, WA, SA & NT combined

	Males			Females		
Age group (years)	Indigenous	Non-Indigenous	Rate ratio[a]	Indigenous	Non-Indigenous	Rate ratio[a]
0–4	273.0	115.3	2.4	203.0	93.1	2.2
5–14	25.2	11.1	2.3	16.7	8.1	2.1
15–24	156.0	60.0	2.6	74.5	24.5	3.0
25–34	328.3	90.2	3.6	169.4	34.3	4.9
35–44	658.2	131.7	5.0	373.6	69.4	5.4
45–54	1089.2	282.6	3.9	663.8	168.2	3.9
55–64	2011.6	673.3	3.0	1466.3	397.7	3.7
65–74	4368.1	1872.8	2.3	3070.0	1083.3	2.8
75+	9374.6	7452.3	1.3	8056.7	6247.1	1.3
Age-standardised death rate[b]	**1381.1**	**711.7**	**1.9**	**1021.2**	**520.8**	**2.0**

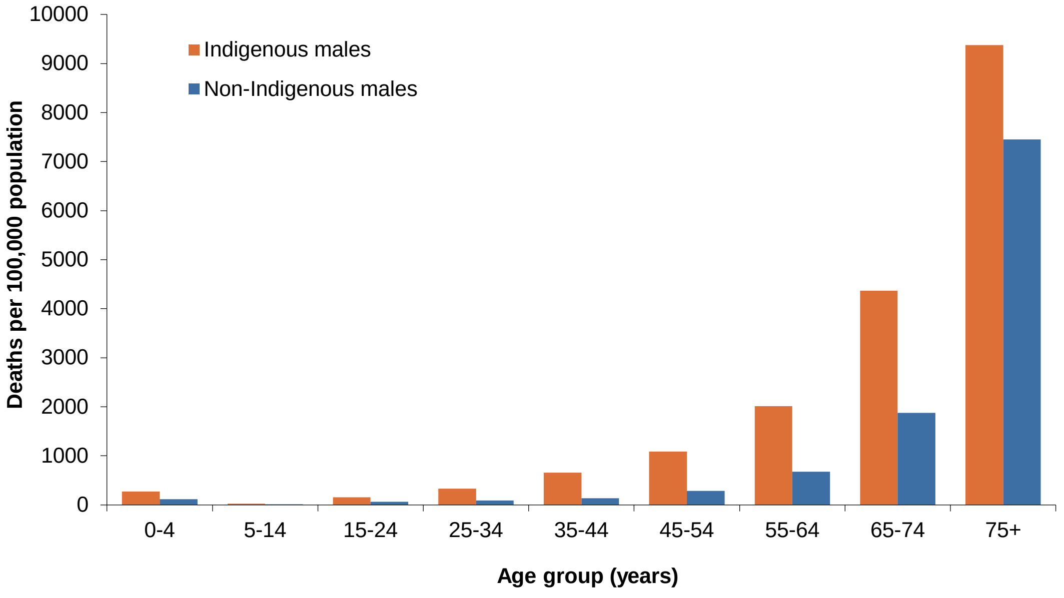
(a) Rate for Indigenous Australians divided by the rate for non-Indigenous Australians.

(b) Directly age-standardised using 2001 Australian population as standard.

Source: AIHW National Mortality Database

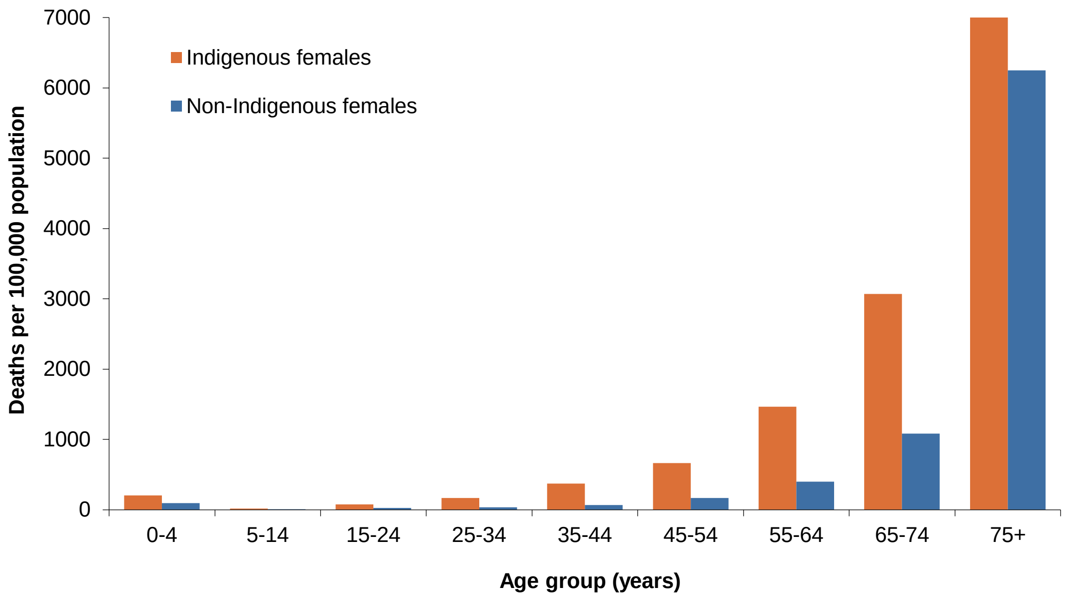
The age-specific death rates by Indigenous status are also shown in Table 5, as well as Figures 1 and 2. The Indigenous mortality rate is higher than for non-Indigenous at each age group, but most significantly for the 25–64 years age group. The age group with the highest rate ratio for each sex is 35–44 years. The male Indigenous death rate at age 35–44 years is 5.0

times higher than for non-Indigenous, and for females is 5.4 times higher. The age group with the next highest rate ratio is 25–34 years (4.9) for females and 45–54 years for males (3.9). The age group with the lowest differential between Indigenous and non-Indigenous mortality is age 75 years and above (males 1.3, females 1.3). This reflects the older age distribution of mortality in the non-Indigenous population, as shown in Figures 1 and 2.



Source: AIHW National Mortality Database

Figure 1: Male age-specific death rates, by Indigenous status, 2004–2008, NSW, Qld, WA, SA & NT combined



Source: AIHW National Mortality Database

Figure 2: Female age-specific death rates, by Indigenous status, 2004–2008, NSW, Qld, WA, SA & NT combined

Causes of death

Table 6 presents a comparison of the leading causes of death for the Indigenous and non-Indigenous population. Circulatory diseases are the leading cause of all deaths for both Indigenous (27%) and non-Indigenous Australians (35%). The next leading cause of death is neoplasms, which accounts for 18% of Indigenous deaths and 30% of non-Indigenous deaths. The other causes of death are generally lower for the non-Indigenous population, because the leading two causes account for a higher proportion of deaths (65%). External causes, endocrine, metabolic and nutritional disorders, which include diabetes, and digestive diseases all comprise a higher proportion of Indigenous compared with non-Indigenous deaths.

The cause proportions do not illustrate the relative risk of mortality for Indigenous versus non-Indigenous Australians for each cause. Therefore, Table 6 also presents the observed number of Indigenous deaths for the leading causes for each sex, compared with the expected number of deaths assuming the non-Indigenous death rates and Indigenous age distribution of population. The standardised mortality ratio (SMR) for each sex and cause is the observed divided by the expected deaths. Where the number of observed deaths is higher than the number of expected deaths, the SMR is greater than 1 and the difference in deaths is the excess number of deaths of Indigenous people.

The SMR is highest for endocrine, metabolic and nutritional disorders for both males (7.2) and females (6.4). Digestive diseases also has a SMR of above 4 for each sex. Of the other major causes, the SMR for circulatory diseases is 3.0 for males and 1.8 for females, while for neoplasms it is the lowest of all causes listed in the table (1.7 for males and 1.3 for females). External causes has a lower SMR than respiratory causes despite having a larger differential in the proportion, largely because its higher proportion is due to the distribution of the Indigenous population being more weighted in the ages where external causes are higher.

The highest proportion of all excess deaths is due to circulatory diseases (26% for males, 24% for females). The next highest proportion of excess deaths for males is external causes (20%), neoplasms (10%), respiratory diseases (9%) and endocrine, metabolic and nutritional disorders (9%). For females, the next leading causes of excess deaths are endocrine, metabolic and nutritional disorders (18%), digestive diseases (10%) and respiratory diseases (9%).

Age-specific causes of death

The higher level of Indigenous mortality in the age range 35–54 years warrants investigation into which causes of death are contributing to the large differentials. Table 7 shows that the leading cause of death for both male and female Indigenous people aged 35–54 years is ischaemic heart disease. The death rate for Indigenous male ischaemic heart disease is 5.9 times higher than the corresponding non-Indigenous rate, while for females it is 10.6 times higher. For males, deaths from ischaemic heart disease contributes to a large proportion of the higher Indigenous death rates in this age group, because its death rate is over two-and-a-half times that of liver diseases, the next leading cause for 35–54 year olds. The rate ratio for diseases of the liver is higher for both males (7.2) and females (13.9). The highest rate ratios for each sex are for diabetes, for which Indigenous death rates for males aged 35–54 years are 18.9 times higher than for non-Indigenous males, and are 26.6 times higher for females. Limitations regarding certification and coding of diabetes need to be borne in mind when interpreting such results. These limitations are canvassed in the discussion section.

Other causes with high rate ratios are other heart diseases and chronic lower respiratory diseases. Malignant neoplasms of the digestive system and intentional self-harm have relatively low rate ratios; for these causes there is no statistically significant difference in female deaths by Indigenous status.

Table 6: Indigenous deaths, main causes by chapter, 2004–2008, NSW, Qld, WA, SA & NT combined

	% of total deaths		Males				Females			
Cause of death	**Indig.**	**Non-Indig.**	**Observed deaths[(a)]**	**Expected deaths[(a)]**	**SMR[(b)]**	**% Excess[(c)]**	**Observed deaths[(a)]**	**Expected deaths[(a)]**	**SMR[(b)]**	**% Excess[(c)]**
Diseases of the circulatory system (I00–I99)	26.8	35.2	321	107	3.0	26.3	260	148	1.8	24.4
Neoplasms (C00–D48)	18.0	29.7	200	120	1.7	9.9	191	150	1.3	8.8
External causes (V01–Y98)	14.9	5.7	225	61	3.7	20.2	98	64	1.5	7.3
Endocrine, metabolic & nutritional disorders (E00–E90)	8.4	3.5	86	12	7.2	9.1	96	15	6.4	17.6
Diseases of the respiratory system (J00–J99)	7.8	8.4	94	24	3.9	8.6	76	33	2.3	9.3
Diseases of the digestive system (K00–K93)	6.0	3.4	70	11	6.4	7.3	59	14	4.2	9.8
Diseases of the nervous system (G00–G99)	2.5	3.7	33	13	2.5	2.5	21	16	1.3	1.1
Conditions originating in the perinatal period (P00–P96)	2.4	0.4	31	14	2.2	2.1	22	14	1.6	1.8
Certain infectious & parasitic diseases (A00–B99)	2.2	1.4	27	6	4.5	2.6	22	7	3.1	3.2
All causes	**100.0**	**100.0**	**1,211**	**397**	**3.1**	**100.0**	**957**	**497**	**1.9**	**100.0**

(a) Observed and expected deaths are reported as average number of annual deaths from 2004–2008. Expected deaths are based on non-Indigenous death rates.

(b) Standardised mortality ratio is the observed Indigenous deaths divided by expected Indigenous deaths, based on the age, sex and cause-specific rates for non-Indigenous persons.

(c) Excess deaths are the observed deaths minus expected deaths. The excess deaths for each cause are expressed as a percentage of total excess deaths for all causes.

Source: AIHW National Mortality Database

Table 7: Age-specific death rates by Indigenous status, main causes, persons age 35–54 years, 2003–2007[(a)], NSW, Qld, WA, SA & NT combined

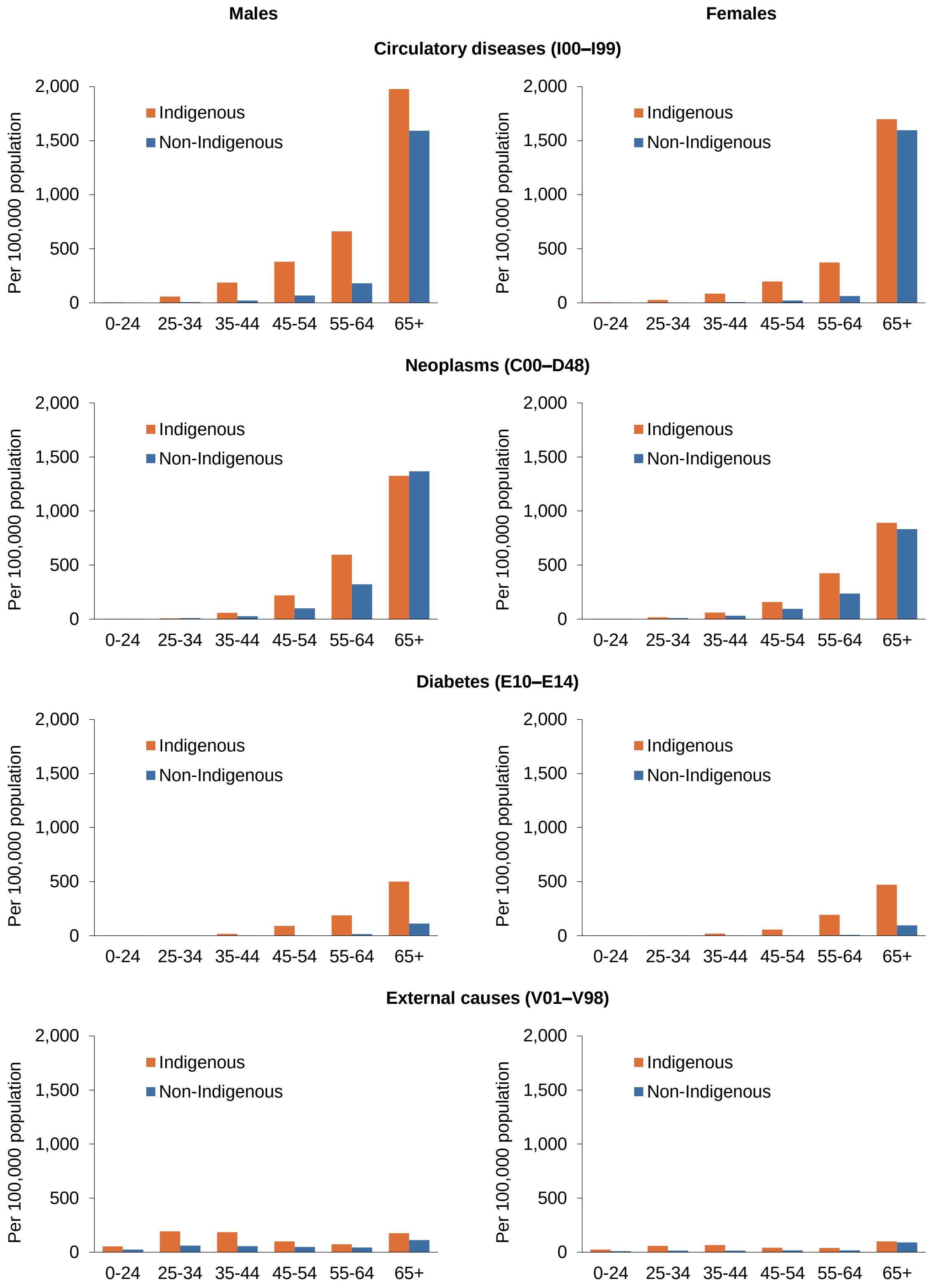
	Males			Females		
Causes	**Indigenous rate per 100,000**	**Non-Indigenous rate per 100,000**	**Rate ratio**	**Indigenous rate per 100,000**	**Non-Indigenous rate per 100,000**	**Rate ratio**
Ischaemic heart disease (I00–I25)	178.1	30.0	5.9	60.2	5.7	10.6
Diseases of the liver (K70–K77)	68.6	9.5	7.2	49.2	3.5	13.9
Diabetes (E10–E14)	47.5	2.5	18.9	35.0	1.3	26.6
Malignant neoplasm of the digestive organs (C15–C26)	46.2	20.3	2.3	17.9	12.4	1.4
Other selected forms of heart disease (I30–I52)	44.0	6.2	7.1	18.7	2.3	8.2
Intentional self-harm (X60–X84)	37.8	20.7	1.8	5.7	5.4	1.0
Ill-defined and unknown causes of mortality (R95–R99)	30.3	5.8	5.2	14.6	2.7	5.4
Malignant neoplasm of the respiratory the intrathoracic organs (C30–C39)	29.9	11.3	2.6	22.0	8.2	2.7
Chronic lower respiratory disease (J40–J47)	25.1	2.2	11.4	17.1	1.9	9.2
Cerebrovascular diseases (I60–I69)	24.6	5.4	4.6	23.6	4.8	4.9

(a) Data of required detail not available for 2008.

Source: AIHW National Mortality Database

Figure 3 presents age-specific death rates for selected major causes for Indigenous and non-Indigenous Australians over the period 2003–2007. Circulatory disease mortality is substantially higher for Indigenous than non-Indigenous males at each age group younger than 65 years. For example, the Indigenous circulatory disease death rate at ages 45–54 years is over five times the non-Indigenous rate. Female circulatory disease mortality rates by Indigenous status follow a similar age pattern as males, although at a predominantly lower level and with a smaller difference at age 65 years and over.

Age-specific death rates from neoplasms are higher for Indigenous males and females at ages 35–64 years. However at age 65 years and over, where death rates from neoplasms are substantially higher, non-Indigenous males have slightly higher death rates than Indigenous males. Diabetes age-specific death rates are substantially higher for Indigenous compared with non-Indigenous population at each age group for both males and females. The magnitude of the difference between Indigenous and non-Indigenous rates ranges from well over 20 times higher at ages 35–44 years to 4–5 times higher at ages 65 years and over. Death rates for external causes are also higher for the Indigenous compared with non-Indigenous population. The difference is greatest at ages 25–44 years for both sexes. Male Indigenous death rates from external causes are highest at ages 25–44 years, and Indigenous females peak at ages 65 years and over.


Males

Females

Circulatory diseases (I00–I99)

Neoplasms (C00–D48)

Diabetes (E10–E14)

External causes (V01–V98)

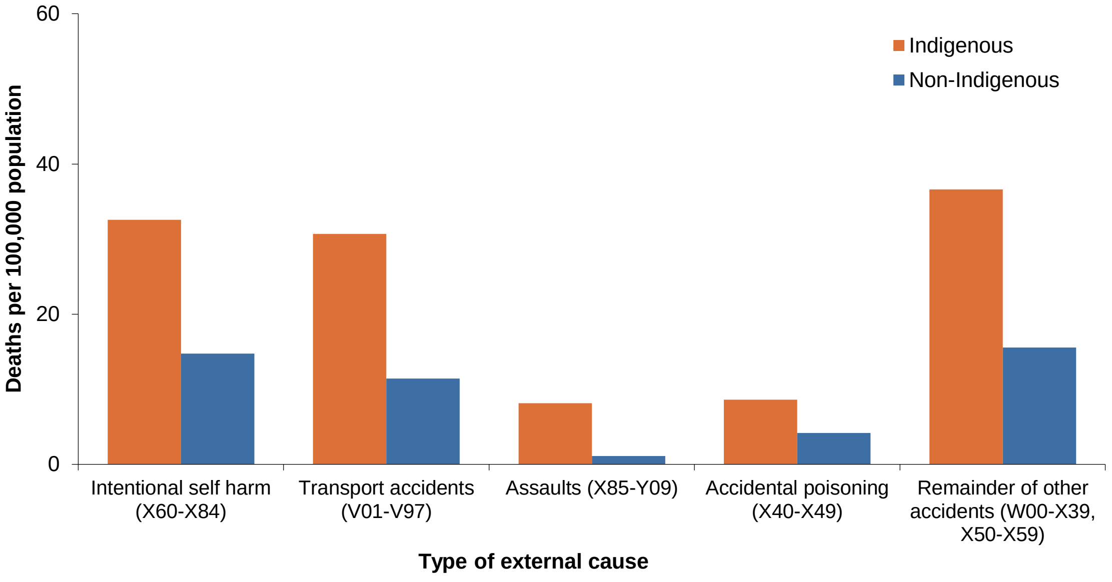
(a) Data of required detail not available for 2008.

Source: AIHW National Mortality Database.

Figure 3: Age-specific death rates for selected causes, Indigenous status and sex, 2003–2007[(a)], NSW, Qld, WA, SA & NT combined

External causes of death

Figure 4 shows the age-standardised death rates of different types of external causes for males for the years 2003–2007. For each type of external cause, Indigenous male death rates are far higher than non-Indigenous male death rates. Intentional self-harm has the highest age-standardised death rate of any specific category for Indigenous males (32.6 per 100,000 population), more than double that for non-Indigenous males (14.7). The death rate for transport accidents for Indigenous males (30.7) is also more than twice the rate for non-indigenous males (11.4). The age-standardised death rate for assaults exhibits the greatest proportionate difference, with the rate for Indigenous males (8.1) over seven times higher than the rate for non-Indigenous males (1.1). The ratio of Indigenous and non-Indigenous male death rates for accidental poisoning (Indigenous 8.6, non-Indigenous 4.2) and other accidents (Indigenous 36.6, non-Indigenous 15.5) the ratio is greater than two.



(a) Data of required detail not available for 2008.

Source: AIHW National Mortality Database

Figure 4: Type of external cause, male age-standardised death rates by Indigenous status, 2003–2007[(a)], NSW, Qld, WA, SA & NT combined

Trends in mortality

The trend in age-standardised death rates for Indigenous and non-Indigenous Australians for Western Australia, South Australia and Northern Territory combined is shown in Table 8 and Figures 5 and 6. The results for Indigenous rates results are best interpreted by examining longer-term trends, because the statistically small number of Indigenous deaths in the three jurisdictions can create large uncertainty in single year estimates.

Male Indigenous age-standardised death rates exhibited a downward trend over the period 1991 to 2005, however there was an increase in the final three years. The 2008 male Indigenous age-standardised death rate (1,998 deaths per 100,000 population) was higher than in 2002 (1,623). The overall trend in male Indigenous rates from 1991 to 2008 was downward and statistically significant.

Male age-standardised death rates for other Australians exhibited a steady downward trend from 1991 to 2008. The ratio of the male Indigenous to other Australian death rates remained in the range 2.1 to 2.4 over the period, with the exception of the two most recent years when it increased to 2.9 because the Indigenous rate rose.

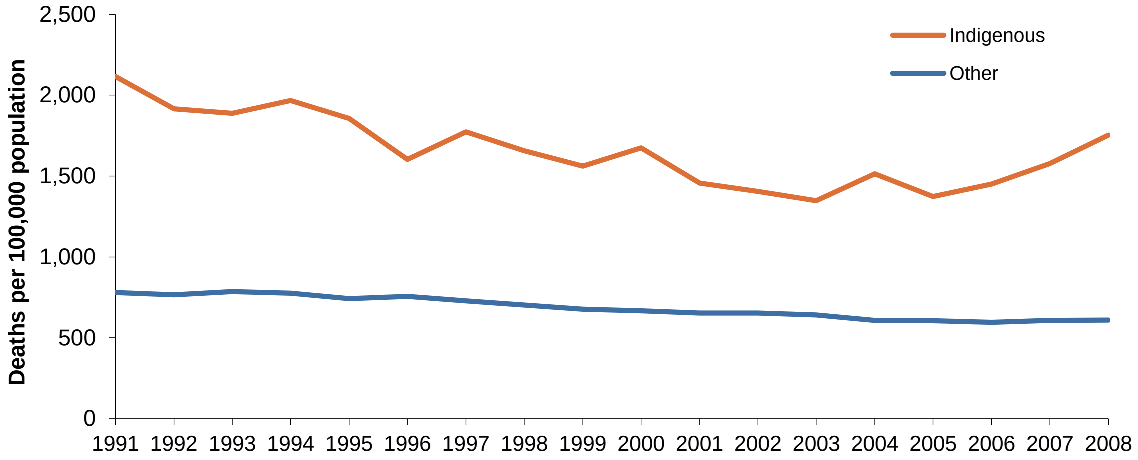
Table 8: Age-standardised death rates[(a)] by sex, Indigenous and other Australians, 1991–2008, WA, SA and NT

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Indigenous rate per 100,000																		
Males	2,299	2,207	2,104	2,145	2,182	1,985	2,147	2,019	1,777	1,939	1,901	1,623	1,756	1,704	1,633	1,695	1,844	1,998
Females	1,948	1,669	1,711	1,802	1,581	1,277	1,472	1,351	1,370	1,454	1,106	1,235	1,022	1,348	1,156	1,244	1,365	1,555
Persons	2,115	1,915	1,889	1,967	1,857	1,604	1,774	1,657	1,561	1,673	1,456	1,406	1,347	1,515	1,373	1,450	1,578	1,754
Other Australian rate per 100,000																		
Males	974	951	972	972	914	930	885	858	825	810	778	771	761	717	718	693	712	700
Females	627	621	640	624	603	615	599	576	556	548	548	553	542	512	507	511	514	527
Persons	780	767	787	777	741	756	727	703	677	666	653	652	642	607	605	596	607	609
Rate ratio[(b)]																		
Males	2.4	2.3	2.2	2.2	2.4	2.1	2.4	2.4	2.2	2.4	2.4	2.1	2.3	2.4	2.3	2.4	2.6	2.9
Females	3.1	2.7	2.7	2.9	2.6	2.1	2.5	2.3	2.5	2.7	2.0	2.2	1.9	2.6	2.3	2.4	2.7	3.0
Persons	2.7	2.5	2.4	2.5	2.5	2.1	2.4	2.4	2.3	2.5	2.2	2.2	2.1	2.5	2.3	2.4	2.6	2.9

(a) Directly age-standardised using 2001 Australian population as standard.

(b) Mortality rate for Indigenous Australian divided by the mortality rate for other Australians.

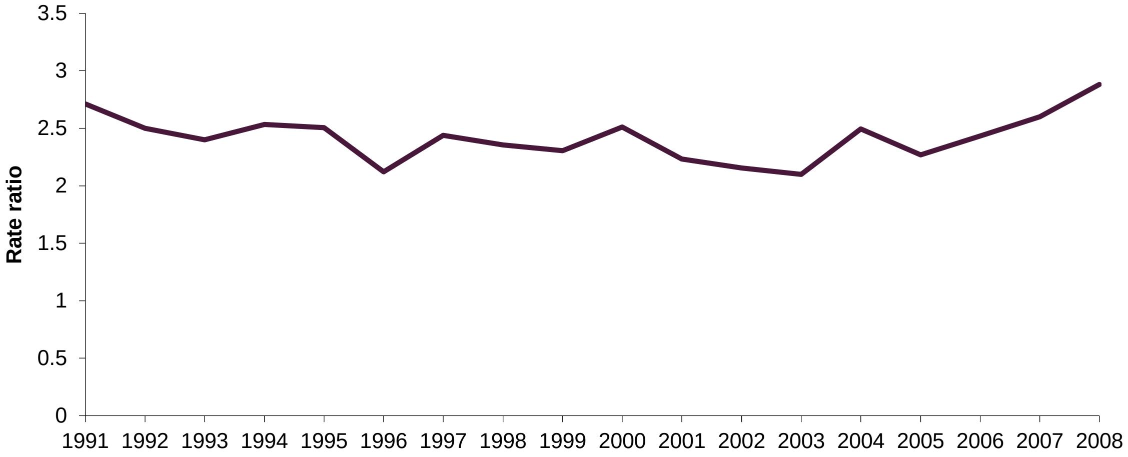
Source: AIHW National Mortality Database



(a) Directly age-standardised using 2001 Australian population as standard.

Source: AIHW National Mortality Database

Figure 5: Age-standardised mortality rates[(a)], Indigenous and other Australians, 1991–2008, WA, SA and NT combined



(a) Mortality rate for Indigenous Australian divided by the mortality rate for other Australians.

(b) Directly age-standardised using 2001 Australian population as standard.

Source: AIHW National Mortality Database.

Figure 6: Rate ratio[(a)] of age-standardised mortality rates[(b)], Indigenous and other Australians, 1991–2008, WA, SA and NT combined

Female Indigenous death rates also declined from 1991 but rose in recent years, increasing from a rate of 1,022 in 2003 to 1,555 in 2008. The overall trend over the period was downward and statistically significant. Female death rates among other Australian females declined steadily from 1991 to 2007. The ratio of female Indigenous to other Australian death rates varied more than the rate ratio for males. In 1991 the ratio was 3.1 and fell to 1.9 by 2003. However, with the recent rise in Indigenous female death rates, it increased to 3.0 in 2007.

Table 9 presents the trend in age-standardised death rates for leading causes from 1997–2008 for Western Australia, South Australia and Northern Territory. Cause of death data experience more variation in single year estimates because of smaller numbers. Therefore, interpretation of trends should again be based on assessment of a number of years of data.

Table 9: Cause specific age-standardised mortality rates[(a)], by Indigenous status, WA, SA and NT combined, 1997–2008

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Circulatory diseases (I00–I99)												
Indigenous rate	687.3	604.5	560.0	541.8	437.2	409.2	409.9	476.8	400.1	360.0	506.9	477.7
Other rate	297.1	284.5	266.9	251.3	245.0	236.3	229.7	210.1	208.0	198.1	200.9	196.4
Rate ratio(b)	2.3	2.1	2.1	2.2	1.8	1.7	1.8	2.3	1.9	1.8	2.5	2.4
Respiratory diseases (J00–J99)												
Indigenous rate	168.5	215.6	162.2	173.7	172.9	168.4	144.2	191.9	132.9	168.0	154.4	139.9
Other rate	63.1	57.5	54.1	60.0	57.5	63.0	62.3	55.0	50.5	48.3	46.4	46.1
Rate ratio(b)	2.7	3.8	3.0	2.9	3.0	2.7	2.3	3.5	2.6	3.5	3.3	3.0
External causes (V01–Y98)												
Indigenous rate	116.3	143.9	105.6	135.2	129.4	126.4	124.9	114.4	147.3	130.9	123.1	165.5
Other rate	41.8	47.7	41.8	43.8	41.0	38.8	39.9	37.9	39.8	37.7	41.6	42.7
Rate ratio(b)	2.8	3.0	2.5	3.1	3.2	3.3	3.1	3.0	3.7	3.5	3.0	3.9
Diabetes (E10–E14)												
Indigenous rate	149.6	103.8	133.0	161.7	160.9	143.2	110.7	140.1	135.5	134.8	129.3	180.8
Other rate	17.5	15.0	15.0	15.1	15.4	15.8	15.1	16.3	15.8	17.0	18.4	18.2
Rate ratio(b)	8.5	6.9	8.9	10.7	10.4	9.1	7.3	8.6	8.6	7.9	7.0	9.9
Kidney diseases (N00–N29)												
Indigenous rate	59.5	78.6	97.4	90.0	30.5	47.2	65.2	38.8	36.9	75.9	61.3	74.8
Other rate	11.1	10.5	9.8	10.2	10.9	10.7	10.5	10.5	9.9	10.6	12.2	12.6
Rate ratio(b)	5.4	7.5	10.0	8.8	2.8	4.4	6.2	3.7	3.7	7.1	5.0	5.9
Neoplasms (C00–D48)												
Indigenous rate	267.5	252.2	217.4	284.0	224.7	240.9	249.9	243.2	223.5	268.3	295.8	338.7
Other rate	202.9	194.2	195.1	192.3	190.3	191.3	187.6	181.6	180.8	182.4	180.6	181.1
Rate ratio(b)	1.3	1.3	1.1	1.5	1.2	1.3	1.3	1.3	1.2	1.5	1.6	1.9

(a) Directly age-standardised using 2001 Australian population as standard.

(b) Rate for Indigenous Australians divided by the rate for non-Indigenous Australians.

Source: AIHW National Mortality Database

Circulatory disease death rate for Indigenous Australians declined strongly over the period 1997 to 2006, although experienced an increase in 2007 and 2008. Circulatory disease mortality rates for other Australians experienced a steady decline over the period. The rate ratio varied over the period, and didn't exhibit a clear trend.

Respiratory disease death rates for Indigenous and other Australians fell over the period. Death rates from external causes and kidney diseases did not change significantly from 1997 to 2008 for either Indigenous or other Australians. Diabetes mortality rates also did not change significantly for Indigenous Australians over the period, but exhibited a small but significant increase for other Australians. The Indigenous death rate from neoplasms also did not change significantly over the period, however there was a small but significant decline in the death rate for other Australians.

Discussion

Estimated Indigenous life expectancy is 11.5 years lower than non-Indigenous life expectancy for males and 9.7 years lower for females, according to the ABS Experimental Life Tables. These differentials are smaller than previous estimates of life expectancy. However, analysis of time trends is difficult because the new estimates of life expectancy use more direct methods of estimating the identification rate of Indigenous status for registered deaths. The difference in estimated life expectancy by Indigenous status is greatest in the Northern Territory, where male Indigenous life expectancy is 14.2 years lower than for non-Indigenous males. The largest differential in mortality rates is in age groups from 25–54 years, where Indigenous rates are 4–5 times higher than for non-Indigenous persons.

Interpretation of these estimates of Indigenous life expectancy should bear in mind that over one-third of registered deaths in Western Australia and Northern Territory were not linked with Census records, and the linked deaths may not have been representative of all deaths (see Box 1). In these jurisdictions, there were more deaths identified as Indigenous at death registration compared with at the Census with PES adjustment. The accuracy of the resultant life expectancy estimates may have been affected by these issues found in the linkage exercise.

This paper analysed trends in mortality from 1991–2008 for Western Australia, South Australia and the Northern Territory using registered deaths unadjusted for the Indigenous identification rate. Both male and female Indigenous death rates declined significantly over this period for these three jurisdictions. The more recent increase in the Indigenous death rate needs to be interpreted with caution, because it may have been caused by an increase in the Indigenous identification rate. Death rates for other Australians also declined for both males and females from 1991–2008.

Analysis of longer-term mortality trends in the Northern Territory revealed that Indigenous life expectancy for males improved from 52 years in 1967 to 60 years in 2004, and life expectancy for females increased from 54 years in 1967 to 68 years for females in 2004 (Wilson et al. 2007). This led to a reduction in the gap between estimated Indigenous and total Northern Territory life expectancy for females, but the gap between estimated Indigenous and total Northern Territory life expectancy for males remained unchanged. Their study also found that improvements in estimated Indigenous life expectancy in the Northern Territory from the late 1960s to the mid-1980s were largely due to infant mortality declines, especially for males. Since the mid-1980s, most life expectancy gains came from mortality declines above age 45 years.

The causes that contribute the most to the excess mortality of Indigenous Australian compared to the non-Indigenous population are circulatory diseases, external causes, neoplasms, respiratory diseases and endocrine, metabolic and nutritional disorders. At ages 35–54 years, where the ratio of Indigenous to non-Indigenous mortality is highest, diabetes, ischaemic heart disease, diseases of the liver and chronic lower respiratory diseases exhibit the largest differentials in death rates by Indigenous status.

Clear trends in major causes of death from 1997–08 in Western Australia, South Australia and the Northern Territory are difficult to identify for the Indigenous population. Only circulatory diseases experienced a clear downward trend over the period, which also declined for other Australians. The decline in circulatory diseases clearly was a major contributor to the overall Indigenous mortality decline, given it is the leading cause of death. However, it is important to note that the gap in death rates did not close significantly for any of the major causes between 1997 and 2008.

Interpretation of the results for causes of death should bear in mind that use of the underlying cause of death to measure chronic disease mortality may not account fully for comorbidity with other diseases. Diabetes, which has a substantially higher death rate for Indigenous compared with non-Indigenous Australians, is such an example. It is commonly reported on death certificates as a multiple cause of death with circulatory diseases. In such cases there may be subjectivity in the reporting of diabetes as either a direct or associated cause of the death certificate, which will determine if diabetes or circulatory diseases is the underlying cause (Adair & Rao 2010). However, the impact of this issue on the quality of Indigenous cause of death reporting for diabetes and other chronic diseases is unclear.

Higher exposure to risk factors lead to the higher mortality of Indigenous Australians. Tobacco smoking is the leading cause of burden of disease and injury among Indigenous Australians, and contributes significantly to mortality from circulatory diseases, respiratory diseases and cancers (AIHW 2008, Vos et al. 2007). Excessive alcohol consumption, high overweight/obesity and poor nutrition are also related to excess Indigenous mortality (ABS & AIHW 2008). Many of these risk factors are linked to the lower socio-economic status of Indigenous Australians. There is also lower utilisation of health services among Indigenous compared with non-Indigenous Australians for a number of reasons, including cost, availability of services, transport and distance to access services, and language and cultural barriers (ABS & AIHW 2008).

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