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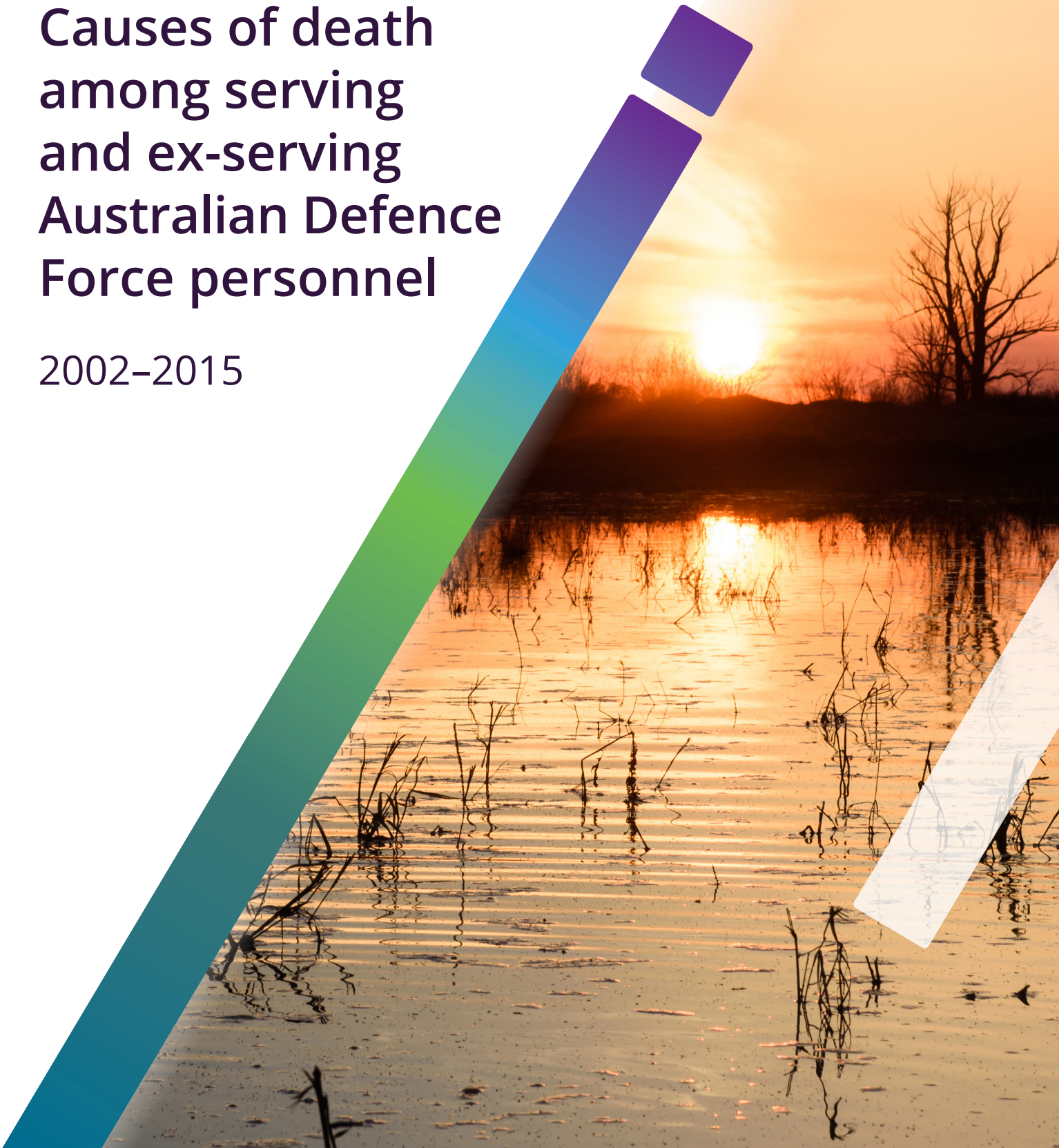
Causes of death among serving and ex-serving Australian Defence Force personnel

2002–2015



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Causes of death among serving and ex-serving Australian Defence Force personnel

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Australian Institute of Health and Welfare
Canberra
Cat. no. PHE 228

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Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Tel: (02) 6244 1000
Email: info@aihw.gov.au

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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

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This study was funded by DVA. A 3-year partnership between DVA and AIHW has been established from 2017–18 to 2019–20. The aim of the program of work over the 3 years is to build a comprehensive profile of the health and welfare of Australia's veteran population. This report makes a valuable contribution to our understanding in this area. For the purpose of this work, a veteran is defined as anyone with at least 1 day of Australian Defence Force service. The program of work will take a coordinated, whole-of-population approach to monitoring and reporting on the current status and future needs of veterans and their families, in support of DVA's strategic, research and data needs, including informing reporting to government on Veteran Centric Reform initiatives.

The AIHW Ethics Committee and the Departments of Defence and Veterans' Affairs Human Research Ethics Committee approved the research.

If you need help or support, please contact:

Veterans and Veterans Families Counselling Service **1800 011 046**, or <www.vvcs.gov.au>

ADF All-hours Support Line **1800 628 036**

Operation Life Online <http://at-ease.dva.gov.au/suicideprevention>

Lifeline **13 11 14**, or <www.lifeline.org.au>

Suicide Call Back Service **1300 659 467**, or <https://www.suicidecallbackservice.org.au>

Beyondblue Support Service **1300 22 4636**, or <www.beyondblue.org.au>.

For information on support provided by DVA see:

<https://www.dva.gov.au/health-and-wellbeing/mental-health>

<https://www.dva.gov.au/factsheet-hsv99-mental-health-support>.

Abbreviations

ABS	Australian Bureau of Statistics
ADF	Australian Defence Force
AIHW	Australian Institute of Health and Welfare
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth revision
NDI	National Death Index
NMD	National Mortality Database
PMKeyS	Personnel Management Key Solution
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
SMR	Standardised Mortality Ratio
UK	United Kingdom
WHO	World Health Organization

Symbols

. .	not applicable
=	equals
<	less than
%	per cent
+	plus
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data.
n	population size (number of deaths).
*	Analysis of crude and age-adjusted rates show a statistically significant difference between rate for the ADF service status group and Australia.
#	Analysis of crude rates show the rate for the ADF service status group was significantly higher than for Australia. After adjusting for age, the difference in the rate for the ADF service status group and Australia was not statistically significant.
^	Analysis of crude rates show no statistically significant difference in the rate for the ADF service status group and Australia. After adjusting for age, the rate for the ADF service status group was significantly lower than for Australia.
∆	Analysis of crude rates show the rate for the ADF service status group was significantly lower than for Australia. After adjusting for age, the difference in the rate for the ADF service status group and Australia was not statistically significant.

Summary

Valuable information on the health of a population can be gained by looking at how many people die and what caused their death. Comparing causes of death between populations frames this information within the context of the wider community and can help to explain differences in the health of populations. Differences in patterns of death between populations can result from differences in behaviours, exposures to disease or injury, and social and environmental circumstances. This information can be used to guide and evaluate health policy and interventions.

This report examines leading causes of death among three Australian Defence Force (ADF) service status groups—personnel serving full time, personnel in the reserves, and ex-serving personnel. Comparisons are made with leading causes of death in the Australian population to determine if any groups of ADF personnel are at greater risk of death from particular causes. This analysis builds on findings from the 2018 AIHW study into the incidence of suicide among serving and ex-serving ADF personnel and is based on the same data as the comparative analysis undertaken for that study (AIHW 2018b).

Results are based on analysis of 1,939 deaths that occurred between 2002 and 2015 among serving and ex-serving personnel with at least 1 day of ADF service since 1 January 2001. As such, the maximum length of follow-up between discharge and death for ex-serving personnel in this study is 15 years, and less for those discharged after 2001.

Overseas deaths, including deaths that occur on operational deployments, are generally outside the scope of Australian death statistics, and are therefore largely not captured in these results. While the proportion of women in the ADF is increasing, the number of women serving in the ADF has historically been low. As such, analysis focuses on men as they made up the majority of both ADF personnel (around 85%) and deaths (92%) in the study. Some of the results in this study are based on small numbers, particularly those involving women. Rates produced using small numbers can be sensitive to small changes in counts of deaths over time. This should be taken into account when interpreting the findings from this study.

Rates of death from all causes are generally lower for serving, reserve and ex-serving men and women than for the Australian population

Between 2002 and 2015, there were 1,790 deaths of men and 149 deaths of women with at least 1 day of service since 2001. For men, 52% (929) were ex-serving at the time of their death, 26% (468) were in the reserves and 22% (393) were serving full time. The all-cause mortality rate was generally lower for men across all age groups examined for each of the three ADF service status groups than for men in the same age range in the Australian population.

In most cases, the all-cause mortality rate for women—for all ages combined and by age group—was lower than the rate for women in the same age range in the Australian population.

Leading causes of death by age are similar between serving, reserve and ex-serving men and Australian men

For all Australian men aged 16–29, suicide, land transport accidents and accidental poisonings were the top three leading causes of death. These causes of death also appeared in the top three leading causes for men in the same age range who were serving full time, in the reserves and ex-serving at the time of their death.

Suicide was the leading cause of death for men aged 30–49 in the Australian population, and for men in the same age range in each of the three ADF service status groups. Land transport accident deaths and deaths due to coronary heart disease featured prominently among other leading causes of death for these groups.

For men aged 50 and over, chronic diseases were the leading causes of death in the Australian population, and across each of the three ADF service status groups.

Death rates due to chronic diseases are lower, or similar, for serving, reserve and ex-serving men than for Australian men

Men in the three ADF service status groups generally had statistically significantly lower rates of death due to chronic diseases than men in the Australian population of the same age range. This is a key factor contributing to the lower all-cause mortality rates for men across the three ADF service status groups when compared with rates for Australian men in the same age range.

The exception was rates of death due to melanoma in each of the three ADF service status groups, which were similar to the rates for Australian men in the same age range.

Death rates due to injury are generally lower, or similar, for serving, reserve and ex-serving men than for Australian men

Men in the three ADF service status groups generally had statistically significantly lower, or similar, rates of death due to external causes (injury) than men in the Australian population of the same age range. Rates of death were compared for the top three external causes of death in these populations: suicide, land transport accidents and accidental poisoning.

Suicide

Men who were serving full time and in the reserves had significantly lower age-adjusted rates of suicide than Australian men in the same age range.

Between 2002 and 2015, the rate among ex-serving men, after adjusting for age, was similar to that for Australian men in the same age range. However, the rate of death due to suicide was significantly higher for ex-serving men aged under 30 than for Australian men in the same age range. These findings were reported previously in *Incidence of suicide in serving and ex-serving Australian Defence Force personnel: detailed analysis 2001–2015* (AIHW 2018b). It is important to note that high-level information on the rate of suicide in the three ADF service status groups will be updated annually as new cause of death information becomes available. This may result in changes to previously published results.

Land transport accidents

For men serving in the reserves, and ex-serving men, age-adjusted rates of land transport accident death were significantly lower than for all Australian men in the same age range.

The age-adjusted rate of land transport accident death among serving men was similar to the rate for men in the Australian population in the same age range.

Accidental poisoning

The age-adjusted rates of death due to accidental poisoning for men in all three ADF service groups were significantly lower than the rates for all Australian men in the same age range.

1 Introduction

The health and wellbeing of Australia's veterans is a high priority for the Australian Government, and for the Department of Veterans' Affairs and the Department of Defence in particular. This is recognised in a recent inquiry that highlighted the need to improve the integration of service responses for veterans and to invest in prevention and early intervention to improve their health and wellbeing (JSCFADT 2015).

Between 2002 and 2015, there were 1,939 deaths among serving, reserve and ex-serving Australian Defence Force (ADF) personnel with at least 1 day of service since January 2001 (hereafter referred to as the three ADF service status groups).

The three ADF service status groups included in the study are defined in Box 1.1.

Box 1.1: The three ADF service status groups—definitions

Serving full time: ADF members serving in the Royal Australian Navy (RAN, hereafter referred to as Navy), Australian Army (hereafter Army) or Royal Australian Air Force (RAAF, hereafter Air Force) in either a regular capacity, on continuous full-time service, or participating in the gap year program at the time of data extract, 10 April 2016.

Reserve: ADF members in the active or inactive reserve forces for the Navy, Army or Air Force at the time of data extract, 10 April 2016. Most members leaving full-time service make the transition to the inactive reserve forces, unless there are medical or other grounds preventing this.

Ex-serving: ADF members in the serving or reserve population on or after 1 January 2001 and who were discharged after 1 January 2001. The ex-serving population increased by around 5,000 per year in the period of study (2001 to 2015).

This report explores the leading causes of death among ADF personnel in the three service status groups who died between 2002 and 2015. It is structured as follows:

- Chapter 1 describes the data and methods used in the study
- Chapter 2 provides an overview of some of the key demographic differences between the three ADF service status groups and the Australian population
- Chapter 3 presents the leading causes of death between 2002 and 2015 among the three ADF service status groups, by sex and broad age groups and compares these with leading causes of death in the Australian population
- Chapter 4 compares rates of death due to the leading causes of death identified in Chapter 3 between men and women in the three ADF service status groups and Australia
- Chapter 5 explores in detail deaths due to land transport accidents (the leading cause of death among serving men, and the third leading cause of death among men in the reserves and ex-serving men) to determine if any type of land transport accident was more common among men in the three ADF service status groups, and to identify groups who may be at a higher risk of death from particular land transport accidents than Australian men in general.

This report builds on recent work by the Australian Institute of Health and Welfare (AIHW) to calculate numbers and rates of suicide among serving, reserve and ex-serving ADF

personnel (AIHW 2018b). Some of the analysis presented in that study has been reproduced within the context of this report for completeness.

Important factors to consider when reading this report are outlined in Box 1.2, with further detail provided later in this chapter (see the section headed 'Factors to consider when reading this report').

Box 1.2: Factors to consider when reading this report

- The counts of deaths presented in this report are calculated from certified deaths information only; that is, official fact of death and cause of death determination from the Registrars of Births, Deaths and Marriages in each state and territory and the National Coronial Information System.
- This study excludes an unknown number of deaths that occurred overseas during the study period, such as deaths that occurred on operational deployment. Overseas deaths are generally outside the scope of Australian death statistics, and are therefore largely not captured in these results.
- Cause of death for a small number of records linked to the 2013 (revised), 2014 (preliminary) and 2015 (preliminary) Cause of Death Unit Record File may change where a death is being investigated by a coroner, and more up-to-date information becomes available as a result of the revision process.
- Differences between the results of this study and other publicly reported estimates may be due to the study scope and/or the source of cause of death information.
- The ex-serving group in this study is only a subset of the overall veteran population and has a younger age profile. Results of this study cannot be used to estimate the number and causes of deaths among people who left the ADF before 1 January 2001 and therefore cannot be extrapolated to the broader veteran/ex-serving population in Australia.
- Some of the results are based on small numbers, particularly those involving women. Rates produced using small numbers can be sensitive to small changes in counts of deaths over time.
- Statistically significant differences are indicated in this report hereafter by being described as 'significantly higher'/'significantly lower' (see Box 1.3 for the definition of statistical significance used in this report).

Methods

This section provides an overview of the data, scope and statistical methods used in the study.

Data

This study is based on the same data used in the report *Incidence of suicide among serving and ex-serving Australian Defence Force personnel: 2001–2015* (AIHW 2018b).

The study population was derived from the Personnel Management Key Solution (PMKeyS) database (held by the Department of Defence), which was linked with the National Death Index (NDI) (held by the AIHW) to determine the number of deceased ADF personnel. This data set was then supplemented by cause of death information from the National Mortality Database (NMD). See Appendix A1 for detail on each of these data sources. Additional information on the data linkage process is in Appendix B.

Scope

The scope of this study is all ADF personnel with at least 1 day of ADF service on or after 1 January 2001 to 10 April 2016 (the date of the PMKeyS data extract). In this report, counts and rates of death due to leading causes, and comparisons with the Australian population, are reported for the period 2002–2015.

Counting deaths by leading causes

Analysis in this report is based on the year of occurrence of death. The latest available cause of death information at the time of analysis was for 2015. The number of deaths among the leading causes were derived from all deaths with a valid date of death between 1 January 2002 and 31 December 2015. The underlying cause of death (as included on the NDI) is used to assign the cause of death. The underlying cause is the disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury (AIHW 2018a). It reflects the primary or main cause of death.

Identifying the leading causes of death in a population involves ranking the causes based on the number of deaths each cause accounts for. In this report, the underlying causes of death are categorised according to the leading cause of death groupings routinely used by the AIHW and recommended by the World Health Organization (WHO) (Becker et al. 2006). Minor modifications are made to these groupings to suit the Australian context. See Table A1 for the list of the leading cause of death groupings used in this report.

Between 2002 and 2015, there were 59 deaths identified through linkage to the NDI with no cause of death information on the NDI at the time of linkage. These were retained in the analysis data set as valid deaths and included in counts of all deaths, and in calculating all-cause mortality rates. These deaths were excluded from the calculation of proportions for leading causes of death in Chapter 3 as specific cause of death information was not available to inform this analysis.

Deaths that occur outside Australia are generally outside the scope of the NDI and are therefore largely excluded from this analysis. However, there is a very small proportion of overseas deaths recorded in the NDI. Since 2001, there have been overseas conflicts in which ADF personnel have died, the major ones being those in Iraq and Afghanistan. There were 57 overseas deaths reported in the PMKeyS data extract used for this study. Of these, 27 were linked to the NDI and had cause of death information. The majority of these were coded as R99 (ill-defined, unknown or unspecified) or X59 (exposure to unspecified factor) and were included in analysis for consistency in comparisons made with the Australian population.

Age groups

Distinct comparison populations were required for each of the three ADF service status groups due to their differing age structures. Lower and upper ages were defined by the lower and upper ages observed within the study set for each group of interest. The following age ranges were used to provide overall results for men:

- serving full time: 17–70
- in the reserves: 16–78
- ex-serving: 17–84.

To facilitate comparisons of leading causes of death among men across each of the ADF service status groups, three broad age groups were used (16–29, 30–49 and 50–84) when

calculating age-specific rates. These age groups are based on the age range of the population at risk.

The broad age-specific rates used in this report vary slightly from those used in the AIHW suicide study (AIHW 2018b). The age groupings used in that study to report age-specific rates were 18–29, 30–49 and 50–69 and were defined by the lower and upper ages of suicide death in the study populations.

Comparing death rates with those of the Australian population

To examine whether ADF service may have an impact on the risk of death among personnel serving full time, in the reserves and ex-serving personnel, it is important to consider death rates across these groups within the context of death rates for the wider community.

This report uses crude rates and age-specific rates for comparisons with the Australian population. Crude rates complement information on the number of deaths by the leading causes, by accounting for the size of the underlying population. Age-specific rates and standardised mortality ratios (SMRs) are used to control for the difference in age structures between each of the ADF service status groups and the comparison (Australian) population.

For more detail on the measures used in this report, see Box 1.3.

Box 1.3: Key statistical terms used in this report—definitions

Age-specific rate: the number of deaths divided by the corresponding population, then multiplied by 100,000 to provide a rate (per 100,000 population) within a particular age-group in a given time period.

Counts of death: the number of deaths in a population in a given time period.

Crude rate: the number of deaths divided by the corresponding population, then multiplied by 100,000 to provide a rate (per 100,000 population) in a given time period.

Standardised mortality ratio (SMR): a ratio to compare the suicide rates for the three ADF service status groups with those of the Australian population, adjusting for differences in age structure. It is calculated as the observed number of events (deaths due to a specific cause) divided by the number of events that would be expected if the study population had the same age- and sex-specific rates as those observed in the comparison population. If the age- and sex-specific rates are the same in each population, the ratio is 1.0. If the age- and sex-specific rates are higher overall in the ADF service status group than in the Australian population, the ratio will be more than 1.0. If the age- and sex-specific rates are lower overall in the ADF service status group than in the Australian population, the ratio will be less than 1.0.

Statistical significance: a statistical measure that indicates how likely the observed difference is due to chance alone. In the context of this study, the random element comes from the selection of a reference period. If a different reference period was used in the analysis, it is likely that some or all of the observed rates would also be different. Statistical significance is reported to indicate how likely it is that the observed difference is due to that randomness alone.

If the difference is deemed to be sufficiently unlikely to be due to chance alone, it is said to be statistically significant. Statistically significant differences are described in this report as being ‘significantly higher’/‘significantly lower’.

Important note: In this study, 95% confidence intervals are provided for crude rates and age-specific rates to indicate the level of uncertainty around these estimates. Estimates produced using small numbers can be sensitive to small changes in counts of deaths over

time and will therefore have wide confidence intervals. 95% confidence intervals are provided in this report as they may account for the variation in absolute counts of deaths over time (related to the small sample size). Use of confidence intervals is the simplest way to test for significant differences. For the purposes of this report, rates are deemed to be statistically significantly different when their confidence intervals do not overlap with each other.

Factors to consider when reading this report

Certain factors should be considered when interpreting the results presented in this report.

Small number of deaths

Some of the results presented in this report are based on small numbers of deaths. Rates produced using small numbers can be sensitive to small changes in counts of deaths over time and will therefore have wide confidence intervals. This should be taken into account when interpreting the findings.

Counts and rates are not reported where there were fewer than 5 deaths as estimates based on such small numbers may be volatile over time.

Short follow-up period

The scope of the cause of death analysis is restricted to ADF personnel with at least 1 day of service since 1 January 2001 and who died between 1 January 2002 and 31 December 2015. As such, the maximum length of follow-up between discharge and death for ex-serving personnel is 15 years, and less for those discharged after 2001. This means more information is available on deaths that occur a shorter time after discharge than on those that occur a longer time after discharge. If certain characteristics are more likely to be associated with death a longer time after discharge, there may not be enough information in the current data set to identify these as significant risk factors at this stage. As more data are added, and the ex-serving population increases and ages, additional causes of death and risk factors may be identified. Hence, it is important to note that the ex-serving group in this study is only a subset of the overall veteran population, and that it has a younger age profile.

2 The study populations

This study focuses on 199,466 ADF personnel who had at least 1 day of service from 1 January 2001 to 10 April 2016 (the date of the PMKeyS extract). The three study populations were:

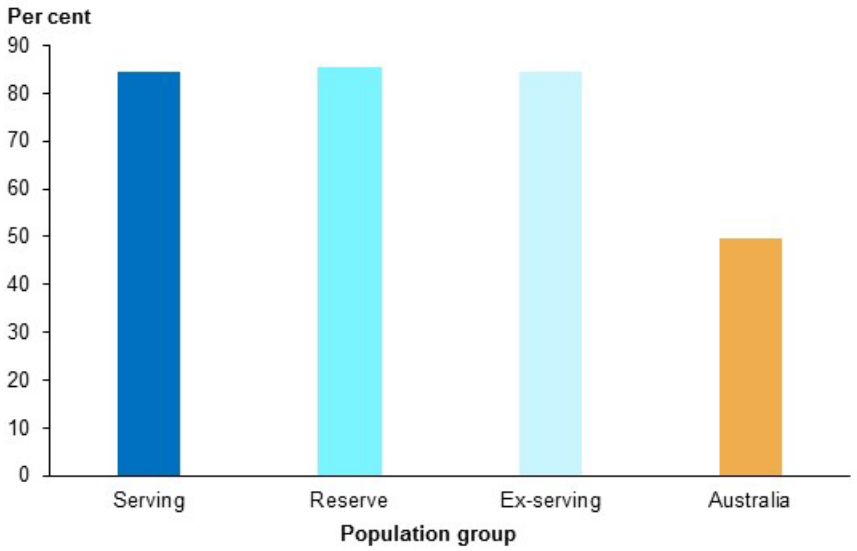
- 59,568 people serving full time
- 45,343 people in the reserves
- 94,555 people separated from the ADF (ex-serving).

These study populations are referred to as the three ADF service status groups. For a description of these groups, see Box 1.1.

The size of the serving full time and reserve populations is relatively stable each year, at around 55,000 for those serving full time and 42,000 for the reserves, with some annual variation reflecting operational requirements, recruitment and separation. In contrast, the ex-serving population for this study was zero (0) on 1 January 2001 and increased by around 5,000 per year.

There are a number of other key differences between those serving full time, those in the reserves and ex-serving ADF personnel and the Australian population examined in this study.

For example, across all ages from 16 to 85, each of the ADF service status groups had a higher proportion of men (84%–85%) than the Australian population in the same age range (50%) (Figure 2.1; Table 2.1).



Sources: AIHW analysis of linked PMKeyS–NDI data 2001–2015; Australian Bureau of Statistics (ABS) Australian Demographic Statistics 2016.

Figure 2.1: Percentage of men in each of the ADF service status groups and in the Australian population, ages 16–85, 2001–2015

Table 2.1: Demographic profile of people aged 16–85[a] with ADF service from 1 January 2001, by ADF service status group, as at 10 April 2016

	Serving[b]		Reserve[c]		Ex-serving[d]		Australia (16–85)	
Characteristic	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Sex[e]								
Men	50,276	84	38,705	85	79,821	84	8,249,161	50
Women	9,292	16	6,638	15	14,733	16	8,390,561	50
Men[e]								
Age group (years)								
16–24	12,472	25	2,868	7	4,471	6	1,355,346	16
25–34	19,218	38	12,882	33	22,871	29	1,538,704	19
35–44	10,342	21	9,090	23	22,532	28	1,533,176	19
45–54	6,797	14	7,867	20	15,226	19	1,439,549	18
55–64	1,422	3	5,671	15	9,125	11	1,165,526	14
65–85	25	0	327	1	5,596	7	1,216,859	15
Median age	*30*	*. .*	*38*	*. .*	*40*	*. .*	*43*	*. .*
Total men	**50,276**	**100**	**38,705**	**100**	**79,821**	**100**	**8,249,160**	**100**
Women[e]								
Age group (years)								
16–24	2,666	29	474	7	955	6	1,295,611	15
25–34	3,750	40	2,046	31	4,091	28	1,530,592	18
35–44	1,870	20	2,054	31	5,040	34	1,554,791	19
45–54	901	10	1,435	22	3,243	22	1,464,086	17
55–64	104	1	608	9	1,104	7	1,172,255	14
65–85	1	0	21	0	300	2	1,373,227	16
Median age	*29*	*. .*	*38*	*. .*	*39*	*. .*	*43*	*. .*
Total women	**9,292**	**100**	**6,638**	**100**	**14,733**	**100**	**8,390,562**	**100**
Total	**59,568**		**45,343**		**94,555**		**16,639,722**	

(a) Age was calculated as at 10 April 2016 (or at the time of death).

(b) Consists of individuals serving in a regular capacity in the Navy, Army or Air Force; those on continuous full-time service; and those participating in the gap year program, as at 10 April 2016 (or at the time of their death).

(c) Consists of individuals in the active or inactive reserve forces for the Navy, Army or Air Force, as at 10 April 2016 (or at the time of their death).

(d) Consists of individuals who were separated from the ADF, as at 10 April 2016 (or at the time of their death).

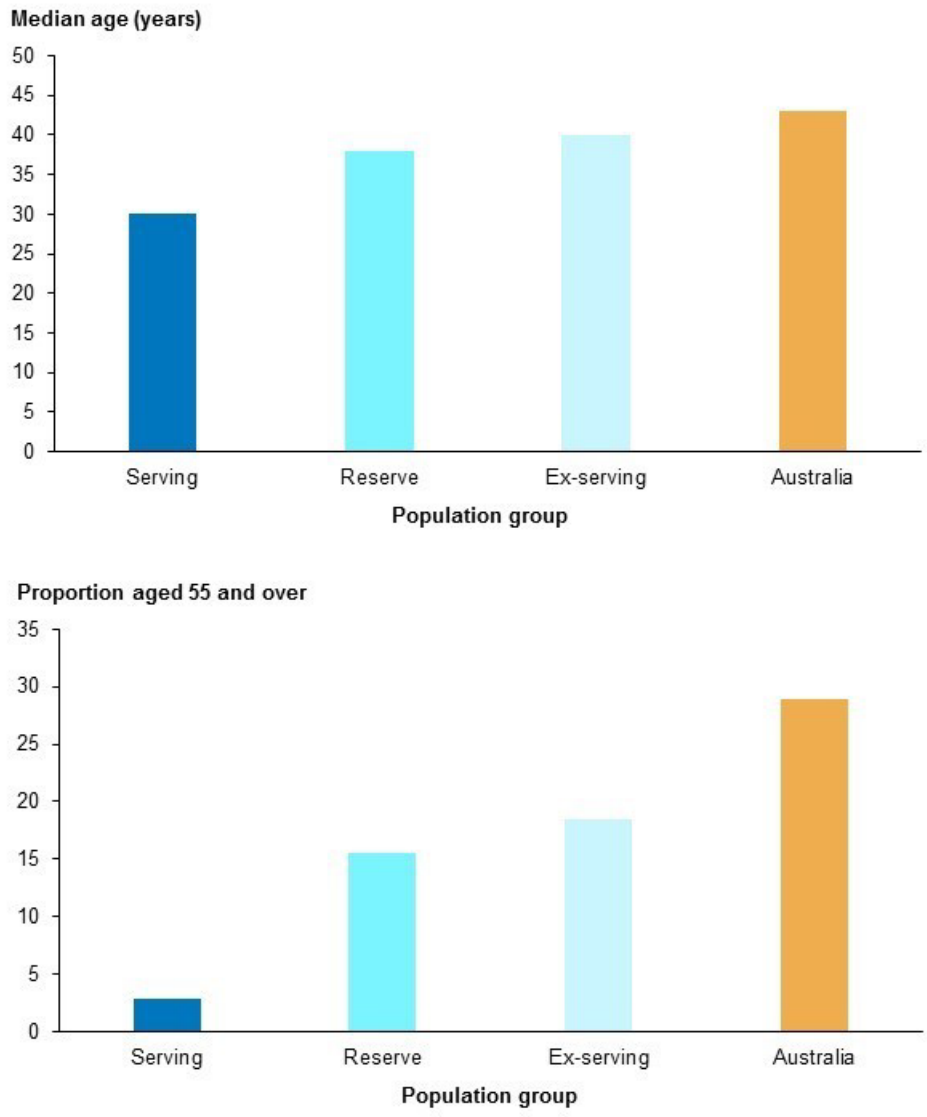
(e) One individual in the ex-serving group with missing information on this variable is excluded from counts by sex, but is included in the total ex-serving population count.

Note: Columns may not add due to rounding.

Sources: ABS Australian Demographic Statistics 2016; AIHW analysis of linked PMKeyS–NDI data 2001–2015.

As well, the three ADF service status groups of men (aged 16–85) had a younger median age than the Australian population of men in the same age range (Figure 2.2). The serving population of men is youngest (median age 30), followed by the population of men in the reserves (median age 38), while the ex-serving population is the oldest (median age 40). In comparison, the population of all Australian men aged 16–85 has a median age of 43. Further, each of the ADF service status groups had a much lower proportion of men aged 55 and over than Australian men in the same age range.

The differences in the age and sex structures of the three ADF service status groups and the Australian population have been taken into account in comparisons using age-specific rates and SMRs presented in this report.



Sources: ABS Australian Demographic Statistics 2016; AIHW analysis of linked PMKeyS–NDI data 2001–2015.

Figure 2.2: Key demographic characteristics among men in each of the ADF service status groups compared with Australian men aged 16–85, 2001–2015

3 Identifying leading causes of death

Between 2002 and 2015, there were 1,939 deaths among men and women serving full time, in the reserves and ex-serving with at least 1 day of ADF service since 2001. This total comprises 421 deaths (22%) in the population serving full time, 507 (26%) in the reserve population and 1,011 (52%) in the ex-serving population.

Men accounted for 9 in 10 deaths (1,790 deaths, 92%) and made up 84%–85% of the population in each of the three ADF service status groups. Women accounted for 149 deaths (8%).

In this report, deaths are categorised according to leading cause of death groupings routinely used by the AIHW and recommended by the WHO (Becker et al. 2006). Minor modifications are made to these groupings to suit the Australian context. See Table A1 for the list of the leading cause of death groupings used in this report.

Leading cause of death analysis highlights the causes associated with the largest number of deaths in a population. Comparing proportions of deaths due to leading causes across populations can provide some indication of whether a cause of death is associated with a larger proportion of deaths in one population compared with another. However, comparisons can be misleading if the populations being compared have different age and sex structures as leading causes of death differ by age, and for men and women (ABS 2016b).

Leading causes of death can be broadly classified as deaths due to injury or chronic diseases (for definitions of these terms, see Box 3.1). In Australia, injury-related deaths feature more prominently in the leading causes of death among Australian men aged 15–24 and 25–34 than among those aged over 35 (where deaths due to chronic diseases feature more prominently) (ABS 2016b).

Box 3.1: General mortality terms used in this report

All-cause mortality: deaths due to any cause.

Deaths from chronic diseases: chronic diseases are the leading cause of death in Australia and are caused by multiple factors, including a person's genetic make-up, lifestyle and environment (AIHW 2012). They are long-term health conditions that cannot be directly spread from one person to another. Examples of chronic diseases include asthma, cancer, diabetes and heart disease. Deaths due to chronic diseases are more common in older populations as age is a major risk factor.

Deaths from external causes: an external cause of death (hereafter referred to as an injury-related death) is related to cases where the underlying cause is determined to be one of a group of causes external to the body (for example, suicide, transport accidents, falls, poisonings and assault) (ABS 2016b).

This chapter first presents the leading causes of death among men in each of the three ADF service status groups. Due to the smaller number of women in this study, it is only possible to present high-level analysis of the leading causes of death in women combined across the three ADF service status groups.

Further analysis of leading causes of death in men by ADF service status and broad age groupings (16–29, 30–49 and 50 and over) is then presented, with comparisons made with leading causes of death in the Australian population. These comparisons take into account the differences in the age structures across the serving, reserve and ex-serving populations and the Australian population.

It is important to note that deaths that occur overseas, such as deaths on operational deployment, are generally outside the scope of the NDI, and therefore are largely not captured in these results. See the section in Chapter 1 headed ‘Counting deaths by leading cases’ for further detail.

Leading causes of death among serving men

This study found that between 2002 and 2015 there were 358 deaths with a known cause among men serving full time aged 17–70 (Table 3.1). Land transport accidents were the leading cause of death among these men, accounting for 25% of all deaths in this population. Suicide was the second leading cause and accidental poisoning the fourth, accounting for 20% and 4% of all deaths, respectively. Together, these three causes of injury-related death accounted for almost 50% of all deaths among serving men between 2002 and 2015.

Deaths due to chronic diseases accounted for 15% of the top 10 leading causes of death in men serving full time:

- Coronary heart disease was the third leading cause, accounting for 8% of all deaths.
- Three cancers appear in the top 10 leading causes: melanoma (4%), pancreatic cancer (2%) and unknown ill-defined cancers (2%).

Table 3.1: Top 10 leading causes of death among serving men aged 17–70, 2002–2015

Rank	Cause of death	Count	Per cent
1	Land transport accidents	90	25
2	Suicide	71	20
3	Coronary heart disease	28	8
4	Accidental poisoning	13	4
4	Melanoma	13	4
5	Other ill-defined causes[(a)]	12	3
6	Exposure to unspecified factors	10	3
7	Pancreatic cancer	8	2
8	Air and space transport accidents	6	2
8	Cancer, unknown, ill-defined	6	2
	Other[(b)]	101	28
	Deaths with underlying cause information	**358**	**100**
	Deaths with no underlying cause information	**35**	**. .**
	Total deaths	**393**	**. .**
	Median age at death (years)	32	. .

(a) ‘Other ill-defined causes’ includes: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (excluding R95: Sudden infant death syndrome (SIDS); Cardiac arrest, unspecified; Hypotension, unspecified; Other and unspecified disorders of circulatory system; Acute respiratory failure; Respiratory failure, unspecified. See Table A1 for categorisations.

(b) The ‘Other’ category consists of deaths with a known cause not in the top 10 causes of death. See Table A1 for categorisations.

Notes

1. Where the number of deaths due to specific causes are equal, the same rank is given.
2. Percentages may not sum to 100% due to rounding.

Source: AIHW analysis of linked PMKeyS–NDI data 2002–2015.

Leading causes of death among men in the reserves

Between 2002 and 2015, there were 466 deaths with a known cause among men of all ages in the reserves (Table 3.2). Two of the top 10 leading causes of death among these men were due to injury. Suicide was the leading cause of death among men in the reserves, accounting for 13% of all deaths, while land transport accidents were the third leading cause of death (8%).

The remaining eight leading causes of death among men in the reserves were due to chronic diseases:

- Coronary heart disease was the second leading cause, accounting for 10% of all deaths.
- Five cancers appear in the top 10 leading causes: melanoma (6%), colorectal cancer (5%), brain cancer (5%), lung cancer (4%) and malignant neoplasms of mesothelial and soft tissue (3%).
- Liver disease (3%) and cerebrovascular disease (3%) were the eighth and tenth ranked leading causes of death among men in the reserves.

Table 3.2: Top 10 leading causes of death among men in the reserves aged 16–78, 2002–2015

Rank	Cause of death	Count	Per cent
1	Suicide	60	13
2	Coronary heart disease	48	10
3	Land transport accidents	37	8
4	Melanoma	29	6
5	Colorectal cancer	22	5
6	Brain cancer	21	5
7	Lung cancer	20	4
8	Liver disease	16	3
9	Malignant neoplasms of mesothelial and soft tissue	15	3
10	Cerebrovascular disease	13	3
	Other[(a)]	185	40
	Deaths with underlying cause information	**466**	**100**
	Deaths with no underlying cause information	**2**	**. .**
	Total deaths	**468**	**. .**
	Median age at death (years)	50	. .

(a) The 'Other' category consists of deaths with a known cause not in the top 10 causes of death. See Table A1 for cause of death categorisations.

Note: Percentages may not sum to 100% due to rounding.

Source: AIHW analysis of linked PMKeyS–NDI data 2002–2015.

Leading causes of death among ex-serving men

Between 2002 and 2015, there were 909 deaths with a known cause among ex-serving men of all ages (Table 3.3). Three of the top 10 leading causes of death in this group were due to injury. Suicide was the leading cause of death, accounting for 17% of all deaths. Land transport accidents were the third leading cause of death (6% of all deaths) and accidental poisoning, the fifth leading cause of death (4%).

The remaining seven leading causes of death among ex-serving men were due to chronic diseases:

- Coronary heart disease was the second leading cause, accounting for 11% of all deaths.
- Five cancers appear in the top 10 leading causes: lung cancer (5%), colorectal cancer (3%), melanoma (3%), brain cancer (3%) and prostate cancer (3%).
- Liver disease (3%) was the eighth ranked leading cause of death.

Table 3.3: Top 10 leading causes of death among ex-serving men aged 17–84, 2002–2015

Rank	Cause of death	Count	Per cent
1	Suicide	154	17
2	Coronary heart disease	98	11
3	Land transport accidents	56	6
4	Lung cancer	49	5
5	Accidental poisoning	36	4
6	Colorectal cancer	28	3
7	Melanoma	25	3
7	Brain cancer	25	3
8	Liver disease	24	3
8	Prostate cancer	24	3
	Other[(a)]	390	43
	Deaths with underlying cause information	**909**	**100**
	Deaths with no underlying cause information	**20**	**. .**
	Total deaths	**929**	**. .**
	Median age at death (years)	50	. .

(a) The 'Other' category consists of deaths with a known cause not in the top 10 causes of death. See Table A1 for cause of death categorisations.

Notes

1. Where the number of deaths due to specific causes are equal, the same rank is given.
2. Percentages may not sum to 100% due to rounding.

Source: AIHW analysis of linked PMKeyS–NDI data 2002–2015.

Leading causes of death among women

Due to the smaller number of women in this study, it was not possible to analyse the leading causes of death for each of the three ADF service status groups (serving full time, in the reserves and ex-serving personnel) separately. So, a broad analysis combined across these groups follows.

Women made up 8% (147) of deaths with a known cause across the three ADF service status groups between 2002 and 2015 (Table 3.4). The leading cause of death among these women was breast cancer, accounting for 26 deaths (18%), followed by suicide with 19 deaths (13%) and land transport accidents with 17 deaths (12%) (Table 3.4).

Table 3.4: Leading causes of death among women of all ages across the three ADF service status groups combined, 2002–2015

Rank	Cause of death	Count	Per cent
1	Breast cancer	26	18
2	Suicide	19	13
3	Land transport accidents	17	12
4	Lung cancer	12	8
5	Brain cancer	6	4
5	Cerebrovascular disease	6	4
	Other[(a)]	61	42
	Deaths with underlying cause information	**147**	**100**
	Deaths with no underlying cause information	**2**	**. .**
	Total deaths	**149**	**. .**
	Median age at death (years)	43	. .

(a) The 'Other' category consists of deaths with a known cause not in the top 10 causes of death. See Table A1 for cause of death categorisations.

Notes

1. Where the number of deaths due to specific causes are equal, the same rank is given.
2. Percentages may not sum to 100% due to rounding.

Source: AIHW analysis of linked PMKeyS–NDI data 2002–2015.

Comparing leading causes of death

The following analysis considers leading causes of death within three broad age groups across the three ADF service status groups—serving, reserve and ex-serving personnel—and includes comparisons with the Australian population for context. Due to the smaller number of women in the study, this section does not include detailed analysis of women.

When considering the leading causes of death by broad age groups, similar patterns emerged for men for each of the service status groups and Australian men in the same age range. These are explored in the following subsections.

Leading causes of death among men aged 16–29

The top five leading causes of death among Australian men aged 16–29 between 2002 and 2015 were due to injury (Table 3.5). This was also the case for men serving full time, in the reserves and ex-serving who died during this period.

Table 3.5: Top five leading causes of death among men aged 16–29 by ADF service status group compared with Australian men in the same age range, 2002–2015

	ADF service status group			
Rank	**Serving (n = 145)**	**Reserve (n = 54)**	**Ex-serving (n = 131)**	**Australia**
1	Land transport accidents (63, 43%)	Suicide (15, 28%)	Suicide (55, 42%)	Suicide (27%)
2	Suicide (40, 28%)	Land transport accidents (8, 15%)	Land transport accidents (24, 18%)	Land transport accidents (25%)
3	Accidental poisoning (8, 6%)	n.p.	Accidental poisoning (10, 8%)	Accidental poisoning (8%)
4	Exposure to unspecified factor (7, 5%)	n.p.	Event of undetermined intent (6, 5%)	Assault (3%)
5	Other ill-defined causes (5, 3%)	n.p.	n.p.	Accidental drowning and submersion (2%)

Notes

1. The columns do not sum to 100% as not all causes of death are listed.
2. Excludes deaths that have no underlying cause recorded.
3. 'Other ill-defined causes' includes: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (excluding R95: Sudden infant death syndrome (SIDS); Cardiac arrest, unspecified; Hypotension, unspecified; Other and unspecified disorders of circulatory system; Acute respiratory failure; Respiratory failure, unspecified. See Table A1 for categorisations.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Between 2002 and 2015, for men aged 16–29:

- deaths by suicide for ex-serving men (42%) accounted for a higher proportion of deaths than for Australian men in the same age range (27%)
- deaths from land transport accidents among ex-serving men accounted for a lower proportion of deaths (18%) than for Australian men in the same age range (25%)
- deaths from land transport accidents (43%) among serving men accounted for a higher proportion of death than for Australian men in the same age range (25%)
- due to the small number of deaths among reserve personnel (54), only the top two causes of death are reported. The proportion of suicide deaths among men in the reserves was similar to that among Australian men in the same age range (28% compared with 27%), while the percentage of deaths by land transport accidents was considerably lower among men in the reserves (15% compared with 25%).

Leading causes of death among men aged 30–49

Between 2002 and 2015, suicide was the leading cause of death among all Australian men aged 30–49 (Table 3.6). It was also the leading cause of death across the three ADF service status groups during this period. Land transport accidents and coronary heart disease featured prominently among other leading causes of death for men aged 30–49 in Australia and across all ADF service status groups.

Table 3.6: Top five leading causes of death among men aged 30–49 by ADF service status group, compared with Australian men in the same age range, 2002–2015

	ADF service status group			
Rank	**Serving (n = 161)**	**Reserve (n = 171)**	**Ex-serving (n = 320)**	**Australia**
1	Suicide (29, 18%)	Suicide (35, 20%)	Suicide (88, 28%)	Suicide (17%)
2	Land transport accidents (25, 16%)	Coronary heart disease (23, 13%)	Land transport accidents (27, 8%)	Coronary heart disease (11%)
3	Coronary heart disease (21, 13%)	Land transport accidents (22, 13%)	Coronary heart disease (26, 8%)	Accidental poisoning (7%)
4	Melanoma (9, 6%)	Cerebrovascular disease (8, 5%)	Accidental poisoning (23, 7%)	Land transport accidents (7%)
5	Other ill-defined causes (7, 4%)	Melanoma (7, 4%)	Event of undetermined intent (10, 3%)	Liver disease (4%)

Notes

1. The columns do not sum to 100% as not all causes of death are listed.
2. Excludes deaths that have no underlying cause recorded.
3. 'Other ill-defined causes' includes: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (excluding R95: Sudden infant death syndrome (SIDS); Cardiac arrest, unspecified; Hypotension, unspecified; Other and unspecified disorders of circulatory system; Acute respiratory failure; Respiratory failure, unspecified. See Table A1 for categorisations.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015, AIHW NMD 2002–2015.

Between 2002 and 2015, for men aged 30–49:

- suicide deaths among ex-serving men (28%) accounted for a higher proportion of deaths than for Australian men in the same age range (17%)
- accidental poisoning was the third ranked cause of death among Australian men, but does not appear in the leading causes of death among serving or reserve men
- land transport accident deaths among serving men and men in the reserves accounted for a higher proportion of deaths (16% and 13%, respectively) than for Australian men in the same age range (7%)
- suicide (20%), coronary heart disease (13%) and land transport accidents (13%) among men in the reserves accounted for a higher proportion of deaths than for Australian men in the same age range (17%, 11% and 7%, respectively).

Leading causes of death among men aged 50 and over

Coronary heart disease was the leading cause of death among men aged 50 and over both in the Australian population and across each of the three ADF service status groups (Table 3.7). The remaining leading causes of death in each of these groups were other chronic diseases. This was to be expected, given that the top five leading causes of death among Australian men aged 50 and over between 2002 and 2015 were chronic diseases.

Table 3.7: Top 5 leading causes of death among men aged 50 and over by ADF service status group, compared with Australian men in the same age range, 2002–2015

	ADF service status group			
Rank	**Serving (n = 52)**	**Reserve (n = 241)**	**Ex-serving (n = 458)**	**Australia**
1	Coronary heart disease (6, 12%)	Coronary heart disease (24, 10%)	Coronary heart disease (72, 16%)	Coronary heart disease (17%)
2	n.p.	Melanoma (22, 9%)	Lung cancer (42, 9%)	Lung cancer (9%)
3	n.p.	Colorectal cancer (17, 7%)	Prostate cancer (23, 5%)	Cerebrovascular disease (6%)
4	n.p.	Lung cancer (16, 7%)	Colorectal cancer (22, 5%)	Chronic obstructive pulmonary disease (5%)
5	n.p.	Liver disease (15, 6%)	Cerebrovascular disease (18, 4%)	Prostate cancer (4%)

Notes

1. The columns do not sum to 100% as not all causes of death are listed.
2. Excludes deaths that have no underlying cause recorded.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Between 2002 and 2015, for men aged 50 and over:

- the proportion of deaths due to coronary heart disease was lower in men serving full time (12%) and in the reserves (10%) at the time of their death, than for ex-serving personnel (16%) and Australian men (17%).
- Melanoma was the second leading cause of death among men in the reserves (9%); however, it did not appear in the top five leading causes of death for men serving full time or ex-serving at their time of their death, or for men of the same age in the Australian population.

4 Comparing rates of leading causes of death

Leading cause analysis is used in Chapter 3 to identify the causes associated with the largest number of deaths in each of the three ADF service status groups, and to indicate which causes may warrant further investigation. This chapter presents further analyses of those identified causes, by comparing rates of death among men and women in the three ADF service status groups with rates observed in the Australian population.

Crude rates complement information on the number of deaths due to a leading cause by taking the size of the underlying population into account, allowing comparisons between populations regardless of their size. However, they do not take into account differences in the age structures of populations. As well as crude rates, age-specific rates (using broad age groupings) were calculated to allow more direct comparisons by age.

Both crude and age-specific rates enable comparison between the three ADF service status groups, as well as between these groups and the Australian population. This chapter presents analysis of all-cause mortality rates, followed by analysis of rates due to leading causes of death, grouped as deaths due to injury and chronic diseases (see Box 3.1 for a definition of these terms). To see additional notes on the methods used in this chapter, see Box 4.1.

Box 4.1: Note on methods used in this chapter

Analysis using crude rates is presented in this chapter as crude rates allow for comparison between the three ADF service status groups, and between these groups and the Australian population. However, crude rates do not account for differences in age structure in these populations (Table 2.1).

The SMR can be used to compare death rates between two populations, adjusting for their differences in age structure (see Box 1.3). However, SMRs cannot be compared with each other because different weighting is used to generate each result (AIHW 2011).

Both crude rates and SMRs were produced for all comparisons between the study populations (the three ADF service status groups) and the Australian population in this study.

In most instances, there was no difference in the statistical significance of comparisons made between the study populations and the Australian population using crude rates or SMRs, despite the crude rates not adjusting for age.

To reduce the repetition of results, crude rates are presented throughout this report. In instances where statistical significance differs between comparisons based on crude rates and those based on SMRs, the statistical significance of the SMR is reported as this is considered to be the more precise measure. The SMRs, and associated confidence intervals for each piece of analysis, are provided in Appendix tables C24 and C25 for reference.

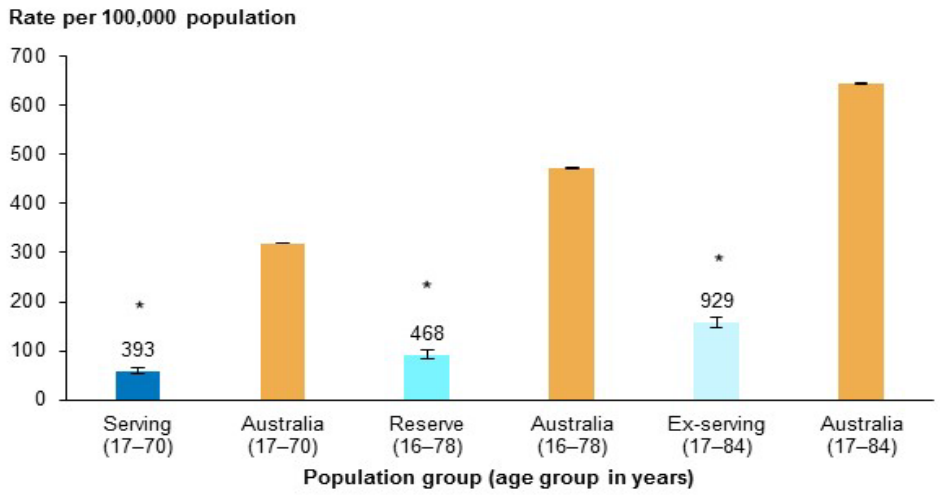
Men

Crude and age-specific rates of death among men are presented for leading causes of death due to injury and chronic diseases. These are compared across the three ADF service status groups, and with the Australian population, where numbers permit.

Comparing rates of death due to all causes

Crude all-cause mortality rates have been produced to provide context to rates for the individual leading causes of death. When compared with equivalent rates for Australian men in the same age range, the crude all-cause mortality rates for men in each of the three ADF service status groups were significantly lower (Figure 4.1). Between 2002 and 2015 there were:

- 393 deaths among serving men aged 17–70 (a crude rate of 59 per 100,000 population). This rate was significantly lower than the crude rate for men in the Australian population in the same age range (319 per 100,000)
- 468 deaths among reserve men aged 16–78 (a crude rate of 92 per 100,000 population). This rate was significantly lower than the crude rate for men in the Australian population in the same age range (472 per 100,000)
- 929 deaths among ex-serving men aged 17–84 (a crude rate of 158 per 100,000 population). This rate was significantly lower than the crude rate for men in the Australian population in the same age range (645 per 100,000).



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C1.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.1: Crude rates of all-cause mortality, men in the ADF service status groups and Australian men, 2002–2015

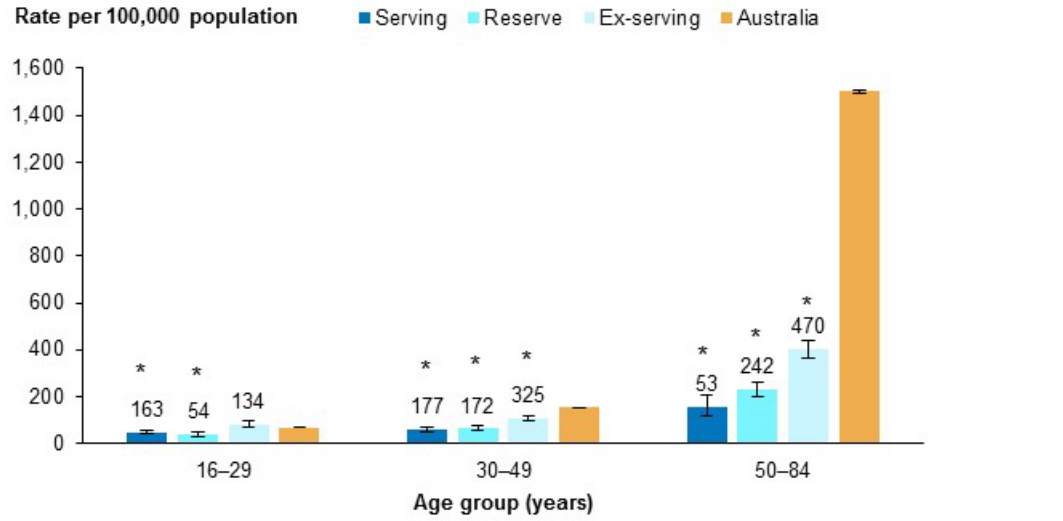
Between 2002 and 2015, the age-specific rates of all-cause mortality for men in the three ADF service status groups aged 16–29, 30–49 and 50–84 were significantly lower than the rates for Australian men in the same age range in nearly all cases (Figure 4.2). This can partly be attributed to the healthy worker effect. For an explanation of the healthy worker effect see Box 4.2.

Box 4.2: Healthy worker effect

The healthy worker effect is shown in the generally better health and lower mortality of employed populations compared with the general population, usually due to lower participation in employment among people with serious illness, injury or disability.

The healthy worker effect in military personnel is recognised in numerous studies both in Australia and internationally (Dunt 2009; Jelfs et al. 2003; Kang et al. 2015; Kapur et al. 2009; Wilson et al. 2005;). A number of these studies also recognise the 'healthy soldier effect' as protection afforded above that of the general employed population, due mainly to the ongoing need to maintain fitness and having ready access to health care during service (Jelfs et al. 2003; Kang et al. 2015).

While most of the rates were significantly lower, the rate for ex-serving men aged 16–29, (82 per 100,000 population) was similar to that for Australian men in the same age range (69 per 100,000).



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C2.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.2: Age-specific rates of all-cause mortality, men in the ADF service status groups and Australian men, 2002–2015

Comparing rates of leading causes of death due to injury

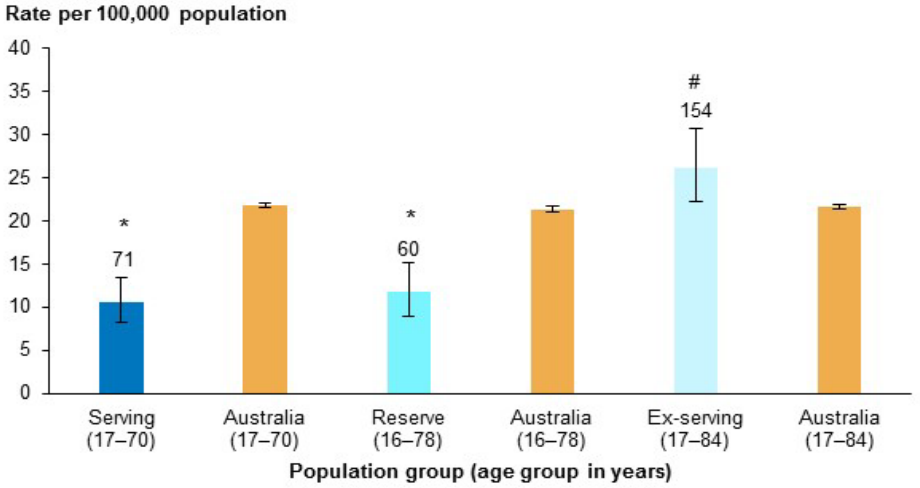
Suicide, land transport accidents and accidental poisoning were the top three causes of death due to injury among men across the three ADF service status groups.

Suicide

The key findings of the analysis of suicide rates in this study have been reported previously in a detailed study of suicide among serving and ex-serving ADF personnel (AIHW 2018b). These findings are included in the current report for completeness.

The crude rates of suicide death among men serving full time and in the reserves were significantly lower than those for Australian men in the same age range, despite suicide being the leading cause of death among men in the reserves and the second leading cause among serving men.

The rate of suicide in serving men aged 17–70 was 11 per 100,000 population compared with 22 per 100,000 for Australian men in the same age range (Figure 4.3). The rate for men in the reserves aged 16–78 was 12 per 100,000 compared with 21 per 100,000 for Australian men in the same age range.



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

\# Analysis of crude rates show the rate for ex-serving men was significantly higher than for Australian men. After adjusting for age, the difference in the rate of suicide for ex-serving and Australian men was not statistically significant

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure is available in Appendix Table C3.

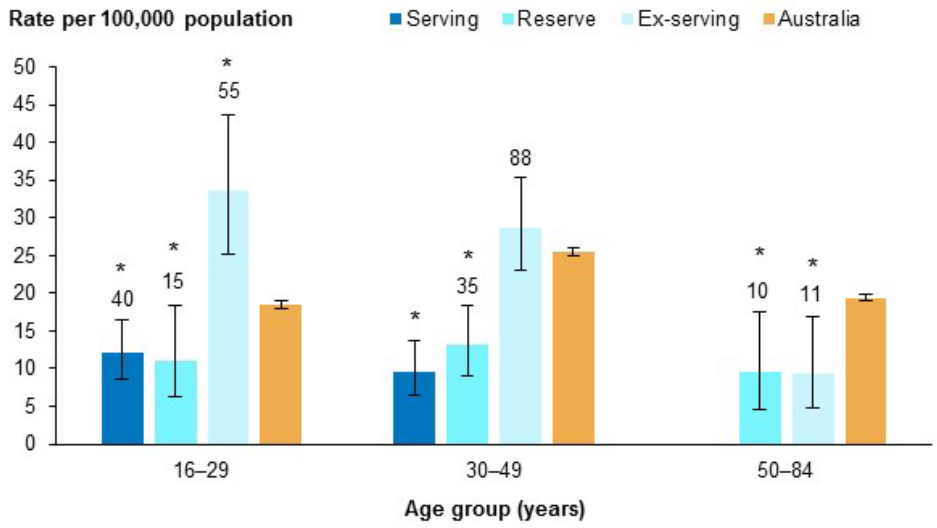
Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.3: Crude rates of suicide deaths, men in the ADF service status groups and Australian men, 2002–2015

While suicide was the leading cause of death in ex-serving men, after adjusting for age the difference in the rate of suicide among ex-serving men aged 17–84 and Australian men in the same age range was not statistically significant (Appendix Table C24; Box 4.1). Among ex-serving men aged 17–84, the crude rate of suicide death was 26 per 100,000 population. The crude rate for men in the Australian population in the same age range was 22 per 100,000.

The age-specific rates of suicide for men across the three ADF service status groups were significantly lower than rates for Australian men in the same age range, except for ex-serving men aged 16–29 and 30–49 (Figure 4.4).

The rate of suicide among ex-serving men aged 16–29 was around 2 times as high as the rate for men in the same age range in the Australian population (34 per 100,000 population compared with 19 per 100,000 for Australian men). This difference was statistically significant. The age-specific rate of suicide for ex-serving men aged 30–49 was similar to that for Australian men in the same age range (29 per 100,000 compared with 26 per 100,000 for Australian men).



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C4. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.4: Age-specific rates of suicide deaths, men in the ADF service status groups and Australian men, 2002–2015

Recent reporting on suicide among serving and ex-serving ADF personnel provides further detail on groups of ex-serving men at increased risk of suicide (AIHW 2018b).

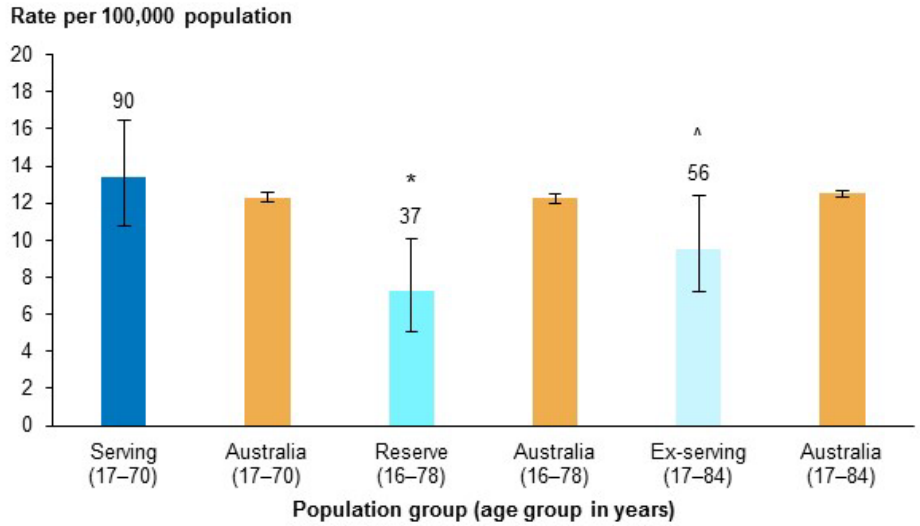
Land transport accidents

Land transport accidents were the leading cause of death among serving men between 2002 and 2015 and were the third leading cause of death among men in the reserves and ex-serving personnel at the time of their death.

Among serving men aged 17–70, the crude rate of death from land transport accidents (13 per 100,000 population) was similar to the rate for men in the same age range in the Australian population (12 per 100,000) (Figure 4.5). This result is of interest given that serving men have a lower all-cause mortality rate than men in the Australian population. These results align with a recent study from the United Kingdom (UK) which found that UK Regular Armed Forces were at an increased risk of death from land transport accidents when compared with the United Kingdom population (Ministry of Defence 2017).

The crude rate of death due to land transport accidents for men aged 16–78 in the reserves (7 per 100,000 population) was significantly lower than that for Australian men in the same age range (12 per 100,000).

After adjusting for age, the rate of death due to land transport accidents for ex-serving men aged 17–84 was significantly lower than that for Australian men of the same age range (Box 4.1; Appendix Table C24). For ex-serving men, the crude rate of death due to land transport accidents was 10 per 100,000 population; the crude rate for men in the same age range in the Australian population was 13 per 100,000.



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

^ Analysis of crude rates show no statistically significant difference in the rate of death due to land transport accidents for ex-serving and Australian men. After adjusting for age, the rate for ex-serving men was significantly lower than for Australian men

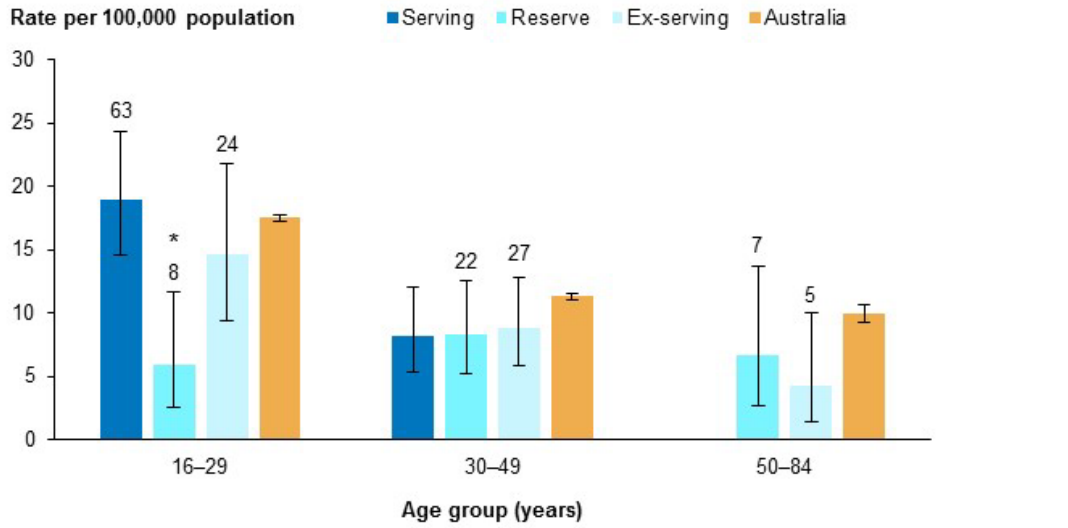
Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C6.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.5: Crude rates of land transport accident deaths, men in the ADF service status groups and Australian men, 2002–2015

In nearly all age-specific comparisons between men in the three ADF service status groups and Australian men in the same age range, the crude rate of death from land transport accidents was similar (Figure 4.6).

The exception to this was among men aged 16–29 in the reserves, where the age-specific rate of death from land transport accidents (6 per 100,000 population) was significantly lower than that for men in the Australian population in the same age range (18 per 100,000). It is important to note that this result was only based only on 8 land transport accident deaths.



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C7. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.6: Age-specific rates of land transport accident deaths, men in the ADF service status groups and Australian men, 2002–2015

It was possible to perform further analysis on deaths due to land transport accidents among ex-serving men by the service-related characteristics available within the data (service, rank, operational service and length of service). Analysis has shown that ex-serving men of all ages who were involuntarily discharged were significantly more likely to die from a land transport accident than those who were voluntarily discharged (Appendix Table C5). No other statistically significant differences were found when comparing rates of land transport accident deaths across ex-serving personnel with other service-related characteristics.

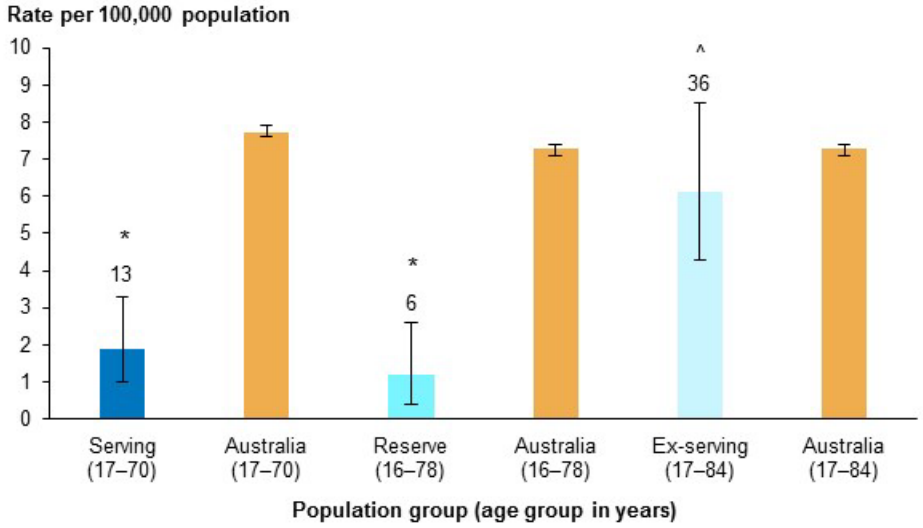
Accidental poisoning

Accidental poisoning was the fourth leading cause of death among men serving full time, and the fifth leading cause among ex-serving men between 2002 and 2015. The definition of accidental poisoning is based on the International Classification of Diseases and Related Health Problems, Tenth revision (ICD-10) coding and includes death due to:

- accidental overdose of drug, wrong drug given or taken in error, and drug taken inadvertently
- accidents in the use of drugs, medicaments and biological substances in medical and surgical procedures.

The crude rate of accidental poisoning deaths among serving men aged 17–70 (2 per 100,000 population) was significantly lower than the rate for men in the Australian population in the same age range (8 per 100,000) (Figure 4.7). The crude rate of accidental poisoning deaths among men in the reserves aged 16–78 (1 per 100,000) was also significantly lower than that for Australian men in the same age range (7 per 100,000).

After adjusting for age, the rate of death due to accidental poisoning for ex-serving men aged 17–84 was significantly lower than that for Australian men in the same age range (Box 4.1; Table C24). Among ex-serving men, the crude rate of death due to accidental poisoning was 6 per 100,000 population; the crude rate for men in the Australian population in the same age range was 7 per 100,000.



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

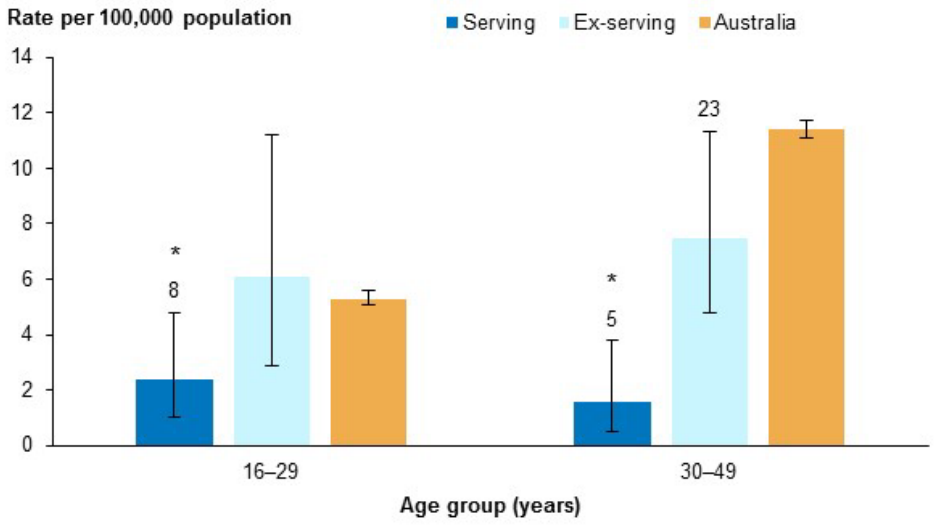
^ Analysis of crude rates show no statistically significant difference in the rate of death due to accidental poisoning for ex-serving and Australian men. After adjusting for age, the rate for ex-serving men was significantly lower than the rate for Australian men

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C8.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.7: Crude rates of accidental poisoning deaths, men in the ADF service status groups and Australian men, 2002–2015

Men serving at the time of their death aged 16–29 and 30–49 had significantly lower rates of death from accidental poisonings than those for Australian men in the same age ranges (Figure 4.8). Ex-serving men aged 16–29 and 30–49, had similar rates of death due to accidental poisoning as men in the same age ranges in the Australian population.



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C9. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.8: Age-specific rates of accidental poisoning deaths, men in the ADF service status groups and Australian men, 2002–2015

Comparing rates of leading causes of death due to chronic disease

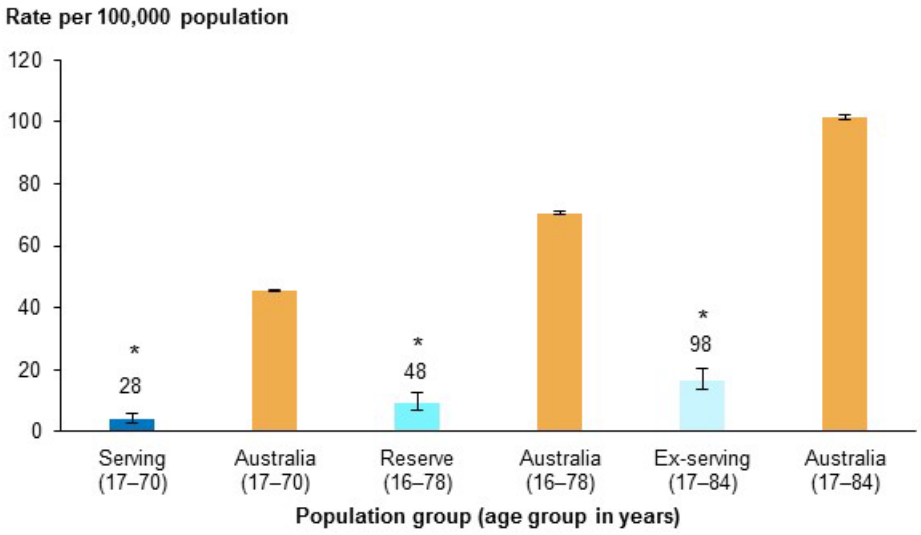
Coronary heart disease, melanoma and lung cancer were the top three causes of death from chronic diseases among the three ADF service status groups between 2002 and 2015.

Coronary heart disease

Coronary heart disease was one of the top three leading causes of death (and the most prominent of the chronic diseases) among each of the three ADF service status groups between 2002 and 2015.

The crude rates of death from coronary heart disease for each of the three ADF service status groups were significantly lower than rates for Australian men in the same age range—this is in line with all-cause death rates for these groups (Figure 4.9).

Age-specific rates of death from coronary heart disease for those aged 30–49 and 50–84 were significantly lower for men across each of the three ADF service status groups compared with the rate for Australian men in the same age groups (Figure 4.10).

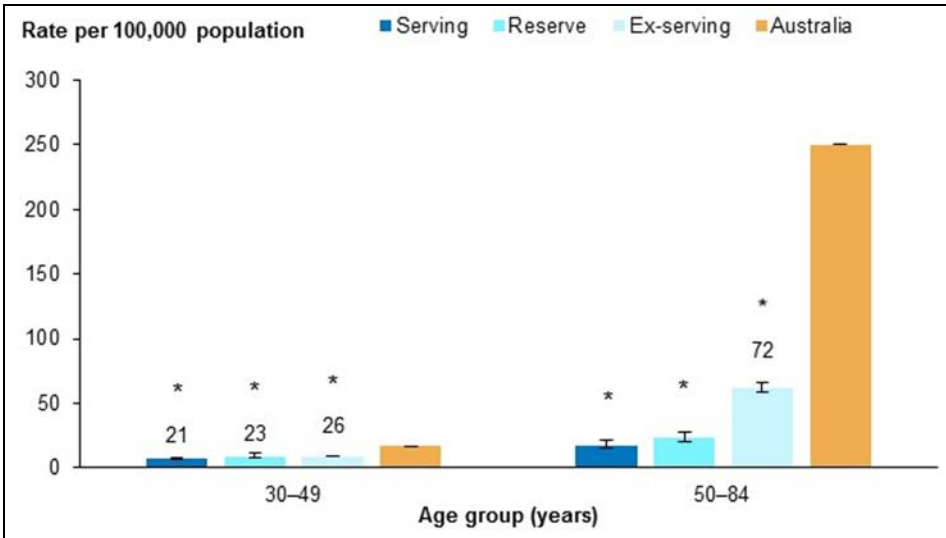


* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C10.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.9: Crude rates of coronary heart disease deaths, men in the ADF service status groups and Australian men, 2002–2015



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C11. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

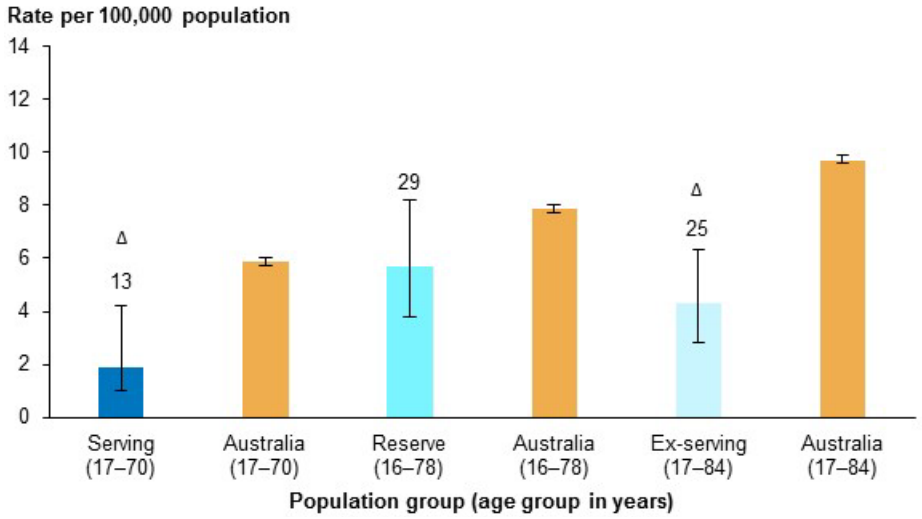
Figure 4.10: Age-specific rates of coronary heart disease deaths, men in the ADF service status groups and Australian men, 2002–2015

Melanoma

Melanoma was the fifth leading cause of death among serving men and the fourth leading cause among men in the reserves, between 2002 and 2015.

The crude rate of death due to melanoma for men aged 16–78 in the reserves was similar to the rate for Australian men in the same age range (Figure 4.11).

After adjusting for age, the rates of death from melanoma for serving and ex-serving men of all ages were similar to the rates for Australian men (Box 4.1; Appendix Table C25). This finding is of interest given that ADF personnel may have greater exposure to sunlight (a major risk factor for melanoma) because of their military duties, which often involve working and training outdoors and deployment to environments where ultraviolet radiation is more intense (Armed Forces Health Surveillance Center 2014).



Δ Analysis of crude rates show the rate of death due to melanoma for the ADF service status group was significantly lower than for Australia. After adjusting for age, the difference in the melanoma death rate for the ADF service status group and for Australia was not statistically significant

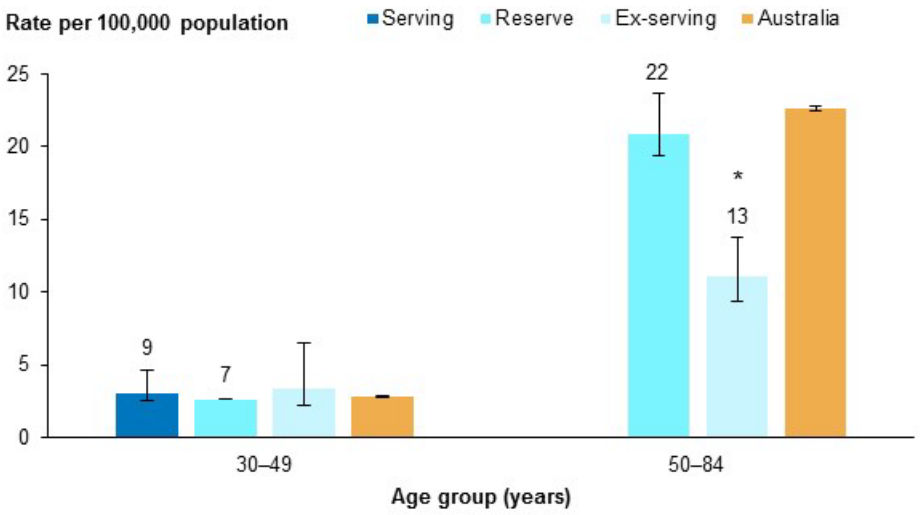
Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C12.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.11: Crude rates of melanoma deaths, men in the ADF service status groups and Australian men, 2002–2015

The age-specific rates of melanoma deaths among men aged 30–49 was similar for the three ADF service status groups, and for Australian men in the same age range (around 3 per 100,000 population) (Figure 4.12).

The rate of melanoma deaths among men in the reserves aged 50–84 (21 per 100,000 population) was similar to that for men in the same age range in the Australian population (23 per 100,000). In contrast, the rate of melanoma deaths among ex-serving men aged 50–84 (11 per 100,000) was significantly lower than that for men in the Australian population in the same age range (23 per 100,000).



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C13. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.12: Age-specific rates of melanoma deaths, men in the ADF service status groups and Australian men, 2002–2015

Lung cancer

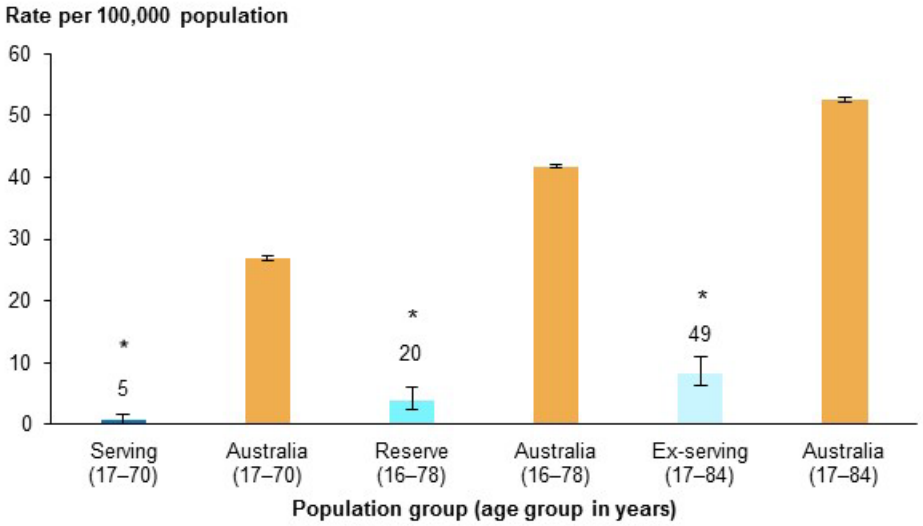
Lung cancer was one of the top 10 leading causes of death for each of the three ADF service status groups. It was most prominent as a cause of death in men who were in the reserves at the time of their death.

Rates of lung cancer death were significantly lower for men of all ages across each of the three ADF service status groups than for age-matched groups of Australian men (Figure 4.13).

The age-specific rates of lung cancer for men aged 50–84 in the reserve (15 per 100,000 population) and ex-serving population (36 per 100,000), were significantly lower than those for Australian men in the same age range (134 per 100,000) (Figure 4.14).

The rate of lung cancer death for ex-serving men aged 30–49 was similar to the rate for Australian men in the same age range. It is important to note that this result is based on 7 lung cancer deaths in ex-serving men aged 30–49 during the period of the study.

It was not possible to produce age-specific rates for men serving full time at the time of their death due to the small number of deaths in this group over the study period.

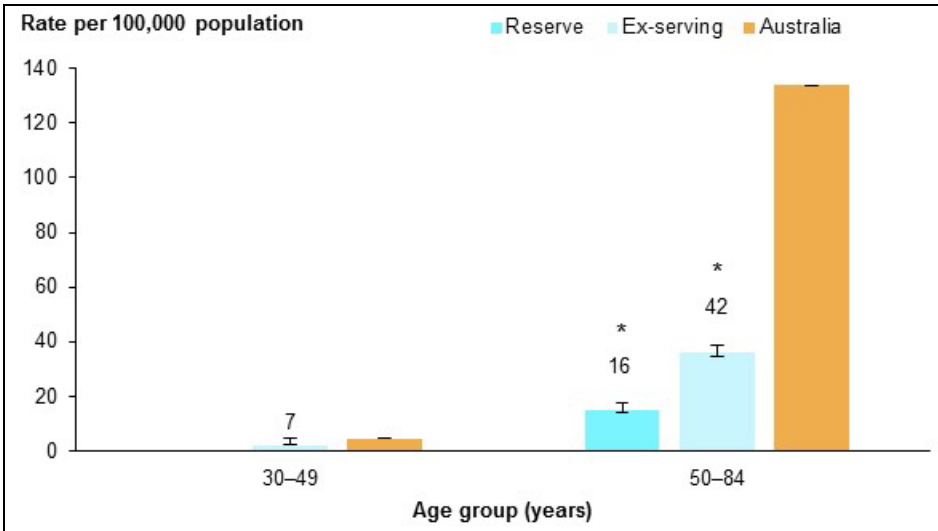


* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C14.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.13: Crude rates of lung cancer deaths, men in the ADF service status groups and Australian men, 2002–2015



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C15.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 4.14: Age-specific rates of lung cancer deaths, men in the ADF service status groups and Australian men, 2002–2015

Women

Between 2002 and 2015, there were 149 deaths among women combined across the three ADF service status groups (Appendix Table C16). This total comprises 28 deaths (19%) in the population serving full time, 39 (26%) in the reserve population and 82 (55%) in the ex-serving population. Due to the relatively small number of deaths within each ADF service status group, analysis by leading cause of death across the three groups, combined, follows. Crude and age-specific rates of death among women are presented for leading causes of death, where numbers permit.

Comparing rates of death due to all causes

Across the three ADF service status groups combined, women aged 17–80 had a significantly lower crude rate of all-cause mortality (48 per 100,000 population) than women in the Australian population in the same age range (337 per 100,000 population). This reflects the significantly lower rate of all-cause mortality among women aged 30–80 in the three ADF service status groups (60 per 100,000) than among Australian women in the same age range (434 per 100,000).

In contrast, the age-specific rate of all-cause mortality among women aged 17–29, across the three ADF service status groups (27 per 100,000 population) was similar to the rate for Australian women in the same age range (29 per 100,000) (Appendix Table C16).

Comparing rates of leading causes of death

Breast cancer

Between 2002 and 2015, breast cancer was the leading cause of death among women across the three ADF service status groups combined, with 26 deaths (Appendix Table C17).

The crude rate of breast cancer among women aged 17–80, across the three ADF service status groups combined (8 per 100,000 population) was significantly lower than that for women in the Australian population in the same age range (26 per 100,000).

There were no deaths due to breast cancer among women in the three ADF service status groups aged 17–29 during the study period.

Suicide

Suicide was the second ranked leading cause of death between 2002 and 2015, with 19 deaths among women combined across the three ADF service status groups (Appendix Table C18).

The rate of suicide death among women in all ADF service status groups, aged 17–29 was similar to the rate for Australian women in the same age range (9 and 6 per 100,000 population, respectively). This result is based on 10 suicide deaths among women across the ADF service status groups combined.

Similarly, the suicide rate for women in all ADF service status groups aged 30–80 was similar to the rate for Australian women in the same age range (5 and 7 per 100,000 population, respectively). It is important to note that this result is based on 9 suicide deaths in women across the three ADF service status groups aged 30–80 during the study period. Rates produced using small numbers can be sensitive to small changes in counts of deaths over time.

These findings have been reported previously in a detailed study of suicide among serving and ex-serving ADF personnel (AIHW 2018b) and are included in the current report for completeness.

Land transport accidents

The third ranked leading cause of death among women combined across the three ADF service status groups was land transport accidents, with 17 deaths observed during the study period (Appendix Table C19).

The crude rate of land transport accident deaths for women aged 17–80 across the three ADF service status groups was similar to the rate for Australian women in the same age range.

The age-specific rates of death from land transport accidents among women aged 17–29 and 30–80 across the three ADF service status groups were similar to the rates for Australian women in the same age ranges. It is important to note that these results are based on a small number of deaths due to land transport accidents observed for women across all three ADF service status groups during the study period.

5 Detailed analysis—land transport accidents

This section presents detailed analysis of land transport accidents across the three ADF service status groups. This cause of death is explored in detail, as the analysis in Chapter 3 identified land transport accidents as the leading cause of death among serving men in 2002–2015, with 1 in 4 (90 deaths) attributed to this cause. Further, deaths due to land transport accidents were the third leading cause of death among men in the reserves and ex-serving personnel at the time of their death between 2002 and 2015.

These results are consistent with findings from UK studies that identify land transport accidents as a leading cause of death among military personnel (Fear et al. 2008; Ministry of Defence 2017).

The definition of land transport accidents is broad and based on ICD-10 coding. It encompasses death from motor vehicle accidents, motorcycle accidents or as a pedestrian. This section focuses on analysing death due to motorcycle accidents and motor vehicle accidents by each of three ADF service status groups and by age. An analysis of deaths by land transport accidents among women across all ADF service status groups was not undertaken due to the small number of deaths due to this cause.

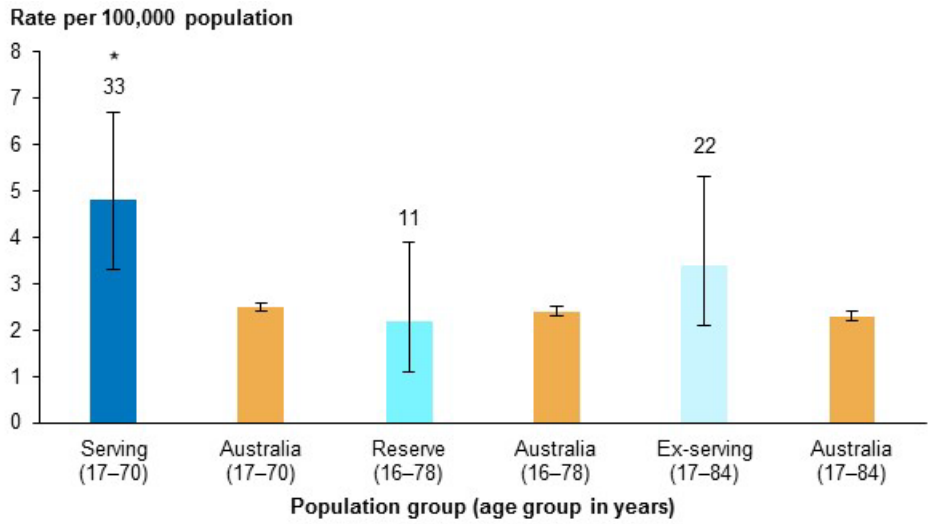
Motorcycle accident deaths

Between 2002 and 2015, there were 66 motorcycle deaths among men across the three ADF service status groups; half (33) occurred in personnel serving full time at the time of their death. The crude rate of motorcycle accident deaths among serving men aged 17–70 (5 per 100,000 population) was around 2 times as high as the rate for Australian men in the same age range (3 per 100,000) (Figure 5.1). This difference was statistically significant.

This is consistent with results from a recent study that showed UK Armed Forces personnel having a higher risk of death from a motorcycle accident than the UK population (Ministry of Defence 2017).

There are a number of factors that may influence the higher rate of motorcycle accident deaths among serving men when compared with all Australian men. Potential differences that may influence this result include differences in the rate of motorcycle ownership between these populations, the frequency of motorcycle use and distance travelled. While considering these potential differences, the findings presented highlight the risk this population has to death due to motorcycle accidents; a potentially avoidable cause of death.

There were 22 motorcycle accident deaths among ex-serving men aged 17–84, and 11 among men in the reserves aged 16–78. The crude rates of death due to motorcycle accidents for ex-serving men and men in the reserves were similar to rates for Australian men in the same age ranges (Figure 5.1).



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

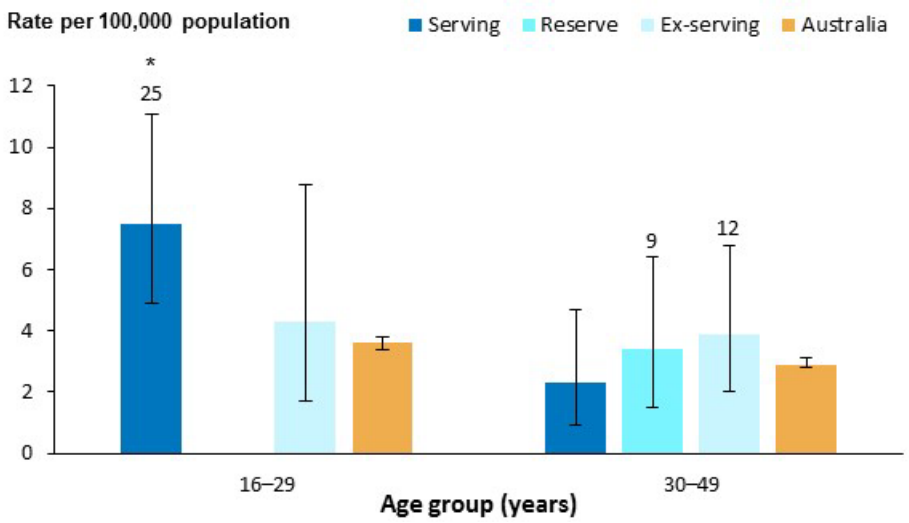
Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure is available in Appendix Table C20.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015, AIHW NMD 2002–2015.

Figure 5.1: Crude rates of motorcycle accident deaths, men in the ADF service status groups and Australian men, 2002–2015

The age-specific rate of death from motorcycle accidents among serving men aged 16–29 was around 2 times as high as the rate for men in the same age range in the Australian population (8 per 100,000 population compared with 4 per 100,000) (Figure 5.2). This result was statistically significant. In contrast, the rate of motorcycle accident deaths for ex-serving men aged 16–29 was similar to that for Australian men in the same age range.

Among men aged 30–49 in each of the three ADF service status groups, the age-specific rates of motorcycle accident deaths were similar to the rate for Australian men in the same age range.



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C21. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

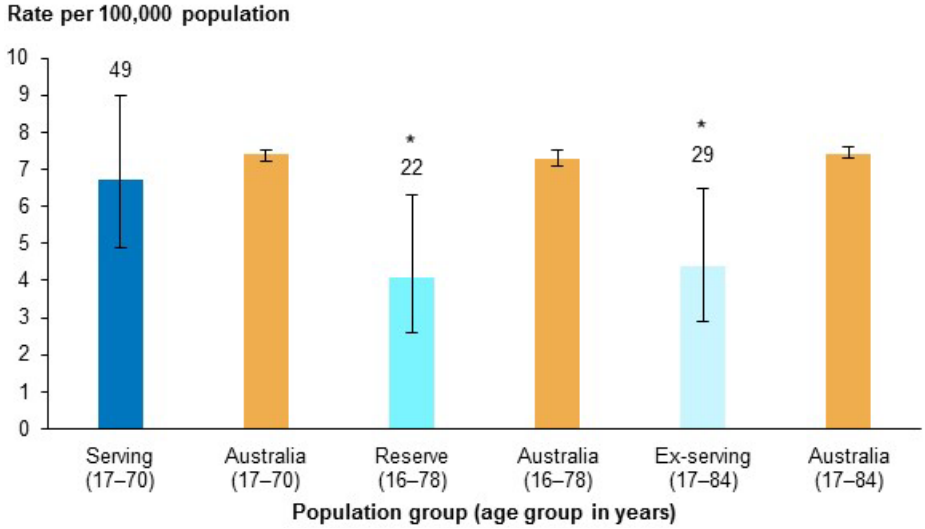
Figure 5.2: Age-specific rates of motorcycle accident deaths, men in the ADF service status groups and Australian men, 2002–2015

Motor vehicle accident deaths

Between 2002 and 2015 there were 100 deaths due to motor vehicle accidents among men across the three ADF service status groups; around half (49) were personnel serving full time at the time of their death.

The crude rates of death from motor vehicle accidents for men in the reserves aged 16–78 (4 per 100,000 population) and for ex-serving men aged 17–84 (5 per 100,000) were significantly lower than the rates for Australian men in the same age range (8 per 100,000 in each case) (Figure 5.3).

The crude rate of death from motor vehicle accidents for serving men aged 17–70 (7 per 100,000 population) was similar to the rate for Australian men in the same age range (8 per 100,000).



* Analysis of crude and age-adjusted rates show a statistically significant difference between rates for the ADF service status group and Australia

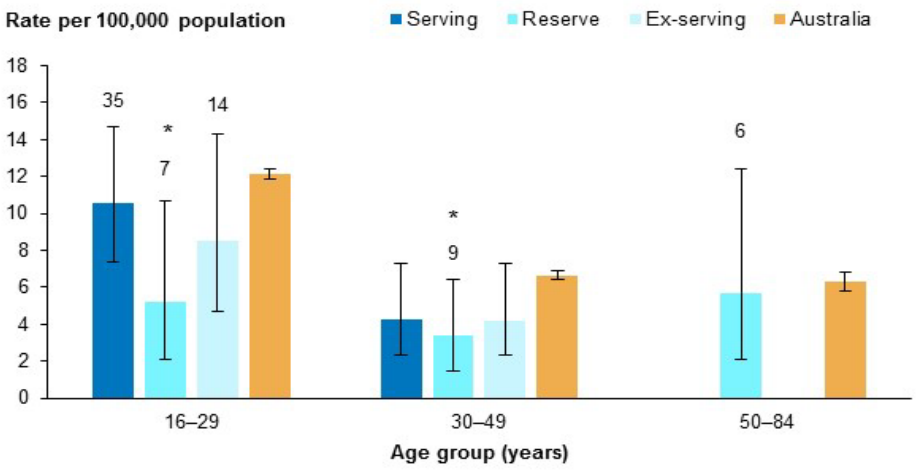
Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C22.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 5.3: Crude rates of motor vehicle accident deaths, men in the ADF service status groups and Australian men, 2002–2015

Men aged 16–29 and 30–49 who were in the reserves at the time of their death had significantly lower age-specific rates of death due to motor vehicle accidents than Australian men in the same age range (Figure 5.4). The rate for men in the reserves aged 16–29 was 5 per 100,000 population compared with 12 per 100,000 for Australian men in the same age range. For men in the reserves aged 30–49, the rate was 3 per 100,000 compared with 7 per 100,000 for Australian men in the same age range.

At the time of their death, men aged 16–29 and 30–49 who were serving and ex-serving, and men in the reserves aged 50–84, had rates of motor vehicle accident death that were similar to those for Australian men in the same age range.



* Analysis of age-specific rates show a statistically significant difference between the ADF service status group and Australian men in the same age range

Note: The number of deaths in each ADF service status group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% confidence intervals. Data underlying this figure are available in Appendix Table C23. Numbers not shown have been suppressed to ensure confidentiality.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Figure 5.4: Age-specific rates of motor vehicle accident deaths, men in the ADF service status groups and Australian men, 2002–2015

Appendix A: Data sources and classifications

A1 Data sources

Australian Defence Force populations

The Department of Defence supplied ADF population data for the serving full time and reserve study groups. Populations were available from 2002 onwards. Population data for the ex-serving group were calculated using the linked PMKeyS–NDI data from 2001 onwards, starting with zero (0) as at 1 January 2001. Due to the high level of volatility observed in estimates run including the 2001 ex-serving population, the analysis of ex-serving personnel was restricted to data from 2002 onwards, in line with reporting for serving and reserve groups. The populations used for analysis in this report were estimated as at 30 June each year.

It is important to note that the annual population size for each of the service status groups differs. While the serving and reserve populations are relatively stable over time at around 55,000 and 42,000 people, respectively per year, the ex-serving population in the analysis set starts at zero (0) on 1 January 2001 and increases by around 5,000 people per year. Unlike the serving and reserve populations, the ex-serving population is also ageing over time.

For these reasons, population rates have been used in addition to counts of deaths to illustrate the difference between service status groups.

Australian population

Australian population data used in this report were sourced from the ABS using the most up-to-date estimates available at the time of analysis (ABS 2016a).

National Death Index

The NDI, housed at the AIHW, contains information on all Australian registered deaths since 1980. This information consists of cause of death sourced from the Cause of Death Unit Record File provided to the AIHW by the Registries of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice), and causes of death coded by the ABS. This data set exists solely for data linkage purposes, and ethics approval is required to use the NDI for research purposes. The Data Quality Statement for the NDI is available on the AIHW website at <http://meteor.aihw.gov.au/content/index.phtml/itemId/480010>.

National Mortality Database

Cause of Death Unit Record File data were provided to the AIHW by the Registries of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice) and include cause of death coded by the ABS. This is the source of cause of death information as used in the NDI. The data are maintained by the AIHW in the NMD.

At the time of analysis, the causes of death data were final for 2012, revised for 2013 and preliminary for 2014 and 2015. Cause of death for a small number of deaths occurring in 2013, 2014 and 2015 may be revised in future years, pending the outcome of coronial investigations.

Analysis in this report is based on year of occurrence of death. Year of death is an underestimate for the preliminary data in the most recent year of data (2015), as some deaths are not registered until later years. Historical analysis of the NMD shows that this lag in registration results in around 5% of late registrations. The NDI is updated monthly with fact of death information, and so registration lag is not a factor for this data set. Hence, it can be expected that the total number of deaths would be 5% lower in the NMD-derived comparison populations than the NDI-linked ADF service status groups.

The data quality statements underpinning the NMD can be found in the following ABS publications:

- ABS quality declaration summary for Deaths, Australia <http://www.abs.gov.au/ausstats/abs%40.nsf/mf/3302.0/>
- ABS quality declaration summary for Causes of Death, Australia <http://www.abs.gov.au/ausstats/abs%40.nsf/mf/3303.0/>.

Personnel Management Key Solution data

The PMKeyS is a staff and payroll management system that contains information on all people with at least 1 day of ADF service on or after 1 January 2001, when the system was introduced. This database contains demographic and service information at a point in time. The Department of Defence provided the AIHW with an extract from the PMKeyS for personnel with ADF service on or after 1 January 2001 up to the point of data extract on 10 April 2016.

A2 Classifications

International Statistical Classification of Diseases and Related Health Conditions

The ICD is used to classify diseases and other health problems (including symptoms and injuries) in clinical and administrative records. In Australia, mortality cause of death data are coded according to the ICD. Data from 1997 are based on the tenth revision (ICD-10). The list of the leading cause of death groupings used in this report is provided in Table A1.

Table A1: List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
Suicide	
X60–X84, Y87.0	Suicide and sequelae of intentional self-harm
Other external causes of death	
V01–V89	Land transport accidents
V90–V94	Water transport accidents
V95–V97	Air and space transport accidents
V98–V99	Other and unspecified transport accidents
W00–W19	Accidental falls
W20–W49 (excl. W32, W33, W34)	Exposure to inanimate mechanical forces excluding firearms
W32–W34	Non-intentional firearm discharge
W50–W64	Exposure to animate mechanical forces
W65–W74	Accidental drowning and submersion
W75–W84	Accidental threats to breathing
W85–W99	Exposure to electric current, radiation and extreme ambient air temperature and pressure
X00–X09	Exposure to smoke, fire and flames
X10–X19	Contact with heat and hot substances
X20–X29	Contact with venomous animals and plants
X30–X39	Exposure to forces of nature
X40–X49	Accidental poisoning
X50–X57	Overexertion, travel and privation
X58	Exposure to other specified factors
X59	Exposure to unspecified factor
X85–Y09	Assault
Y10–Y34	Event of undetermined intent
Y35–Y36	Legal intervention and operations of war
Y40–Y59	Drugs, medicaments and biological substances causing adverse effects in therapeutic use
Y60–Y69	Misadventures to patients during surgical and medical care
Y70–Y82	Medical devices associated with misadventures in diagnostic and therapeutic use
Y83–Y84	Surgical and other medical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure
Y85–Y89 (excl. Y87.0)	Sequelae of external causes of morbidity and mortality
Y90–Y98	Supplementary factors related to causes of morbidity and mortality classified elsewhere

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
Certain infectious and parasitic diseases	
A00–A09	Intestinal infectious diseases
A15–A19	Tuberculosis
A20, A44, A75–A79, A82–A84, A852, A90–A96, A980–A982, A988, B50–B57	Vector-borne and rabies
A21–A28	Certain zoonotic bacterial diseases excluding plague
A30–A49 (excl. A33–A37, A39, A40–A41)	Other bacterial diseases excluding vaccine preventable, meningitis, sepsis
A33–A37, A80, B01, B05, B06, B15, B16, B170, B180, B181, B189, B19, B26	Vaccine preventable diseases
A39, A87, G00–G03	Meningitis
A40–A41	Septicaemia
A50–A64	Infections with predominantly sexual mode of transmission
A65–A69	Other sprirochaetal diseases
A70–A74	Other diseases caused by chlamydiae
A80–A89 (excl. A80, A82–A84, A85.2)	Viral infections of the central nervous system excl. vaccine-preventable diseases, vector-borne diseases and rabies.
B00–B09 (excl. B01, B05, B06)	Viral infections with skin & mucous lesions excluding vaccine preventable
B20–B24	Human immunodeficiency virus (HIV) disease
B25–B34 (excl. B26)	Other viral diseases excluding mumps
B35–B49	Mycoses
B50–B64 (excl. B50–B57)	Protozoal diseases excluding vector-borne diseases
B65–B83	Helminthiases
B85–B89	Pediculosis, acariasis and other infestations
B90–B94	Sequelae of infectious and parasitic diseases
B95–B98	Bacterial, viral and other infectious agents
B99	Other infectious diseases
Neoplasms	
C00–C14	Malignant neoplasms of lip, oral cavity and pharynx
C15	Oesophageal cancer
C16	Stomach cancer
C17	Malignant neoplasm of small intestine
C18–C21	Colorectal cancer
C22	Liver cancer
C23, C24	Gallbladder cancer
C25	Pancreatic cancer
C26, C39, C76–C80	Cancer, unknown, ill-defined

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
C30, C31, C35–C38	Selected malignant neoplasms of respiratory and intrathoracic organs
C32	Laryngeal cancer
C33, C34	Lung cancer
C40–C41	Malignant neoplasms of bone and articular cartilage
C43	Melanoma
C44	Other malignant neoplasms of skin
C45–C49	Malignant neoplasms of mesothelial and soft tissue
C50	Breast cancer
C51, C52, C57, C58	Malignant neoplasms of vulva, vagina, other female genital organs, placenta
C53–C55	Uterine cancer
C56	Ovarian cancer
C60, C62, C63	Malignant neoplasms of penis, testis, other genital
C61	Prostate cancer
C64	Kidney cancer
C69, C70, C72	Malignant neoplasms of eye, adnexa, meninges, spinal cord, other central nervous system
C71	Brain cancer
C73–C75	Malignant neoplasms of thyroid and other endocrine glands
C81–C86, C96	Lymphomas
C88–C90	Malignant immunoproliferative diseases, multiple myeloma and malignant plasma cell neoplasms
C91–C95	Leukaemia
C97	Malignant neoplasms of independent (primary) multiple sites
D00–D48	Benign neoplasms, in situ and uncertain behaviour
Diseases of the blood, blood-forming organs and certain disorders involving the immune system	
D50–D53, E40–E64	Malnutrition and nutritional anaemias
D55–D59	Haemolytic anaemias
D60–D64	Aplastic and other anaemias
D65–D69	Coagulation defects, purpura and other haemorrhagic conditions
D70–D77	Other diseases of blood and blood-forming organs
D80–D89	Certain disorders involving the immune mechanism
Endocrine, nutritional and metabolic diseases	
E00–E07	Disorders of thyroid gland
E09	Impaired glucose regulation
E10–E14	Diabetes
E15, E16	Other disorders of glucose regulation and pancreatic internal secretion

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
E20–E35	Disorders of other endocrine glands
E65–E68	Obesity and other hyperalimentation
E70–E89 (excl. E86, E87)	Selected metabolic disorders excluding dehydration
E86–E87	Disorders of fluid, electrolyte and acid-based balance (dehydration)
Mental and behavioural disorders	
F01, F03, G30	Dementia and Alzheimer disease
F04–F09	Organic mental disorders excluding dementia
F10–F19	Mental and behavioural disorders due to psychoactive substance use
F20–F29	Schizophrenia, schizotypal and delusional disorders
F30–F39	Mood (affective) disorders
F40–F48	Neurotic, stress-related and somatoform disorders
F50–F59	Behavioural syndromes associated with physiological disturbances and physical factors
F60–F69	Disorders of adult personality and behaviour
F70–F79	Mental retardation
F80–F89	Disorders of psychological development
F90–F98	Behavioural and emotional disorders with onset usually occurring in childhood and adolescence
F99	Unspecified mental disorder
Diseases of the nervous system	
G04–G09	Inflammatory diseases of the central nervous system excluding meningitis
G10, G11, G13	Huntington disease and hereditary ataxia
G12	Spinal muscular atrophy and related syndromes
G14	Postpolio syndrome
G20	Parkinson disease
G21–G26	Extrapyramidal and movement disorders excluding Parkinson disease
G31–G32	Other degenerative diseases of nervous system excluding Alzheimer disease
G35–G37	Demyelinating diseases of the central nervous system
G40, G41	Epilepsy and status epilepticus
G42–G47	Episodic and paroxysmal disorders excluding epilepsy
G50–G59	Nerve, nerve root and plexus disorders
G60–G64	Polyneuropathies and other disorders of the peripheral nervous system
G70–G73	Diseases of myoneural junction and muscle
G80–G83	Cerebral palsy and other paralytic syndromes

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
G90–G99	Other disorders of the nervous system
Diseases of the eye, adnexa, ear and mastoid process	
H00–H59	Diseases of the eye and adnexa
H60–H95	Diseases of the ear and mastoid process
Diseases of the circulatory system	
I00–I02	Acute rheumatic fever
I05–I09	Chronic rheumatic heart diseases
I10–I15	Hypertensive diseases
I20–I25	Coronary heart diseases
I26–I28	Pulmonary heart disease and diseases of pulmonary circulation
I30–I33, I39–I41, I43–I45, I52	Selected other forms of heart disease
I34–I38	Nonrheumatic valve disorders
I42	Cardiomyopathy
I46 (excl. I46.9)	Cardiac arrest, excluding unspecified
I47–I49	Cardiac arrhythmias
I50–I51	Heart failure and complications and ill-defined heart diseases
I60–I69	Cerebrovascular diseases
I70	Atherosclerosis
I71	Aortic aneurysm and dissection
I72–I79	Diseases of arteries, arterioles and capillaries excluding atherosclerosis, aortic aneurysm
I80–I89	Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified
I95–I98 (excl. I95.9)	Other and unspecified disorders of the circulatory system
Diseases of the respiratory system	
J00–J06, J20–J22	Acute respiratory diseases excluding influenza and pneumonia
J09–J18	Influenza and pneumonia
J30–J39	Other diseases of upper respiratory tract
J40–J44	Chronic obstructive pulmonary disease (COPD)
J45–J46	Asthma
J47	Bronchiectasis
J60–J70	Lung diseases due to external agents
J80–J84	Pulmonary oedema and other interstitial pulmonary diseases
J85–J86	Suppuratives and necrotic conditions of lower respiratory tract
J90–J94	Other diseases of pleura
J95–J99 (excl. J96)	Other diseases of the respiratory system

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
J96.1 (excl. J96.0, J96.9)	Chronic respiratory failure
Disorders of the digestive system	
K00–K14	Diseases of oral cavity, salivary glands and jaws
K20–K31	Diseases of oesophagus, stomach and duodenum
K35–K46, K56	Appendicitis, hernia and intestinal obstruction
K50–K52	Non-infective enteritis and colitis
K55, K57–K64	Other diseases of intestines excluding paralytic ileus and intestinal obstruction without hernia
K65–K67	Diseases of peritoneum
K70–K76	Liver disease
K80–K87	Disorders of gallbladder, biliary tract and pancreas
K90–K93	Other diseases of the digestive system
Diseases of the skin, subcutaneous tissue and musculoskeletal system	
L00–L08	Infections of the skin and subcutaneous tissue
L10–L14	Bullous disorders
L20–L30	Dermatitis and eczema
L40–L45	Papulosquamous disorders
L50–L54	Urticaria and erythema
L55–L59	Radiation-related disorders of the skin and subcutaneous tissue
L60–L75	Disorders of skin appendages
L80–L99	Other disorders of the skin and subcutaneous tissue
M00–M99	Diseases of the musculoskeletal system and connective tissue
Diseases of the genitourinary system	
N00–N08	Glomerular disease
N10–N16	Renal tubulo-interstitial disease
N17–N19	Kidney failure
N20–N23	Urolithiasis
N25–N29	Other kidney or ureter disorders
N30–N39	Other urinary disorders
N40–N51	Diseases of male genital organs
N60–N64	Disorders of breast
N70–N77	Inflammatory diseases of female pelvic organs
N80–N98	Non-inflammatory disorders of female genital tract
N99	Other disorders of genitourinary tract

(continued)

Table A1 (continued): List of the leading cause of death groupings used in this report

ICD-10 code	Leading cause of death grouping (underlying cause of death group)
Pregnancy, perinatal and congenital	
O00–O99	Conditions of pregnancy, childbirth and puerperium
P00–P96, Q00–Q99 (excl. P28.5)	Certain conditions originating in the perinatal period, congenital malformations, deformations and chromosomal abnormalities
R95	Sudden infant death syndrome (SIDS)
Other ill-defined causes	
I46.9, I95.9, I99, J96.0, J96.9, P28.5, R00–R94, R96–R99	Unspecified and other ill-defined causes: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (excluding R95: Sudden infant death syndrome (SIDS); Cardiac arrest, unspecified; Hypotension, unspecified; Other and unspecified disorders of circulatory system; Acute respiratory failure; Respiratory failure, unspecified; Respiratory failure of newborn

Appendix B: Data linkage

Data linkage, also known as data integration, is a process that brings together information relating to an individual from more than one source.

An extract of PMKeyS data on 10 April 2016 provided records of all people with at least 1 day of ADF service on or after 1 January 2001.

The AIHW undertook data linkage between the PMKeyS and NDI to determine the number of in-scope personnel who have died, and to confirm the cause of death. This linkage was done using a probabilistic linkage procedure, based on the Fellegi and Sunter methodology, matching name, sex, date of birth, date of death and address, followed by a manual clerical review (Fellegi & Sunter 1969).

A total of 2,144 links between the NDI and PMKeyS data were identified.

All data linking was carried out by the Data Linkage Unit at the AIHW—one of three accredited Commonwealth Integrating Authorities. This accreditation requires the AIHW to adhere to stringent criteria and abide by the National Statistical Service *High level principles for data integration involving Commonwealth data for statistical and research purposes* and *Best practice guidelines*. As well as these guidelines, data linkage at the AIHW is carried out under the protection of the *Privacy Act 1988*, and the *Australian Institute of Health and Welfare Act 1987* (which carries additional privacy protections for companies and deceased people).

Strict separation of identifiable information and content data is maintained within the Data Linkage Unit in accordance with the AIHW linkage protocols, so that no one person will ever have access to both. Summary results from the linked data set are presented in aggregate format. Personal identifying information is not released and no individual can be identified in any reporting. The linked data set created for this study will be stored securely on site at the AIHW for a period of at least 10 years.

Appendix C: Statistical tables

Table C1: Crude rates of all-cause mortality (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service							
Serving	17–70	393	58.6	53.0	64.7	Yes	Lower
Reserve	16–78	468	92.3	84.1	101.1	Yes	Lower
Ex-serving	17–84	929	158.2	148.2	168.7	Yes	Lower
Australian men							
	17–70	333,110	319.3	318.2	320.4	. .	. .
	16–78	533,465	472.1	470.8	473.4	. .	. .
	17–84	735,825	645.2	643.7	646.7	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C2: Age-specific rates of all-cause mortality (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	163	49.2	41.9	57.3	Yes	Lower
30–49	177	58.1	49.8	67.3	Yes	Lower
50–84	53	155.7	116.6	203.6	Yes	Lower
Reserve						
16–29	54	39.9	30.0	52.1	Yes	Lower
30–49	172	64.5	55.2	74.9	Yes	Lower
50–84	242	230.3	202.2	261.3	Yes	Lower
Ex-serving						
16–29	134	81.6	68.4	96.7	No	. .
30–49	325	106.1	94.9	118.3	Yes	Lower
50–84	470	402.6	367	440.7	Yes	Lower
Australia						
16–29	20,712	69.0	68.1	70.0	. .	. .
30–49	65,155	152.6	151.4	153.7	. .	. .
50–84	650,606	1500.7	1497	1504.3	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C3: Crude rates of suicide deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	71	10.6	8.3	13.4	Yes	Lower
Reserve	16–78	60	11.8	9.0	15.2	Yes	Lower
Ex-serving	17–84	154	26.2	22.3	30.7	Yes	Higher
Australian men							
	17–70	22,773	21.8	21.5	22.1	. .	. .
	16–78	24,161	21.4	21.1	21.7	. .	. .
	17–84	24,720	21.7	21.4	21.9	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C4: Age-specific rates of suicide deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	40	12.1	8.6	16.4	Yes	Lower
30–49	n.p.	9.5	6.4	13.7	Yes	Lower
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Reserve						
16–29	15	11.1	6.2	18.3	Yes	Lower
30–49	35	13.1	9.1	18.3	Yes	Lower
50–84	10	9.5	4.6	17.5	Yes	Lower
Ex-serving						
16–29	55	33.5	25.2	43.6	Yes	Higher
30–49	88	28.7	23.0	35.4	No	. .
50–84	11	9.4	4.7	16.9	Yes	Lower
Australia						
16–29	5,555	18.5	18.0	19.0	. .	. .
30–49	10,899	25.5	25.0	26.0	. .	. .
50–84	8,418	19.4	19.0	19.8	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C5: Crude rates of land transport accident deaths (per 100,000 population), ex-serving men, by service related characteristics, 2002–2015

Population	Number	Rate	Confidence interval		Statistically significant	Direction of difference
			Lower	Upper		
Service						
Army	42	11.1	8.0	15.0	No	. .
Navy	n.p.	9.6	4.6	17.7	No	. .
Air Force	n.p.	n.p.	n.p.	n.p.	. .	. .
Rank						
Commissioned officer	n.p.	n.p.	n.p.	n.p.	. .	. .
All other ranks	n.p.	11.2	8.4	14.6	No	. .
Operational service[(a)]						
Any	7	18.9	7.6	38.9	No	. .
None	24	11.3	7.2	16.8	No	. .
Length of service (years)						
<1	6	7.0	2.6	15.3	No	. .
1–<5	23	16.5	10.4	24.7	No	. .
5–<10	8	8.6	3.7	16.9	No	. .
10+	19	7.1	4.3	11.0	No	. .
Reason for discharge						
Voluntary	25	6.8	4.4	10.0	No	. .
Involuntary	29	18.4	12.3	26.4	Yes[(b)]	Higher
Involuntary discharge reason						
Medical	15	27.3	15.3	45.0	No	. .
Non-medical	14	13.6	7.4	22.8	No	. .

(a) Operational service refers to four broad categories of deployment or operations: warlike operational service, non-warlike operational service, overseas operational service and, domestic operational. Individuals with at least one type of operational service are counted in 'Any', and those with no operational service are counted in 'None'. Only operational service since 1 January 1999 has been consistently identified across the four operational service categories. To ensure comparability, analysis of operational service covers only personnel hired on or after 1 January 1999.

(b) Compared with the rate for those with a voluntary reason for discharge.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015.

Table C6: Crude rates of land transport accident deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	90	13.4	10.8	16.5	No	. .
Reserve	16–78	37	7.3	5.1	10.1	Yes	Lower
Ex-serving	17–84	56	9.5	7.2	12.4	No	. .
Australian men							
	17–70	12,870	12.3	12.1	12.6	. .	. .
	16–78	13,844	12.3	12.0	12.5	. .	. .
	17–84	14,227	12.5	12.3	12.7	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C7: Age-specific rates of land transport deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	63	19	14.6	24.3	No	. .
30–49	n.p.	8.2	5.3	12.1	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Reserve						
16–29	8	5.9	2.6	11.7	Yes	Lower
30–49	22	8.3	5.2	12.5	No	. .
50–84	7	6.7	2.7	13.7	No	. .
Ex-serving						
16–29	24	14.6	9.4	21.8	No	. .
30–49	27	8.8	5.8	12.8	No	. .
50–84	5	4.3	1.4	10.0	No	. .
Australia						
16–29	5,257	17.5	17.0	18.0	. .	. .
30–49	4,812	11.3	11.0	11.6	. .	. .
50–84	4,339	10.0	9.7	10.3	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C8: Crude rates of accidental poisoning deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	13	1.9	1.0	3.3	Yes	Lower
Reserve	16–78	6	1.2	0.4	2.6	Yes	Lower
Ex-serving	17–84	36	6.1	4.3	8.5	No	. .
Australian men							
	17–70	8,073	7.7	7.6	7.9	. .	. .
	16–78	8,215	7.3	7.1	7.4	. .	. .
	17–84	8,277	7.3	7.1	7.4	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C9: Age-specific rates of accidental poisoning deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	8	2.4	1.0	4.8	Yes	Lower
30–49	5	1.6	0.5	3.8	Yes	Lower
50–84	0	. .	. .	. .	. .	. .
Ex-serving						
16–29	n.p.	6.1	2.9	11.2	No	. .
30–49	23	7.5	4.8	11.3	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Australia						
16–29	1,600	5.3	5.1	5.6	. .	. .
30–49	4,856	11.4	11.1	11.7	. .	. .
50–84	1,834	4.2	4.0	4.4	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Note: Analysis of accidental poisoning deaths in Reserve personnel cannot be published due to small numbers.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C10: Crude rates of coronary heart disease deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	28	4.2	2.8	6.0	Yes	Lower
Reserve	16–78	48	9.5	7.0	12.6	Yes	Lower
Ex-serving	17–84	98	16.7	13.6	20.3	Yes	Lower
Australian men							
	17–70	47,496	45.5	45.1	45.9	. .	. .
	16–78	79,836	70.7	70.2	71.1	. .	. .
	17–84	115,842	101.6	101	102.2	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C11: Age-specific rates of coronary heart disease deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	21	6.9	4.3	10.5	Yes	Lower
50–84	n.p.	17.6	6.5	38.4	Yes	Lower
Reserve						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	23	8.6	5.5	12.9	Yes	Lower
50–84	n.p.	22.8	14.6	34.0	Yes	Lower
Ex-serving						
16–29	0	. .	. .	. .	. .	. .
30–49	26	8.5	5.5	12.4	Yes	Lower
50–84	72	61.7	48.3	77.7	Yes	Lower
Australia						
16–29	234	0.8	0.7	0.9	. .	. .
30–49	7,045	16.5	16.1	16.9	. .	. .
50–84	108,564	250.4	248.9	251.9	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C12: Crude rates of melanoma deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	13	1.9	1.0	3.3	Yes	Lower
Reserve	16–78	29	5.7	3.8	8.2	No	. .
Ex-serving	17–84	25	4.3	2.8	6.3	Yes	Lower
Australian men							
	17–70	6,114	5.9	5.7	6.0	. .	. .
	16–78	8,891	7.9	7.7	8.0	. .	. .
	17–84	11,119	9.7	9.6	9.9	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C13: Age-specific rates of melanoma deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	9	3.0	1.4	5.6	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Reserve						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	7	2.6	1.1	5.4	. .	. .
50–84	22	20.9	13.1	31.7	No	. .
Ex-serving						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	n.p.	3.3	1.6	6.0	No	. .
50–84	13	11.1	5.9	19	No	. .
Australia						
16–29	125	0.4	0.3	0.5	. .	. .
30–49	1,200	2.8	2.7	3.0	. .	. .
50–84	9,795	22.6	22.1	23	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C14: Crude rates of lung cancer deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	5	0.7	0.2	1.7	Yes	Lower
Reserve	16–78	20	3.9	2.4	6.1	Yes	Lower
Ex-serving	17–84	49	8.3	6.2	11	Yes	Lower
Australian men							
	17–70	28,057	26.9	26.6	27.2	. .	. .
	16–78	47,279	41.8	41.5	42.2	. .	. .
	17–84	59,880	52.5	52.1	52.9	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C15: Age-specific rates of lung cancer deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Reserve						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	n.p.	n.p.	n.p.	n.p.	. .	. .
50–84	16	15.2	8.7	24.7	Yes	Lower
Ex-serving						
16–29	0	. .	. .	. .	. .	. .
30–49	7	2.3	0.9	4.7	No	. .
50–84	42	36.0	25.9	48.6	Yes	Lower
Australia						
16–29	29	0.1	0.1	0.1	. .	. .
30–49	1,874	4.4	4.2	4.6	. .	. .
50–84	57,977	133.7	132.6	134.8	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Note: Analysis of lung cancer deaths in serving personnel cannot be published due to small numbers.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C16: Crude rates of all-cause mortality (per 100,000 population), women in the three ADF service status groups combined and by age, compared with Australian women, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
ADF service status groups combined						
17–29	32	27.1	18.5	38.3	No	. .
30–80	117	60.0	49.7	72.0	Yes	Lower
Total	**149**	**47.6**	**40.3**	**55.9**	**Yes**	**Lower**
Australian women						
17–29	7,760	28.7	28.1	29.3	. .	. .
30–80	374,457	434.2	432.8	435.6	. .	. .
Total	**382,217**	**337.4**	**336.3**	**338.5**	**. .**	**. .**

(a) Refers to a statistically significant difference between the ADF service status group and Australian women in the same age range.

(b) When compared with Australian women in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C17: Crude rates of deaths from breast cancer (per 100,000 population), women in the three ADF service status groups combined and by age, compared with Australian women, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
ADF service status groups combined						
17–29	0	. .	. .	. .	. .	. .
30–80	26	13.3	8.7	19.6	Yes	Lower
Total	**26**	**8.3**	**5.4**	**12.2**	**Yes**	**Lower**
Australian women						
17–29	68	0.3	0.2	0.3	. .	. .
30–80	28,783	33.4	33.0	33.8	. .	. .
Total	**28,851**	**25.5**	**25.2**	**25.8**	**. .**	**. .**

(a) Refers to a statistically significant difference between the ADF service status group and Australian women in the same age range.

(b) When compared with Australian women in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C18: Crude rates of deaths from suicide (per 100,000 population), women in the three ADF service status groups combined and by age, compared with Australian women, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
ADF service status groups combined						
17–29	10	8.5	4.1	15.6	No	. .
30–80	9	4.6	2.1	8.8	No	. .
Total	**19**	**6.1**	**3.7**	**9.5**	**No**	**. .**
Australian women						
17–29	1,517	5.6	5.3	5.9	. .	. .
30–80	5,712	6.6	6.5	6.8	. .	. .
Total	**7,229**	**6.4**	**6.2**	**6.5**	**. .**	**. .**

(a) Refers to a statistically significant difference between the ADF service status group and Australian women in the same age range.

(b) When compared with Australian women in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C19: Crude rates of deaths from land transport accidents (per 100,000 population), women in the three ADF service status groups combined and age, compared with Australian women, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
ADF service status groups combined						
17–29	9	7.6	3.5	14.5	No	. .
30–80	8	4.1	1.8	8.1	No	. .
Total	**17**	**5.4**	**3.2**	**8.7**	**No**	**. .**
Australian women						
17–29	1,448	5.4	5.1	5.6	. .	. .
30–80	3,107	3.6	3.5	3.7	. .	. .
Total	**4,555**	**4.0**	**3.9**	**4.1**	**. .**	**. .**

(a) Refers to a statistically significant difference between the ADF service status group and Australian women in the same age range.

(b) When compared with Australian women in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C20: Crude rates of motorcycle accident deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	33	4.9	3.4	6.9	Yes	Higher
Reserve	16–78	11	2.2	1.1	3.9	No	. .
Ex-serving	17–84	22	3.7	2.3	5.7	No	. .
Australian men							
	17–70	2,836	2.7	2.6	2.8	. .	. .
	16–78	2,905	2.6	2.5	2.7	. .	. .
	17–84	2,885	2.5	2.4	2.6	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C21: Age-specific rates of motorcycle accident deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	25	7.5	4.9	11.1	Yes	Higher
30–49	n.p.	2.3	0.9	4.7	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Reserve						
16–29	n.p.	n.p.	n.p.	n.p.	. .	. .
30–49	9	3.4	1.5	6.4	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Ex-serving						
16–29	n.p.	4.3	1.7	8.8	No	. .
30–49	12	3.9	2.0	6.8	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Australia						
16–29	1,084	3.6	3.4	3.8	. .	. .
30–49	1,255	2.9	2.8	3.1	. .	. .
50–84	576	1.3	1.2	1.4	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C22: Crude rates of motor vehicle accident deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population	Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
				Lower	Upper		
ADF service status group							
Serving	17–70	49	7.3	5.4	9.7	No	. .
Reserve	16–78	22	4.3	2.7	6.6	Yes	Lower
Ex-serving	17–84	29	4.9	3.3	7.1	Yes	Lower
Australian men							
	17–70	8,159	7.8	7.7	8.0	. .	. .
	16–78	8,794	7.8	7.6	7.9	. .	. .
	17–84	9,065	7.9	7.8	8.1	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C23: Age-specific rates of motor vehicle accident deaths (per 100,000 population), men in the ADF service status groups and Australian men, 2002–2015

Population/ Age group (years)	Number	Rate	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
Serving						
16–29	35	10.6	7.4	14.7	No	. .
30–49	n.p.	4.3	2.3	7.3	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Reserve						
16–29	7	5.2	2.1	10.7	Yes	Lower
30–49	9	3.4	1.5	6.4	Yes	Lower
50–84	6	5.7	2.1	12.4	No	. .
Ex-serving						
16–29	14	8.5	4.7	14.3	No	. .
30–49	n.p.	4.2	2.3	7.3	No	. .
50–84	n.p.	n.p.	n.p.	n.p.	. .	. .
Australia						
16–29	3,619	12.1	11.7	12.5	. .	. .
30–49	2,821	6.6	6.4	6.9	. .	. .
50–84	2,743	6.3	6.1	6.6	. .	. .

(a) Refers to a statistically significant difference between the ADF service status group and Australian men in the same age range.

(b) When compared with Australian men in the same age range.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C24: Comparative rates of leading causes of death due to injury, men in the ADF service status groups and Australian men, 2002–2015

Cause of death/ ADF population	Number	SMR	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
All-cause mortality						
Serving	393	0.47	0.43	0.52	Yes	Lower
Reserve	468	0.33	0.30	0.36	Yes	Lower
Ex-serving	929	0.45	0.42	0.48	Yes	Lower
Suicide						
Serving	71	0.47	0.37	0.59	Yes	Lower
Reserve	60	0.51	0.39	0.66	Yes	Lower
Ex-serving	154	1.14	0.97	1.34	No	. .
Land transport accidents						
Serving	90	0.92	0.74	1.14	No	. .
Reserve	37	0.59	0.41	0.81	Yes	Lower
Ex-serving	56	0.75	0.56	0.97	Yes	Lower
Accidental poisoning						
Serving	13	0.22	0.12	0.38	Yes	Lower
Reserve	6	0.13	0.05	0.29	Yes	Lower
Ex-serving	36	0.69	0.48	0.95	Yes	Lower

(a) Refers to a statistically significant difference between the ADF service status group and an age-matched population of Australian men.

(b) When compared with an age-matched population of Australian men.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Table C25: Comparative rates of leading causes of death due to chronic conditions, men in the ADF service status groups and Australian men, 2002–2015

Cause of death/ ADF population	Number	SMR	Confidence interval		Statistically significant[a]	Direction of difference[b]
			Lower	Upper		
All-cause mortality						
Serving	393	0.47	0.43	0.52	Yes	Lower
Reserve	468	0.33	0.30	0.36	Yes	Lower
Ex-serving	929	0.45	0.42	0.48	Yes	Lower
Coronary heart disease						
Serving	28	0.40	0.27	0.58	Yes	Lower
Reserve	48	0.25	0.18	0.33	Yes	Lower
Ex-serving	98	0.33	0.27	0.40	Yes	Lower
Lung cancer						
Serving	5	0.20	0.06	0.46	Yes	Lower
Reserve	20	0.20	0.12	0.30	Yes	Lower
Ex-serving	49	0.34	0.25	0.45	Yes	Lower
Melanoma						
Serving	13	1.06	0.56	1.80	No	. .
Reserve	29	1.20	0.80	1.72	No	. .
Ex-serving	25	0.78	0.51	1.15	No	. .

(a) Refers to a statistically significant difference between the ADF service status group and an age-matched population of Australian men.

(b) When compared with an age-matched population of Australian men.

Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; AIHW NMD 2002–2015.

Glossary

ADF personnel: Serving and ex-serving Australian Defence Force (ADF) members. Civilian personnel employed by the Department of Defence are not included.

age-specific rate: A rate for a specific age group. The numerator and denominator relate to the same age group. In this report, rates are stated per 100,000 population.

age-standardisation: A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many causes of death vary with age. The age structures of the different populations are converted to the same 'standard' structure, and then the disease rates that would have occurred with that structure are calculated and compared.

age structure: The relative number of people in each age group in a population.

all-cause mortality: Deaths due to any cause.

all ranks other than commissioned officer: A Defence member who holds a Sailor, Other Ranks or Airman/Airwoman rank.

cause of death: The causes of death entered on the Medical Certificate of Cause of Death are all diseases, morbid conditions or injuries that either resulted in or contributed to death, and the circumstances of the accident or violence that produced any such injuries. Causes of death are commonly reported by the **underlying cause of death**.

chronic diseases/conditions: A diverse group of diseases/conditions, such as heart disease, cancer and arthritis, which tend to be long lasting and persistent in their symptoms or development. Although these features also apply to some communicable diseases (infectious diseases), the term is usually confined to non-communicable diseases. Examples of chronic diseases include diabetes, asthma and heart disease.

combat death: A death that occurs during an action fought between two military forces.

commissioned officer: An appointed Defence member who holds a rank of Midshipman or Officer Cadet, or higher.

confidence interval: A range determined by variability in data, within which there is a specified (usually 95%) chance that the true value of a calculated parameter lies.

counts of death: The number of deaths in a population in a given time period.

crude rate: The number of deaths divided by the corresponding population multiplied by 100,000 to provide a rate per 100,000 population in a given time period.

data linkage: Also known as data integration, a process that brings together information relating to an individual from more than one source.

demographic characteristics: Characteristics of a population expressed statistically, such as age and sex.

deployment: See **operational service**.

discharge: Separation from the Australian Defence Force.

ex-serving: Australian Defence Force members in the serving or **reserve** population on or after 1 January 2001 and who were **discharged** after 1 January 2001.

external cause of death (or injury-related death): Is one of a group of causes external to the body (for example, suicide, transport accidents, falls, poisonings and assault).

incidence of suicide: The number of suicide deaths in a population in a given time period.

leading cause of death: The **underlying cause of death** categories (ICD-10) or groupings (such as coronary heart disease, land transport accidents) that usually account for the largest numbers of deaths within different populations or age groups.

length of service: The time between the date of hire and date of separation (**discharge**) from the Australian Defence Force.

median age: The age at which half the population is older than that age and half is younger than that age.

operational service: The four broad categories of deployment or operations: warlike operational service—warlike/active service deployments; non-warlike operational service—non-warlike deployments (for example, peace keeping, peace monitoring, United Nations assistance missions); overseas operational service—humanitarian/disaster relief (international) or border protection deployments; domestic operational service—deployment of Defence aid to the civilian community. Individuals with at least one type of operational service are counted in 'Any'; those with no operational service are counted in 'None'.

rank: One's position in the Australian Defence Force operational hierarchy. Analysis by rank is presented for two broad groups: **commissioned officer**, and **all ranks other than commissioned officer**.

rate: One number (the numerator) divided by another number (the denominator).The numerator is commonly the number of events in a specified time. The denominator is the population "at risk" of the event. Rates (**crude rates**, **age-specific rates** and **age-standardised** – see **age-standardisation**) are generally multiplied by a number such as 100,000 to create whole numbers.

reason for discharge: The main reason recorded for a person's separation (**discharge**) from the Australian Defence Force. Analysis by reason for discharge is presented for two broad groups: voluntary discharge—comprises personnel who take voluntary redundancies and who resign; and involuntary discharge—comprises personnel deemed unsuitable for further duty for disciplinary, medical and operational reasons. Involuntary discharge is further divided into discharge for medical reasons, and non-medical involuntary discharge (which includes being physically unfit for service, training failure and disciplinary reasons).

reserve: Australian Defence Force members in the active or inactive reserve forces for the RAN, Australian Army or Air Force, at the time of data extract, 10 April 2016. Most members leaving full-time service make the transition to the inactive reserve forces, unless there are medical or other grounds preventing this.

risk: The probability of an event occurring during a specified period of time.

service: The three broad arms of the ADF—Navy, Army and Air Force.

service status: The broad nature of an individual's employment with the Australian Defence Force, namely: serving full time, in the **reserves** and **ex-serving**.

serving full time: Australian Defence Force members serving in a regular capacity in the Navy, Army or Air Force, on continuous full-time service, or participating in the gap year program at the time of data extract, 10 April 2016.

standardised mortality ratio (SMR): A ratio to compare the suicide rates for the three Australia Defence Force (ADF) **service status** groups with the Australian population, adjusting for differences in **age structure**. It is calculated as the observed number of events (deaths due to a specific cause) divided by the number of events that would be expected if the study population had the same age and sex specific rates as those observed in the comparison population. If the age and sex-specific rates are the same in each population, the ratio is 1.0; if they are higher overall in the ADF service status group than in the Australian population, the ratio will be more than 1.0 and if they are lower overall than the Australian population, the ratio will be less than 1.0.

statistical significance: A statistical measure indicating how likely the observed difference is due to chance alone. For the purpose of this report, rates are deemed to have a difference that is statistically significant when their **confidence intervals** do not overlap, since their difference is greater than what could be explained by chance. In this report, statistically significant differences are indicated by a symbol, or are described as being 'significantly higher'/'significantly lower'.

suicide: An action to deliberately end one's own life.

ultraviolet radiation: High-energy rays which are invisible to the human eye. Ultraviolet (UV) radiation is divided into three types according to wavelength (UVA, UVB and UVC); UVA and to a lesser extent UVB are not wholly absorbed by atmospheric ozone and therefore are of interest for human health.

underlying cause of death: The disease or injury that initiated the train of events leading directly to death; that is, the primary or main cause of death. The underlying cause of death as reported on the National Mortality Database is used to assign the cause of death.

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List of tables

List of figures

List of boxes

Related publications

The following AIHW publications, relating to incidence and causes of mortality among ADF personnel, might also be of interest:

- AIHW (Australian Institute of Health and Welfare) 2018. National suicide monitoring of serving and ex-serving Australian Defence Force personnel: 2018 update. Cat. no. PHE 222. Canberra: AIHW.
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Rates of death from all causes were generally lower among serving, reserve and ex-serving Australian Defence Force (ADF) personnel than for the Australian population. The leading causes of death among men in the three ADF service status groups were similar, by age, to those for Australian men, while rates of death for the leading causes identified were generally lower, or similar, for men in the ADF service status groups than for Australian men.

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