

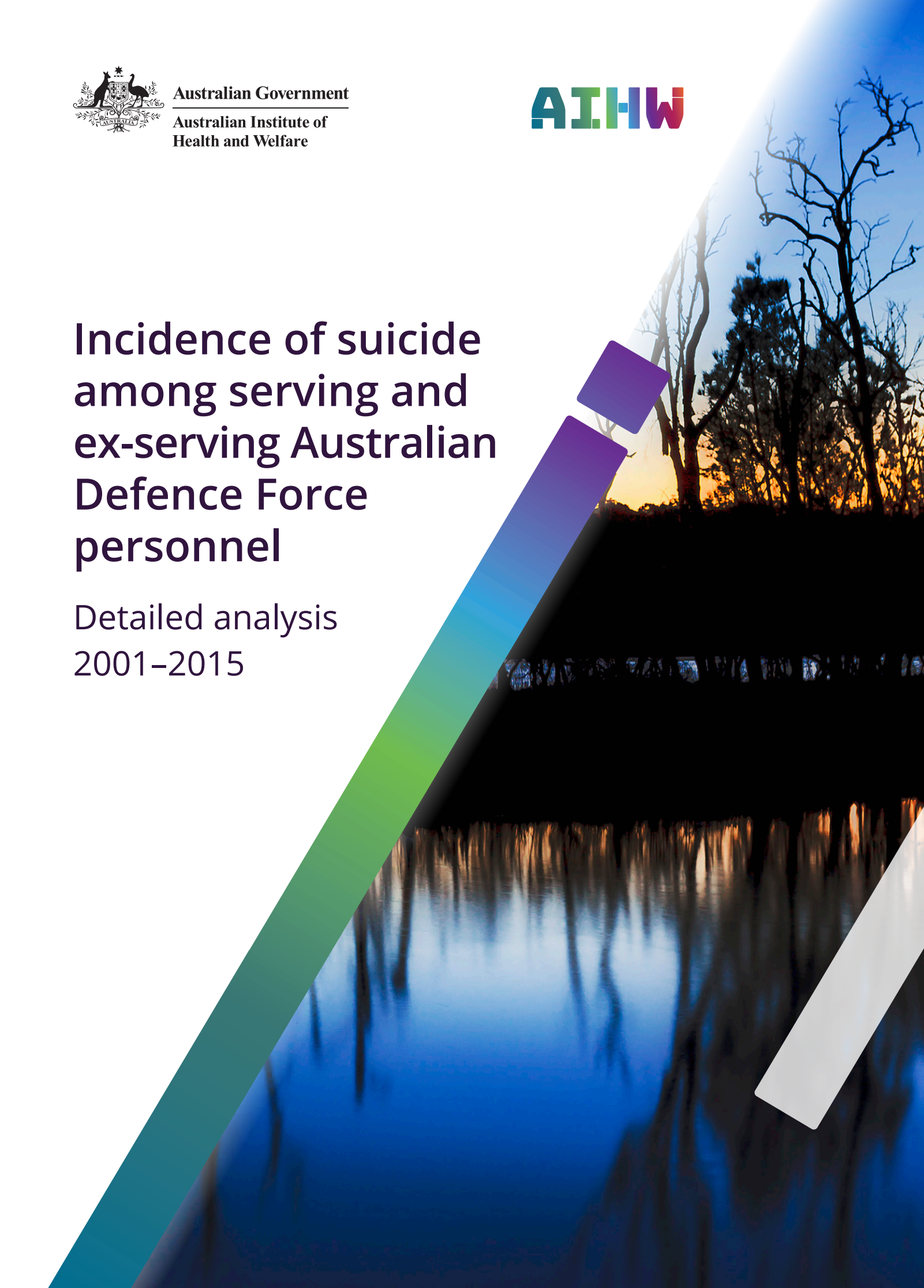


Australian Government  
Australian Institute of  
Health and Welfare

AIHW

# Incidence of suicide among serving and ex-serving Australian Defence Force personnel

Detailed analysis  
2001–2015







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**Australian Institute of  
Health and Welfare**

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## **Detailed analysis**

**2001–2015**

Australian Institute of Health and Welfare  
Canberra

Cat. no. PHE 218

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The AIHW Ethics Committee, the DVA Human Research Ethics Committee and the Australian Defence Human Research Ethics Committee approved the research.

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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](http://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](http://www.beyondblue.org.au)>.

# Abbreviations

ABS	Australian Bureau of Statistics
ADF	Australian Defence Force
AIHW	Australian Institute of Health and Welfare
CFTS	continuous full-time service
CI	confidence interval
DISC	Data Integration Services Centre
DSD	Defence Suicide Database
DVA	Department of Veterans' Affairs
HREC	Human Research Ethics Committee
ICD-10	International Classification of Diseases 10th revision
NDI	National Death Index
NMD	National Mortality Database
PMKeyS	Personnel Management Key Solution
PTSD	post-traumatic stress disorder
Air Force	Royal Australian Air Force
Navy	Royal Australian Navy
SMR	standardised mortality ratio
VEA	<i>Veterans' Entitlements Act 1986</i> (Cwth)

# Symbols

..	not applicable
=	equals
<	less than
≤	less than or equal to
≥	greater than or equal to
%	per cent
+	plus
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

# Summary

This report quantifies the level of suicide among serving and ex-serving Australian Defence Force (ADF) personnel and identifies factors that may be associated with suicide risk. For completeness, it includes results of the earlier summary report (AIHW 2017b) alongside the detailed analysis supporting them, including additional analyses by age group and over time. Analysis in the summary report examined each service-related characteristic associated with risk of suicide individually. This report extends on this analysis to use regression modelling to simultaneously measure the impact of age and all other available factors on the likelihood of suicide death in ex-serving men.

This analysis is part of an authoritative study commissioned by the Department of Veterans' Affairs on the incidence of suicide among serving and ex-serving ADF personnel. Results will provide a baseline for the ongoing monitoring of suicide rates among these personnel.

## Key findings

Between 2001 and 2015, there were 325 certified suicide deaths among people with at least 1 day of ADF service since 2001. Of these, 51% (166) were ex-serving at the time of their death, 28% (90) were serving full time and 21% (69) were in the reserves.

Men made up 84% of the ADF populations examined in the study. The clear majority of suicide deaths identified (93% or 303 deaths) occurred among men, with 7% (22 deaths) among women. Due to the smaller number of women in the study, detailed analysis on women was not possible. Hence, the report focuses primarily on suicide death among men.

### Ex-serving men have higher suicide rates

Suicide rates among men serving full time and in the reserves were significantly lower than for all Australian men. In contrast, the suicide rate for ex-serving men was:

- 14% higher than for men in the general population after adjusting for age; this was not statistically significant, but important when considered in the context of significantly lower all-cause mortality in ex-serving men compared with all Australian men
- significantly higher for ex-serving men aged 18–29 compared with all Australian men of the same age
- more than twice as high as for men serving full time or in the reserves
- more than twice as high as for ex-serving women.

Based on these findings, this report focuses primarily on risk factors for suicide death among ex-serving men.

### No change in ex-serving suicide rate

Between 2007–2009 and 2013–2015, there was no statistically significant change in the crude suicide rate among ex-serving men. This will continue to be monitored as more years of data become available.

### Risk groups among ex-serving men

Analysis for the summary report found younger age, involuntary discharge (particularly medical discharge), less than 1 year of service, and discharge in all ranks other than commissioned officer to be associated with higher suicide risk. This analysis examined each of these characteristics individually so it was not possible to separate out the effects of



potentially interrelated characteristics (for example, younger age and short length of service) to show which was most strongly associated with suicide death when all other factors were controlled for. Logistic regression was undertaken in this report for this purpose.

Results of the modelling largely support earlier findings based on crude rates and show that, when age and all other available factors are controlled for, the following service-related characteristics were associated with significantly higher suicide risk among ex-serving men:

- Medical discharge (the odds for suicide are 1.9 times the odds for those discharged voluntarily).
- Discharge in all ranks other than commissioned officers (the odds for suicide are 2.2 times the odds for commissioned officers).

Length of service was not a significant predictor of suicide death once all other factors were controlled for. However, the results of this analysis still suggest an increased likelihood of suicide in ex-serving men with less than 1 year of service when compared with men who served 10 years or more.

This study identifies groups of people who may be at higher risk of suicide death, but it cannot indicate if a particular characteristic is the cause of the suicide death. Other analyses, such as qualitative or case-study analysis, would be needed to provide useful insight into the circumstances leading up to these deaths. Nonetheless, the information and data in this report may help to inform policy and to develop interventions to reduce suicide rates among serving and ex-serving ADF personnel.



# 1 Introduction

In response to concerns about the incidence of suicide in serving and ex-serving Australian Defence Force (ADF) personnel, the Department of Veterans' Affairs (DVA) commissioned the Australian Institute of Health and Welfare (AIHW) in 2016 to calculate accurate numbers and rates of suicide death among serving and ex-serving ADF personnel, and to identify the service-related characteristics of ex-serving ADF personnel associated with higher risk of suicide. The overall aims of this study are to:

- *enumerate* suicide deaths among serving and ex-serving ADF personnel with contemporary service experience in 2001–2015
- determine if there are *differences* in the rate of suicide death between men in the ADF service groups and the general Australian male population in 2002–2015. See the section 'Comparing suicide rates' on page 17 for detail on the scope of this analysis
- identify any service-related characteristics that may *influence* those differences.

The scope of information available for this study means it is not possible to examine the full range of factors known to increase the risk of suicide—particularly demographic and psychological factors, such as remoteness of residence, marital or family breakdown, social isolation, substance misuse and mental health conditions. However, it does mean that some service-related factors—service, rank, operational service, length of service and reason for discharge—can be examined in detail and in depth.

To meet the strong demand for this information and ensure timely results, this study has, to date, been published in three parts:

- A fact sheet containing preliminary results was published in November 2016.
- Summary results were published in June 2017.
- Detailed results are published in the current report.

The scope of analysis for these publications, and their key findings, are described in the sections that follow.

The population groups used throughout the study are defined in Box 1.1.

## **Box 1.1: ADF populations—definitions**

**Serving full time:** ADF members serving in a regular capacity in the Royal Australian Navy (RAN, hereafter referred to as Navy), Australian Army (hereafter Army) or the Royal Australian Air Force (RAAF, hereafter Air Force) on or after 1 January 2001, on continuous full-time service, or participating in the gap year program.

**Reserve:** ADF members in the active or inactive reserve forces for the Navy, Army or the Air Force on or after 1 January 2001. Most members leaving full-time service make the transition to the inactive reserve forces, unless there are medical or other grounds preventing this. See the section headed 'Australian Defence Force' on page 5 for further detail.

**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 (2001–2015).

## Preliminary results 2001–2014

In 2016, the AIHW published preliminary results (a fact sheet) as the first part of this study for three ADF populations—those serving full time, those in the reserve, and ex-serving personnel—based on data for the period 2001–2014 (AIHW 2016).

The preliminary results showed that men in the serving full time and reserve populations had lower (statistically significant) rates of suicide than an age-matched population of Australian men. However, ex-serving men—discharged up to 15 years previously—were 13% more likely to die from suicide than men in the Australian population (though the difference was not statistically significant) (AIHW 2016).

Reducing the incidence of suicide in these populations is a priority for the ADF and DVA (Tehan 2017). The preliminary results helped to identify younger ex-serving men (aged 18–29) as a key risk group. This information is being used by the ADF and DVA to inform suicide prevention services provided to current and former members of the ADF. As a result, prevention services will now include a focus on support for ex-serving ADF personnel under the age of 30 (Tehan 2017).

## Summary results 2001–2015

A summary report, published in June 2017 (AIHW 2017b), formed the second part of the study. The report extended the preliminary findings to compare suicide and all-cause mortality rates between contemporary serving, reserve and ex-serving ADF personnel and the Australian population, and to identify characteristics that may be associated with suicide death in the ex-serving group. It updated preliminary death estimates to use 15 years of data for the years 2001–2015 and found that during this period, after adjusting for age, the suicide rate for ex-serving men was 14% higher (not statistically significant) while the all-cause mortality rate was 55% lower (statistically significant) than rates for all Australian men.

Analysis of risk factors undertaken for the summary report found that, as well as age, certain service-related characteristics were associated with higher crude suicide rates among ex-serving men:

- *Involuntary discharge*: the suicide rate for men discharged involuntarily was 2.4 times as high as for those discharged for voluntary reasons, particularly if the involuntary discharge was for medical reasons (3.6 times as high as for those discharged for voluntary reasons).
- *Shorter length of service*: those who left the ADF after less than 1 year of service had a suicide rate that was 2.4 times as high as for those who had served for 10 years or more.
- *Ranks other than commissioned officer*: the suicide rate for men discharged from these ranks was 2.8 times as high as for commissioned officers.

The summary report analysed each service-related characteristic associated with risk of suicide individually, but did not consider potential relationships between them.

## Detailed results 2001–2015

This detailed report is the third part of the authoritative study on the incidence of suicide among serving and ex-serving ADF personnel. Results of the summary report are included throughout this report for completeness. In addition, this report extends key findings

published in the summary report to provide further detail on:

- differences in the rate of suicide and all-cause death between men in the ADF service groups and an age-matched population of Australian men, with additional detail by age group and changes over time for the serving and reserve populations
- the individual service-related characteristics associated with suicide risk in contemporary ex-serving men to include age-specific rates of suicide death across all service categories
- the modelled effect of service-related characteristics associated with suicide risk in ex-serving men to identify risk factors that persist after all other available information is considered.

A set of key measures are currently being developed to monitor suicide rates for serving and ex-serving ADF personnel, based on the results of this study. It is expected that these will be updated annually as new data become available.

Important factors to consider when reading this report are outlined in Box 1.2.

**Box 1.2: Factors to consider when reading this report**

- The counts of suicide deaths presented are calculated from certified deaths information only; that is, official fact of death and cause of death determination (including suicide death) from the Registrars of Births, Deaths and Marriages in each state and territory and the National Coronial Information System.
- This study may exclude an unknown number of suspected suicide deaths that were officially attributed to another cause after investigation by a coroner.
- 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 revisions process. This may have a small effect on the number of deaths attributed to suicide each year, as some deaths currently coded as 'undetermined intent' could later be identified as 'intentional self-harm'.
- 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 results of this study cannot be used to estimate the number of suicide deaths among people who left the ADF before 1 January 2001. Therefore, the results cannot be extrapolated to the broader veteran/ex-serving population in Australia.
- The results identify groups of people with characteristics that may be associated with higher risk of suicide death. However, they cannot provide information on the reason for the suicide death.
- As only certain administrative information about individuals was available in the Personnel Management Key Solution (PMKeyS) data used in this study, it was not possible to analyse a number of other potentially important social, demographic and psychological factors that may contribute to suicide risk.
- 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 an asterisk, or by being described as 'significantly higher'/'significantly lower'. See Box 2.1 on page 12 for the definition of statistical significance used in this report.

## Structure of this report

This report has three broad sections:

1. The first section provides context and background to the study (this chapter), and a summary of the methods and classifications used in this report (Chapter 2).
2. The second section presents results:
  - Chapter 3 profiles the three study populations: ADF personnel serving full time, in the reserves, and ex-serving personnel.
  - Chapter 4 presents information on the incidence of suicide death across these three populations.
  - Chapter 5 compares suicide rates across the three populations and with the Australian population. It includes comparisons based on crude rates, and age-adjusted rates produced using the standardised mortality ratio.
  - Chapter 6 explores service-related characteristics associated with suicide death in ex-serving men in detail.
  - Chapter 7 presents the results of regression modelling undertaken to understand how the individual service-related characteristics simultaneously affect the probability of suicide death in ex-serving men.

High-level results, previously published in the summary report (AIHW 2017b), are included in each section (as appropriate) for completeness, followed by results of the detailed analysis supporting them.

3. The third section discusses the interpretation and implications of those results (Chapter 8), and includes detailed methods and technical notes (Appendix A), data sources (Appendix B) and detailed tables of results (Appendix C).

# Background

The following sections outline the structure and pathways through the ADF, and present more information on those service-related characteristics identified as being associated with increased risk of suicide death among ex-serving personnel. Terminology used in this chapter and throughout this report is defined in Appendix A5, Box A5.1.

## Australian Defence Force

The services and service status groups that make up the ADF are depicted in general terms in Figure 1.1.

		Services		
		Royal Australian Navy (RAN)	Australian Army	Royal Australian Air Force (RAAF)
Service status				
Permanent / Regular	Permanent Navy	Regular Army	Permanent Air Force	
Reserve	Naval Reserve	Army Reserve	Air Force Reserve	
	<i>Standby Naval Reserve</i>	<i>Inactive Army Reserve</i>	<i>Standby Air Force Reserve</i>	
Ex-serving				

**Figure 1.1: Services and service status groups in the ADF**

The ADF is commanded by the Chief of the Defence Force and consists of three services: the Navy, the Army and the Air Force. The three services have historically operated independently, yet cooperatively, with different rank titles, job roles, enlistment and training requirements and operational roles.

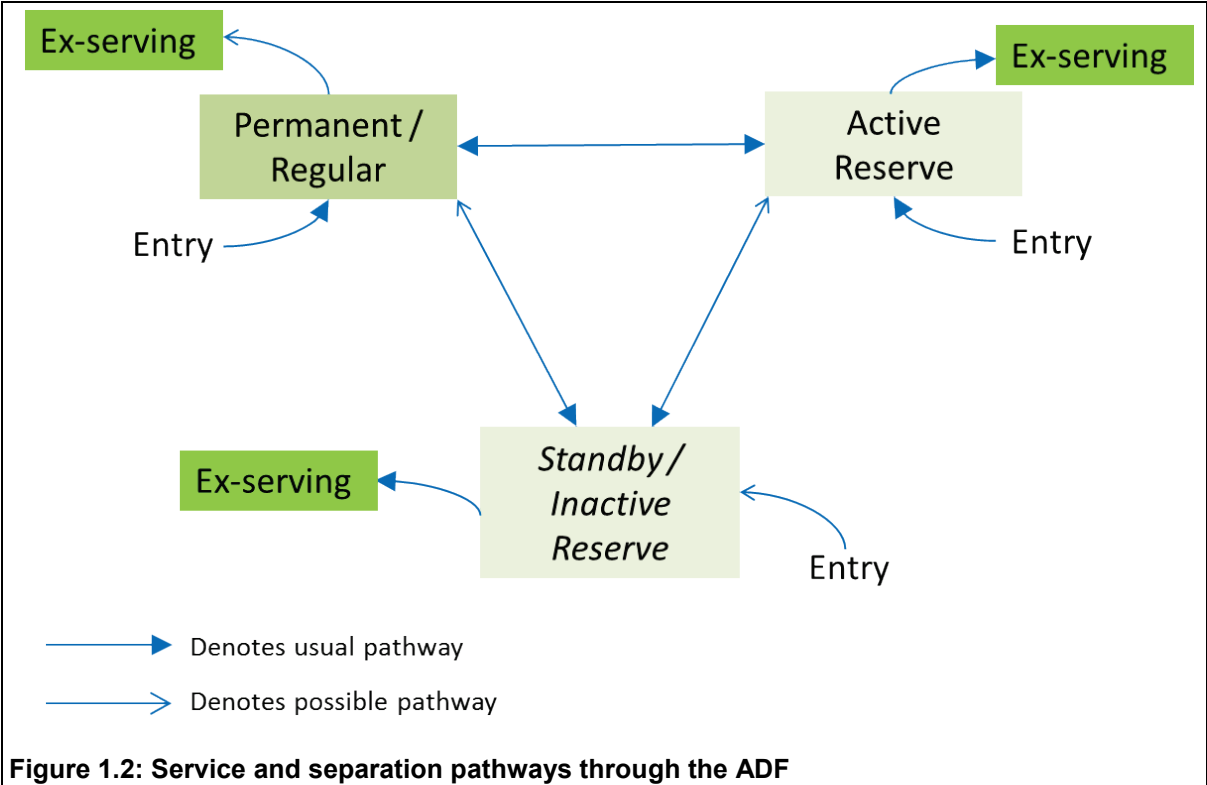
ADF personnel may be appointed to the permanent/regular or reserve forces as a commissioned officer or enlisted as a non-commissioned officer rank (see Appendix Table A5.1 for a full list of ADF ranks included in these groups). Members of the permanent forces—Permanent Navy, Regular Army and Permanent Air Force—usually serve in a full-time capacity, and commit to an initial minimum period of service commensurate with the job role, rank and level of training.

Members of the active reserve forces—the Naval Reserve, Army Reserve and Air Force Reserve—serve under a voluntary and flexible commitment to the ADF, which requires a minimum 20 days of service per year. Reserve members may voluntarily engage in full-time service, known as continuous full-time service (CFTS), and are obliged to provide CFTS if

called on to do so by the Governor-General. Each service also has a standby (or inactive) reserve component with no service obligation; this ensures that critical skills and experience are retained and can be called on in emergency situations.

Recruitment into the ADF follows a multi-phase selection process, including job aptitude testing, assessments of physical fitness and general health, and evaluation of psychological suitability for service.

After enlistment, there are several potential pathways through the ADF, including training and promotion, transfer between services, change in service capacity (full-time or reserve), deployment, and separation to civilian life. Figure 1.2 depicts those potential pathways, indicating the potential complexity of an ADF service career.



**Figure 1.2: Service and separation pathways through the ADF**

**The healthy ADF population**

The healthy worker effect is evident 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; Harrex et al. 2003; Kang et al. 2015; Kapur et al. 2009; Wilson et al. 2005). A number of these 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 (Harrex et al. 2003; Kang et al. 2015).

This study found significantly lower all-cause mortality rates across each of the three groups of interest (personnel serving full time, reserve and ex-serving personnel) when compared with an age-matched population of Australian men (AIHW 2017b).

Significantly lower all-cause mortality in the full-time serving and reserve ADF populations compared with all Australian men provides evidence of a healthy soldier effect; this could



be the result of the rigorous training processes, annual physical assessments and job-specific testing for ongoing suitability for ADF service. These processes ensure that persons recruited into and serving in the ADF are healthy, physically fit and mentally resilient—essentially fit for service in what can be an extremely demanding job, both physically and mentally.

The lower all-cause mortality rate found in ex-serving men compared with all Australian men suggests that some of the protective factors associated with the healthy soldier effect (for example, good physical health) may still be present to some degree in the ex-serving ADF population (AIHW 2017b).

The interaction between the healthy soldier effect and suicide risk in the serving ADF population is complex. The high physical, medical and mental health standards required for service act as protective factors that may reduce suicide risk. However, the risks to physical health (including loss of life) and mental health (such as exposure to psychological trauma) inherent in ADF service and deployment may increase the risk of suicide death in ADF personnel.

Findings of significantly lower suicide rates for men serving full time and in the reserves, compared with all Australian men (AIHW 2017b), are consistent with significantly lower mortality from all causes of death in these groups. Together, these results suggest there is no excess in suicide mortality in men currently serving full time or in the reserves in the ADF. However, the higher suicide rate found in ex-serving men compared with all Australian men suggests that the protective factors (individual or systemic) that may be associated with the lower suicide rates for men serving full time and in the reserves are compromised (AIHW 2017b).

International literature broadly supports these findings. Studies from Canada and New Zealand show that the risk of suicide is lower among serving personnel, and studies from Canada, the United States and the United Kingdom show that the risk of suicide is higher among ex-serving personnel, compared with the general population in each of those countries (Bruce 2010; Kang et al. 2015; Kapur et al. 2009; Rolland-Harris et al. 2015; Skegg et al. 2010).

Added challenges in the transition from full-time or reserve service to ex-serving—such as those associated with loss of employment—are also likely to contribute to the higher suicide rate in the ex-serving group (NMHC 2017). This is discussed in further detail under the section headed ‘Transition and separation from the ADF’ on page 10.

## **Service-related risk factors for suicide death**

While there are inherent protective factors in ADF service, evidence from Australia provided in the current study, and from international studies, show that there are also individual and service-related risk factors for suicide death among ex-serving personnel.

International studies identify younger age, lower rank, shorter length of service, and serving in the Army (and Marines in the United States) as being associated with suicide risk (Kang et al. 2015; Kapur et al. 2009; Rolland-Harris et al. 2015). Despite several methodological differences, the findings of this study to date are broadly consistent with younger age, shorter length of service, and rank other than commissioned officer being found to be associated with suicide risk in ADF personnel (AIHW 2017b). As well, involuntary discharge—particularly medical discharge—was found to be significantly associated with suicide death in ex-serving Australian ADF personnel (AIHW 2017b).

Deployment to a conflict zone, and the physical and mental traumas associated with this, are also hypothesised to increase risk. Results from Australian and international studies are inconsistent, however, with some studies finding lower suicide mortality in deployed veterans compared with non-deployed veterans (Kang et al. 2015; Knapik et al. 2009) and others finding higher or little to no difference in suicide mortality between these groups (Knapik et al. 2009; Rolland-Harris et al. 2015). To date, the current study has found no significant difference in crude suicide rates by deployment status (AIHW 2017b).

In Australia and internationally, the processes of separation and transition out of service are recognised as periods of adjustment that can be particularly difficult for some ADF personnel, and may be associated with increased risk of suicide death, particularly in the period soon after discharge (AIHW 2017b; Blackburn 2016; Dunt 2009; DVA 2013; Kang et al. 2015; Kapur et al. 2009; NMHC 2017).

Further contextual information on service-related risk factors associated with suicide death in the Australian context is provided in the following sections. Transition out of the ADF and the timing of suicide death after discharge are also discussed.

## **Service**

Service describes the three broad arms of the ADF—the Navy, the Army and the Air Force.

In Australia and most allied nations, the army (land forces) is the largest service arm, with the highest proportion of general entry personnel. Differences such as this, and in the age structure and proportion of personnel at lower ranks across Defence services, may contribute to differences between the service arms in suicide rates.

International studies find service in the Army (and Marines in the United States) to be associated with increased risk of suicide death (Kang et al. 2015; Kapur et al. 2009; Rolland-Harris et al. 2015). However, results of the current study to date find no difference in crude suicide rates across personnel leaving the Navy, the Army or the Air Force.

## **Rank**

Rank describes one's position in the ADF operational hierarchy. Commissioned officers have leadership and management responsibilities and specific education and service requirements. Personnel in lower ranks—ranks other than commissioned officers—hold trade and service positions. For a full list of ranks included in these groups see Appendix Table A5.1.

Personnel of lower rank at the time of discharge have been shown in multiple international studies to be at increased risk of suicide death (Kang et al. 2015; Kapur et al. 2009; Rolland-Harris et al. 2015). Reasons for this may include younger age, fewer deployment opportunities during service, less autonomy and sense of control, and fewer identifiable job opportunities where ex-serving personnel can use their skills after discharge. Rank can be used as a proxy measure for socioeconomic status, incorporating measures of income, education and housing. People of a higher rank (commissioned officer) generally have a higher level of education, training and income and, by nature of their rank, transferrable managerial skills. Literature shows that, in the general population, socioeconomic status is inversely associated with risk of suicide death, with the risk increasing as socioeconomic status decreases (AIHW: Harrison & Henley 2014).

Results of the current study to date show that discharge in all ranks other than commissioned officers may be associated with higher crude rates of suicide in the Australian ex-serving population (AIHW 2017b).

## Operational service

Operational service refers to deployment to a warlike conflict zone, non-warlike peace keeping mission, overseas areas for border protection activities or humanitarian aid, or domestic service in providing aid to the civilian community during emergency situations.

Australian and international studies are divided on the effect of deployment on the risk of suicide. In most cases, there is insufficient statistical evidence to unequivocally associate deployment with increased risk of suicide death, and some studies find deployment to be associated with lower risk of suicide death (AIHW 2017b; Kang et al. 2015; Knapik et al. 2009; Rolland-Harris et al. 2015; Sim et al. 2015). Among individuals who served in the United States military from 2001 to 2007 and separated from active duty before the end of 2007, Kang et al. (2015) found a lower risk of suicide death in veterans deployed (to Iraq or Afghanistan) compared with those who were not deployed. Knapik et al. (2009) reviewed studies comparing post-deployment injury-related mortality (including suicide mortality) of members serving in conflict zones (in Vietnam and the Gulf War) with the suicide mortality of those who did not serve in those conflict zones. These authors found a few studies on Vietnam veterans that showed a higher proportion or rate of suicide mortality in veterans who served in Vietnam than in those who did not, as well as other studies that showed little or no difference in the suicide mortality between these groups. In studies reviewed on Gulf War veterans, Knapik et al. (2009) found suicide death in Gulf War veterans was generally somewhat lower than for non-Gulf War veterans. Rolland-Harris et al. (2015) found men in the Canadian Regular Force with a history of deployment to be at an increased risk of suicide compared with those who have never been deployed; however, the difference was not statistically significant. Within the Australian context, results of this study to date have found no statistically significant difference in crude suicide rates between ex-serving men with and without operational service (AIHW 2017b).

Personnel deploying to a conflict zone are likely to have the highest level of job-specific capability, physical fitness and psychological resilience, along with the benefit of strong institutional and team supports; however, the nature of those deployments place personnel in situations where they are likely to be exposed to potentially traumatic events that may result in physical and psychological injury (Hamilton 2011; Martin 2000; Sim et al. 2015). These injuries are recognised as risk factors for mental health conditions, including substance misuse, post-traumatic stress disorder (PTSD), chronic depression and suicide (DVA 2013; Hamilton 2011; Martin 2000; Phoenix Australia 2017). Further, it is recognised that the nature of contemporary deployment to conflict zones—with multiple and shorter deployments of smaller contingents, engaged in urban environments, and often with civilian involvement—may weaken the protective structures and supports, and increase those potentially adverse effects of deployment (DVA 2013). Operational service may, therefore, be protective at first and decrease as the latent effects of trauma experience arise after discharge (Kang et al. 2015).

Not all deployments are to conflict zones. In this report, four broad categories of deployment are included in the definition of operational service: warlike/active service deployments, non-warlike deployments (for example, peace keeping, peace monitoring, United Nations assistance missions), overseas deployments to humanitarian/disaster relief or border protection deployments, and deployment of Defence aid to the civilian community. Some research has shown that deployment to non-conflict zones may also be associated with the development of PTSD and psychiatric disorders, with an Australian study finding levels of psychiatric disorder after peace keeping deployment similar to levels seen following warlike deployment (Forbes et al. 2016).

Compared with personnel with operational service experience, those without this experience may be younger; have had increased rates of other lifetime trauma; and have a lower level of training, physical fitness and psychological resilience, rendering them unsuitable for operational service (Kang et al. 2015; Rolland-Harris et al. 2015; Van Hooff et al. 2014). Personnel with no operational service may also be exposed to other stressful aspects of military service that could have an impact on their mental health and risk of suicide death. Results of the *Australian Defence Force Mental Health Prevalence and Wellbeing Study* show that deployment status did not have an impact on mental disorder rates, including rates for anxiety disorders, affective disorders, alcohol disorders and mental disorders (Van Hooff et al. 2014). As well, studies suggest that ADF members with no operational service experience PTSD at the same rates as those with operational service (Defence 2017b). This may suggest that while the risk factors for suicide death to which those with and without operational service are exposed differ, both groups are at similar risk.

Personnel with and without operational service are likely to represent two quite distinct groups and have a wide range of differing characteristics—beyond operational service status—that may confound estimates of suicide risk across these two groups.

### **Length of service**

Length of service refers to the time between enlistment and discharge. Evidence from the United Kingdom shows shorter length of service to be associated with increased risk of suicide death (Kapur et al. 2009). Shorter length of service may indicate adverse experience or unsuitability for ongoing service. For some personnel, it will also be commensurate with lower training level, lower rank and no operational experience. Increased risk of suicide death among people with shorter length of service may also be associated with factors present before ADF service (Kapur et al. 2009).

In line with findings internationally, results of this study to date have found that ex-serving personnel who left the ADF after less than 1 year of service had significantly higher rates of suicide death than ex-serving personnel who had served for 10 years or more (AIHW 2017b).

### **Reason for discharge**

The reason for discharge may be voluntary (resignation, voluntary redundancy) or involuntary (disciplinary, medical, being physically unfit for service). In Australia, results of this study to date have found that men discharged involuntarily—particularly for medical reasons—have a significantly higher crude rate of suicide death than men discharged voluntarily (AIHW 2017b), while a study from the United Kingdom found no significant difference in suicide risk by type of discharge (administrative/medical) (Kapur et al. 2009).

Involuntary discharge will, in most cases, end a military career prematurely and, potentially, in challenging circumstances. The need to embark on a new and unplanned career path, and/or manage the effects of illness, injury and disability, may further compound the complex process of reintegrating into civilian life.

### **Transition and separation from the ADF**

DVA and Defence are jointly responsible for providing support to those separating from the ADF into civilian life—a process referred to as ‘transition’ (JSCFADT 2015). The transition process is recognised as a time of stress, anxiety, vulnerability and uncertainty for some individuals, and has been raised in several forums as a risk factor for poor outcomes,

including suicide death, among ex-serving personnel (DVA 2013; JSCFADT 2015; Kapur et al. 2009).

The ADF transition program reflects the complexity of the transition and separation process as personnel move from the structured, purpose-driven and supported military environment—where housing, medical services, training and education are provided or subsidised as a condition of service—to the largely unstructured and unsupported nature of civilian life. The program provides ADF personnel and their families with support and services, including financial management, medical (including registering for Medicare, sourcing private health insurance, and finding a general practitioner), employment and interview skills, training and education, housing and relocation, and rehabilitation and compensation as needed (Defence 2017a).

During transition, Defence is responsible for providing health care up to the date of transition. After transition, this responsibility shifts to civilian health-care services and, if relevant, health services paid for by DVA.

Elements of the transition and separation process that may be either risk factors or protective factors include the reason for, and timing of discharge; and access to (and use of) support services in the period before, during and after separation (Hoffmire et al. 2015; Katz et al. 2012). Unemployment or underemployment, homelessness, family breakdown, social isolation and escalating physical or mental health conditions have also been found to be associated with this transition period (McKay et al., cited in AISRAP 2016:8; NMHC 2017). These are independent risk factors for suicide death.

### **Time since discharge**

Time since discharge, in the context of this study, is the period between separation from the ADF and death by suicide. A shorter time since discharge may indicate adverse experience during service or unmet need during transition or after separation and has been found to be associated with some increased risk of suicide death (Kang et al. 2015; Kapur et al. 2009). Results of the current study to date suggest there may be an elevated risk of suicide in the first 5 years after discharge, but the finding was not statistically significant (AIHW 2017b).

### **Non-service related risk factors**

There are several non-service related factors associated with increased risk of suicide death among ex-serving personnel. These include younger age, male sex and unmarried status (AISRAP 2016). These factors are consistent with whole-of-population suicide risk factors. Other population-level factors not considered in the service-specific studies examined to date, but which may also contribute to suicide risk among ex-serving ADF personnel, include remoteness of residence, marital or family breakdown, substance misuse, and mental health conditions (AISRAP 2016; McCarthy et al. 2015).

While adjustments for sex and age can be made in the current study, it is not possible to analyse other potentially important social, demographic and psychological factors that may contribute to suicide risk.

## 2 How the study was conducted

The study was conducted in five broad steps, which are listed here and then briefly described:

- Step 1—constructing the data set and determining fact and cause of death
- Step 2—defining the scope
- Step 3—counting suicide deaths
- Step 4—comparing suicide rates
- Step 5—modelling suicide risk.

The technical terminology and measures used in the rest of this report are described in Box 2.1 and a number of the key calculations are detailed in Figure 2.1 on page 14.

### Box 2.1: Measures used in this report—definitions

**Count of suicide deaths (also referred to as incidence of suicide):** The number of ADF deaths from suicide in a given time period.

**Correlation:** The strength and direction of an association between variables is given by a value between  $-1.0$  and  $1.0$ , with stronger relationships indicated by values further away from  $0$ . High correlation can be defined as being greater than  $0.70$  or less than  $-0.70$ . If values of both variables increase and decrease together, the association is positive. If the value of one variable increases as the other decreases, the association is negative.

**Crude suicide rate:** The number of serving and ex-serving ADF suicide deaths divided by the number in the corresponding ADF population and then multiplied by a factor—in this case  $100,000$ —to provide a rate per  $100,000$  population in a given time period.

**Odds ratio:** The odds ratio between two categories of a predictor variable represents the proportional change in odds of a certain result that would occur when moving between the categories, if all other factors are held constant. For example, if the odds ratio between *all ranks other than commissioned officers* and *commissioned officers* is  $2.2$ , this means that the particular outcome (such as death due to suicide) has  $2.2$  times the odds for *all ranks other than commissioned officers* than for *commissioned officers*, if all other factors (such as reason for discharge and service) are held constant. The model cannot account for factors for which there are no data, so it is possible that differences in odds between the categories of explanatory variables are due to unknown confounding factors, because the model cannot hold these factors constant.

**Standardised mortality ratio (SMR):** A ratio to compare the suicide rates for the ADF populations with the Australian population, adjusting for differences in age structure. It is calculated as the observed number of events (suicide deaths) 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 population than in the Australian population, the ratio will be greater than  $1.0$ . If the age and sex-specific rates for the ADF populations are lower overall than the Australian population, the ratio will be less than  $1.0$ .

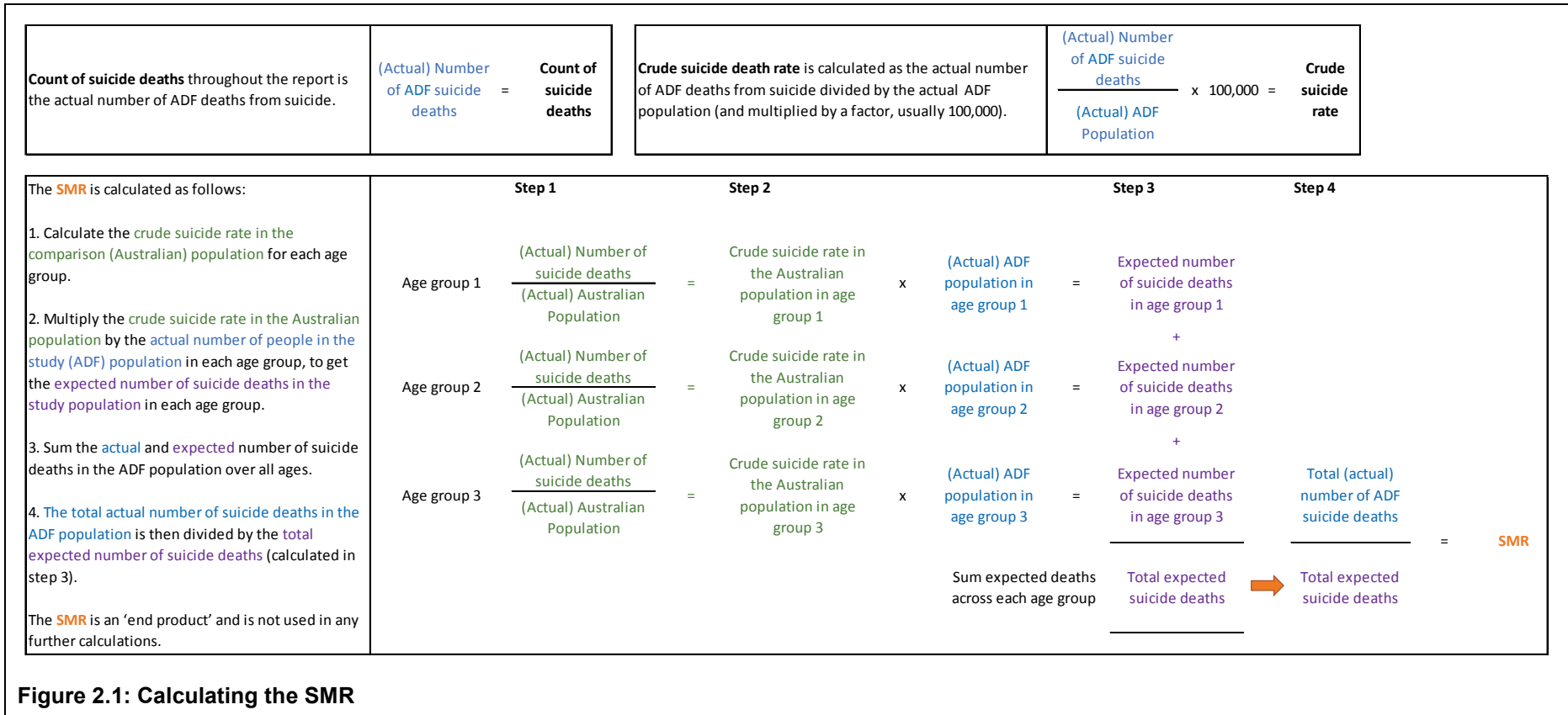
(continued)

**Box 2.1 (continued): Measures used in this report—definitions**

**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 provide an indication of 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, the difference is said to be statistically significant. Statistically significant differences are indicated in this report by an asterisk, or described as being 'significantly higher'/'significantly lower'. For further detail see the section headed 'Confidence intervals and significance testing' on page 81.

**Important note:** In this study, 95% confidence intervals (CIs) are provided for each standardised mortality ratio (SMR) and most crude 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 CIs. While it is not standard to calculate CIs for population-based data, 95% CIs are provided within this report as they may account for the variation in absolute counts of suicide deaths over time (related to the small sample size). Use of CIs is the simplest way to test for significant differences. If CIs do not overlap with each other (when comparing crude rates) or 1.0 (in the case of an SMR), the difference is statistically significant. Performing significance tests for rate differences by comparing their CIs for overlap is not as precise as calculating exact *p*-values. The CI comparison is conservative in that, on occasion, the intervals overlap a small amount when the difference is significant but close to the significance threshold. In this study, in cases where CIs overlapped slightly (by a difference of up to 5 between the lower limit of one estimate and the upper limit of the comparison estimate), the exact *p*-value was calculated and used to determine statistical significance.





## Constructing the data set and determining fact and cause of death

The study population was derived from the PMKeyS database (held by the Department of Defence—hereafter referred to as Defence), which was linked with the National Death Index (NDI) (held by the AIHW). This linked data set was then supplemented by information from Defence’s database of confirmed and suspected suicide deaths—the Defence Suicide Database (DSD)—and cause of death information from the National Mortality Database (NMD). See Appendix B1 for detail on each of these data sources.

The numbers of deceased personnel were determined through linkage to the NDI, or matching to the DSD. Further information on the data linkage process is in Appendix A1.

Cause of death (suicide) data were obtained only from certified sources; that is, official fact of death and cause of death determination (including suicide death) from the Registrars of Births, Deaths and Marriages in each state and territory and the National Coronial Information System.

These data underpin the NMD (that provides cause of death information to the NDI) and the DSD, the sources of certified death information used in this study.

Reporting only certified deaths ensures that the results presented here are defensible, comparable over time and can be reproduced. The most recent year of cause of death data available at the time of reporting was 2015.

Differences between the results of this study and other publicly reported estimates may be due to differences in scope and/or the source of cause of death information.

## Defining the scope

The scope of the study is all ADF personnel with at least 1 day of ADF service from 1 January 2001 to 10 April 2016 (the date of the PMKeyS data extract).

The linked PMKeyS–NDI data set was reviewed against this scope and a number of logical checks performed. The results of these checks indicated the data set included records that were out of scope. To be in scope:

- a person’s record must have a hire date before the data extract date (10 April 2016)
- the person must be currently serving full time or in the reserves  
or
- if discharged from the ADF, the person must have a termination date after 1 January 2001, and at least 1 day of service between the hire date and termination date (1 day of service).

Further checks were also performed on the data, and a total of 1,030 records were excluded from the linked data set as they were out of scope. This left **199,466 unique in-scope records** for analysis.

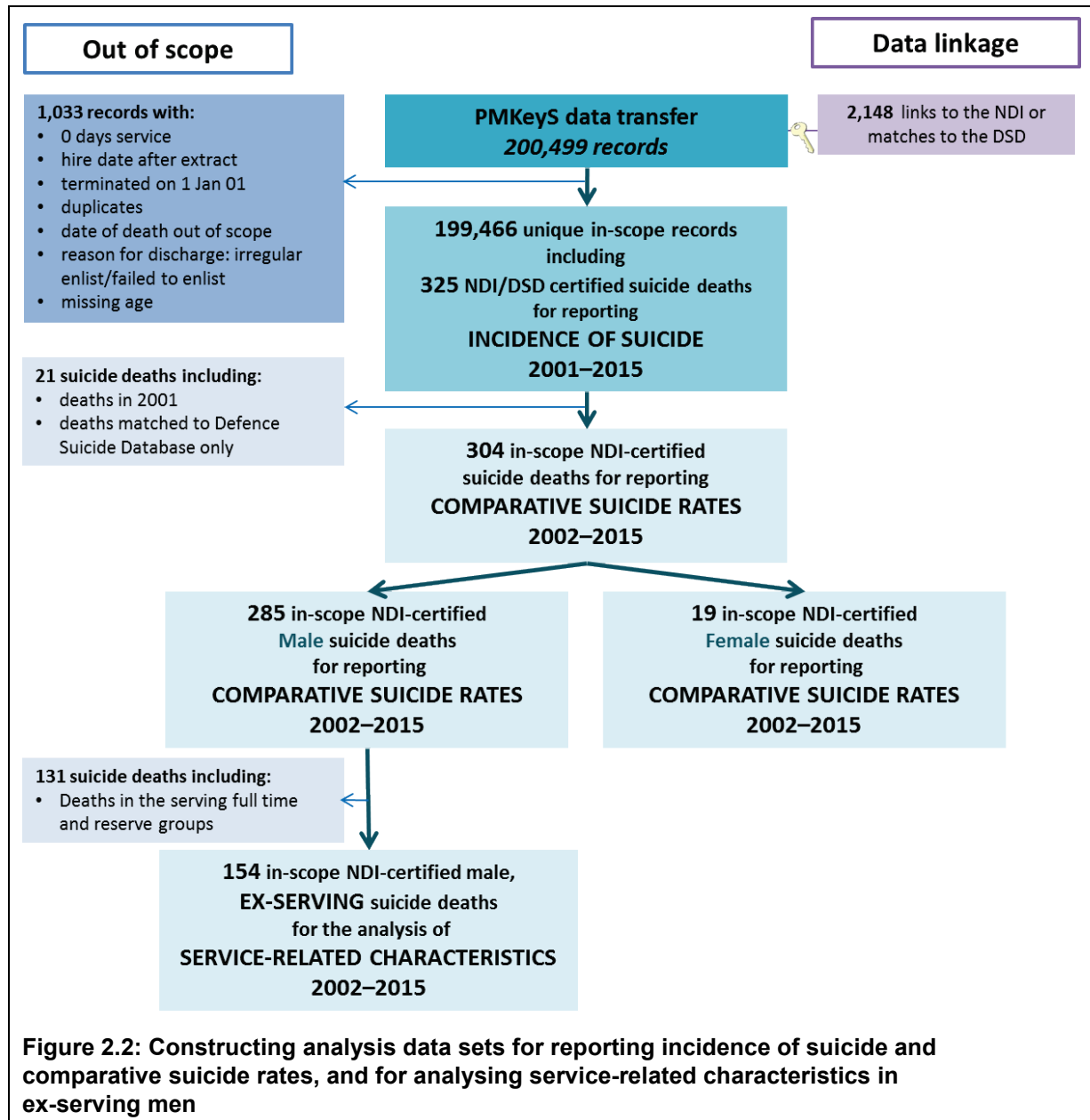
The adjustments and exclusions performed on the data are detailed in appendixes A2 and A3.

Analysis data sets were then constructed for two time periods:

- 2001–2015 for reporting the incidence of suicide (counting suicide deaths)

- 2002–2015 for comparisons with the Australian population.

The construction of these data sets is summarised in Figure 2.2 and further detail provided in the sections headed ‘Counting suicide deaths’ on page 17 and ‘Comparing suicide rates’ on page 17.



## Counting suicide deaths

The most recent year of cause of death information at the time of analysis was 2015.

The numbers of suicide deaths are reported for men and women and are derived from all deaths with a valid date of death from 2 January 2001 to 31 December 2015 and a cause of death from a certified source:

- The NDI, where the underlying cause of death was determined as intentional self-harm (or sequelae of intentional self-harm) (International Classification of Diseases, 10th revision—ICD-10—codes X60–X84, Y87.0).
- The DSD with a status of ‘Confirmed’.

Counts produced by using this data set represent the total number of certified suicide deaths during the period 2001–2015 and are presented in Chapter 4, ‘Incidence of suicide 2001–2015’ on page 25. Comparing counts of suicide deaths across different groups helps to identify where the largest number of suicide deaths are occurring.

The age-specific numbers and rates of suicide deaths presented in this report are based on the age of the ADF personnel at the time of death.

## Comparing suicide rates

To examine whether service in the ADF has an impact on the risk of suicide in serving full time, reserve and ex-serving personnel, it is important to consider rates of suicide across these groups within the context of suicide rates for the wider community. Doing so indicates whether suicide rates for each service group are higher, lower or the same as for the general Australian population (adjusted for differences in age structure) from which the defence forces personnel have been drawn, and hence whether there is evidence of service having an impact on suicide rates.

In the current study, it is not possible to account for all potential differences—such as marital and mental health status—between people who enter the ADF and those who do not. However, it is possible to account for two key demographic factors, age and sex, when comparing ADF service groups and the general Australian population.

Age and sex are both known risk factors for death by suicide. In Australia, 29% of suicide deaths occurred among men aged 25–44 in 2015 (ABS 2016a). The rate of suicide death in that age group is around 3.5 times as high as for women of the same age. The available data show that the age and sex profiles of the ADF service status groups and the Australian population differ. The comparative Australian population is older and around 50% male, compared with the younger and 85% male ADF service groups (see Figure 3.1 on page 24).

Further, it is known 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 per year (respectively), 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, crude comparisons of counts of death due to suicide between the service status groups and the Australian population are misleading. To make comparisons with the Australian population, it is necessary to standardise data by both age and sex

(see section under the heading 'Comparisons using the standardised mortality ratio' on page 18 for detail on the method of standardisation used in this report).

Comparative analysis is restricted to deaths identified through linkage to the NDI only, and are reported for the period 1 January 2002 to 31 December 2015 for the following reasons:

- Cause of death information on the NDI (used to identify deaths in the study populations) and the NMD is drawn from the same source (Cause of Death Unit Record File). Restricting deaths in the study population to those identified through linkage only to the NDI makes sure that the definition of a death and of death by suicide was consistent across both the ADF service groups and the Australian population, ensuring comparisons are as valid and robust as possible.
- Data for serving and reserve populations were not available before 2002 due to a change in personnel management systems at that time.
- 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 and increasing by around 5,000 per year. Due to high volatility in estimates obtained when including the 2001 ex-serving population, analysis of ex-serving personnel was restricted to data from 2002 onwards, in line with reporting for serving and reserve groups.

## Comparisons using crude rates

Crude rates complement information on the number of suicide deaths by taking into account the size of the underlying population to provide information on how often suicide death occurs in that population. Unlike the SMR (see following section), crude rates do not adjust for differences in the age structure between populations but, again unlike SMRs, can be validly compared with each other, and over time, to usefully indicate where suicide rates may be higher within different population groups.

Age-specific crude rates are also used in this report to explore some of the effect of age on overall crude rates. The age groupings used are shown for each piece of analysis. Rates are not reported for age groups where there were fewer than 5 suicide deaths, as estimates based on such small numbers are not considered robust. Instances where age-specific rates are not reported due to counts fewer than 5 are noted in this report.

In a small number of cases, age groups have been combined to enable age-specific rates for a group to be reported. This was done only in cases where rates were similar across the two age groups combined—where not doing so would prevent age-specific rates being reported for the group. Instances where age groups have been combined to report age-specific rates are noted in this report.

## Comparisons using the standardised mortality ratio

In this study, the SMR is used to control for the difference in age structures between study populations (the three ADF service status groups) and the comparison (Australian) population.

The SMR is a widely used and robust method of standardisation for analysing statistically rare events, such as suicide data. In this report, it is calculated by multiplying the crude suicide rate in each age group in the Australian population by the number of people in the ADF population in the corresponding age group to get the 'expected' number of suicide deaths in each age group in the ADF population. These expected counts are then summed across all age groups to obtain the total expected number of suicide deaths in the ADF

population. The total actual count of suicide deaths in the ADF population is then divided by the total expected number of suicide deaths to calculate the SMR.

If the age and sex-specific rates are:

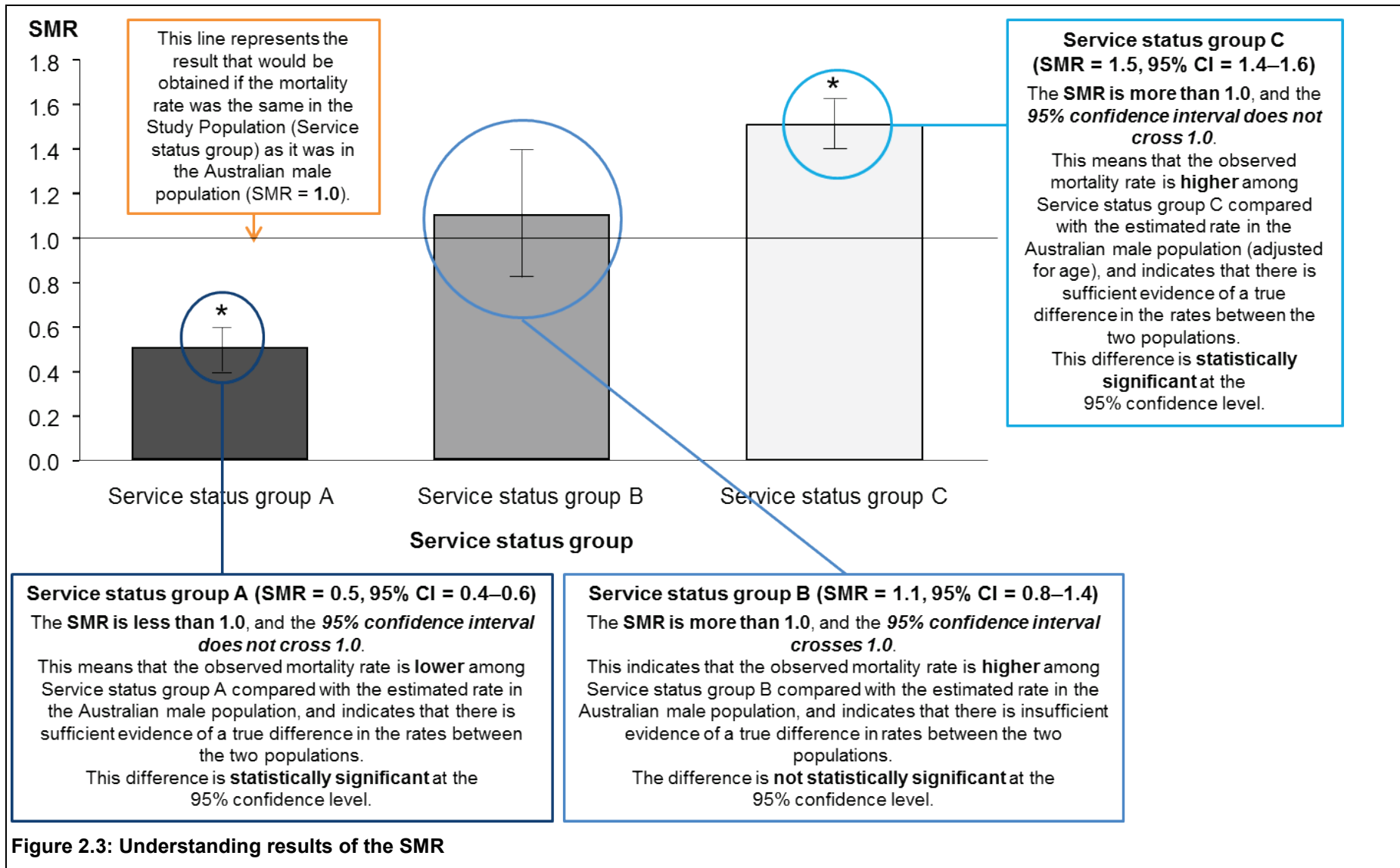
- the same in each population, the SMR is 1.0
- on the whole, higher in the ADF service group than in the Australian population, the SMR will be greater than 1.0
- on the whole, lower in the ADF service group than in the Australian population, the SMR will be less than 1.0.

Figure 2.1 on page 14 provides an example of how this measure is calculated and Figure 2.3 on page 20 shows how these results will be presented in this report.

It is important to note that SMRs cannot be compared with each other because different weighting is used to generate each result (AIHW 2011).

To calculate robust SMRs, the comparison population needs to be large enough to provide stable age-specific suicide rates. Small counts in either the number of suicide deaths and/or the underlying population will result in age-specific suicide rates that are subject to a high level of volatility. This means that it is not possible to calculate robust comparisons between the ex-serving and serving population due to relatively small numbers in both populations. It also means it is not possible to calculate age-standardised comparisons directly between personnel with different service characteristics within the ex-serving population. As a result, crude rates are used for these comparisons in this report.

Additional detail on this method is provided in Appendix A3.



## Modelling suicide risk

In this study, crude suicide rates and SMRs are used to examine each service-related characteristic associated with risk of suicide. This method is effective in identifying groups who have been observed to have a higher suicide rate, but it does not separate out the effects of the different characteristics. To simultaneously measure the impact of age, and all other available service-related characteristics on the likelihood of suicide death, a logistic regression model was fitted for the event of suicide; that is, the odds of suicide were modelled in terms of age, length of service, service (Navy, Army or Air Force), rank, operational service, reason for discharge and time since discharge. The main aim of modelling within this study was to further clarify and understand key findings based on crude rates reported in the summary report (AIHW 2017b). Furthermore, the modelling would reveal, when controlling for other factors, if there was any one characteristic most strongly associated with suicide death that might be influencing results across the other characteristics.

Results of logistic regression are expressed as odds ratios. The odds ratio is a relative measure that compares the odds of people in a particular group experiencing an event (for example, death due to suicide) with the odds of people in another group experiencing the same event. For example, the odds of suicide death in ex-serving men who separated from the ADF in all ranks other than commissioned officer (group A) can be compared with the odds of suicide in ex-serving men who separated from the ADF as commissioned officers (group B). In this example, group B is the reference group.

The interpretation of an odds ratio is as follows:

- An odds ratio of 1.0 means that the odds of the event's occurring is equal in both groups.
- An odds ratio of greater than 1.0 means that the odds of the event's occurring is higher for people in group A than in group B.
- An odds ratio of less than 1.0 means that odds of the event's occurring is less for people in group A than in group B.

More information about the data sources, statistical measures and methods used in this study are in appendixes A and B.

Detailed statistical tables can be found in Appendix C.

The findings of this study are presented next. High-level results, previously published in the summary report (AIHW 2017b), are included in these results—as appropriate—for completeness. These are followed by results of the detailed analysis behind them.

### 3 Study populations

#### Summary of key findings

There are several key differences between the serving full time, reserve and ex-serving populations examined in this study.

Numbers in the serving full time and reserve populations are relatively stable each year while the ex-serving population for this study was zero (0) on 1 January 2001 and increases by around 5,000 per year.

Other key demographic and service-related differences between the service status groups include:

- the serving population is young (median age 30), 51% are in the Army, 26% are of commissioned officer rank, and 41% have operational service experience
- the reserve population is older (median age 38), 71% are in the Army, 26% are of commissioned officer rank and 27% have operational service experience
- the ex-serving population is the oldest (median age 40) and ageing, 62% served in the Army, 20% were commissioned officers, and 10% had operational service experience.

The PMKeyS data underpinning this study were extracted on 10 April 2016. This extract provided a snapshot of several demographic and service-related characteristics of ADF personnel as at this date, including rank, service, operational service status, employment status and service banding. Several extra characteristics were then derived from information in the original extract, including age, service status, length of service, time since discharge and vital status. For consistency, derived characteristics were also calculated as at 10 April 2016, or at the time of death.

A total of 199,466 people aged 16–85 had at least 1 day of ADF service from 1 January 2001 to 10 April 2016 (extract date), and were in scope for this study. Of these:

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

The serving full time and reserve populations are relatively stable each year, at around 55,000 for those serving full time and 42,000 for the reserve forces (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 increases by around 5,000 per year.

There are other key demographic and service-related differences between the service status groups:

- The serving population is young (median age 30), 51% are in the Army, 26% are of commissioned officer rank, and 41% have operational service experience.
- The reserve population is older (median age 38), 71% are in the Army, 26% are of commissioned officer rank and 27% have operational service experience.
- The ex-serving population is the oldest (median age 40) and ageing, 62% served in the Army, 20% were commissioned officers, and 10% had operational service experience (Table 3.1).



**Table 3.1: Demographic profile of persons aged 16–85 with ADF service from 1 January 2001, by service status, as at 10 April 2016**

Characteristics	Serving <sup>(a)</sup>		Reserve <sup>(b)</sup>		Ex-serving <sup>(c)</sup>	
	Number	%	Number	%	Number	%
Sex/gender <sup>(d)</sup>						
Male	50,276	84.4	38,705	85.4	79,821	84.4
Female	9,292	15.6	6,638	14.6	14,733	15.6
Median age (years)	30	..	38	..	40	..
Service						
Navy	14,510	24.4	6,622	14.6	19,185	20.3
Army	30,467	51.1	32,133	70.9	58,712	62.1
Air Force	14,591	24.5	6,588	14.5	16,658	17.6
Operational service <sup>(e)</sup>						
Any	24,292	40.8	12,256	27.0	9,820	10.4
None	21,465	36.0	14,023	30.9	37,530	39.7
Rank group <sup>(f)</sup>						
Commissioned officer	15,196	25.5	11,886	26.2	18,607	19.7
All ranks other than commissioned officer	44,372	74.5	33,457	73.8	75,948	80.3
<b>Total</b>	<b>59,568</b>	<b>100.0</b>	<b>45,343</b>	<b>100.0</b>	<b>94,555</b>	<b>100.0</b>

(a) Includes 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).

(b) Includes 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).

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

(d) One (1) individual in the ex-serving group with missing information on this variable is excluded from counts by sex/gender.

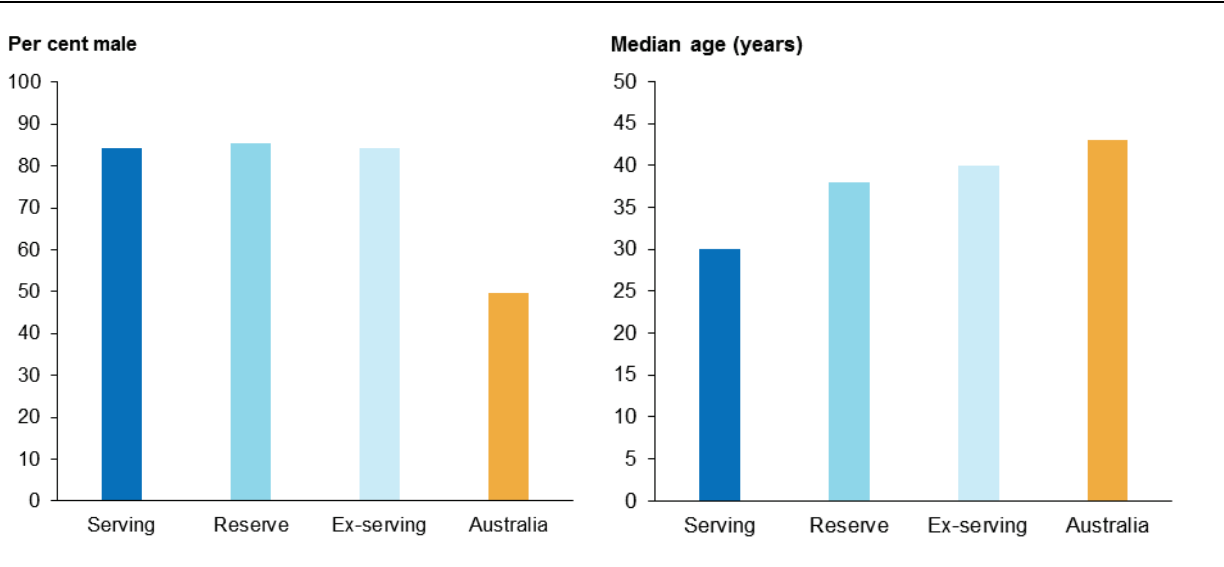
(e) Operational service falls into four broad categories: warlike, non-warlike, overseas and domestic. Individuals with at least one type of operational service are counted in 'Any', and those with no operational service are counted in 'None'. Only operational service since 1 January 1999 has been consistently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

(f) Ranks are broadly grouped into 'Commissioned officer' and 'All ranks other than commissioned officer' (see Appendix Table A5.1 for a full list of ADF ranks included in these groups). Counts for 'All ranks other than commissioned officer' also include 2 individuals with unknown rank.

*Note:* Columns may not add due to rounding.

*Source:* AIHW analysis of linked PMKeyS–NDI data 2001–2015.

The general Australian population (aged 16–85) is 50% male and has a median age of 43. In comparison, the ADF population (aged 16–85) has a higher proportion of men (84%–85%) and is younger (median age 30–40) (Figure 3.1). These differences have been taken into account in the population comparisons presented in chapters 5 and 6.



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

**Figure 3.1: Key demographic characteristics of the ADF and Australian populations aged 16–85, 2001–2015**

## 4 Incidence of suicide 2001–2015

### Summary of key findings

Between 2001 and 2015, there were 325 certified suicide deaths among people with at least 1 day of ADF service since 2001.

Of these deaths:

- 51% (166) were of people no longer serving at the time of their death (ex-serving group)
- 28% (90) were of people serving full time at the time of their death
- 21% (69) were of people serving in the active and inactive reserves at the time of their death.

Men made up the clear majority of these suicide deaths (93% or 303 deaths) and 84% of the ADF populations examined in this study.

Women made up the remaining 7% of suicide deaths in the ADF population (22 deaths), including 11 suicide deaths in ex-serving women.

As published in the summary report (AIHW 2017b), this study identified a total of 325 certified suicide deaths between 2001 and 2015 among serving, reserve and ex-serving personnel with at least 1 day of ADF service in that period. This total comprises 90 suicide deaths in the population serving full time, 69 in the reserve population and 166 in the ex-serving population.

Men accounted for more than 9 in 10 suicide deaths (303 deaths, 93%) and 84% of the ADF populations examined in this study. Women accounted for 22 suicide deaths (7%), including 11 suicide deaths in ex-serving women.

The largest number of suicide deaths occurred in serving, reserve and ex-serving personnel aged 18–29 (132, 41%). There were 92 suicide deaths (28%) in serving, reserve and ex-serving personnel aged 30–39 and 101 suicide deaths in those aged 40–69 (31%).

## 5 Comparative suicide rates 2002–2015

### Summary of key findings

#### Men

- Men serving full time or in the reserves had significantly lower suicide rates than for men in the general population (53% and 49% lower, respectively), after adjusting for age.
- The crude suicide rate for all ex-serving men was more than twice as high as for those serving full time or in the reserves (26 suicide deaths per 100,000 population, compared with 11 and 12 per 100,000, respectively).
- After adjusting for age, the suicide rate for all ex-serving men was also slightly higher than for their counterparts in the general population (14% higher; however, this difference was not statistically significant).
- Ex-serving men aged 18–24 were at particular risk—2 times more likely to die from suicide than Australian men of the same age.
- Ex-serving men aged 25–29 accounted for slightly more deaths than other age groups and were 1.4 times more likely to die from suicide than Australian men of the same age. This difference was not statistically significant.
- The suicide rate for ex-serving men aged 50–84 was significantly lower than rates for ex-serving men aged 18–24, 25–29, 30–34, 35–39, 40–44 and 45–49. Suicide rates for men in these age groups were between 3 and 4 times as high as for men aged 50–84.

#### Women

- The rate of suicide death among women in all service groups (serving, reserve and ex-serving) was highest for those aged 18–29. This was slightly higher than the rate in Australian women of the same age; however, this difference was not statistically significant.
- Ex-serving women had lower crude suicide rates than ex-serving men. The crude suicide rate in ex-serving men was 2.6 times as high as the crude rate in ex-serving women.

#### Changes over time

Analyses of changes over time were conducted for the periods 2007–2009 to 2013–2015 and showed that:

- rates for men in the serving and reserve populations have been relatively stable across the study period
- while there appears to be a slight increase in the rate of suicide for ex-serving men over the study period (largely driven by increases in the suicide rate for those aged 18–29 during this time), these increases were not statistically significant
- The AIHW will continue to monitor trends in suicide deaths as more years of data become available.

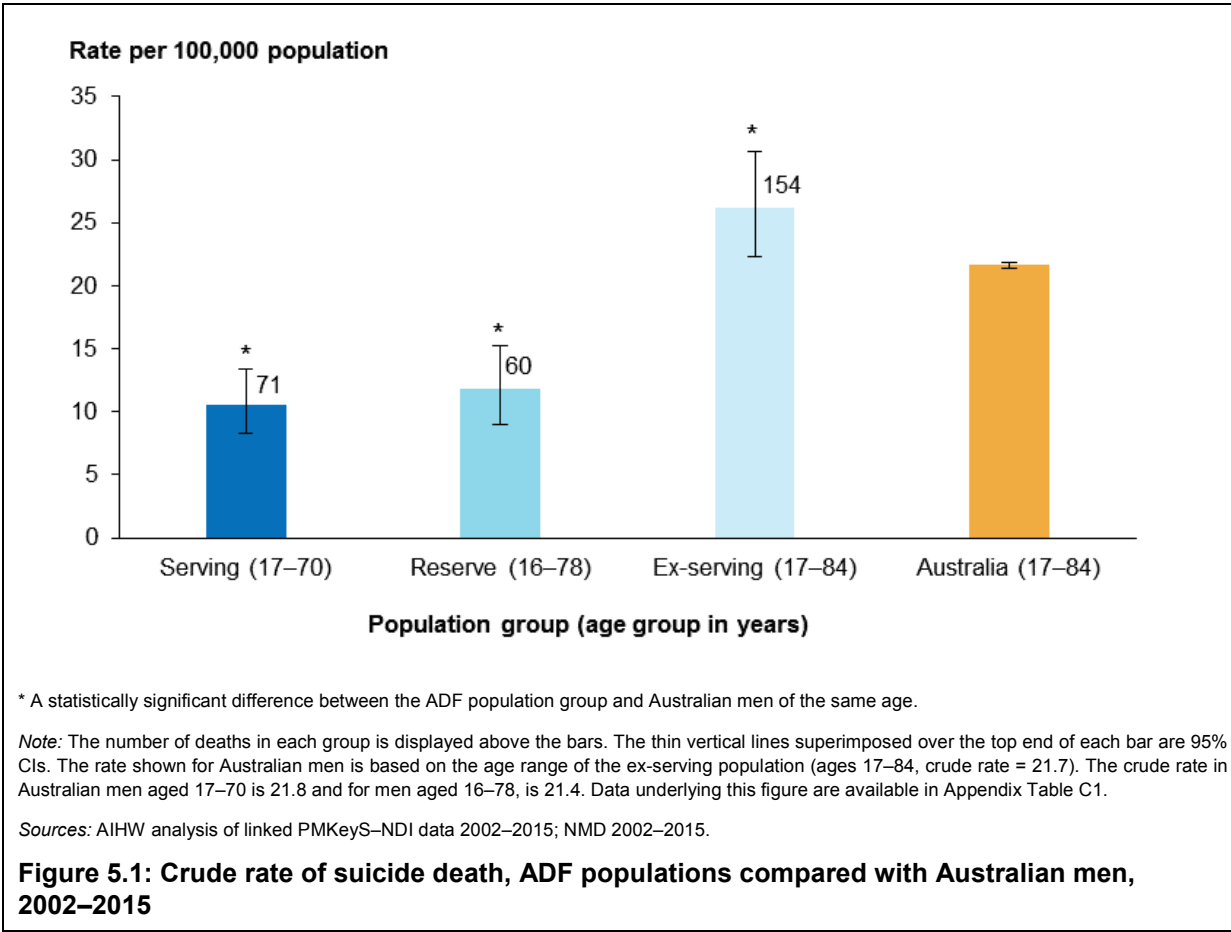
In examining whether ADF service has an impact on the incidence of suicide in serving full time, reserve and ex-serving personnel, it is important to consider rates of suicide across these groups within the context of suicide rates for the wider community. In other words, it is necessary to examine whether suicide rates for each service group are significantly higher than, lower than or the same as rates for the Australian population from which the defence forces are recruited—and hence whether there is evidence of service being associated with suicide risk.

It is not possible in the current study to account for all potential differences—such as marital and mental health status—between people who enter the ADF and those who do not. However, it is possible to account for two key demographic factors—age and sex—when comparing the ADF service groups and the general Australian population.

Crude and age-adjusted suicide rates for men and women are now presented, followed by an analysis by age across service groups, and compared with the Australian population.

### Men: crude rates by service status

Between 2002 and 2015, there were 71 suicide deaths among serving men (a crude rate of 11 per 100,000 population) and 60 suicide deaths among men in the reserves (a crude rate of 12 per 100,000—see Figure 5.1). Both these rates were significantly lower than the crude suicide rate for men in the Australian population (22 per 100,000 population).

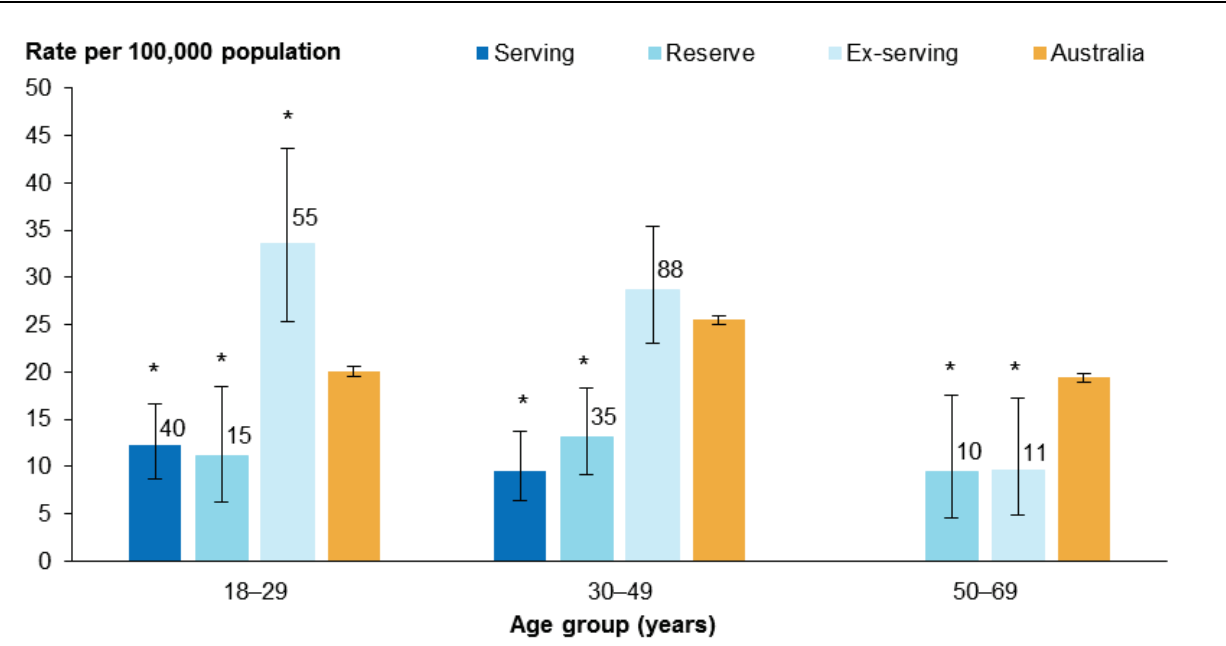


During the same period, there were 154 suicide deaths among the ex-serving population, a crude rate of 26 per 100,000 population. This rate was more than twice as high as rates for

the serving full time and reserve populations and 1.18 times as high as (18% higher than) the crude suicide rate for men in the Australian population (22 per 100,000 population). This difference is statistically significant but does not take into account differences in the age structure between the two populations.

### ADF populations by age

Between 2002 and 2015, younger ex-serving men had a higher rate of suicide death than Australian men of the same age (Figure 5. 2).



\* A statistically significant difference between the ADF population group and Australian men of the same age.  
 Note: The number of deaths in each group is displayed above the bars. Numbers not shown have been suppressed to ensure confidentiality. The thin vertical lines superimposed over the top end of each bar are 95% CIs. Data underlying this figure are available in Appendix Table C2.  
 Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; NMD 2002–2015.

**Figure 5.2: Age-specific rate of suicide death, by broad age group, ADF populations and all Australian men, 2002–2015**

The rate of suicide among ex-serving men aged 18–29 was 1.7 times as high as the rate in men of the same age in the Australian population (34 per 100,000 population compared with 20 per 100,000 for Australian men). The age-specific rate in the 30–49 age group was also higher than that for Australian men (29 per 100,000 population compared with 26 per 100,000 for Australian men) but the difference was not statistically significant.

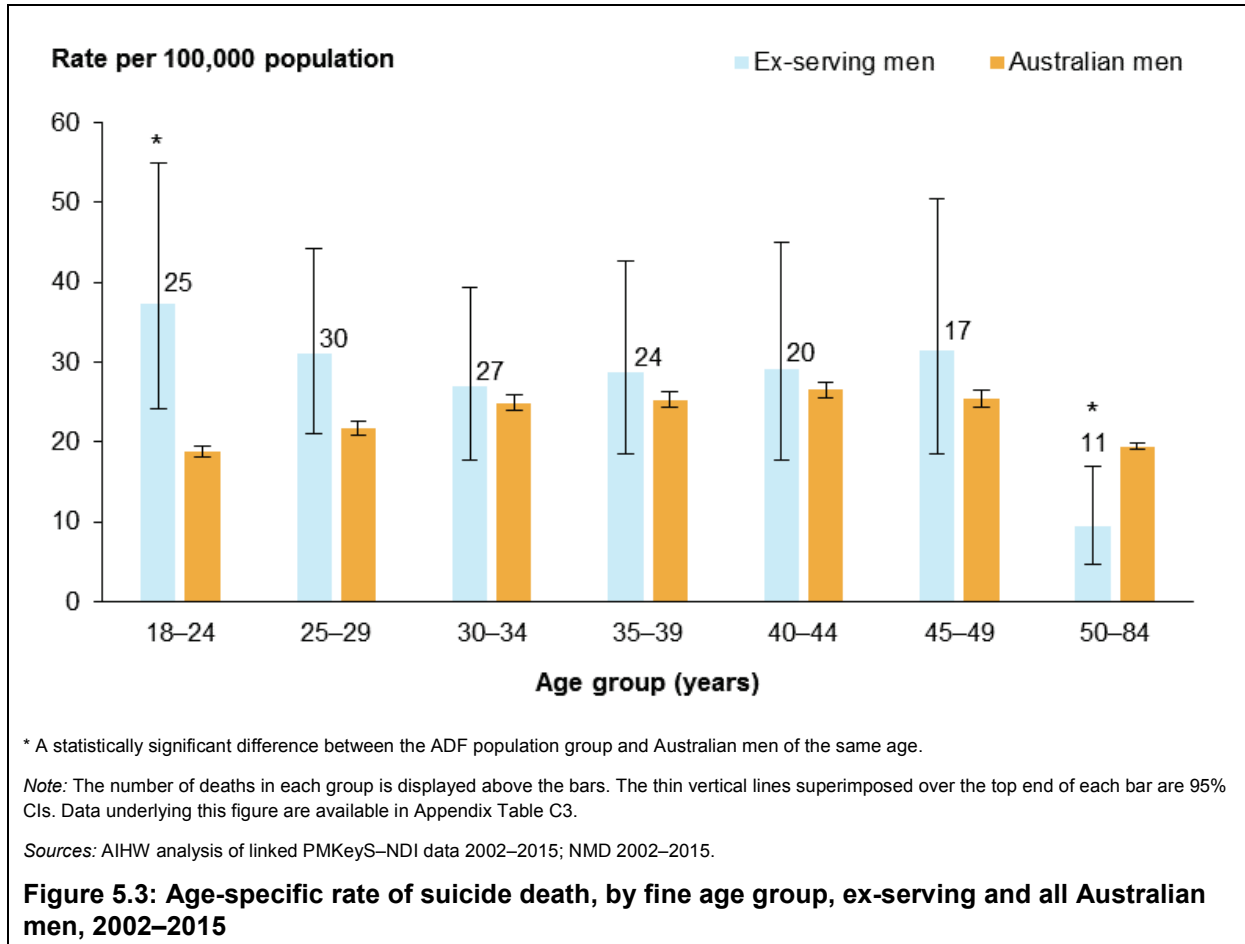
Compared with Australian men of the same age, age-specific rates were significantly lower for the following groups: men serving full time aged 18–29 and 30–49; men in the reserves aged 18–29, 30–49 and 50–69; and ex-serving men aged 50–69.

The rate for serving men aged 50–69 has not been shown due the small number of deaths in this age group.

The small number of suicide deaths in the serving full time and reserve populations prevented analysis using smaller age groupings.

## Ex-serving men by age

Between 2002 and 2015, there was little difference in the age-specific rates of suicide among ex-serving men aged under 50 (ranging from 27 per 100,000 population in the 30–34 age group to 37 per 100,000 population in the 18–24 age group) (Figure 5.3). The suicide rate was much lower among ex-serving men aged 50–84 (9 per 100,000; statistically different), where rates for the other age groups were between 3 and 4 times as high.



In the period 2002–2015, younger ex-serving men aged 18–29 had a higher rate of suicide death than all Australian men of the same age.

Ex-serving men aged 18–24 had a suicide rate twice that of Australian men of the same age (37 per 100,000 population compared with 19 per 100,000). This difference was statistically significant.

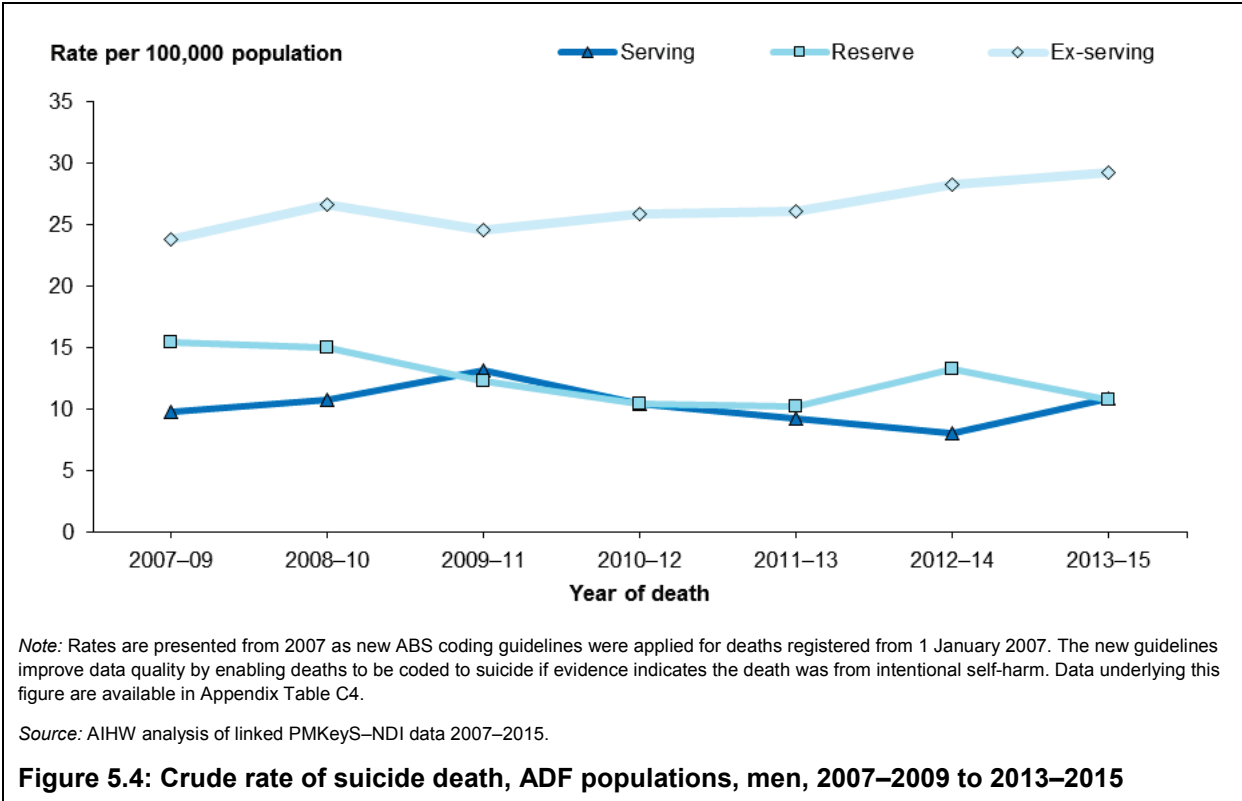
Ex-serving men aged 25–29 had a suicide rate 1.4 times as high as that for Australian men of the same age (31 per 100,000 population compared with 22 per 100,000). However, the difference was not statistically significant.

## Changes over time

There were 28 suicide deaths among ex-serving men in the 3-year period from 2007 to 2009, 42 between 2010 and 2012, and 60 between 2013 and 2015. While this suggests an increase in the number of suicides over the period (2007–2009 to 2013–2015), the ex-serving population was increasing by around 5,000 people per year; this increase in the number of suicides was only marginally higher than would be expected from increases in the

ex-serving population during this time. Therefore, it is important to look at rates to account for the increasing size of the study population.

Rates of the number of suicides per 100,000 population (crude rates) are presented in Figure 5.4. These are considered a better measure to assess changes over time than the number of deaths as they take into account changes in the size of the underlying population. Due to changes in ABS coding guidelines for suicide deaths, rates for this section are presented from 2007.



Between 2007–2009 and 2013–2015, the crude rate of suicide among:

- serving men, fluctuated around 10 per 100,000 population
- the reserve population, fluctuated between 10 and 15 per 100,000 population
- the ex-serving population, gradually increased from 24 per 100,000 in 2007–2009 to 29 per 100,000 in 2013–2015 (but this increase was not statistically significant based on overlapping CIs) (Figure 5.4).

From 2010–2012 onwards, crude suicide rates for the ex-serving population were significantly higher than those for the serving population. They were also significantly higher than those for the reserve population across the same period, except for the period 2012–2014.

**Changes over time: ex-serving men by age**

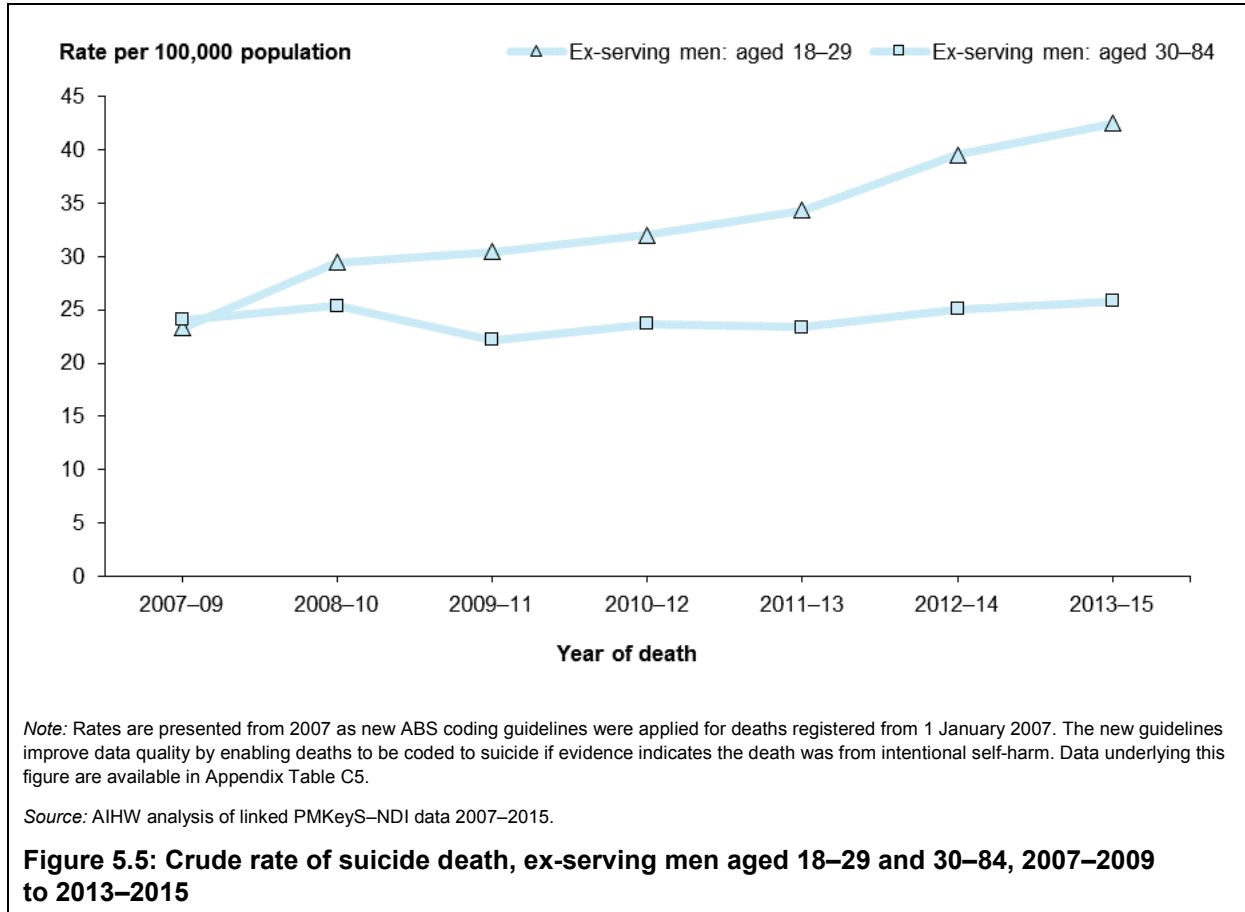
Between 2007–2009 and 2013–2015, crude suicide rates for ex-serving men aged 18–29 tended to be higher than rates for ex-serving men aged 30–84 (Figure 5.5). However, these differences were not statistically significant.

During this period, suicide rates for men aged 18–29 increased from 23 per 100,000 population in 2007–2009 to 42 per 100,000 in 2013–2015. This increase was not statistically



significant based on overlapping CIs, but this will continue to be monitored as more years of data become available.

Crude suicide rates for men aged 30–84 fluctuated between 23 and 26 per 100,000 population during the same period.



## Women: crude rates

In 2002–2015, there were 19 suicide deaths among women with at least 1 day of service on or after 1 January 2001; 11 were ex-serving personnel.

The crude rate of suicide death in ex-serving women was 10 per 100,000 population. The crude suicide rate for ex-serving men is 2.6 times as high as this (26 per 100,000). This suggests that ex-serving men have higher crude suicide rates than ex-serving women.

The suicide rate in younger women (aged 18–29) across all service groups (serving full time, reserve and ex-serving) was 1.8 times as high as the rate for women aged 30–69.

The rate of suicide death among women in all service groups (serving, reserve and ex-serving) aged 18–29 was 9 per 100,000 population, which is higher than the rate in Australian women of the same age (6 per 100,000). This difference was not statistically significant.

The rate of suicide death among women across all service groups aged 30–69 was 5 per 100,000 population, which is lower than the rate in Australian women of the same age (7 per 100,000). This difference was not statistically significant.

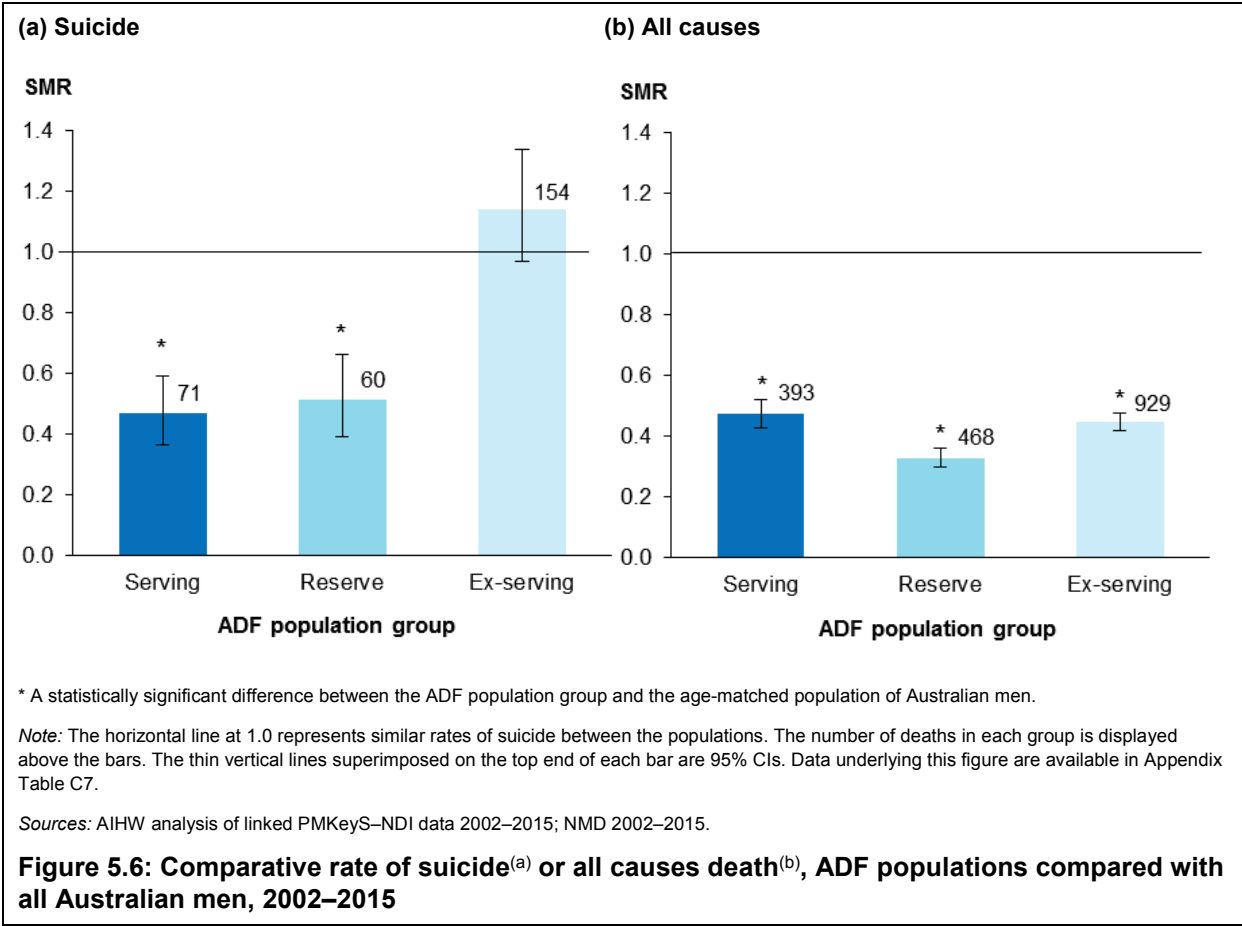
It is important to note that these findings are based on small numbers of deaths. Due to the small number of women in the study, it was not possible to perform any further analysis of this group.

## Taking into account different age structures in overall rates

Overall crude rates do not take into account differences in age structure between populations. The ADF study populations (that is, the three ADF service status groups) and the Australian population have different age structures; the ADF populations have a younger age profile than the Australian population (see Figure 3.1 in 'Chapter 3 Study populations').

In this study, the SMR is used to control for the difference in age structures between study populations and the Australian population.

In the period 2002–2015, compared with all Australian men, the suicide rate was 53% lower (SMR = 0.47) among men serving full time and 49% lower (SMR = 0.51) among men in the reserve population, after adjusting for age (Figure 5.6). These differences were statistically significant.



The rate of suicide was 14% higher (SMR = 1.14) among ex-serving men than among all Australian men, after adjusting for age. This difference was not statistically significant.

This finding is more precise than the significant finding based on crude rates (18% higher) reported earlier in the section headed 'Men: crude rates by service status' on page 27 as it takes into account the different age structures across the two populations.

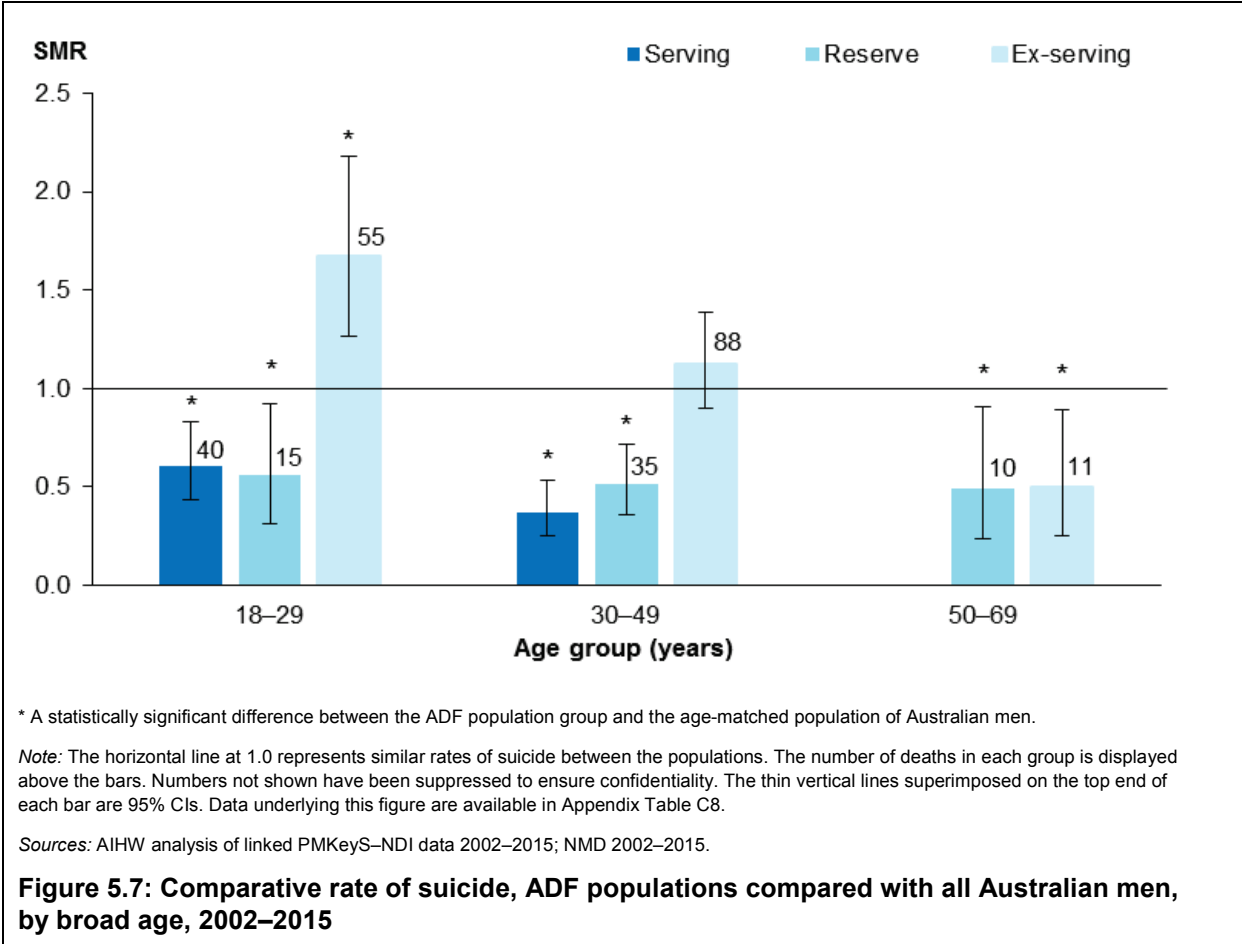
In the period 2002–2015, all-cause mortality rates were similar in men across each of the ADF service groups (serving full time, in the reserves and ex-serving), and significantly lower when compared with all-cause mortality rates for Australian men of the same age.

The all-cause mortality rate was 53% lower (SMR = 0.47) among men serving full time, 67% lower (SMR = 0.33) among men in the reserves and 55% lower (SMR = 0.45) among ex-serving men when compared with an age-matched population of Australian men. These differences were all statistically significant.

**ADF populations: standardised mortality ratios by age**

In the period 2002–2015, men serving full time and in the reserves across all age groups had lower rates of suicide death compared with all Australian men of the same age (Figure 5.7).

The rate of suicide among ex-serving men aged 18–29 was 1.7 times as high as the rate in men of the same age in the Australian population (SMR = 1.7). The age-specific rate in the 30–49 age group was also higher than that for the Australian population (SMR = 1.1) but the difference was not statistically significant. For ex-serving men aged 50–69, the rate of suicide was half that in Australian men of the same age (SMR = 0.5). This difference was statistically different.



The rate for serving men aged 50–69 has not been shown due the small number of deaths in this age group.

## Ex-serving men: standardised mortality ratios by age

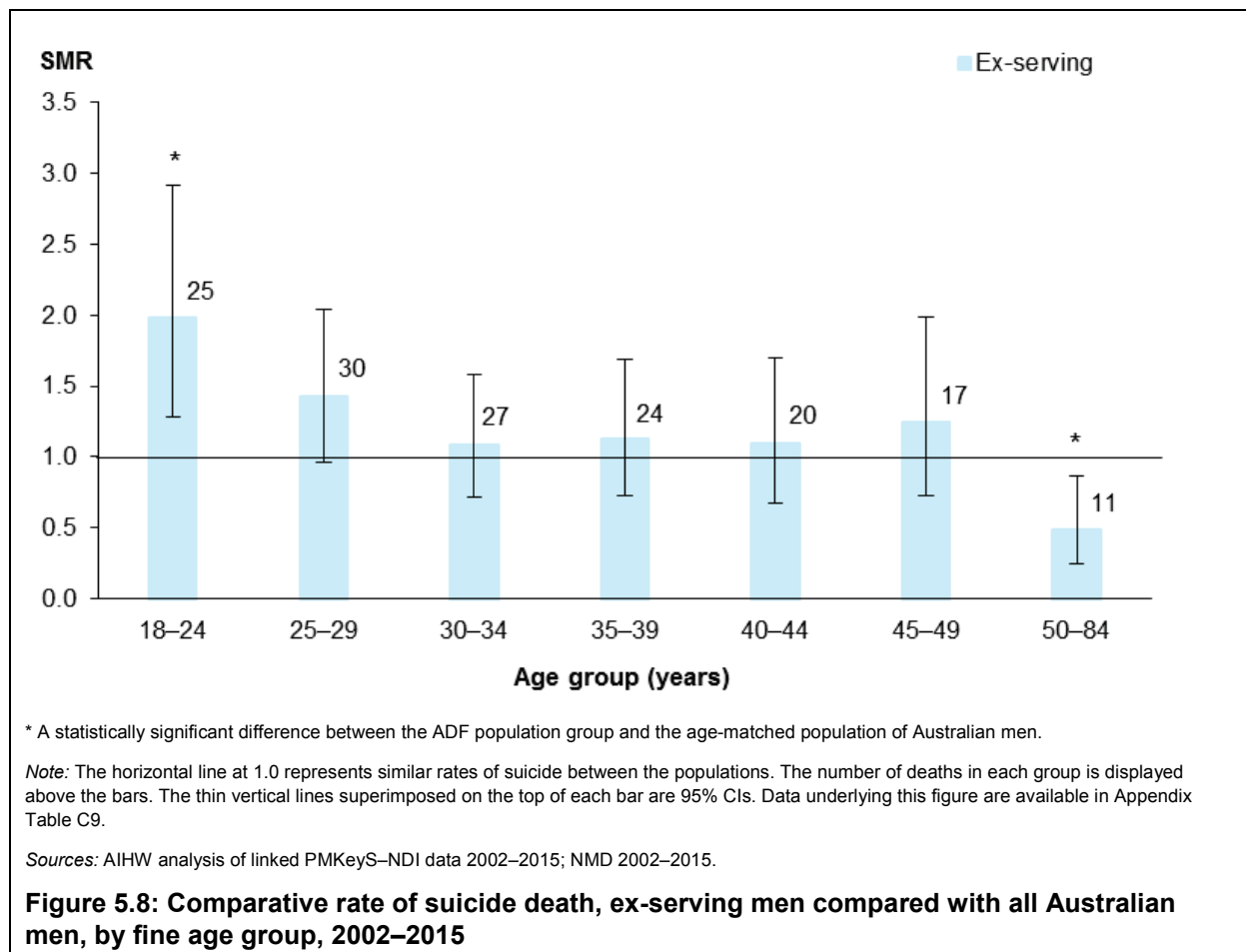
In the period 2002–2015, younger ex-serving men had a higher rate of suicide death than all Australian men of the same age (Figure 5.8).

Among ex-serving men, those aged 18–24 accounted for 1 in 6 suicide deaths (25 deaths, 16%) and had a suicide rate twice that of Australian men of the same age (SMR = 2.0). This difference was statistically significant.

Ex-serving men aged 25–29 accounted for slightly more deaths overall (30 deaths, 19%) and had a suicide rate 1.4 times as high as that for Australian men of the same age (SMR = 1.4). However, the difference was not statistically significant.

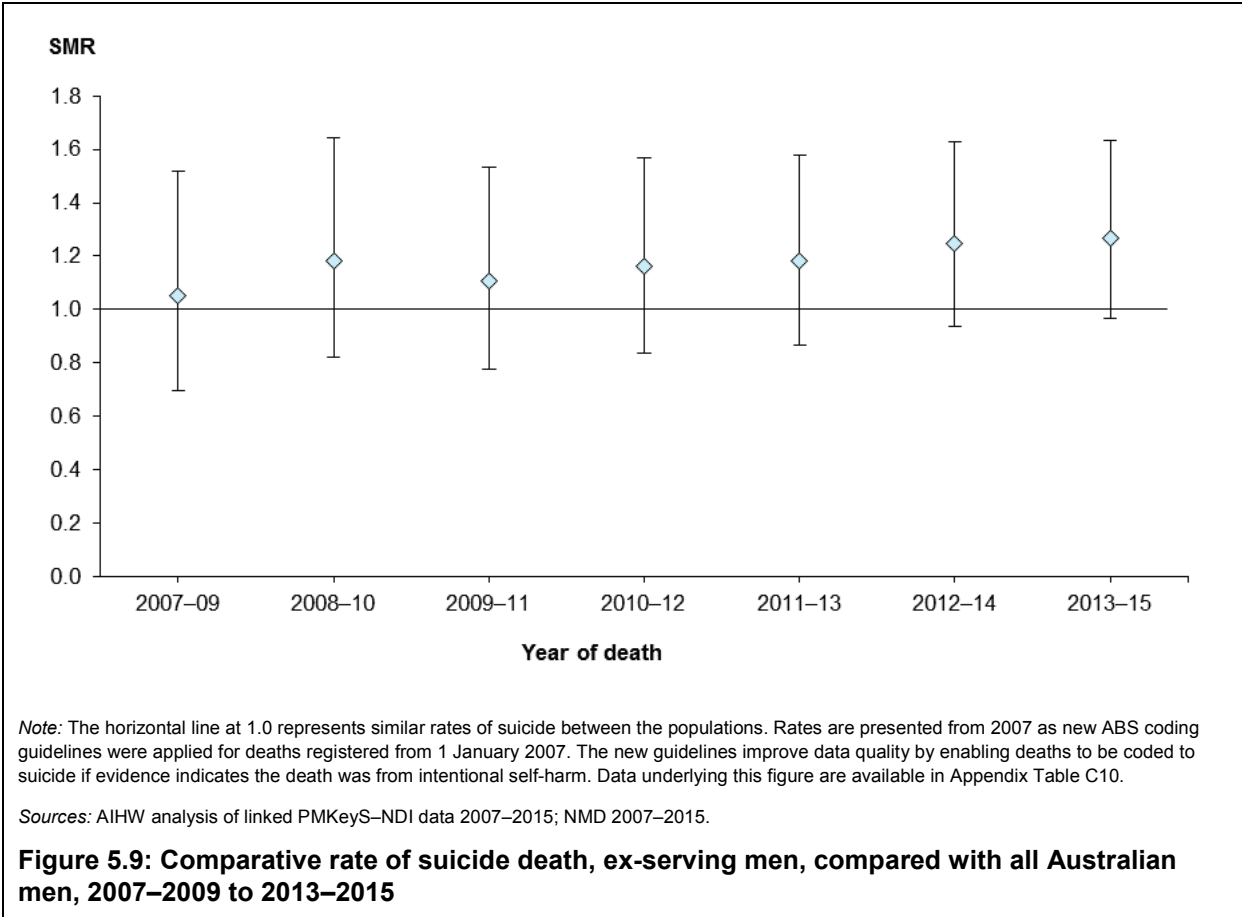
The suicide rates in ex-serving men aged 30–34, 35–39, 40–44 and 45–49 were similar to the rates for Australian men of the same age.

The suicide rate in ex-serving men aged 50–84 was 51% lower than the rate for Australian men of the same age (SMR = 0.49). This difference was statistically significant and based on 11 suicide deaths in ex-serving men in this age group.



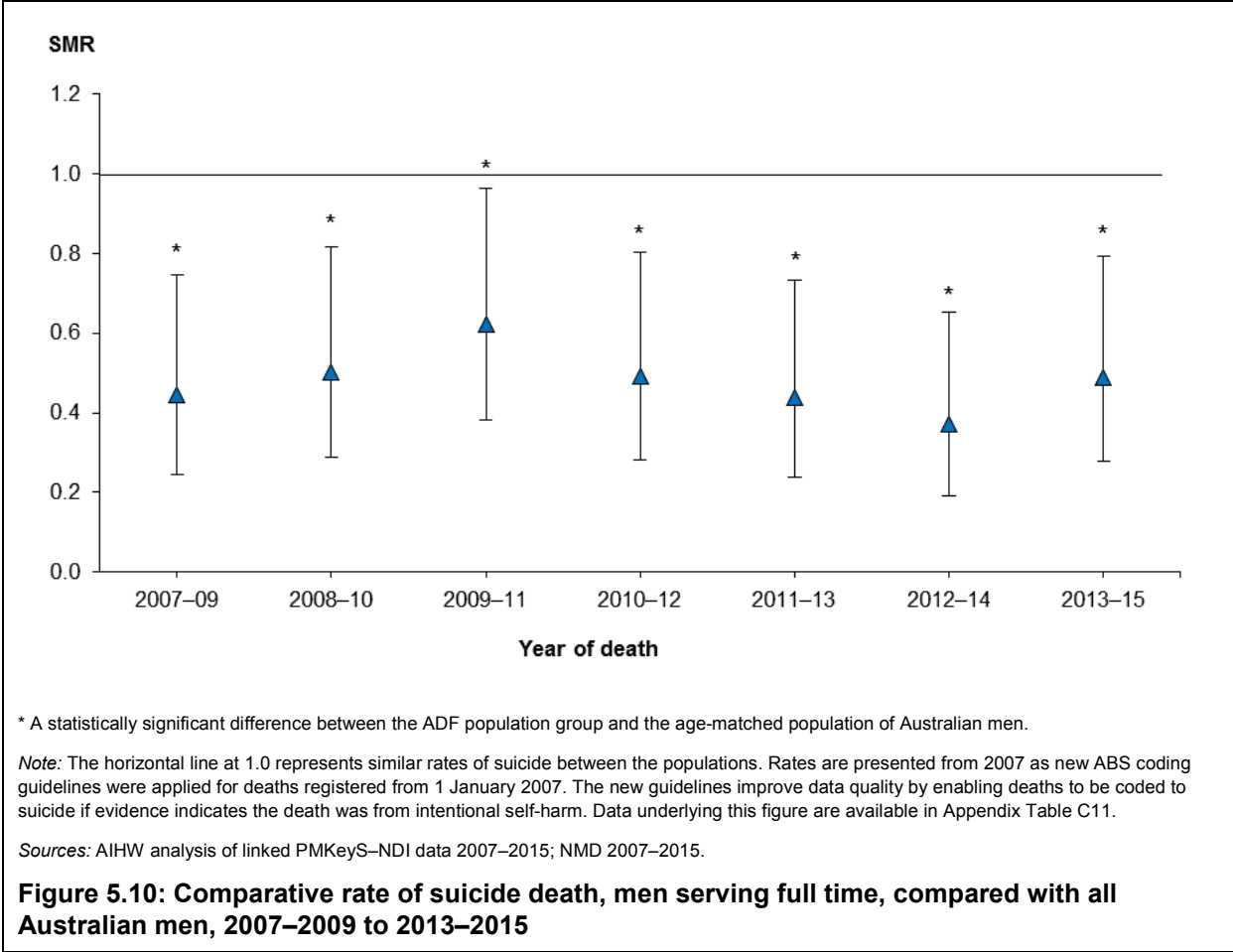
### Standardised mortality ratios by period

There is no statistical difference in suicide rates among ex-serving men across all periods from 2007–2009 to 2013–2015 when compared with rates of suicide in Australian men, and adjusted for age. During this period, suicide rates for ex-serving men ranged from 1.1 times as high (SMR = 1.1) as that for Australian men in 2007–2009 to 1.3 times as high (SMR = 1.3) in 2013–2015 (Figure 5.9).

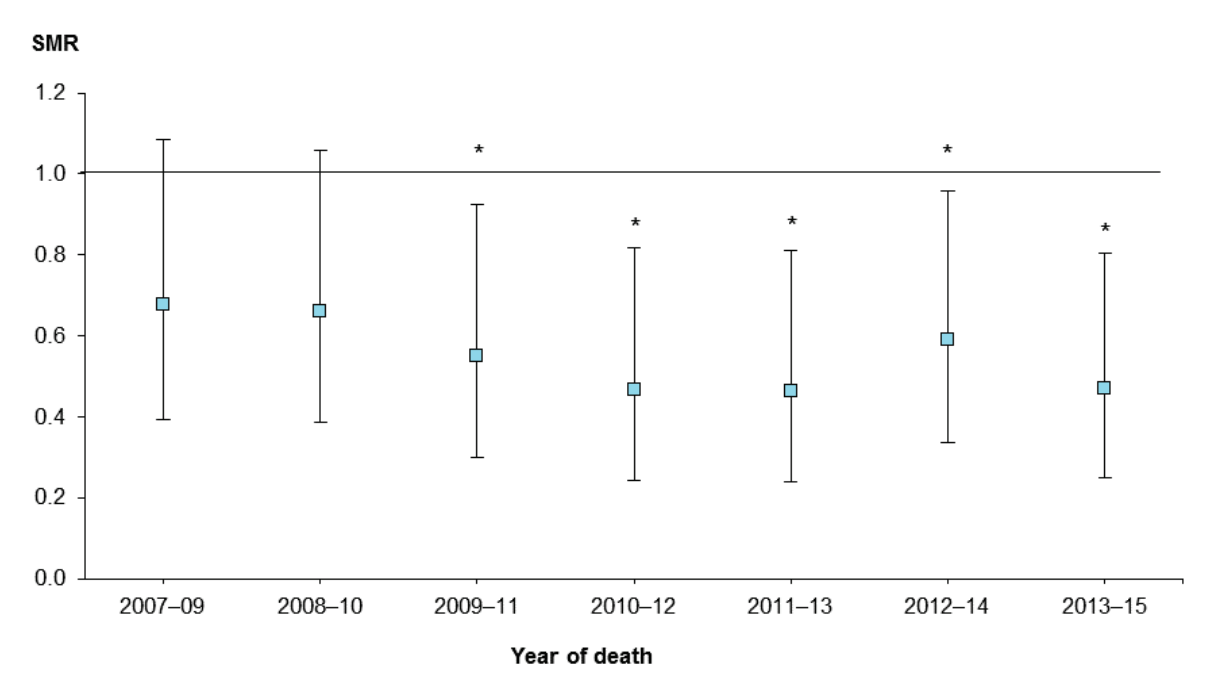


After adjusting for age, suicide rates for men serving full time and in the reserves tended to be lower than in all Australian men between 2007–2009 and 2013–2015.

Suicide rates for men serving full time were significantly lower than rates for the Australian male population during the whole period (Figure 5.10). Rates for men serving full time ranged between 38% lower (SMR = 0.62) in 2009–2011 to 63% lower (SMR = 0.37) in 2012–2014 when compared with an age-matched population of Australian men.



For men in the reserves, suicide rates were significantly lower than rates for the Australian male population from 2009–2011 onwards (Figure 5.11). When compared with an age-matched population of Australian men, rates for men in the reserves ranged from 32% lower (SMR = 0.67) in 2007–2009 to 54% lower (SMR = 0.46) in 2011–2013.



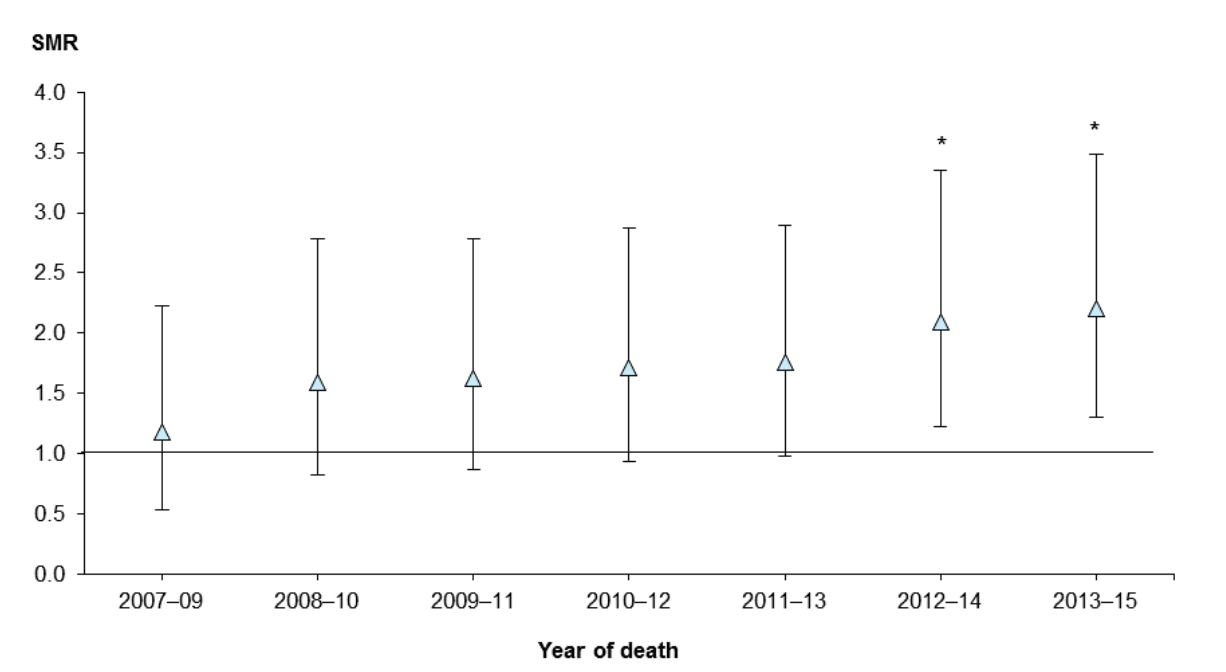
\* A statistically significant difference between the ADF population group and the age-matched population of Australian men.  
 Note: The horizontal line at 1.0 represents similar rates of suicide between the populations. Rates are presented from 2007 as new ABS coding guidelines were applied for deaths registered from 1 January 2007. The new guidelines improve data quality by enabling deaths to be coded to suicide if evidence indicates the death was from intentional self-harm. Data underlying this figure are available in Appendix Table C12.  
 Sources: AIHW analysis of linked PMKeyS–NDI data 2007–2015; NMD 2007–2015.

**Figure 5.11: Comparative rate of suicide death, men in the reserves, compared with all Australian men, 2007–2009 to 2013–2015**

### Standardised mortality ratios for ex-serving men by period and broad age

Suicide rates for ex-serving men aged 18–29 were between 1.2 (SMR = 1.17) and 2.2 (SMR = 2.20) times as high as rates for Australian men, adjusted for age, in each period from 2007–2009 to 2013–2015 (Figure 5.12). When compared with rates for the Australian population, rates for ex-serving men aged 18–29 were significantly higher in 2012–2014 and 2013–2015.

Analysis of the crude rates for Australian men used calculating the SMR in Figure 5.12 show that the suicide rate in Australian men aged 18–29 remained largely stable between 2007–2009 and 2013–2015. In contrast, Figure 5.5 on page 31 shows that the crude suicide rate for ex-serving men aged 18–29 increased between 2007–2009 and 2013–2015 (although this increase was not significant based on overlapping CIs). This suggests that it is the (non-significant) increase in the rate of suicide death in ex-serving men aged 18–29 across the periods shown that is contributing to the significant difference in rates between Australian and ex-serving men in the 18–29 age group in the 2012–2014 and 2013–2015 periods.



\* A statistically significant difference between the ADF population group and the age-matched population of Australian men.

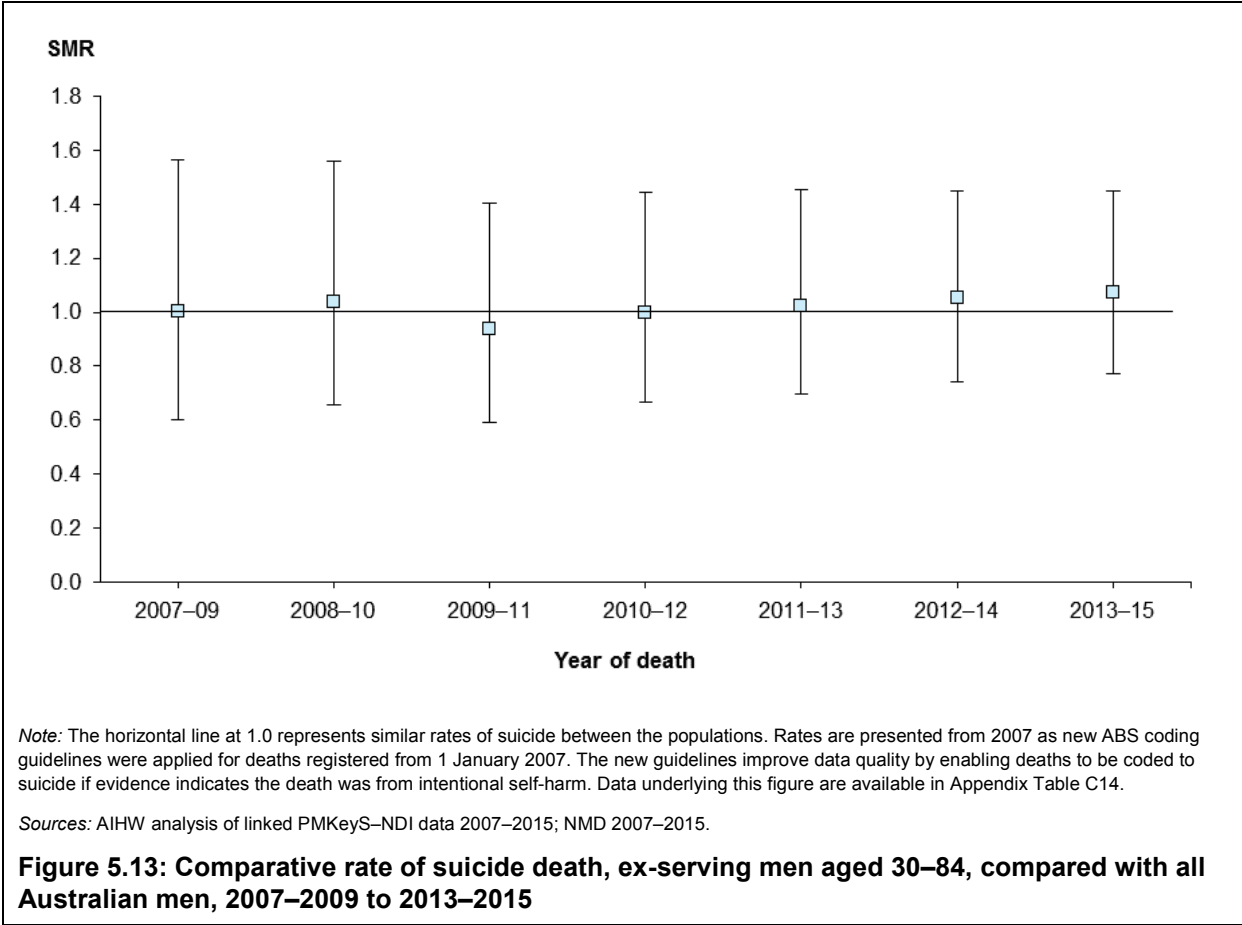
Note: The horizontal line at 1.0 represents similar rates of suicide between the populations. Rates are presented from 2007 as new ABS coding guidelines were applied for deaths registered from 1 January 2007. The new guidelines improve data quality by enabling deaths to be coded to suicide if evidence indicates the death was from intentional self-harm. Data underlying this figure are available in Appendix Table C13.

Sources: AIHW analysis of linked PMKeyS–NDI data 2007–2015; NMD 2007–2015.

**Figure 5.12: Comparative rate of suicide death, ex-serving men aged 18–29, compared with all Australian men, 2007–2009 to 2013–2015**



In contrast, suicide rates for ex-serving men aged 30–83 were similar to those in Australian men of the same age across the periods 2007–2009 to 2013–2015 (Figure 5.13).



## 6 Service-related characteristics associated with suicide death in ex-serving men

### Summary of key findings

Certain service-related characteristics were associated with higher suicide rates among ex-serving men, namely:

- those men discharged involuntarily (suicide rates were 2.4 times as high as for those discharged for voluntary reasons), particularly if the discharge was for medical reasons (3.6 times as high as for those discharged for voluntary reasons)
- those who left the ADF after less than 1 year of service (2.4 times as high as for those who had served for 10 years or more)
- all ranks other than commissioned officers (2.8 times as high as for commissioned officers).

Ex-serving men aged 18–29 with these characteristics (medical or other involuntary discharge, less than 1 year of service, or rank other than commissioned officer) had significantly higher suicide rates compared with Australian men of the same age. This is consistent with the findings for all ex-serving men aged 18–29.

For men discharged involuntarily for medical reasons, suicide rates were significantly higher in all age groups examined, compared with rates for all Australian men of the same age.

There was no significant difference in crude suicide rates between the different services (Army, Navy, Air force).

Analysis of operational service (deployment or operations) was limited to personnel hired on or after 1 January 1999. This showed that there was no significant difference between suicide rates for ex-serving men with any operational service experience and those with no operational service.

In total, 71% of suicide deaths of ex-serving personnel occurred in men discharged from the ADF for less than 6 years at the time of death. Suicide rates were compared for ex-serving men discharged: for less than 1 year, for between 1 and less than 6 years, and for between 6 and less than 13 years. There was no statistically significant difference in suicide rates for men across these groups.

This analysis looks only at each service-related characteristic associated with rate of suicide individually. See Chapter 7, 'Modelling suicide risk' for analysis which examines the factors most strongly associated with death due to suicide when all available service characteristics are controlled for.

This chapter presents more detailed analysis of suicide among the ex-serving ADF population discharged after 1 January 2001 and who died between 2002 and 2015. It explores service-related characteristics that may indicate groups at higher risk of suicide death in this population.

The summary report (AIHW 2017b) compared crude suicide rates across groups of ex-serving men with different service characteristics to identify those characteristics that may be influencing the higher overall rate of suicide in the ex-serving population. Service-related characteristics examined included service, rank, operational service (warlike or non-warlike operations and other designated domestic and international operations), length of service, and reason for discharge. These results are presented here again for completeness, followed by the detail behind these high-level results.

Age-specific rates are also examined for the full range of service-related characteristics, where numbers allow, and compared with age-specific rates for men in the Australian population. This highlights specific age groups that may be influencing higher overall crude suicide rates for each subpopulation.

It is important to note that while crude rates adjust for differences in population size, they do not adjust for differences in characteristics between groups. Therefore, it is possible that higher crude suicide rates may be associated with characteristics that have not been accounted for in the analysis, such as previous mental health conditions or marital status.

As well as an analysis of service-specific characteristics, an analysis of the timing of suicide death in relation to the date of separation from the ADF is also included in this chapter.

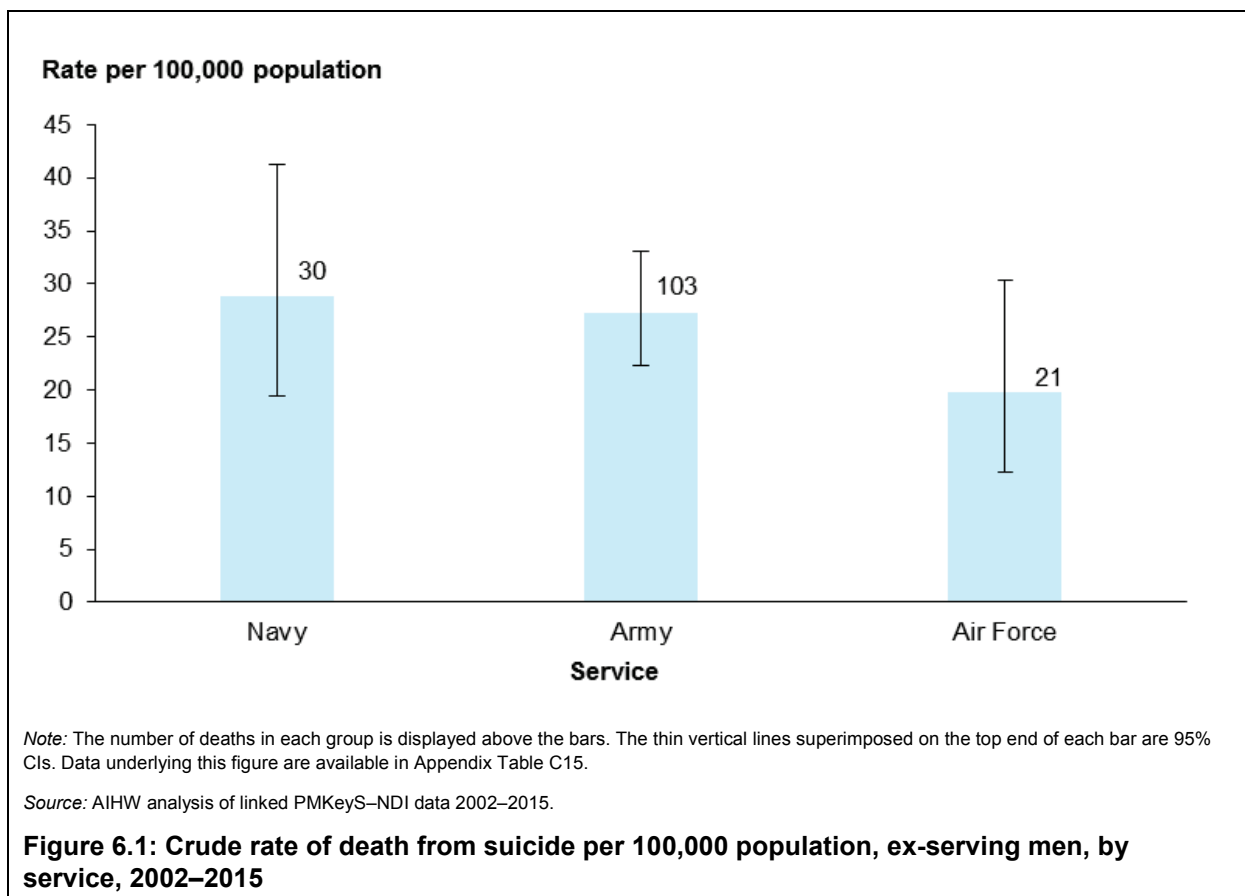
## Service

The ADF has three services: the Navy, Army and the Air Force. An individual can serve in more than one service during their ADF employment, but only the service at the time of separation for ex-serving personnel is available for this study.

Between 2002 and 2015, among ex-serving personnel, there were:

- 30 suicide deaths among those separated from the Navy, a crude suicide rate of 29 per 100,000 population
- 103 suicide deaths among those separated from the Army, a crude rate of 27 per 100,000
- 21 suicide deaths among those separated from the Air Force, a crude rate of 20 per 100,000 (Figure 6.1).

There was no significant difference in crude suicide rates between the different services.



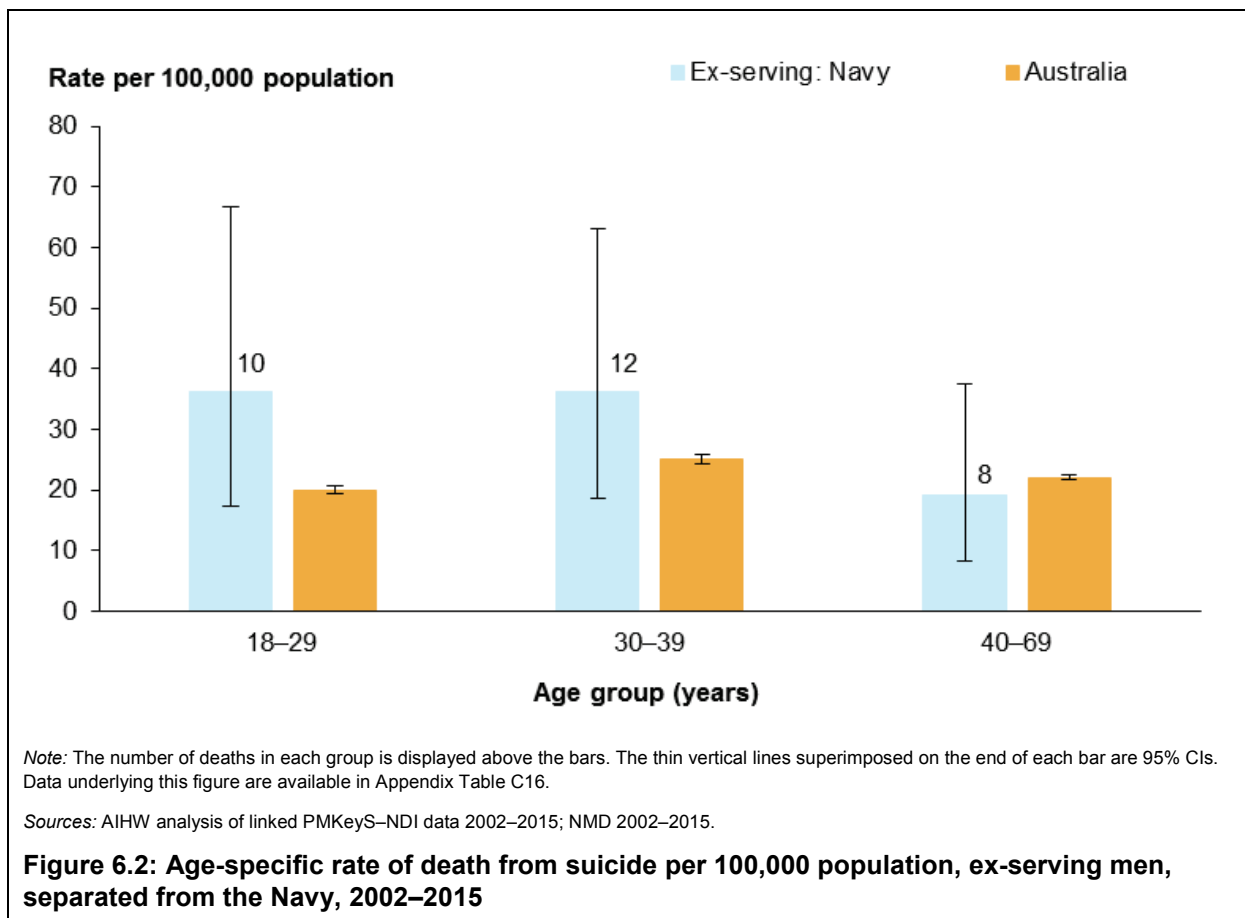
## Navy service by age

Age-specific suicide rates among ex-serving men who separated from the Navy have been grouped for ages 40–49 and 50–69 due to counts of fewer than 5 in one or both groups. Aggregation of these groups was considered appropriate as rates were similar across both groups and not grouping them would result in a loss of comparative information.

There was no significant difference in suicide rates by age group for ex-serving men aged 18–29, 30–39 and 40–69 separated from the Navy.

When compared with men in the Australian population of the same age, suicide rates were higher in those aged 18–29 and 30–39; however, these differences were not statistically significant (Figure 6.2). The highest number of deaths was in the 30–39 age group.

It is important to note, however, that rates for the 18–29 and 40–69 age groups are based on a small number of suicide deaths.



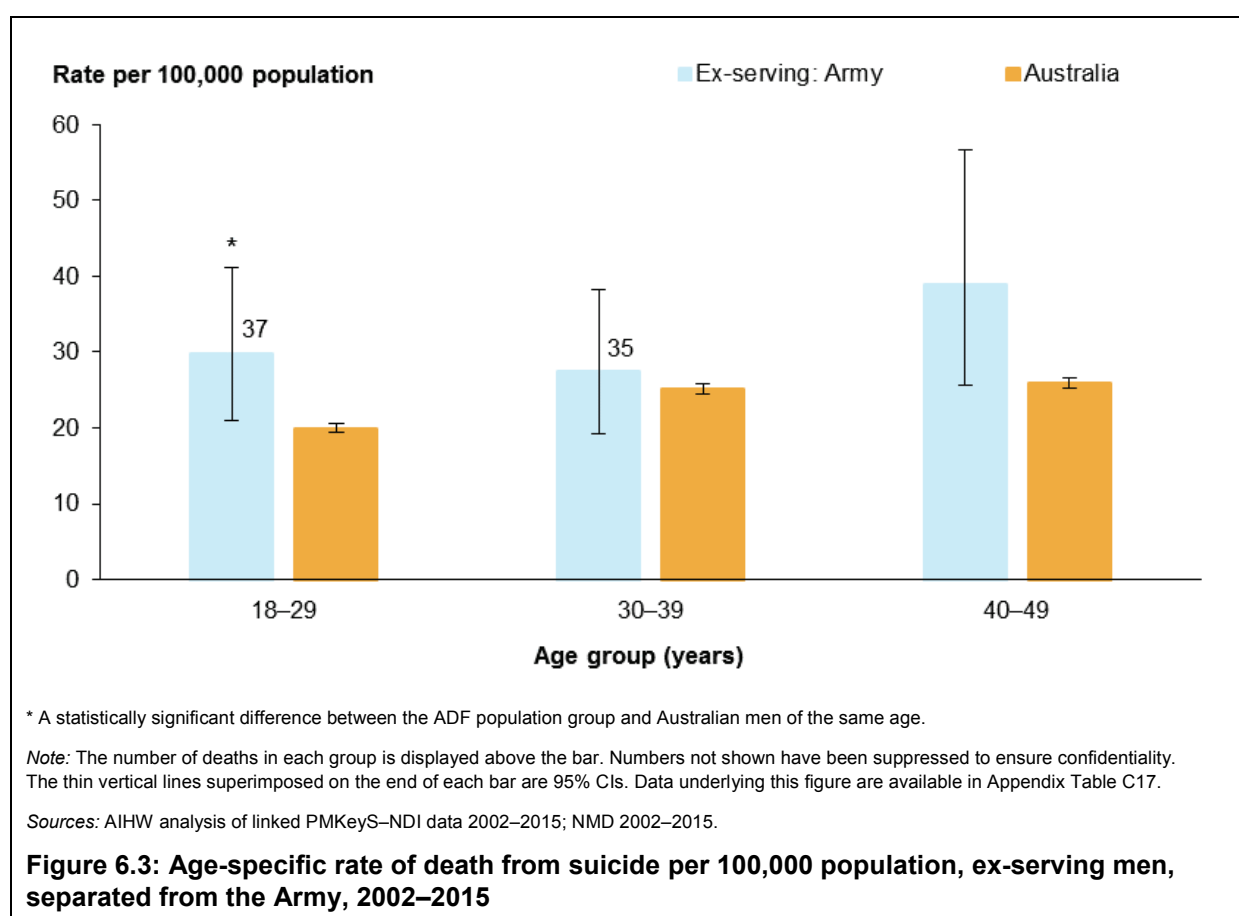
## Army service by age

There was no significant difference in suicide rates by age group for ex-serving men aged 18–49 separated from the Army (Figure 6.3). This is consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

The rate of suicide in men separated from the Army aged 18–29 was 1.5 times as high as the rate for Australian men of the same age (30 compared with 20 per 100,000 population). This difference was statistically significant and in line with findings for all ex-serving men aged 18–29 (see Figure 5.2 on page 28). The highest number of deaths was also in this age group.

There was no statistically significant difference in suicide rates for men separated from the Army aged 30–39 and 40–49 when compared with rates for Australian men of the same age.

The rate for men aged 50–69 has not been shown due the small number of deaths in this group.



### Air Force service by age

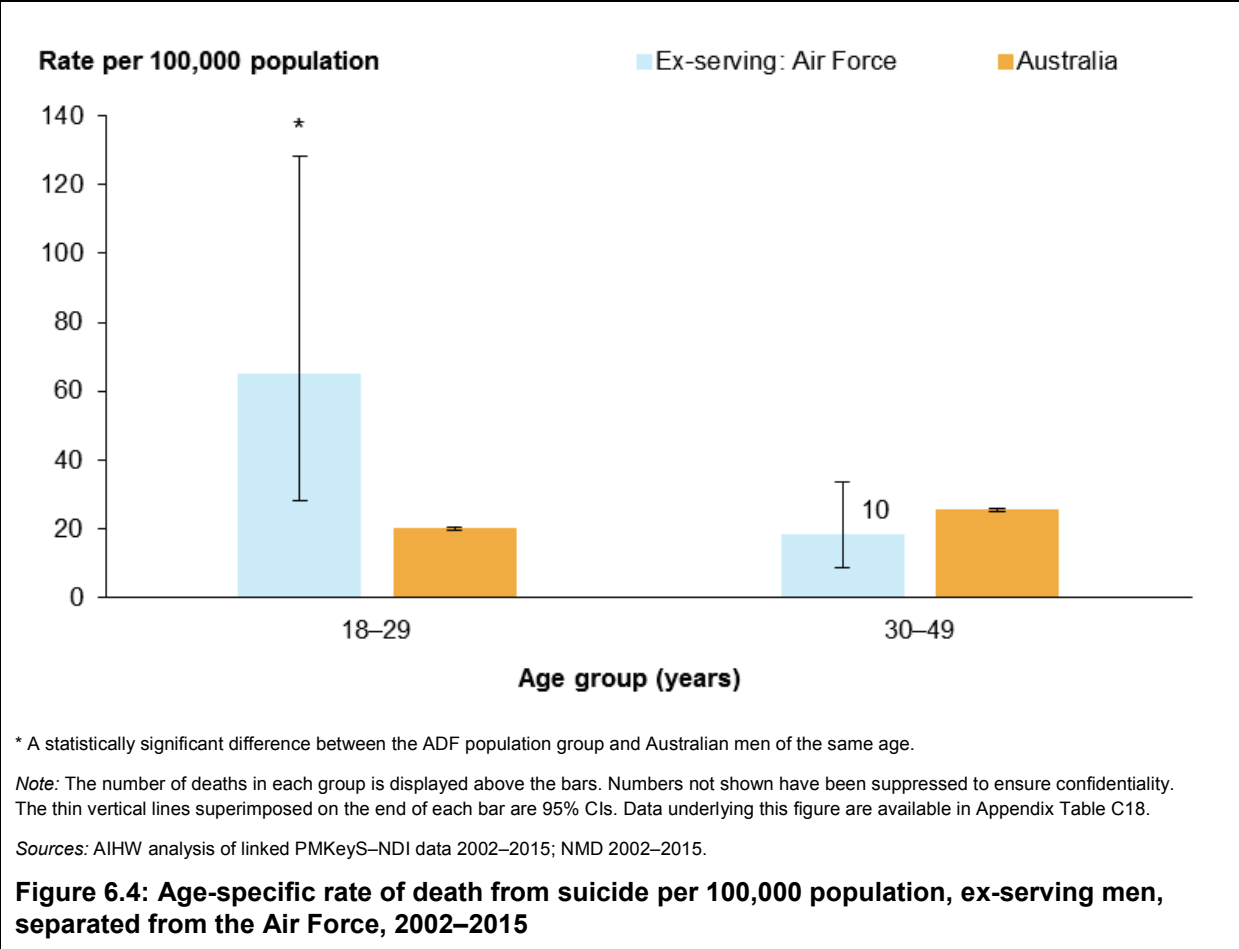
Age-specific suicide rates among ex-serving men who separated from the Air Force have been grouped for ages 30–39 and 40–49 due to counts of fewer than 5 in one of these groups. Aggregation of these groups was considered appropriate as rates were similar across both groups and not grouping them would result in a loss of information.

In men separated from the Air Force, the crude suicide rate for those aged 18–29 was 3.6 times as high as the rate for men aged 30–49 (65 compared with 18 per 100,000 population; Figure 6.4). This difference was statistically significant and differs from the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

The suicide rate for men aged 18–29 was also significantly higher when compared with the rate for Australian men of the same age (65 compared with 20 per 100,000 population; 3.2 times as high). This difference was in line with findings for all ex-serving men aged 18–29 when compared with Australian men of the same age (see Figure 5.2 on page 28).

The suicide rate for men aged 30–49 separated from the Air Force was not statistically different from the rate for Australian men of the same age.

It is important to note, however, that the rate for the 18–29 age group is based on a small number of suicide deaths. The rate for men aged 50–69 has not been shown due the small number of deaths in this age group.

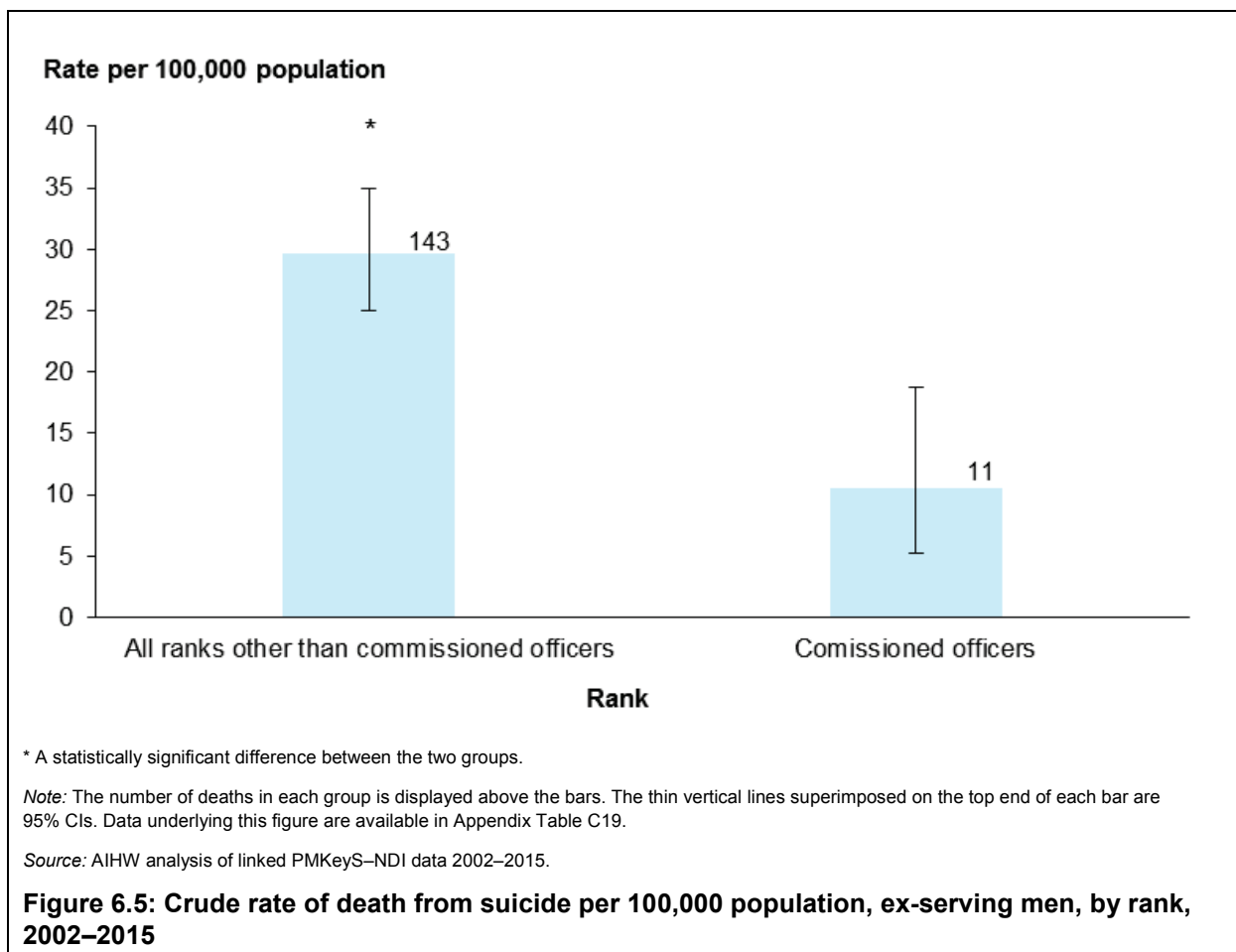


# Rank

Rank describes positions in the ADF operational hierarchy and is a proxy measure for socioeconomic status, including education, training and income. Analysis by rank is presented by two broad groups: commissioned officers, and all ranks other than commissioned officers (see Appendix Table A5.1 for a full list of ADF ranks included in these groups). Results of this analysis may indicate that personnel serving at different ranks in the ADF are at higher or lower risk of suicide.

Between 2002 and 2015, there were 11 suicide deaths among ex-serving personnel who were ranked as commissioned officers at the time of separation, a crude suicide rate of 11 per 100,000 population (Figure 6.5). Among ex-serving personnel serving in all ranks other than commissioned officers at the time of separation, the number of suicide deaths was 143, a crude rate of 30 per 100,000.

The crude suicide rate for those with a rank other than commissioned officer at discharge was 2.8 times as high as the rate for commissioned officers. This difference was statistically significant. These findings suggest that discharge in all ranks other than commissioned officers may be associated with higher crude rates of suicide in the ex-serving population.



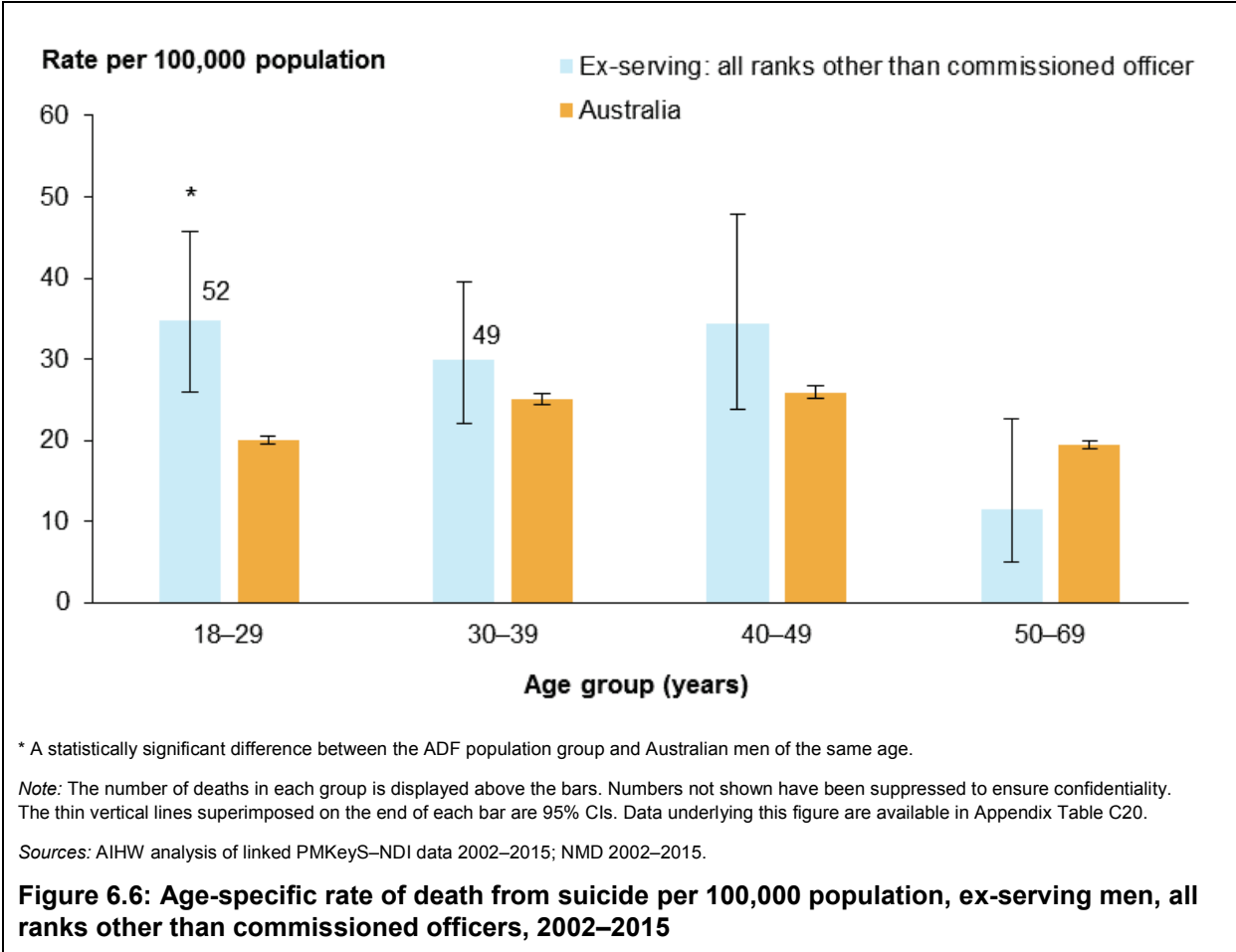


### All ranks other than commissioned officers by age

There was no significant difference in suicide rates by age group for ex-serving men aged 18–29, 30–39 and 40–49 separated in all ranks other than commissioned officer. The suicide rate among ex-serving men in all ranks other than commissioned officer aged 50–69 was significantly lower compared with rates for those aged 18–29, 30–39 and 40–49. These findings are consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

Men in all ranks other than commissioned officer aged 18–29 had a rate that was 1.7 times as high as Australian men of the same age (35 compared with 20 per 100,000 population). This difference was statistically significant and in line with findings for all ex-serving men aged 18–29 (see Figure 5.2 on page 28). The highest number of deaths was in the 18–29 age group.

It is important to note, however, that the rate in the 50–69 age group is based on a small number of suicide deaths.

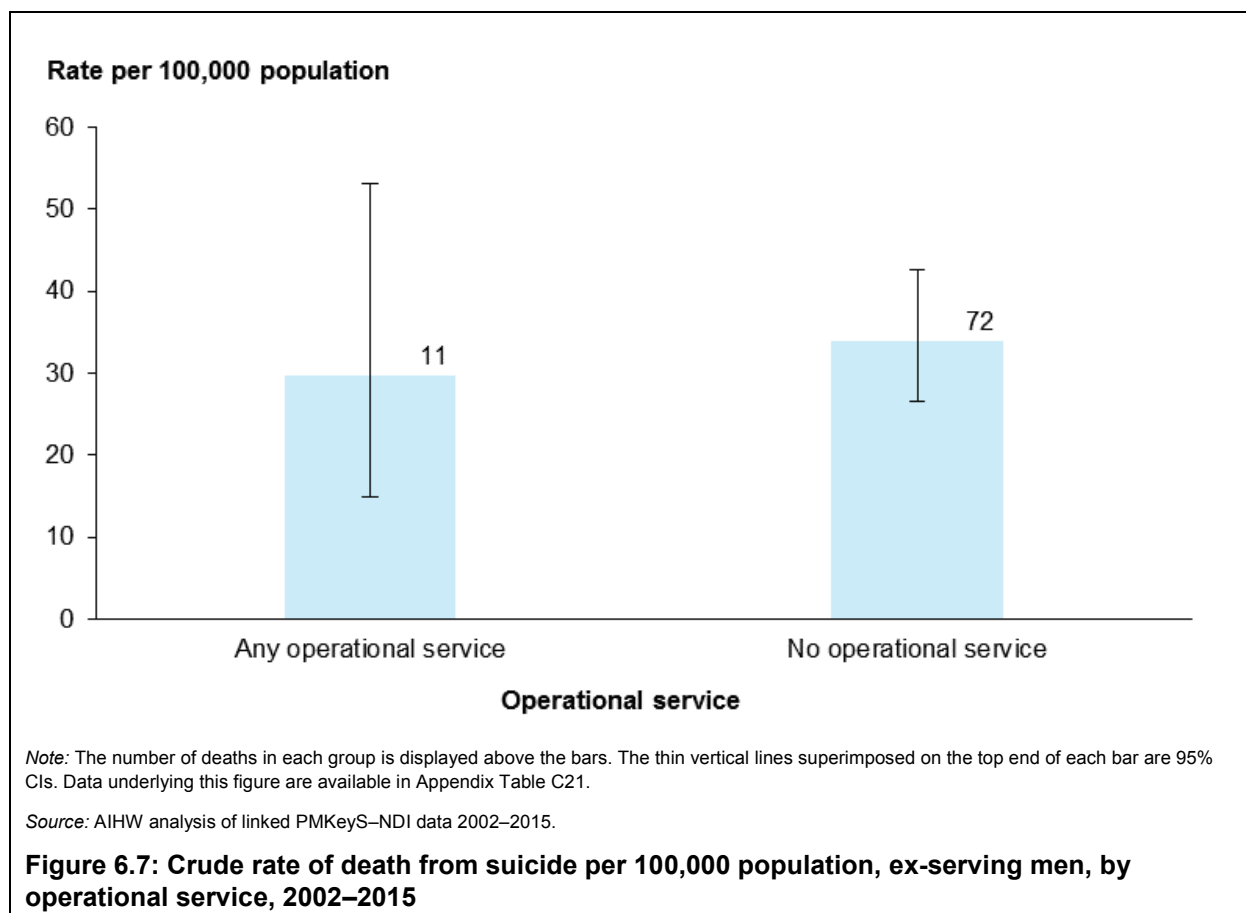


Age-specific suicide rates among ex-serving men ranked as commissioned officers are not presented due to the very small number of deaths in each age group.

## Operational service

*Operational service refers to four broad categories of deployment or operations: warlike operational service relates to warlike/active service deployments, non-warlike operational service relates to non-warlike deployments (for example, peace keeping, peace monitoring, United Nations assistance missions), overseas operational service relates to humanitarian/disaster relief (International) or border protection deployments, and domestic operational service relates to deployment of Defence aid to the civilian community. 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 includes only personnel hired on or after 1 January 1999. Analysis by operational service may indicate both protective factors (such as increased training, experience and resilience) and risk factors (such as physical injury, exposure to high stress and traumatic environments and events).*

Between 2002 and 2015, there were 11 suicide deaths among ex-serving personnel with any operational service, a crude suicide rate of 30 per 100,000 population (Figure 6.7). Of these, 6 were identified as having had warlike operational service. Among ex-serving personnel with no operational service, the number of suicide deaths was 72, a crude rate of 34 per 100,000. There was no statistically significant difference in rates between these groups.

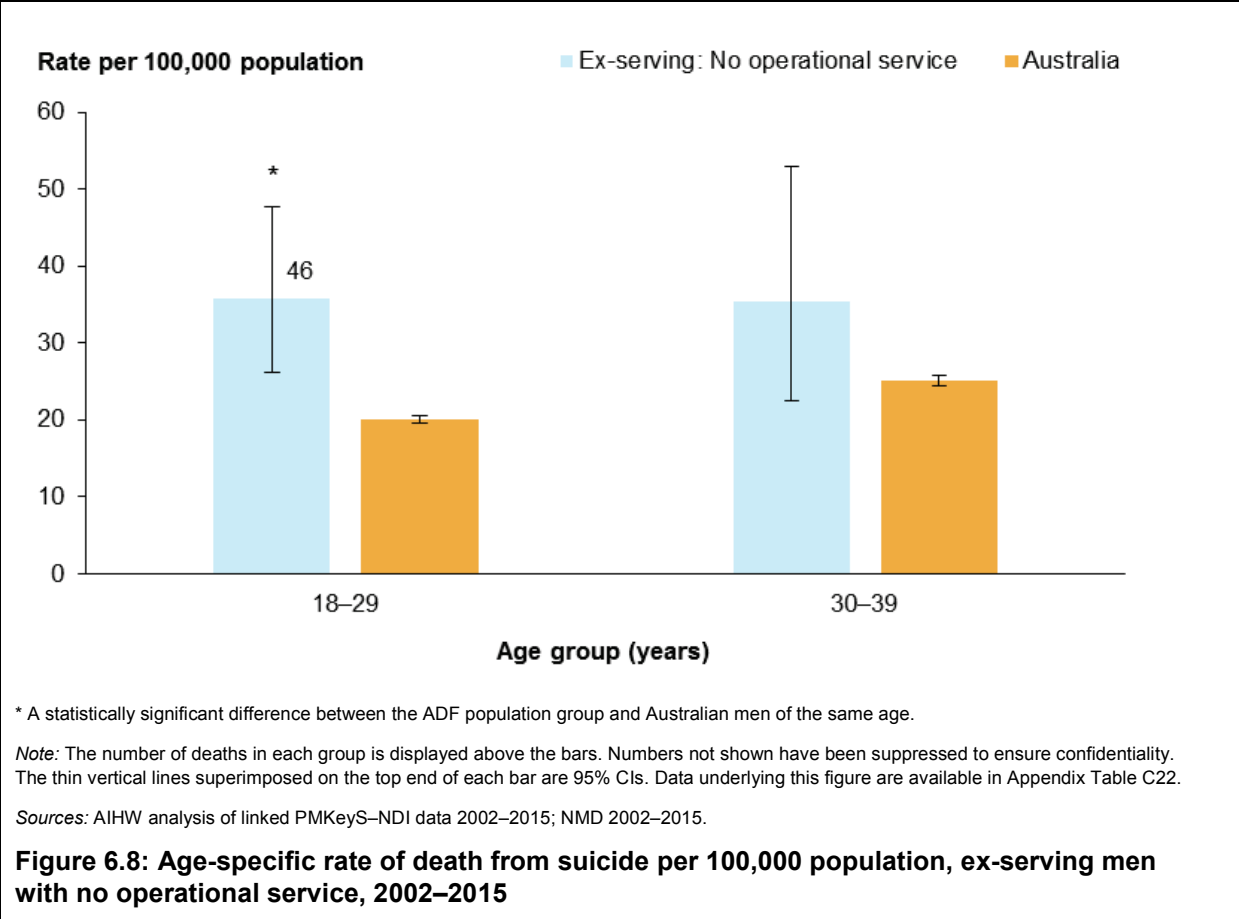


Note: The definition of operational service in the *Veterans' Entitlements Act 1986* (Cwlth) (VEA) differs substantially from how it is defined and presented in this report. To ensure all operations could be included in this study, the term 'operational service' was deemed to be the most appropriate. There are no changes to the legislative and policy definitions of the

term 'operational service' under the VEA. A full definition of operational service as it is used in this study is described in Box A5.1 in Appendix A5.

### No operational service by age

There was no significant difference in suicide rates by age group for ex-serving men aged 18–29 and 30–39 with no operational service (Figure 6.8). This finding is consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).



For ex-serving men with no operational service, the suicide rate for those aged 18–29 was 1.8 times as high as for Australian men of the same age (36 compared with 20 per 100,000 population). This difference was statistically significant and in line with findings for all ex-serving men aged 18–29 (see Figure 5.2 on page 28). The number of deaths was also the highest in this age group.

The suicide rate for those aged 30–39 was 1.4 times as high as for Australian men of the same age (35 compared with 25 per 100,000 population). This difference was not statistically significant—in line with overall findings for ex-serving men aged 30–39.

It is important to note that the rate for men aged 50–69 has not been shown due the small number of deaths in this age group.

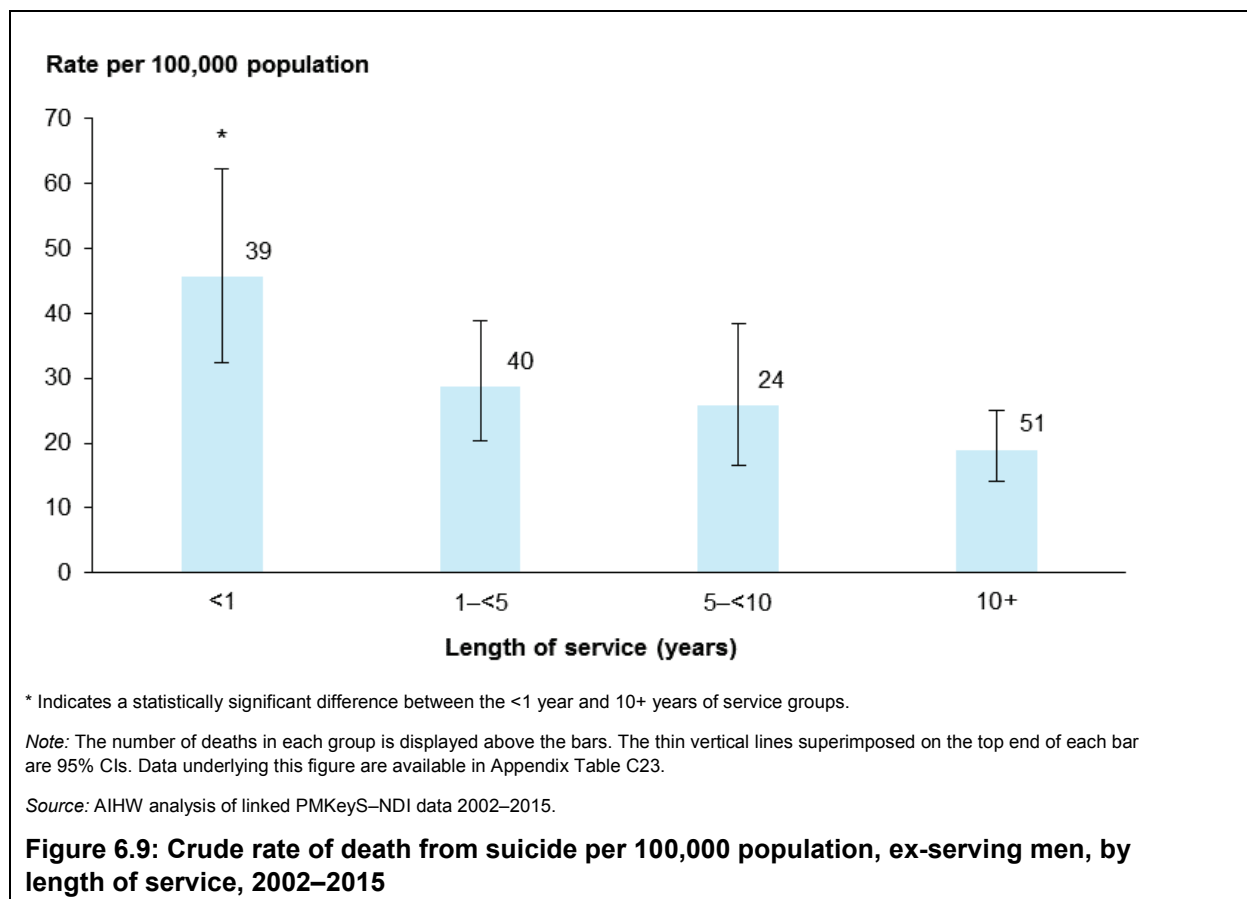
Due to the reduced scope of this analysis (ex-serving personnel hired on or after 1 January 1999), the number of ex-serving personnel with operational service is small. As such, it is not possible to perform further analysis on this group at this stage.

## Length of service

*Length of service describes the period of time between enlistment in the ADF and separation (discharge), and is presented for four groups: less than 1 year of service (<1), 1 to less than 5 years (1-<5), 5 to less than 10 years (5-<10), and 10 or more years of service (10+). These groupings represent early discharge, short and mid-term service and longer periods of service, respectively, and reflect different service experiences and career pathways. Analysis by length of service may identify subgroups of men who may be at higher or lower risk of suicide death.*

Between 2002 and 2015, among ex-serving personnel with:

- less than 1 year of service, there were 39 suicide deaths, a crude suicide rate of 46 per 100,000 population
- 1 to less than 5 years of service, there were 40 suicide deaths, a crude rate of 29 per 100,000
- 5 to less than 10 years of service, there were 24 suicide deaths, a crude rate of 26 per 100,000
- 10 or more years of service, there were 51 suicide deaths, a crude rate of 19 per 100,000 (Figure 6.9).



The crude suicide rate for ex-serving men with a length of service less than 1 year was 2.4 times as high as the rate for those with 10 or more years of service. This difference was statistically significant. These findings suggest that shorter length of service at discharge (less than 1 year) may be associated with a higher crude rate of suicide in the ex-serving population when compared with the rate for those with 10 or more years of service.

## Less than 1 year length of service by age

In ex-serving men with less than 1 year of service at the time of discharge, there was no significant difference in suicide rates by age group in men aged 18–29 and 30–39 (Figure 6.10). This finding is consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

Compared with the rate for Australian men aged 18–29, the suicide rate was significantly higher in ex-serving men of the same age with less than 1 year of service.

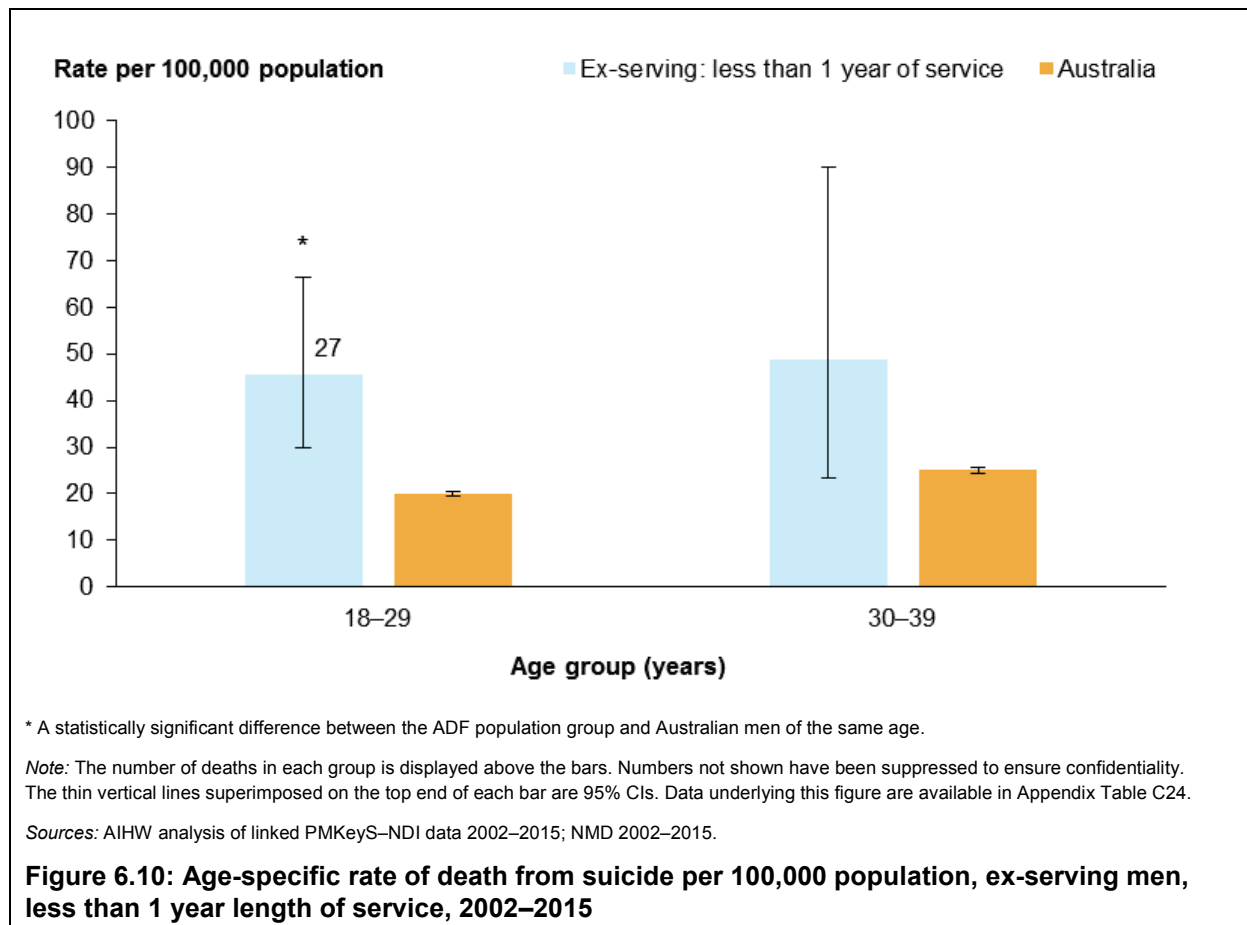
The suicide rate for those aged 18–29 was 2.3 times as high as for Australian men of the same age (46 compared with 20 per 100,000 population). This difference was statistically significant and in line with findings for all ex-serving men aged 18–29 (see Figure 5.2 on page 28).

The suicide rate for those aged 30–39 was 1.9 times as high as for Australian men of the same age (49 compared with 25 per 100,000 population). This difference was not statistically significant and was in line with findings for all ex-serving men aged 30–39.

The rate for men aged 40–49 has not been shown due the small number of deaths in this age group.

The number of deaths was highest in the 18–29 age group.

It is worth noting that ex-serving men with less than 1 year of service are much more likely to be younger than ex-serving men with 10 or more years of service.



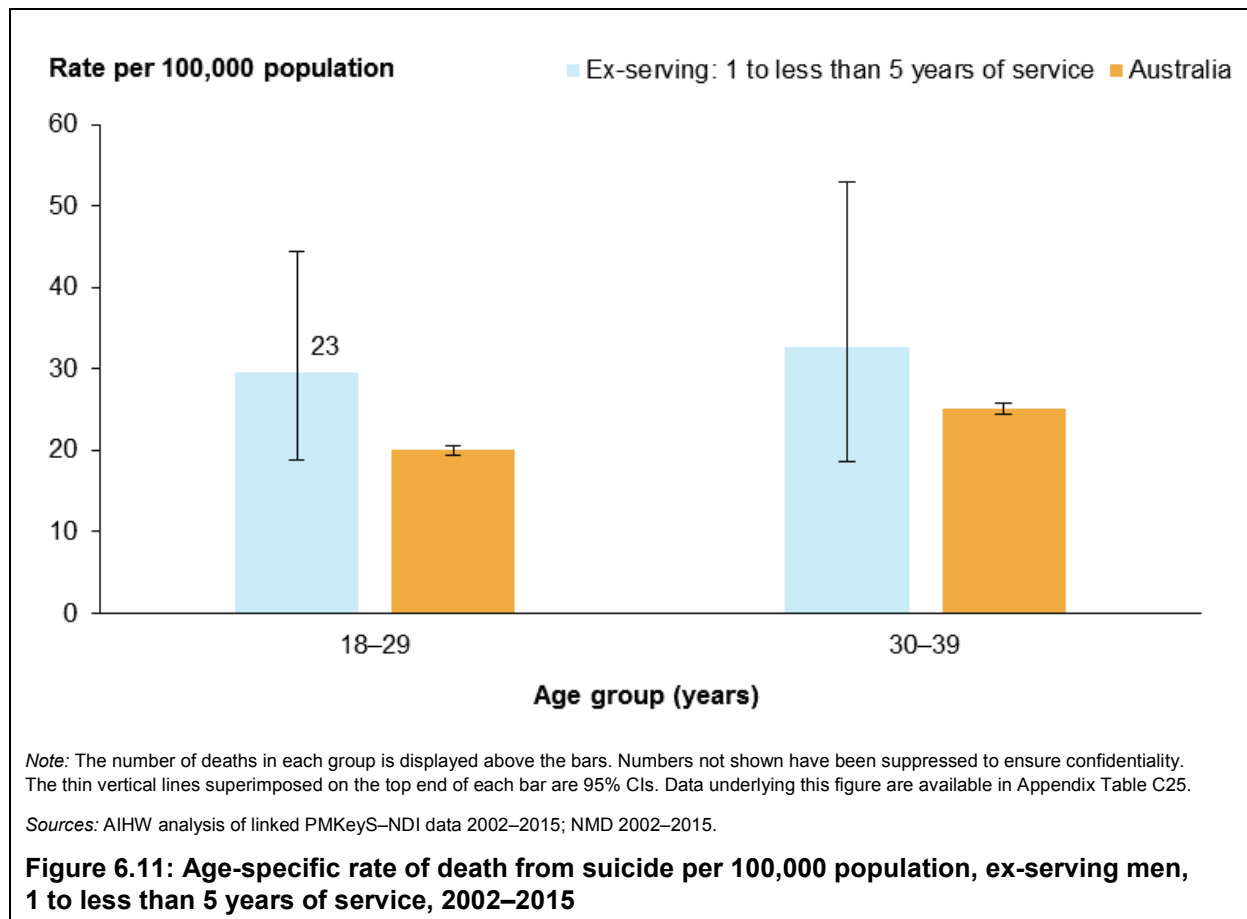
## 1 to less than 5 years of service by age

There was no significant difference in suicide rates by age group in ex-serving men aged 18–29 and 30–39 with 1 to less than 5 years of service at the time of discharge (Figure 6.11). This finding is consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

There was no significant difference in suicide rates for ex-serving men aged 18–29 and 30–39 compared with rates for all men in the Australian population of the same age. The suicide rate for those aged 18–29 was 1.5 times as high as for Australian men of the same age (30 compared with 20 per 100,000 population). For ex-serving men aged 30–39, the rate was 1.3 times as high as for Australian men of the same age (33 compared with 25 per 100,000).

The rate for men aged 40–49 has not been shown due the small number of deaths in this age group.

The number of deaths was highest in the 18–29 age group.



## 5 to less than 10 years of service by age

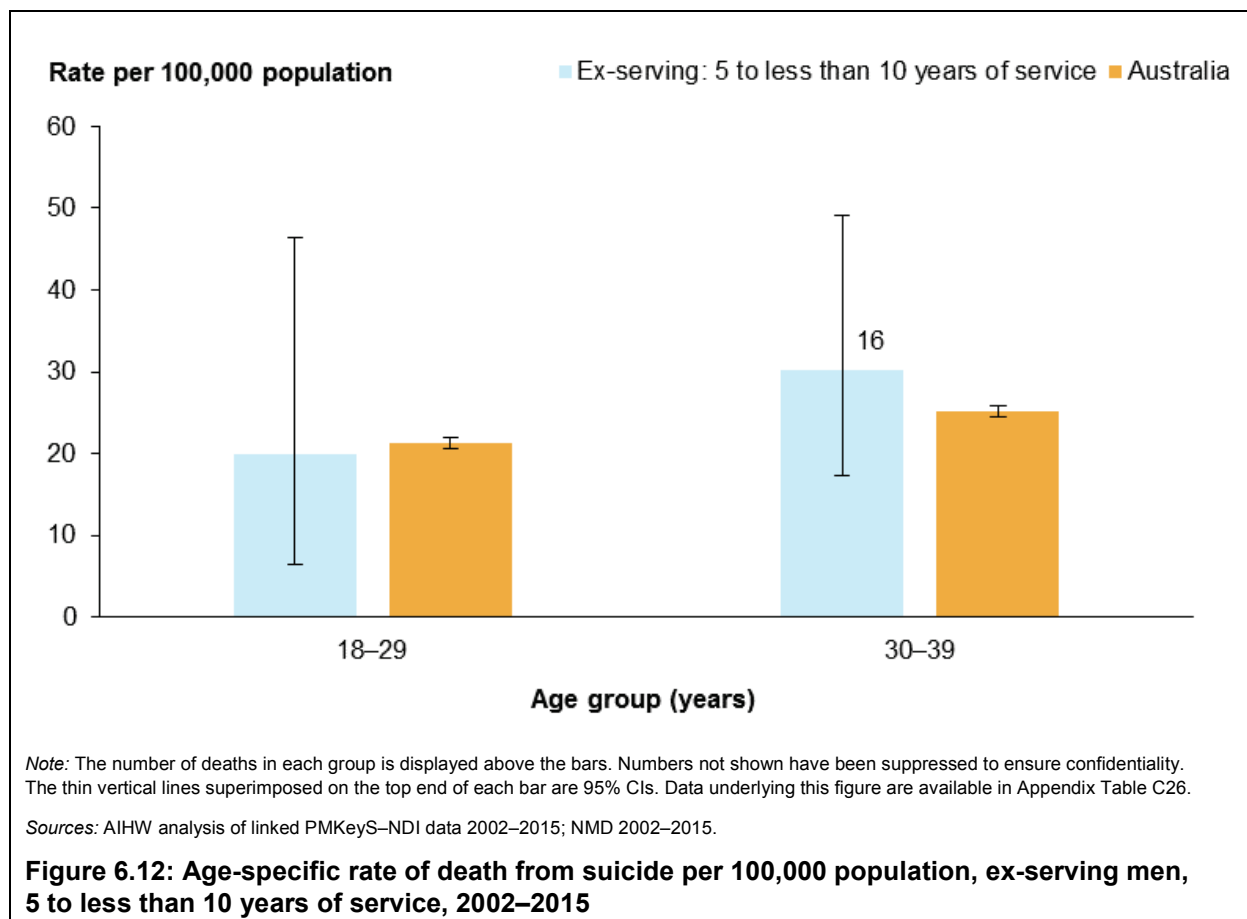
In ex-serving men with 5 to less than 10 years of service at the time of discharge, there was no significant difference in suicide rates by age group in men aged 18–29 and 30–39 (Figure 6.12). This finding is consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

There was no significant difference in suicide rates for ex-serving men aged 18–29 and 30–39 compared with rates for all Australian men of the same age. The suicide rate for those aged 18–29 was similar to the rate for Australian men of the same age. For ex-serving men aged 30–39, the rate was 1.2 times as high as for Australian men of the same age (30 compared with 25 per 100,000 population). This difference was not statistically significant.

The rate for men aged 40–49 has not been shown due the small number of deaths in this age group. It is important to note that the rate in the 18–29 age group is based on a small number of suicide deaths.

The number of deaths was highest in the 30–39 age group.

The rate for men aged 40–49 has not been shown due the small number of deaths in this age group.

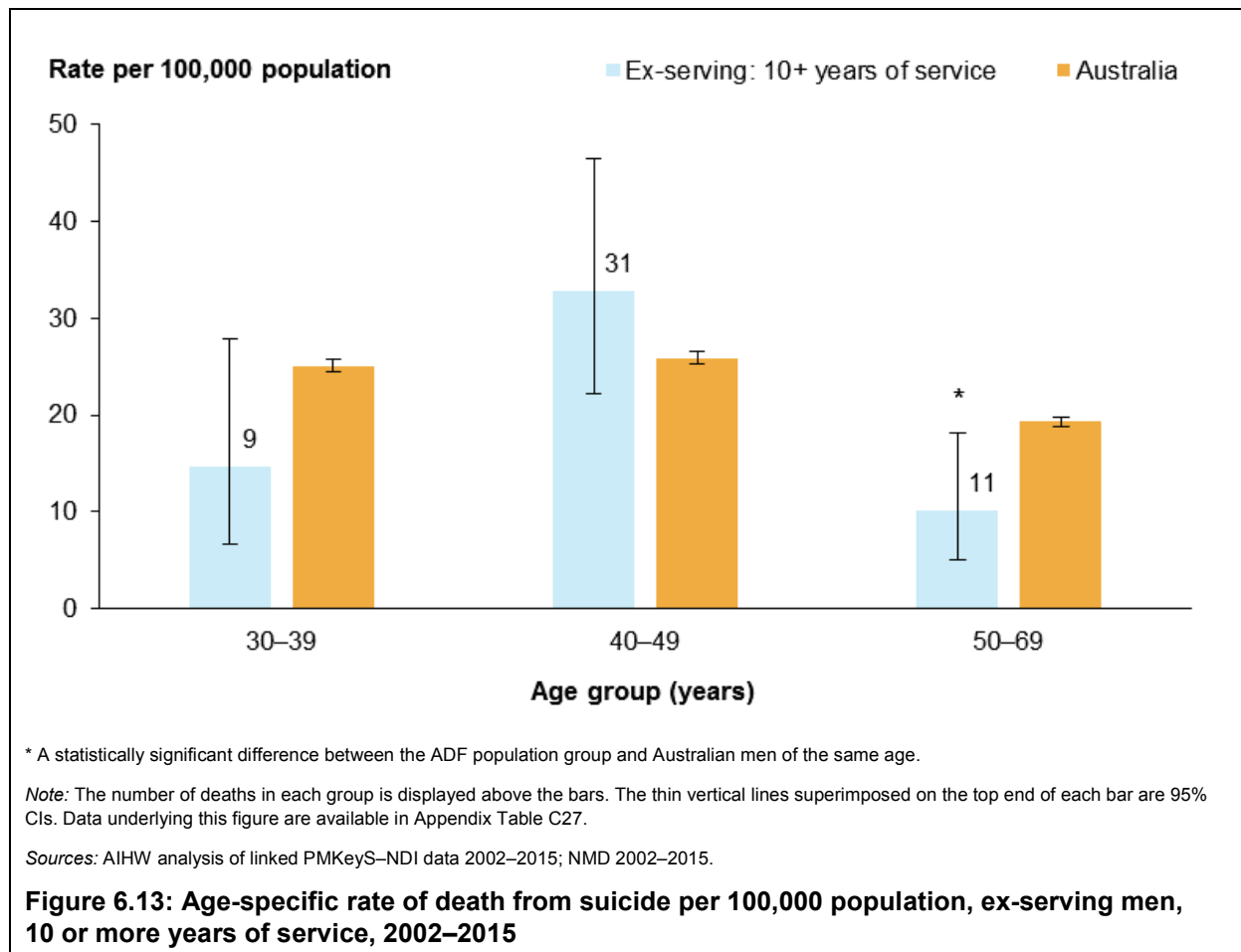


## 10 or more years of service by age

There was no significant difference in suicide rates by age group in ex-serving men aged 30–39 and 40–49 with 10 or more years of service at the time of discharge (Figure 6.13). The rate for ex-serving men aged 50–69 was significantly lower than the rate for men age 40–49. These findings are broadly consistent with the overall pattern of crude suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

The suicide rate for ex-serving men aged 30–39 and 50–69 was around half of the rate for Australian men of the same age; however, this difference was not statistically significant in the 30–39 year age group. It was statistically significant, however, for men aged 50–69, where the rate in the ex-serving group was 10 per 100,000 population compared with 19 per 100,000 in Australian men. For ex-serving men aged 40–49, the rate was 1.3 times as high as for Australian men of the same age (33 compared with 26 per 100,000). This difference was not statistically significant.

The number of deaths was highest in the 40–49 age group.



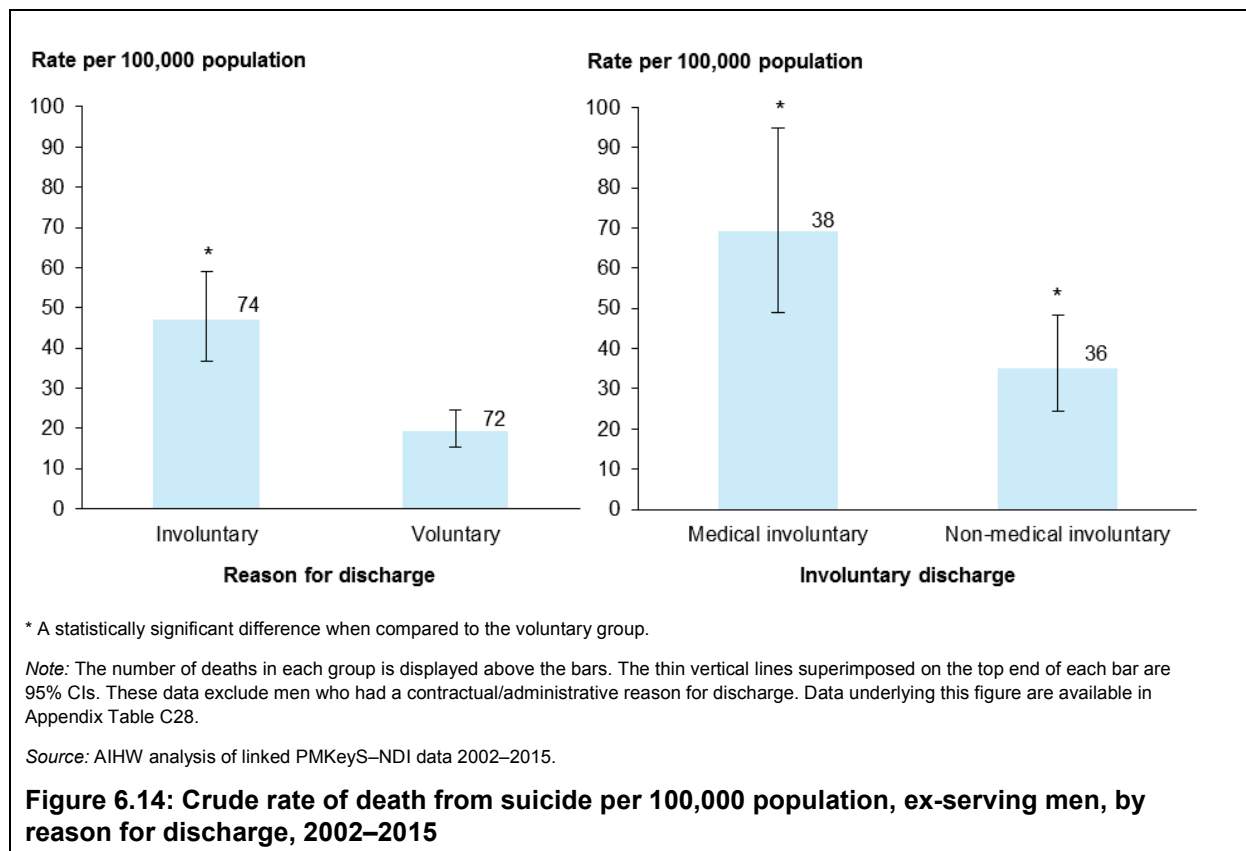


## Reason for discharge

The reason for discharge from the ADF may be voluntary or involuntary. The means and process of discharge may reflect transition pathways associated with increased risk of suicide death. Voluntary discharge includes voluntary redundancies and resignations. Those discharged involuntarily comprise two groups: those discharged for medical reasons (including those deemed medically unfit) and those discharged for non-medical reasons (including those discharged for disciplinary reasons). For a full list of discharge reasons included in each of these groups see Appendix Table A5.2.

Between 2002 and 2015, the crude suicide rate for men discharged for involuntary reasons (including for medical and for non-medical reasons) was 2.4 times as high as for those discharged voluntarily (Figure 6.14). This difference was statistically significant. There were 74 suicide deaths among ex-serving men discharged for involuntary reasons (a crude suicide rate of 47 per 100,000 population), and 72 suicide deaths among those discharged for voluntary reasons (a crude rate of 19 per 100,000).

Among those discharged involuntarily, there were 38 suicide deaths in ex-serving men discharged for medical reasons—a crude rate of 69 per 100,000 population. This rate was 3.6 times as high as the rate for men discharged voluntarily and the difference was statistically significant. There were 36 suicide deaths in those involuntarily discharged for non-medical reasons. This represents a crude rate of 35 suicide deaths per 100,000, which was 1.8 times as high as the rate for men discharged voluntarily. This difference was statistically significant.



The crude suicide rate for personnel discharged for medical reasons was also significantly higher than the overall rate of suicide in the ex-serving population (26 per 100,000 population).

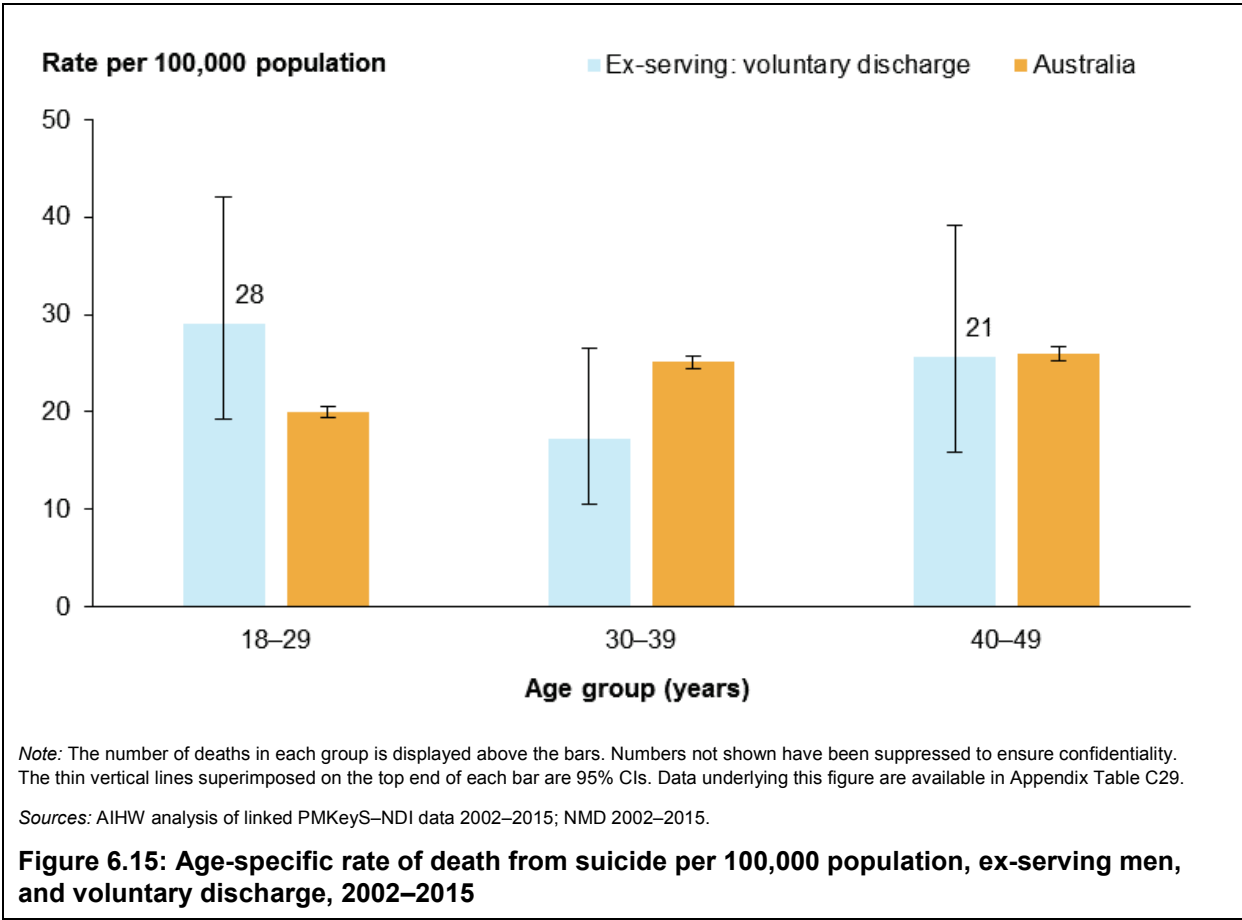
These findings suggest that involuntary discharge—and particularly medical involuntary discharge—may be associated with higher crude rates of suicide in the ex-serving population.

### Voluntary discharge by age

Among men discharged voluntarily, there was no significant difference in suicide rates by age group for those aged under 50 (Figure 6.15). This finding is consistent with the pattern of suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

When compared with rates for Australian men of the same age, there was no significant difference in suicide rates across any of the age groups examined.

The rate for men aged 50–69 has not been shown due the small number of deaths in this age group.



## Involuntary discharge for medical reasons by age

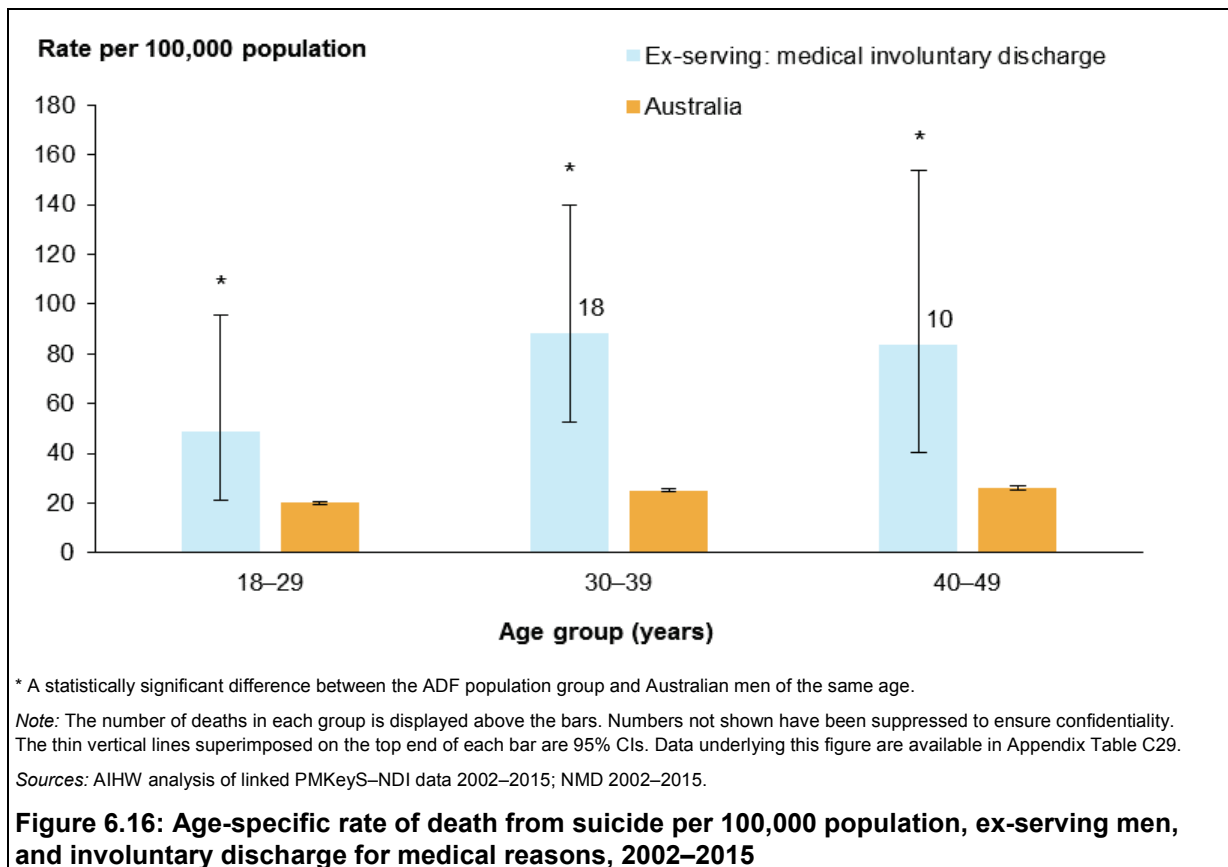
Among men discharged involuntarily for medical reasons, there was no significant difference in suicide rates by age group for those aged under 50 (Figure 6.16). This finding is consistent with the overall pattern of suicide rates for all ex-serving men by age group (see Figure 5.2 on page 28).

Suicide rates were significantly higher for all age groups examined compared with rates for all Australian men of the same age (Figure 6.16). This differs from findings comparing age-specific rates for all ex-serving men with those for Australian men of the same age, where non-significant differences were found in men aged 30–49 (see Figure 5.2 on page 28).

- In ex-serving men aged 18–29, the suicide rate was 2.4 times as high as for Australian men of the same age (49 compared with 20 per 100,000 population).
- In ex-serving men aged 30–39, the suicide rate was 3.5 times as high as for Australian men of the same age (88 compared with 25 per 100,000). This age group had the highest number of suicide deaths.
- In ex-serving men aged 40–49, the rate was 3.2 times as high as for Australian men of the same age (84 compared with 26 per 100,000).

These differences were all statistically significant.

The rate for men aged 50–69 has not been shown due the small number of deaths in this age group.



It is important to note, however, that rates for the groups aged 18–29 and 40–49 are based on a small number of suicide deaths.

### Involuntary discharge for non-medical reasons by age

The highest number of suicide deaths in ex-serving men discharged involuntarily for non-medical reasons was in the 18–29 age group.

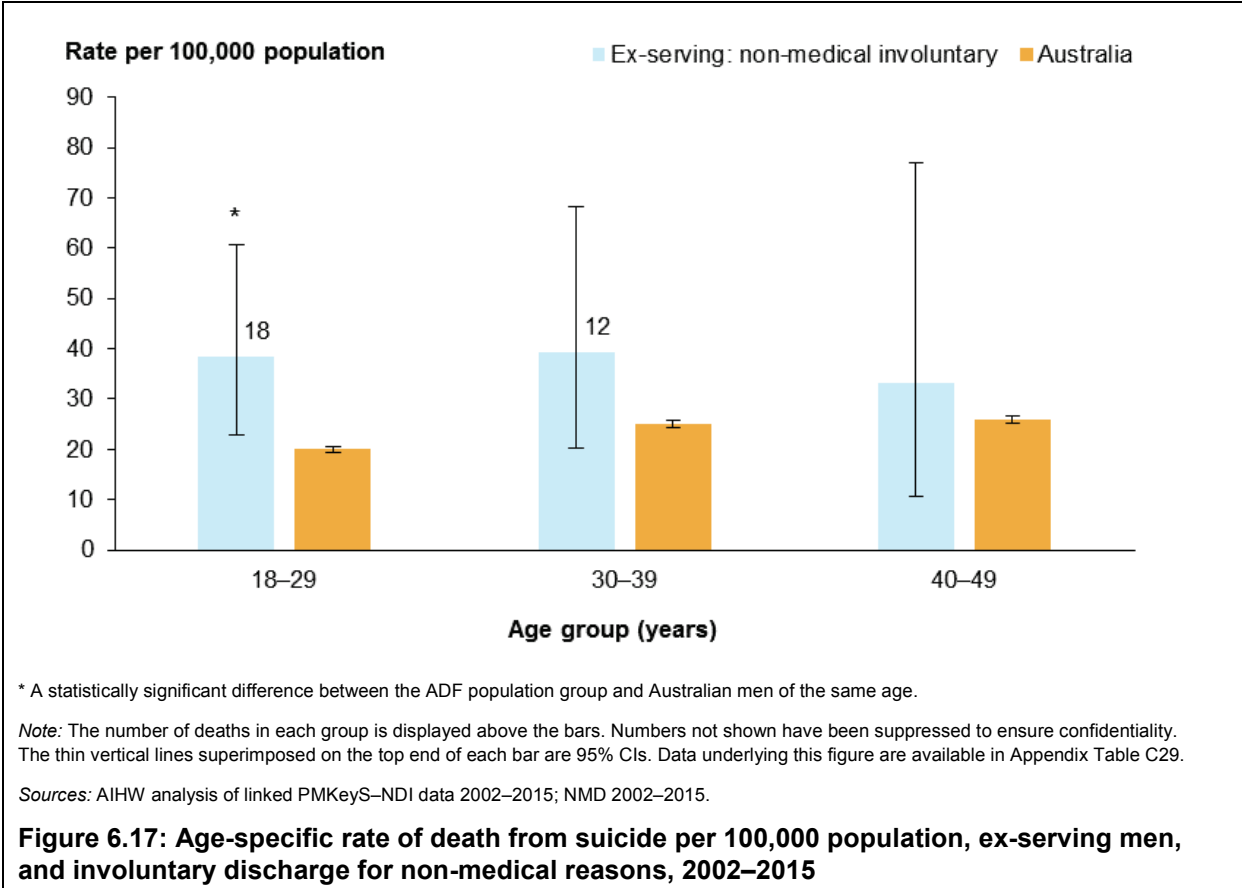
Among men who were involuntarily discharged for non-medical reasons, there was no significant difference in suicide rates by age group for those aged 18–29, 30–39 and 40–49 (Figure 6.17). These findings are consistent with the pattern of suicide rates by age group for all ex-serving men (see Figure 5.2 on page 28).

When compared with Australian men of the same age, the suicide rate was:

- 1.9 times as high in ex-serving men aged 18–29 (38 compared with 20 per 100,000 population). This difference was statistically significant
- 1.6 times as high in ex-serving men aged 30–39 (39 compared with 25 per 100,000), although this difference was not statistically significant
- 1.3 times as high in ex-serving men aged 40–49 (33 compared with 26 per 100,000), although this difference was not statistically significant.

These findings are in line with findings for all ex-serving men by age group (see Figure 5.2 on page 28).

The rate for men aged 50–69 has not been shown due the small number of deaths in this age group.

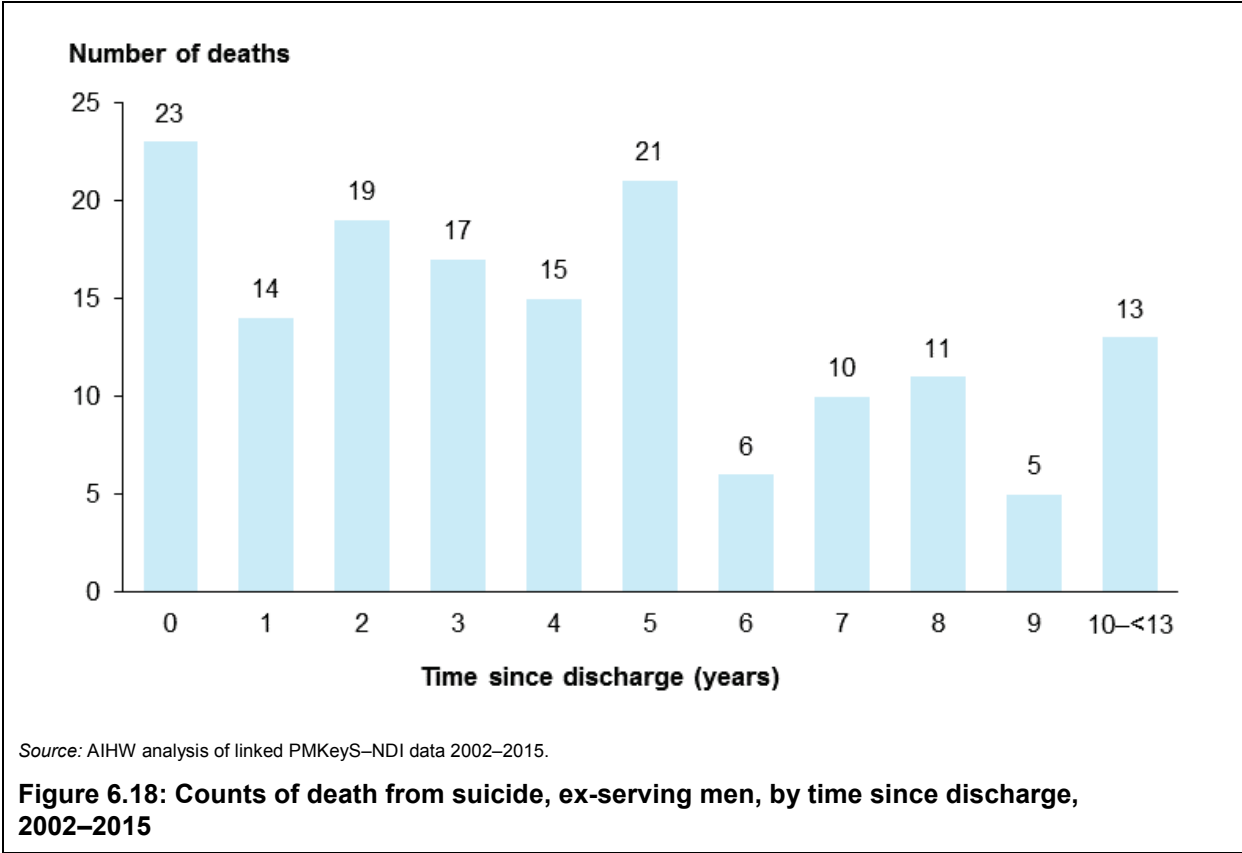


It is important to note, however, that the rate in the group aged 40–49 is based on a small number of suicide deaths and may be volatile over time, as shown by the width of the CIs in Figure 6.17.

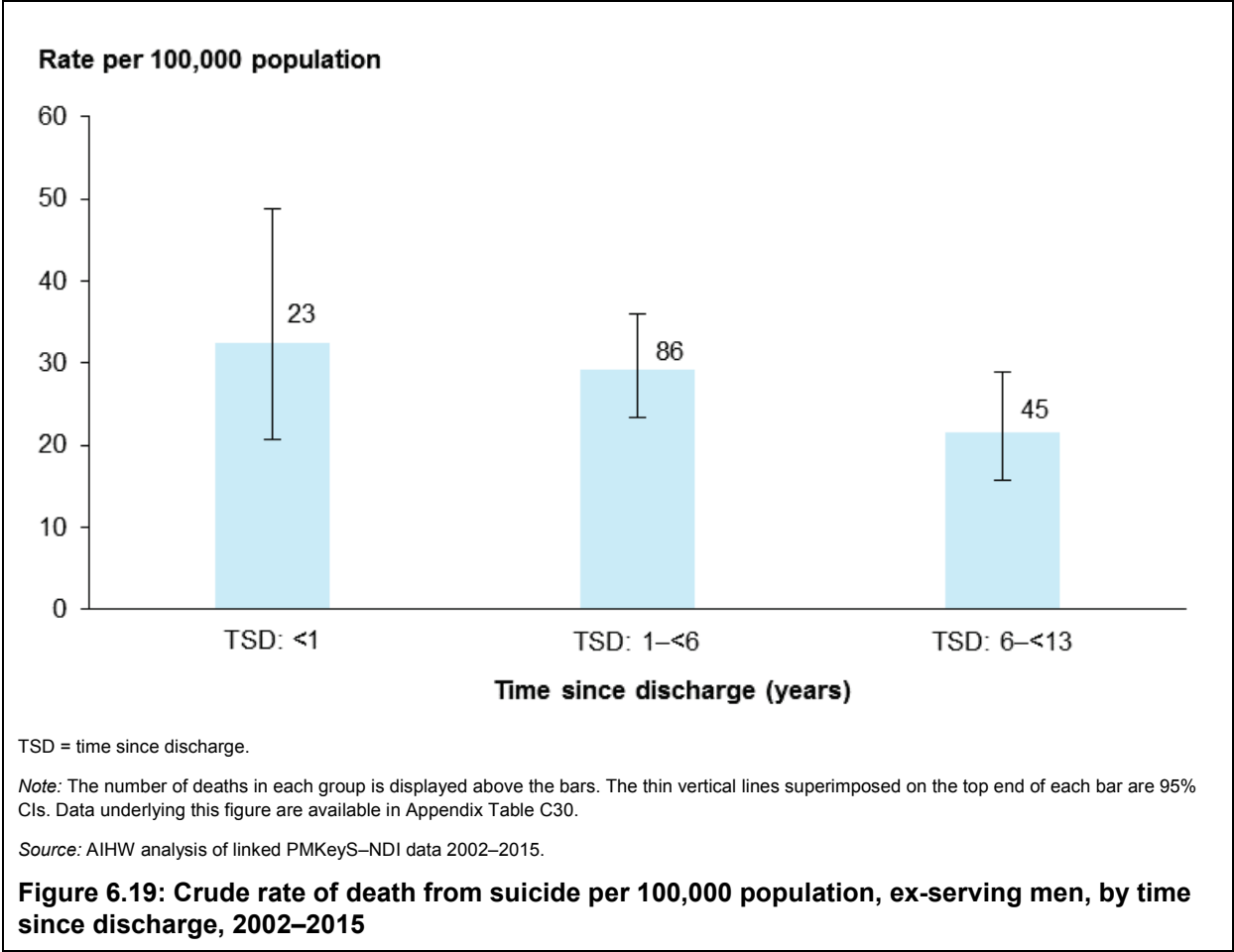
# Timing of suicide death

*Time since discharge is the time between discharge from the ADF and death for ex-serving personnel who have died. Due to the scope of the study, the maximum length of time since discharge that could be observed in this study was 15 years. Analysis by time since discharge may identify periods after discharge where ex-serving men may be at higher or lower risk of suicide death.*

Between 2002 and 2015, there were 23 suicide deaths among men who had been discharged from the ADF for less than 1 year at the time of death (15% of total suicide deaths), and 86 deaths among men who had been discharged from the ADF for between 1 and less than 6 years at the time of death (Figure 6.18). Overall, 71% of ex-serving suicide deaths occurred in men discharged from the ADF for less than 6 years at the time of death (109 suicides out of a total of 154). There were 45 deaths among men who had been discharged from the ADF for between 6 and less than 13 years.



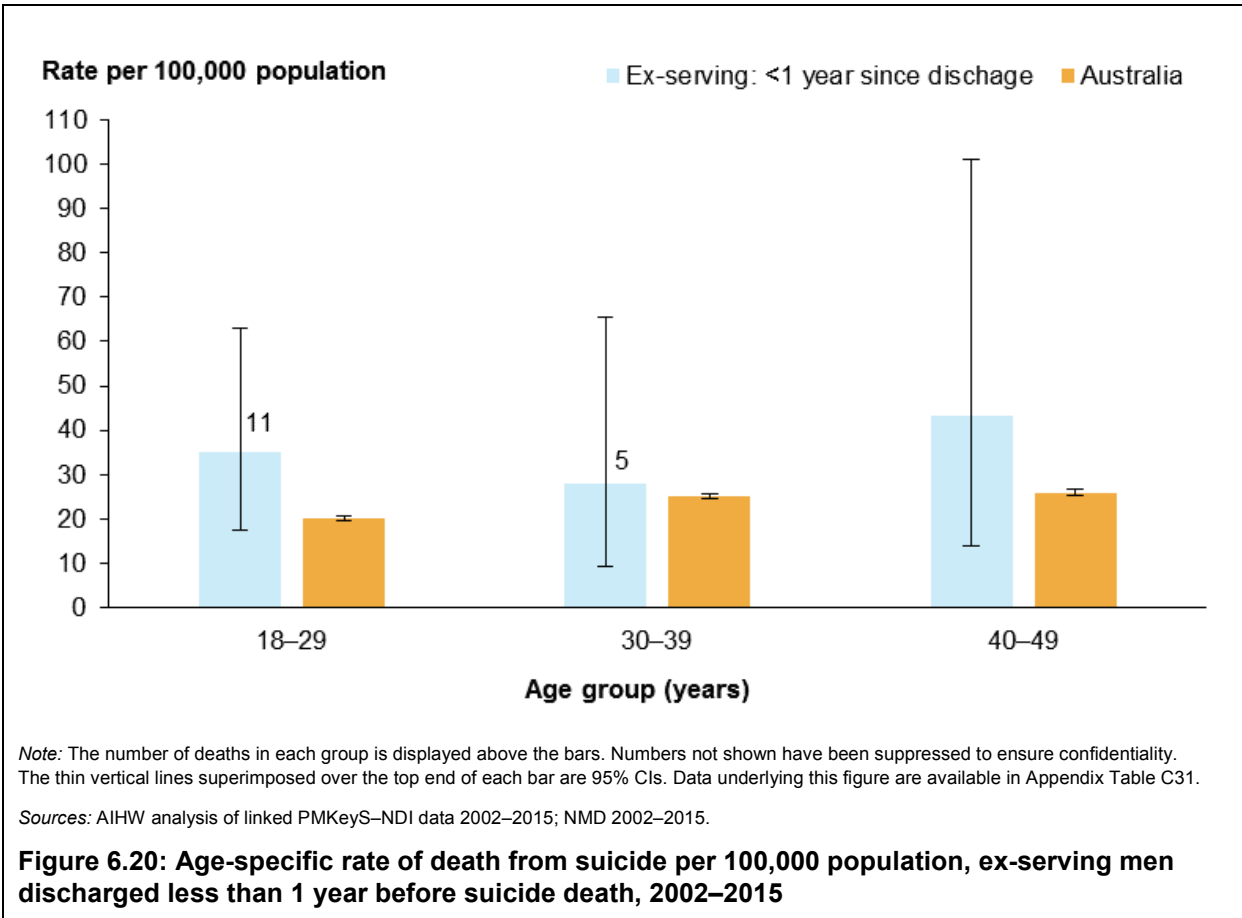
At the time of death, men who had been discharged from the ADF for less than 1 year had a crude suicide rate that was 1.5 times as high as men discharged for between 6 and less than 13 years (33 compared with 22 per 100,000 population) (Figure 6.19). Men discharged between 1 and 6 years at the time of death had a crude rate that was 1.4 times as high as men discharged for between 6 and less than 13 years (30 compared with 22 per 100,000). These differences were not statistically significant.



### Suicide death less than 1 year after discharge by age

There was no significant difference in suicide rates by age group for ex-serving men aged under 50 who had been discharged from the ADF for less than 1 year at the time of their death (Figure 6.20). These findings are consistent with the pattern of suicide rates by age group for all ex-serving men (see Figure 5.2 on page 28).

There was no significant difference in suicide rates for ex-serving men who had been discharged from the ADF for less than 1 year at the time of their death when compared with rates for all Australian men of the same age. The largest difference was in ex-serving men aged 18–29 where the suicide rate was 1.8 times as high as the rate in Australian men of the same age (35 compared with 20 per 100,000 population). However, this difference was not statistically significant. The number of deaths was also highest in the 18–29 age group.



It is important to note, however, that the rates for ex-serving men aged 30–49 are based on a small number of suicide deaths.

The rate for men aged 50–69 has not been shown due the small number of deaths in this group.

### Suicide death 1 to less than 6 years after discharge by age

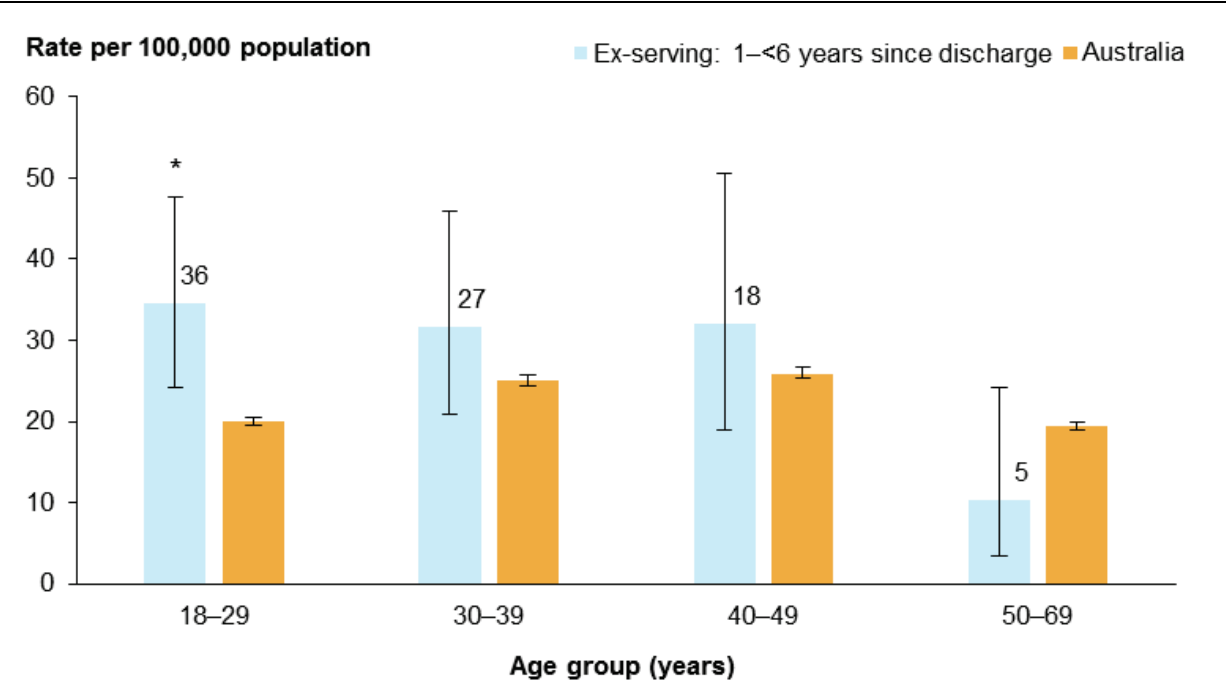
Crude suicide rates in ex-serving men aged 18–29, 30–39 and 40–49 who had been discharged from the ADF for 1 to less than 6 years at the time of their death were between 3.1 and 3.3 times as high as the rate for ex-serving men aged 50–69. For those aged 18–29, this difference was statistically significant (Figure 6.21). These findings are consistent with the pattern of suicide rates by age group for all ex-serving men (see Figure 5.2 on page 28).

For ex-serving men who had been discharged from the ADF for 1 to less than 6 years at the time of their death, the suicide rate in ex-serving men aged 18–29 was 1.7 times as high as the rate in Australian men of the same age (35 compared with 20 per 100,000 population). This difference was statistically significant. The number of deaths was also highest in this age group.

Suicide rates in ex-serving men aged 30–39 and 40–49 who had been discharged from the ADF for 1 to less than 6 years at the time of their death were similar to rates in all Australian men of the same age.

Ex-serving men aged 50–69 had a lower rate of suicide death, between 1 and less than 6 years after discharge, when compared with Australian men of the same age (10 compared with 19 per 100,000 population). This difference was not statistically significant.

It is important to note, however, that the rates for ex-serving men aged 50–69 are based on a small number of suicide deaths.



\* A statistically significant difference between the ADF population group and Australian men of the same age.  
 Note: The number of deaths in each group is displayed above the bars. The thin vertical lines superimposed over the top end of each bar are 95% CIs. Data underlying this figure are available in Appendix Table C31.  
 Sources: AIHW analysis of linked PMKeyS–NDI data 2002–2015; NMD 2002–2015.

**Figure 6.21: Age-specific rate of death from suicide per 100,000 population, ex-serving men discharged 1 to less than 6 years before suicide death, 2002–2015**



## Suicide death 6 to less than 13 years after discharge by age

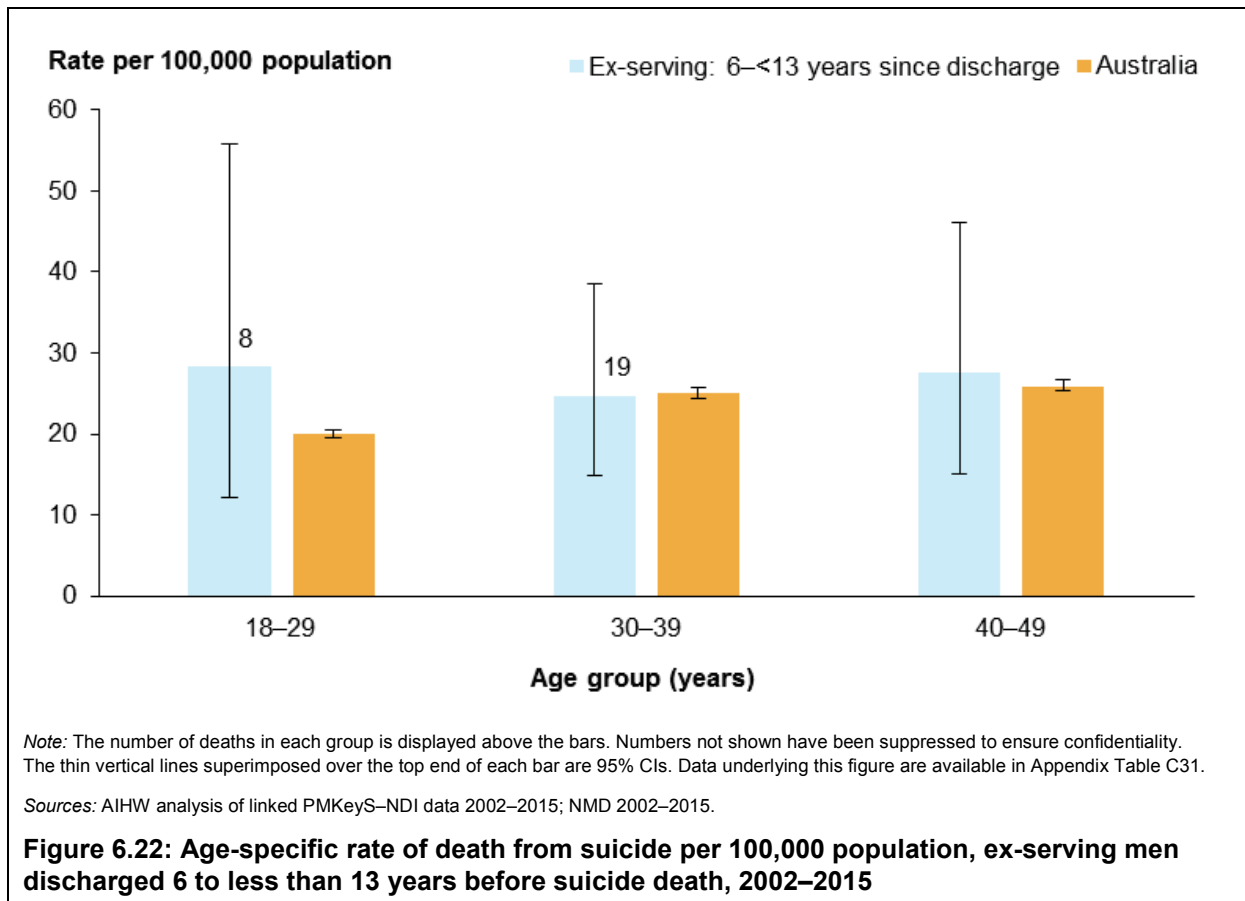
There was no significant difference in suicide rates by age group for ex-serving men aged 18–29, 30–39 and 40–49 who had been discharged from the ADF for 6 and less than 13 years at the time of their death (Figure 6.22). These findings are consistent with the pattern of suicide rates by age group for all ex-serving men (see Figure 5.2 on page 28).

Suicide rates for ex-serving men aged 18–29, 30–39 and 40–49 who had been discharged from the ADF for 6 to less than 13 years at the time of their death were similar when compared with rates for Australian men of the same age.

The number of deaths was highest in the age group 30–39.

It is important to note, however, that the rate for ex-serving men aged 18–29 was based on a small number of suicide deaths.

The rate for men aged 50–69 has not been shown due the small number of deaths in this group.



## 7 Modelling suicide risk

### Summary of key findings

Logistic regression was carried out to see which service-related factors were most strongly associated with suicide death, when age and all other available factors were controlled for.

Results show that the following service-related characteristics were associated with significantly higher suicide risk among ex-serving men:

- medical discharge (the odds for suicide are 1.9 times the odds for those discharged voluntarily)
- all ranks other than commissioned officers (the odds for suicide are 2.2 times the odds for commissioned officers).

Length of service was not found to be a statistically significant predictor of suicide once all other factors were controlled for. This is likely to be due in part to a high correlation between age and length of service. However, when all other factors are controlled for, the results still suggest an increased likelihood of suicide in ex-serving men with shorter length of service (less than 1 year) when compared with men who served 10 years or more, although this finding was not statistically significant.

There was no significant difference in suicide rates between the different services (Army, Navy, Air Force).

There are almost certainly other factors associated with death due to suicide for which information was not available for this study. As well, these results can identify groups of people who may be at higher risk of suicide death by examining characteristics that could be associated with suicide. However, they cannot indicate if the particular characteristic is the reason for the suicide death. Qualitative analysis methods may provide useful insight into the circumstances leading up to suicide death.

The analysis of crude rates in Chapter 6 has shown that there are subpopulations of ex-serving men, defined by their demographic and service characteristics, who have been observed to have an increased rate of suicide. Modelling was undertaken for ex-serving men to see which of these factors were most strongly associated with death due to suicide, when all available factors are controlled for.

Finding a model to fit the data for this study was complex and required careful consideration. The Cox proportional hazards model is a commonly used tool for studying the dependency of survival time on predictor variables. However, testing showed that this model was not appropriate for the data available to this study (see section headed 'Time dependent variables' on page 66). Logistic regression was identified as an appropriate alternative while accepting the limitations around the interpretation of time dependent variables using this model.

The logistic regression model estimates the probability of the event of interest's happening (death due to suicide). This modelling technique has substantial power over crude rates and basic tabulations as one can look at how multiple factors simultaneously affect the probability of an outcome (death due to suicide). It should be noted that not all factors that can influence the likelihood of suicide are considered in the analysis due to the unavailability of such information.

The technical terminology used in this chapter are described in Box 7.1. Details of the model, and methods used to test model assumptions, goodness-of-fit and sensitivities in the data are included in Appendix A4.

#### **Box 7.1: Measures used in this chapter—definitions**

**Correlation:** The linear strength and direction of an association between variables is given by a value between  $-1.0$  and  $1.0$ , where stronger relationships are indicated by values further away from 0. High correlation can be defined as being greater than  $0.70$  or less than  $-0.70$ . If values of both variables increase and decrease together, the association is positive. If the value of one variable increases as the other decreases, the association is negative.

**Odds ratio:** The odds ratio between two categories of a predictor variable represents the proportional change in odds of a certain result that would occur when moving between the categories, if all other factors are held constant. For example, if the odds ratio between *all ranks other than commissioned officers* and *commissioned officers* is  $2.2$ , this means that the particular outcome (death due to suicide) has  $2.2$  times the odds for *all ranks other than commissioned officers* than for *commissioned officers*, if all other factors (such as age, discharge reason and service) are held constant. The model cannot account for factors for which there are no data, so it is possible that differences in odds between the categories of explanatory variable are due to unknown confounding factors, because the model cannot hold these factors constant.

**Statistical significance:** A statistical measure that indicates how likely the observed difference is due to chance alone. If the difference is sufficiently unlikely to be due to chance, the difference is said to be statistically significant. Statistically significant differences are indicated in this report by an asterisk, or described as being 'significantly higher'/'significantly lower'.

## **Setting up the model**

The scope and definition of each of the variables considered for the model are now defined. Important considerations relating to the inclusion of each of these variables in the final model are also described.

### **Service**

The ADF has three services: the Navy, Army and the Air Force. An individual can serve in more than one service during their ADF employment, but only the service at the time of separation for ex-serving personnel is available for this study.

### **Rank**

Rank describes positions in the ADF operational hierarchy and is a proxy measure for socioeconomic status, including education, training and income. Lower rank may also be associated with fewer deployment opportunities during service, less autonomy and sense of control, and fewer identifiable job opportunities where ex-serving personnel can use their skills after discharge. Analysis by rank is presented by two broad groups: commissioned officers, and all ranks other than commissioned officer (see Appendix Table A5.1 for a full list of ADF ranks included in these groups). Analysis by rank at discharge may indicate whether an ex-serving ADF member is at higher or lower risk of suicide.

## **Operational service**

Operational service refers to four broad categories of deployment or operations: warlike operational service relates to warlike/active service deployments, non-warlike operational service relates to non-warlike (for example, peace keeping, peace monitoring, United Nations assistance missions) deployments, overseas operational service relates to humanitarian/disaster relief (International) or border protection deployments, and domestic operational service relates to deployment of Defence aid to the civilian community. 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 categories 'Any' and 'None' include only personnel hired on or after 1 January 1999. ADF personnel hired before this date were given a value of 'N/A' for this analysis.

A high correlation between operational service and age was found (see the section headed 'Testing model assumptions' in Appendix A4). Further to this, the analysis of crude rates suggests that those with operational service have no statistically significant difference in suicide rates than those with no operational service. For these reasons, operational service was not included in the final model.

## **Length of service**

Length of service describes the period of time between enlistment in the ADF and separation (discharge), and is presented in four groups: less than 1 year of service (<1), 1 to less than 5 years (1–<5), 5 to less than 10 years (5–<10), and 10 or more years of service (10+). These groupings represent early discharge, short and mid-term service and longer periods of service, respectively, and reflect different service experiences and career pathways. Analysis by length of service may identify subgroups of men who may be at higher or lower risk of suicide death.

A high correlation between length of service and age was found. Despite this, it was decided to keep the variable in the final model given that the crude rates suggested it was a predictor of suicide, and further testing showed that a model including both age and length of service provided the best fit for the data. For further discussion, see the section headed 'Testing model assumptions' in Appendix A4.

## **Reason for discharge**

The reason for discharge from the ADF may be voluntary or involuntary. The means and process of discharge may reflect transition pathways associated with increased risk of suicide death. Voluntary discharge includes voluntary redundancies and resignations. Those discharged involuntarily comprise two groups: those discharged for medical reasons (including those deemed medically unfit) and those discharged for non-medical reasons (including those discharged for disciplinary reasons). See Appendix Table A5.2 for a full list of discharge reasons included in each group.

## **Time dependent variables**

There are two variables in the model that are time and outcome dependent: age and time since discharge. The value attributed to a record depends on what the outcome for that individual was during the reference period. Those who died (due to any cause) were

assigned the age and time since discharge values correct at the time of their death. Those who did not die were assigned the values as correct at the end of the reference period.

This is different from the other variables discussed earlier (service, rank, operational service, length of service and reason for discharge). In those cases, values are assigned for all records according to the correct value at the time of their discharge.

Due to their nature, the model parameter estimates for both age and time since discharge are difficult to interpret and have been suppressed in Table 7.1. The variables have been retained in the model, however, as they are important factors to control for when estimating the model parameters of the other variables in the model.

Sensitivity analysis was done using a data set that included additional information to capture the exposure of each individual to each age group and year after discharge until their death, or the end of the reference period, in an effort to test the reliability of the results obtained from the original model. As expected, the results indicated that the relationship between the time dependent variables is complex and difficult to interpret. In contrast, the variables that are not time dependent produced stable results across both models.

A description of the time dependent variables is now provided.

## **Age**

For this analysis, the age of an individual is calculated at either the time of death (from suicide or other cause) or at date of extract, 10 April 2016. The variable age was categorised into three main age groups: 18–29, 30–49 and 50+.

## **Timing of suicide death**

Time since discharge is the time between discharge from the ADF and death. The maximum length of time since discharge that could be observed in this study was 15 years, due to the scope of the study—a focus on contemporary ex-serving personnel.

Additional modelling techniques were considered to account for the time dependent variables. The Cox proportional hazards model is a commonly used tool for studying the dependency of survival time on predictor variables. The key mathematical assumption of the proportional hazards model is that the hazard function (or distribution of suicide deaths over time), for one level of a categorical explanatory variable, is proportional to that for each of the other levels of that variable. The validity of this assumption was investigated by comparing plots of the hazard functions, and by applying a parametric test for proportionality. In both cases, it was concluded that the assumption did not hold and hence the Cox proportional hazards model was deemed not appropriate for this study.

Results of the final model are described in the next section.

## **Results of the model**

Table 7.1 displays the results of a logistic regression model, for the probability of suicide death. Interactions between each of the factors included in the model were tested and no significant interactions were identified. A discussion of the results from the modelling process follows.

**Table 7.1: Odds ratios of suicide, together with 95% CIs, for related characteristics**

Characteristic	Odds ratio	Lower 95% CI	Upper 95% CI
<b>Service</b>			
Army versus Navy	0.7	0.45	1.09
Air Force versus Navy	0.8	0.44	1.42
<b>Rank</b>			
All ranks other than commissioned officers versus commissioned officer	2.2*	1.16	4.06
<b>Length of service (LOS) (years)</b>			
LOS<1 versus LOS≥10	1.7	0.98	2.94
1≤LOS<5 versus LOS≥10	1.0	0.59	1.66
5≤LOS<10 versus LOS≥10	0.9	0.51	1.47
<b>Reason for discharge</b>			
Medical involuntary versus voluntary	1.9*	1.22	2.80
Non-medical involuntary versus voluntary	0.9	0.58	1.31

\* Statistically significant difference from reference group at 5% level.

*Note:* Age and time since discharge were included in the model; however, due to their time-dependent nature, the model parameter estimates for these variables are difficult to interpret and are not shown here. The variables have been retained in the model as they are important factors to control for when estimating the model parameters of the other variables.

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

## Service

Statistical modelling found that service in the Navy, Army or Air Force was not a significant predictor of suicide.

## Rank

Statistical modelling showed that rank was a significant predictor of suicide. The odds of suicide death for all ranks other than commissioned officers are around 2.2 times higher than the odds for commissioned officers. This result indicates that those of a lower rank have a higher likelihood of suicide.

## Length of service

The modelling results showed that length of service was not a significant predictor of suicide. This is likely due in part to the high correlation of the length of service with age. One effect of including highly correlated explanatory variables in a logistic model is that the standard errors of the parameter estimates for those variables are likely to become large, making the variables appear to have a weak effect individually. In this case, length of service appears not to be adding significant additional information. While length of service was not significant, it is worth noting, given the correlation between age and length of service, that the model results do suggest that discharge after less than 1 year of service is associated with an

increased likelihood of suicide compared with discharge after service of 10 years or more (odds ratio 1.7), when controlling for other factors. For a discussion on the correlation between the length of service and age variables, see the section headed 'Testing model assumptions' in Appendix A4.

## **Reason for discharge**

In the analysis of reason for discharge, the two types of involuntary discharge (medical and non-medical) were compared with voluntary discharge. Personnel involuntarily discharged for medical reasons had higher odds of suicide death than those discharged voluntarily (odds ratio 1.9). This result was statistically significant. For those involuntarily discharged for other reasons, the odds ratio was not statistically different when compared with the odds for voluntary discharge.

## 8 Discussion

### Contribution of key findings to the evidence base and policy analyses

The summary report—published in June 2017 as part of this ongoing study—compared suicide and all-cause mortality rates between contemporary serving, reserve and ex-serving ADF personnel and the Australian population, and identified individual service-related characteristics associated with suicide death in the ex-serving group (AIHW 2017b).

Analysis in the summary report examined each service-related characteristic associated with risk of suicide individually and did not consider potential relationships between these characteristics. This report complements and extends on that report to provide further detail behind the key findings and to model the demographic and service-specific characteristics of ex-serving ADF personnel who have died by suicide to simultaneously measure the impact of age and all other available characteristics on the likelihood of suicide.

This research provides strong evidence to help target ex-serving ADF personnel most at risk of suicide death. It will be useful to inform not only suicide-prevention projects already underway, but also the development of future policy and services to support serving and ex-serving ADF personnel.

#### Suicide and all-cause mortality in serving and reserve personnel

Results of the summary report (AIHW 2017b) found that, between 2002 and 2015, the suicide rate was 53% lower for men serving full time and 49% lower for men in the reserves than for an age-matched population of Australian men. Further detailed analysis shown in this report has found rates for men serving full time and in the reserves have been consistently lower than rates for Australian men, adjusted for age, between 2007–2009 and 2013–2015. These differences are statistically significant (excluding rates for men in the reserves 2007–2009 and 2008–2010) and are consistent with significantly lower mortality from all causes of death in these groups across the period. Together, these results suggest there is no excess suicide mortality in men currently serving full time or in the reserves in the ADF.

Lower all-cause mortality in these populations compared with an age-matched population of Australian men provides evidence of a healthy soldier effect. This could be the result of the rigorous selection and training processes employed by the ADF, the ongoing need to maintain fitness, and the ready access to health care provided during ADF service. The interface between the healthy soldier effect and suicide risk in the serving ADF population is complex: the high physical, medical and mental health standards for service act as protective factors against the risks to physical (including loss of life) and mental health (such as exposure to psychological trauma) inherent in ADF service and deployment. The healthy soldier effect in military personnel is recognised in numerous studies both in Australia and internationally (DVA & AIHW 2005; Harrex et al. 2003; Kang et al. 2015; Kapur et al. 2009).

#### Suicide and all-cause mortality in contemporary ex-serving personnel

Previous Australian studies of suicide in ex-serving personnel have focused on deaths among men who served in specific conflicts, such as the Vietnam and Korean wars



(Adena et al. 1985; DVA & AIHW 2005; Fett et al. 1987; Harrex et al. 2003; Sim et al. 2015). The findings of these studies have not always been conclusive and have also varied by conflict, method of cohort construction, comparison population and duration of follow-up.

As reported in the summary report (AIHW 2017b), the current study finds that, after adjusting for age, the suicide rate for ex-serving men was 14% higher than the rate for all Australian men. The current report has shown this difference to have been largely consistent across the period 2007–2009 and 2013–2015. This difference was not statistically significant but should be considered in the context of significantly lower mortality from all causes of death within this group across this whole period, and in the context of much lower rates of suicide in the serving and reserve populations.

The lower all-cause mortality rate in ex-serving men compared with an age-matched population of Australian men suggests that some of the protective factors associated with the healthy soldier effect (for example, good physical health) may still be present to some degree in the ex-serving ADF population. However, the higher suicide rate found in ex-serving men compared with Australian men, particularly at younger ages, suggests that the protective factors (individual or systemic) that may be associated with the lower suicide rates for men serving full time and in the reserves are compromised.

Further challenges in transitioning from full-time or reserve service to ex-serving—such as those associated with loss of employment—are also likely to contribute to the higher suicide rate in the ex-serving group (NMHC 2017).

This study also briefly compared suicide rates for ex-serving women across all ages and ex-serving men across all ages. While numbers are small, results suggest that ex-serving men have a higher crude suicide rate than ex-serving women. This finding is consistent with the pattern of suicide rates for the Australian population (AIHW 2017a).

## **Characteristics associated with high rates of suicide in ex-serving men**

Despite several methodological differences, key findings from this study relating to the influence of age, rank and time since discharge on rates of suicide are consistent with findings from studies of ex-serving defence personnel across the United Kingdom, Canada and the United States (Kang et al. 2015; Kapur et al. 2009; Knapik et al. 2009; Rolland-Harris et al. 2015).

The summary report published in June 2017 (AIHW 2017b) found that the suicide rate for ex-serving men varied by some service characteristics. Service characteristics associated individually with higher crude suicide rates among ex-serving men were: *discharge in a rank other than commissioned officer, less than 1 year of service, and involuntary discharge (particularly medical discharge)*. These characteristics were associated with high suicide rates for ex-serving men across all age groups up to age 50, which suggests that no one age group is contributing to the higher suicide rates for ex-serving men with these service characteristics.

Ex-serving personnel aged 18–29 were found to have a significantly higher crude rate of suicide compared with Australian men of the same age—a finding that persisted in the analysis of each of the service characteristics examined (AIHW 2017b). This suggested that ex-serving men aged 18–29 are at high risk of suicide death, regardless of individual service characteristics. These findings are consistent with those found in Kang et al. (2015) and Kapur et al. (2009).

Results of the modelling undertaken as part of the detailed analysis in the current report largely support the findings based on crude rates published to date. They show that, when controlling for all other factors, it is not only younger age contributing to the suicide death rate but also additional factors including rank, discharge reason and length of service. In particular, modelling has shown that, when all other available factors are considered, having a rank other than commissioned officer at the time of separation, and medical discharge, were significantly associated with high suicide risk.

Recent analysis from the United States has shown that non-routine discharge from military service (including those discharged with a disability, and those disqualified or discharged for misconduct) was associated with higher risk of suicide (Brignone et al. 2017). Results of the current analysis suggest that medical discharge is indeed a key factor associated with higher suicide risk in the Australian context. However, modelling has shown that the significance of non-medical involuntary discharge in relation to higher risk of suicide death may be diminished when age and all other available factors are considered.

Shorter length of service has been found in both Australian and international studies to be associated with suicide risk (AIHW 2017b; Kang et al. 2015; Kapur et al. 2009; Knapik et al. 2009; Rolland-Harris et al. 2015). Analysis of crude rates in this report shows that less than 1 year of service before discharge is associated with a significantly higher rate of suicide death compared with the rate for ex-serving personnel with 10 or more years of service. The direction of this finding remains even after controlling for age and all other available factors. However, when all other factors are controlled for, the strength of the association is somewhat diminished and the difference in the likelihood of suicide death between ex-serving men with less than 1 year of service and those with 10 or more years of service is not statistically significant.

Australian and international studies are divided on the effect of deployment on the risk of suicide, with insufficient statistical evidence in most cases to unequivocally associate deployment with increased risk of suicide death; in fact, some studies find deployment to be associated with lower risk of suicide death (AIHW 2017b; Kang et al. 2015; Rolland-Harris et al. 2015; Sim et al. 2015). Due to the reduced scope of analysis by operational service, the number of ex-serving personnel with operational service is small, and crude rates were not able to determine any significant difference in the rate of suicide between those with and those without operational service. This, along with a high correlation between operational service experience and age in the current study, meant that operational service was not included in modelled results and it was not possible at this stage to unequivocally associate having, or not having, operational service with increased risk of suicide death in this study. As the study progresses and data for more years are added, it may be possible to explore suicide rates within these groups in more detail.

## **Timing of suicide death after discharge**

It is recognised that the transition from service to civilian life after discharge—particularly involuntary discharge—requires substantial adjustment (Dunt 2009; NMHC 2017). Negative experiences during this period—such as failure to find employment, and difficulties in redefining a sense of identity and in accepting the circumstances of discharge—could increase suicide risk, particularly in the short term.

This study examined the length of time between discharge and death by suicide but could look only at ADF personnel recently discharged and who died—over the 15-year study period from 1 January 2001 to 31 December 2015. The summary report (AIHW 2017b) found that men who had been discharged from the ADF for less than 6 years at the time of their death had a higher rate of suicide death than those discharged for between 6 and less than

13 years. However, this difference was not statistically significant. Despite not being statistically significant, these results are broadly consistent with those reported by Kapur et al. (2009) who showed that risk of suicide was greatest up to 6 years after being discharged. Kang et al. (2015) showed that the risk of suicide was highest for the first 3 years after discharge. In the current study, rates were also examined for ex-serving personnel discharged from the ADF for less than 1 year at the time of their death. Again, no statistical difference was found between this group and those discharged for between 1 and less than 5 years, or those discharged for between 6 and less than 13 years, at the time of their death.

## **Methodological factors to consider**

There are several methodological factors and data issues that 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 CIs. This should be taken into account when interpreting the findings.

### **Potential underestimation of certified suicide deaths**

Analysis of deaths data in this report is based on year of occurrence of death; however, this can result in an underestimate for the last year of data as some deaths in each year are not registered until later years. There is a fairly consistent lag of about 5% across all years, with this proportion of deaths registered in the following year.

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 revisions process. This will affect tables containing the number of suicides by period, as some deaths currently coded as 'undetermined intent' could later be identified as 'intentional self-harm'.

There are also a few instances where a suicide death may not be included in the current study; namely, where confirmed suicides on the DSD could not be identified on the NDI (comparative analyses only), and where the death occurred overseas.

### **Short follow-up period**

The scope of this study is restricted to contemporary ADF personnel with at least 1 day of service since 1 January 2001 and who died between this time 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 suicide 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 as the study population increases and ages as the study progresses, additional risk factors for suicide may emerge.

## **Interpreting the standardised mortality ratio**

The SMR is a relative measure. It shows whether the rate of deaths due to suicide was higher in the study population than in the Australian population after taking account of the difference in population age structures. Results of the SMR should be interpreted in the context of information on counts of deaths to support decisions about where intervention may have the most impact. SMRs do not consider differences in the underlying all-cause mortality rate of the study and general population and cannot be compared directly with each other as they are standardised to different population distributions (AIHW 2011).

## **Factors not accounted for in this study**

Due to the scope of information available for this study, it was not possible to analyse a number of potentially important social, demographic and psychological factors (such as death of a loved one, history of substance abuse or difficulties finding employment) that may contribute to suicide risk. As well, only a relatively crude measure of operational service was available for analysis. As such, it was not possible to explore potential differences due to length and intensity of operational service, type of war (if served in warlike operations), or the number of times an individual was exposed to traumatic events. There was also limited potential within the data set to identify an individual's complete pathway in and out of service. This was because service status and service were determined as at 10 April 2016 when data were extracted, and movement between services or changes in service status could not be completely captured.

## **Further work**

This study is the first to examine several individual service-related characteristics of the ex-serving ADF population, and to model these characteristics in order to control for their interrelated nature and to determine which ones may be associated with increased risk of suicide among this population.

Further work could seek to investigate any differences in the ex-serving population for those who have had experience serving full time and those who have had reserve experience only.

As well, since July 2003, all personnel who joined the ADF have been routinely required to transfer to the inactive reserves for a period of at least 5 years after their transition from full-time service in the ADF. Since this time, most members leaving full-time service make the transition to the inactive reserve forces, unless they are discharged involuntarily. Involuntary discharges occur due to concerns around the suitability of an ADF member for full-time service. This makes them unsuitable for reserve service as well.

Most inactive reservists will not provide any further ADF service and from a connection to the ADF perspective may be closer to ex-serving members than active reservists. However, other members of the inactive reserves will never have had full-time service. A better reflection of the rate of suicide in personnel no longer providing ADF service may be to consider inactive and active reservists separately in future reporting.

Within Australia, living in remote areas with limited access to services is known to have an impact on both all-cause and suicide mortality rates (AIHW 2017c). Analysis of location at death may provide extra information that is useful in helping to identify key areas where more support may be required.

Qualitative or case-study analysis may also provide useful insight into the circumstances leading up to suicide death. The psychological autopsy methodology, based on

semi-structured interviews with individuals who knew the deceased well, has been used in studies of Australian farmers who died by suicide to understand their 'pathways to suicide' (Kunde et al. 2017). A similar approach could be used to understand the suicidal processes and events leading up to suicide death in ex-serving ADF personnel with the aim of identifying common themes that may suggest extra risk factors for suicide death in this group.

A set of key measures are currently being developed to monitor suicide rates for serving and ex-serving ADF personnel as part of ongoing work on this study. It is expected that the first update of this information will be published in mid-2018 and that this will be updated annually to allow any changes in the suicide rate among ex-serving personnel to be identified.

## Conclusion

Within ex-serving men, suicide rates were high across all age groups between 18 and 49. When compared with men in the Australian population, ex-serving personnel aged 18–29 had a significantly higher crude rate of suicide: 1.7 times higher than Australian men of the same age.

Results of the modelling largely support findings based on crude rates, which show that no one characteristic is primarily associated with suicide death in ex-serving men. Findings of this analysis show that, along with younger age, the risk of suicide death was highest in ex-serving men discharged with a rank other than a commissioned officer and in those discharged for medical reasons. The finding that short length of service (less than 1 year) was associated with higher risk remained even after controlling for age and all other available factors; however, the strength of the association was lower than when based on crude rates only and did not reach statistical significance. It should be noted that there are almost certainly other factors associated with suicide death for which information was not available for this study, and so could not be included in the model.

This study identifies groups of people who may be at higher risk of suicide death, but it cannot indicate if a particular characteristic is the cause of the suicide death. Qualitative analyses may also provide useful insight into the circumstances leading up to suicide death. This may be a useful piece of analysis to explore in future work on this topic.

The information and data in this report may help to inform policy and to develop interventions to reduce suicide rates among serving and ex-serving ADF personnel.

# Appendix A: Methods and technical notes

## A1 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 persons with ADF service on or after 1 January 2001. The file that was transferred to the AIHW contained 200,499 records. A total of 76,487 records were known by Defence to be of people who were alive and were de-identified before transfer. The remaining 124,012 records were in scope for linkage to the NDI.

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(s) 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 only 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 protections 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 7 years.

For more information on data storage, record retention and the privacy principles governing this study, see appendixes A6 and A7.

## Data linkage protocol and linkage report

### Data linkage rate

The data linkage rate cannot be determined as the total number of deaths in the PMKeyS data set is unknown. There is death information in the PMKeyS data set, but it is incomplete. A total of 941 personnel were recorded in the PMKeyS data set as having died (having a valid death date against the record, or an employment status of 'Deceased').

### Missing links

There were 49 records (5.3%) in PMKeyS data that could not be linked to the NDI, even though these had either valid death dates or an employment status of 'Deceased' in PMKeyS data. Of these 49 missing links, 29% (14 personnel) were recorded as overseas deaths, 22%

of missing links (11 personnel) appeared to have died in Australia while the remaining records had no recorded place of death.

Overseas deaths are out of scope for the NDI, although some overseas deaths may still be on the NDI if they are registered in Australia. This may account for 14 of the 49 missing links. The remaining 35 missing links may or may not be included in the NDI. Assuming they are in the NDI, these may not have been linked due to inconsistencies between PMKeyS data and the NDI. For example:

- the recorded name on one data set was a maiden name
- an alias, nickname or alternative first name was recorded in one data set compared with the other
- there was a major typographical error in one name or date field.

The NDI could not confirm if the 49 records were of deceased people. Therefore, they were not included in the deceased population.

## **Data inconsistencies**

### **Updated causes of death**

Records in the NDI can be updated over time with corrections and/or new information. For records where there were multiple lines in the NDI with different information with regards to the underlying cause of death, all cause of death information was preserved.

The AIHW did not assume that an updated cause of death overwrites the initial cause of death. All causes of death were retained in separate fields (cod1\_NDI and cod2\_NDI). Therefore, some records may have more than one cause of death.

### **Date of last contact occurring after date of death**

Termination date was available on the PMKeyS data set. This field was used as a checking variable, taken as a proxy for the date of last contact. Linked records having a termination date occurring after the date of death sourced from the NDI were flagged as inconsistent. These records were double checked manually for accuracy. After this step, 205 linked records remain with a recorded termination date beyond the date of death. These records were deemed to match with sufficiently high accuracy on other linkage variables. These records were therefore included in the in-scope population and considered to have a valid date of death.

### **Date of death occurring before 2001**

The PMKeyS data set identifies all personnel who have had ADF service on or after 1 January 2001. Linked records having a date of death (sourced from the NDI) before year 2001 were flagged as inconsistent. These records were double checked manually for accuracy. In the final data set, 30 linked records remain with a date of death recorded before 2001. These records appeared to link with sufficiently high accuracy on other linkage variables. They were therefore excluded from the in-scope analysis.

### **Conflicting date of death**

At times, the date of death recorded in the NDI conflicted with the date of death recorded in the PMKeyS data set. Both the PMKeyS date of death and the NDI date of death were retained but the NDI date of death was deemed to be more reliable and used throughout the

analysis. Where the format of the date of death on the NDI was invalid, and a date of death was available on the PMKeyS data, these date were used in reporting.

## The analysis data set

The analysis data set retains all row and field variables in the PMKeyS data set except for all name and address variables. Date of birth and date of death variables were retained to allow derivation of period and time variables. Additional fields for postcode, date of death and cause(s) of death were added from the NDI after linkage.

## A2 Counting suicide deaths

For the purpose of analysis, the following were defined:

1. in-scope records (living and deceased persons)
2. fact of death
3. cause of death
4. suicide death.

### In-scope records

The scope of the study is all ADF personnel with at least 1 day of ADF service from 1 January 2001 to 10 April 2016 (the date of the PMKeyS data extract). This means that, to be included in the total analysis set, a record must have a hire date before 10 April 2016, a termination date after 1 January 2001, and at least 1 day of service between the hire date and the termination date. Based on this definition, 401 records were excluded from analysis because they had:

- a termination date on or before 1 January 2001  
or
- zero (0) days of service  
or
- a hire date after the 10 April 2016 extract date  
or
- duplicate records.

A number of logical checks were performed on the data and a total of 632 records were excluded based on:

- a date of death before 1 January 2001
- a date of death before the hire date
- a missing date of death
- a reason for discharge of 'Military – Irregular enlistment' or 'Military – Failed to enlist' and less than 1 year of service. Irregular enlist/failed to enlist is considered out of scope as these individuals do not meet the criteria of having served 1 day in the ADF. Individuals within this group complete the enlistment process and do not attend the first day of service; therefore, they never complete 1 day in service.

This left a total of **199,466 unique in-scope records in the analysis data set.**



Note that linkage with the NDI revealed 16 deaths had occurred since the PMKeyS data extraction on 10 April 2016. For the purposes of this analysis, these individuals were considered to be 'alive', since their death occurred after the extraction date.

## Fact of death

Fact of death was defined by certification as determined through linkage to the NDI or the DSD. This ensures that results are defensible, comparable over time and can be reproduced.

The most recent year of cause of death data available at the time of linkage was 2015. As a result, analysis of deaths is restricted to deaths occurring from 1 January 2001 to 31 December 2015.

Of the 199,466 records in the analysis set, 2089 deaths were identified through linkage to the NDI or the DSD (certified deaths). Of these, 68 had a date of death after 31 December 2015, and were excluded from the analysis of deaths.

This left a total of **2,021 certified deaths for enumeration analysis** for the period 1 January 2001 to 31 December 2015.

## Cause of death

Linked records with two underlying causes of death were examined and it was found that, for each affected record, the more recent underlying cause of death provided more specific information than (and did not contradict) the earlier listed underlying cause of death. The more recent underlying cause of death code was retained for analysis.

Of the 2,021 certified deaths from 1 January 2001 to 31 December 2015, 62 had missing cause of death information from the NDI and the DSD. These were retained in the data set for the cause of death analysis. Over half of these records could be identified on the Defence Roll of Honour with an external cause of death other than intentional self-harm. This supports the decision to include these deaths in the denominator for analysis. Cause of death for the remaining records could not be cross-checked. The result of this may be an underestimation of suicide deaths in these analyses.

## Suicide death

The International Statistical Classification of Diseases and Related Health Conditions (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).

Analyses of the incidence of suicide include only those deaths with a valid date of death and cause of death from a certified source, namely:

- the NDI where the underlying cause of death was determined as intentional self-harm, or sequelae of intentional self-harm: ICD-10 codes X60–X84, Y87.0
- the DSD with a status of 'Confirmed'.

The ICD-10 codes used to define a suicide death in this study are consistent with definitions used in Australia to examine rates of suicide in the general population. The definition is consistent with the definition used in Canadian studies (Rolland-Harris et al. 2015) and differs only slightly from codes used in the 2005 mortality study of Vietnam veterans (DVA & AIHW 2005), which excluded deaths coded to Y87.0, sequelae of intentional self-harm. The current definition excludes events of undetermined intent (Y10–Y34,

excluding Y33.9 and Y87.2) that are used in analysis of suicide deaths in studies of both national and veteran suicide in the United Kingdom (Kapur et al. 2009).

#### **Box A2.1: Changes in coding intentional self-harm (suicide) over time**

Within Australia, cause of death information is coded by the ABS. Practices and guidelines for coding intentional self-harm have changed over time. New coding guidelines were applied for deaths registered from 1 January 2007. The new guidelines improve data quality by enabling deaths to be coded to suicide if evidence from police reports, toxicology reports, autopsy reports and coroners' findings indicates the death was from intentional self-harm. Previously, coding rules required a coroner to determine a death as intentional self-harm for it to be coded as suicide.

To further improve the capture of cause of death on coroner-certified deaths, all coroner-certified deaths registered after 1 January 2006 are subject to a revisions process. This allows cause of death for open coroner's cases to be included at a later stage where the case is closed during the revision period.

The combined result of both changes has been the more complete capture of suicide deaths, and a reduced number of cases with undetermined intent, within Australian mortality data.

Detailed information on coding guidelines for intentional self-harm, and administrative and system changes that can have an impact on the mortality data set, can be found in Explanatory Notes 85–92 of ABS 2016a.

These changes are considered when analysing deaths from suicide over time.

### **A3 Comparing suicide rates**

Comparative analysis was initially based on the 2,021 in-scope certified death records for cause of death analysis, for the period 1 January 2001 to 31 December 2015.

As population data for serving full time and reserve groups were available only from 1 January 2002, and 2001 population data for the ex-serving group were highly volatile, comparative analysis was restricted to the period from 1 January 2002 to 31 December 2015.

Deaths for comparative analysis were restricted to those determined through linkage to the NDI only, as cause of death on both the NDI and the NMD (used in the comparative set) were both sourced from the same file (Cause of Death Unit Record File). This ensured the definition of a death and death by suicide was consistent across study and comparison sets.

The incidence of suicide varies by age and sex. It was therefore necessary to consider these influences when comparing the incidence of suicide in the study set with that in the Australian population.

Based on these decisions, a further 82 deaths were excluded, including:

- deaths occurring in 2001
- deaths sourced from the DSD only.

This left a total of 1,939 NDI-certified cause of death records from 1 January 2002 to 31 December 2015 for comparative analysis.

## Standardised Mortality Ratio

Indirect age-standardisation was used to produce SMRs for suicide and all-cause mortality. The SMR is a widely used method of standardisation employed when there are small numbers of events (suicide deaths) in particular age groups. This method adjusts for age differences between the study and comparison populations by taking the observed number of events (suicide/death) in the study population divided by the number of events that would be expected if the study population had the same age and sex-specific suicide/deaths rates as the comparison population. An SMR greater than 1.0 means the rate of suicide in the ADF population group is higher than that for the Australian male population. An SMR less than 1.0 means the rate of suicide in the ADF population group is lower than that for the Australian male population.

Both overall and age-specific SMRs are used throughout this report to compare suicide and all-cause mortality with the Australian general population. SMRs are considered a robust tool for the analysis of data when there are small numbers of events, such as suicide data. However, SMRs cannot be compared directly with each other as they are standardised to different population distributions (AIHW 2011).

The STDRATE procedure—using the indirect method and assuming a Poisson distribution—of the SAS/STAT 12.1 component, run on Base SAS version 9.3, was used to produce the SMR, along with 95% CIs and *p*-values. For details of that method, see <<https://support.sas.com/documentation/onlinedoc/stat/121/stdrate.pdf>>.

## Age groups

Distinct comparison populations were required for each service status group due to their differing age structure. No population information was excluded from comparisons with lower and upper ages defined by ages observed within the study set for each group of interest.

The following age ranges were used to produce overall SMRs in this report:

- Men Serving full time: 17–70
- Men in the Reserve forces: 16–78
- Ex-serving men: 17–84.

As suicide rates for the Australian population are known to increase considerably with increasing age between ages 16–24, small age groupings (16–17, 18–24) were used to more accurately account for changes in rates across these ages in detailed analysis of the ex-serving population. Data were then grouped into 5-year age groups in calculating overall SMRs.

For overall time series analysis, data were then aggregated across a rolling 3-year period to improve the power of analysis. This also reduces the effect of year-to-year volatility in both the total number of deaths and the number of cause-specific (suicide) deaths.

## Confidence intervals and significance testing

Statistical significance is a 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 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.

To test significance, assumptions must be made about the distribution of the number of suicide deaths observed in a given time period. Suicide is a rare event within the study populations. If assuming that the chance of suicide is the same for all individuals within a study population and that suicide deaths are independent of each other, it follows that one can assume that the number of suicide deaths in the reference period follow a Poisson distribution. This assumption was made in conducting the significance test presented in this report.

The use of CIs is the simplest way to test for significant differences. If CIs do not overlap with each other when comparing crude rates or overlap with 1.0 for SMR CIs, the difference is statistically significant. It is not standard to calculate CIs for population-based data, but they are provided within this report to account for the assumed randomness of the count of suicides and deaths within the data.

Exact Poisson CIs were calculated for SMR estimates, rather than the more commonly employed Normal approximation to the Poisson distribution, as the number of suicide deaths by year in the service status groups is small. Detailed methodology for constructing the CIs is provided in Box A3.1.

### Box A3.1: Method for calculating confidence intervals

When constructing CIs for, and performing tests of, statistical significance on the SMRs, it has been assumed that the number of suicide deaths observed in the Defence population within a given time period is random and follows a Poisson distribution.

The STDRATE procedure of the SAS/STAT 12.1 component, run on Base SAS version 9.3, was used to produce exact Poisson distribution CIs and perform tests of hypothesis on the SMRs as follows:

The  $(1 - \alpha)$  CI for the SMR is given by

$$\left( \frac{q_l}{2\varepsilon}, \frac{q_u}{2\varepsilon} \right)$$

where, if  $\mathcal{S}$  denotes the number of deaths due to suicide in the Defence population,  $\mathcal{D}_{aj}$  the number of all deaths in the  $j$ th age group of the Defence population and  $\hat{\lambda}_{cj}$  the proportion of deaths in the  $j$ th age group of the comparison population that are due to suicide,

$$q_l = (\chi_{2\mathcal{S}}^2)^{-1}(\alpha/2)$$

is the  $(\alpha/2)$  quantile of the  $\chi^2$  distribution with  $2\mathcal{S}$  degrees of freedom,

$$q_u = (\chi_{2(\mathcal{S}+1)}^2)^{-1}(1 - \alpha/2)$$

is the  $(1 - \alpha/2)$  quantile of the  $\chi^2$  distribution with  $2(\mathcal{S} + 1)$  degrees of freedom, and

$$\varepsilon = \sum_j \mathcal{D}_{aj} \hat{\lambda}_{cj}$$

is the expected number of suicide deaths in the Defence population.

The  $p$ -value for the test of the null hypothesis  $H_0: \text{SMR} = 1$  is given by

$$2 \min \left( \sum_{k=0}^{\mathcal{S}} \frac{e^{-\varepsilon} \varepsilon^k}{k!}, \sum_{k=\mathcal{S}}^{\infty} \frac{e^{-\varepsilon} \varepsilon^k}{k!} \right).$$

Full details of the STDRATE procedure can be found in the SAS online documentation <<http://support.sas.com/documentation/onlinedoc/stat/141/stdrate.pdf>>.

CIs were also calculated for crude rates.

Performing significance tests for rate differences by comparing their CIs for overlap is not as precise as calculating exact  $p$ -values. The CI comparison is conservative in that, on occasion, the intervals overlap a small amount when the difference is significant but close to the significance threshold. In this study, in cases where CIs overlapped slightly, the exact  $p$ -value was calculated and used to determine statistical significance. The methodology of this test is described in Box A3.2.

**Box A3.2: Conditional test due to Przyborowski and Wilenski (1940)**

Let  $X_{11}, X_{12}, \dots, X_{1n_1}$  and  $X_{21}, X_{22}, \dots, X_{2n_2}$  be independent samples, respectively, from Poisson( $\lambda_1$ ) and Poisson( $\lambda_2$ ) distributions. It follows that

$$X_1 = \sum_{i=1}^{n_1} X_{1i} \sim \text{Poisson}(n_1\lambda_1)$$

independently of

$$X_2 = \sum_{i=1}^{n_2} X_{2i} \sim \text{Poisson}(n_2\lambda_2).$$

Let  $k_1$  and  $k_2$  be the observed values of  $X_1$  and  $X_2$ , respectively.

The conditional test due to Przyborowski and Wilenski (1940), as described by Krishnamoorthy & Thomson (2004), is based on the conditional distribution of  $X_1$ , given  $X_1 + X_2 = k$ . The distribution of  $X_1$ , conditionally given  $X_1 + X_2 = k$ , is binomial, with the number of trials  $k$  and success probability

$$p\left(\frac{\lambda_1}{\lambda_2}\right) = \frac{n_1}{n_2} \times \frac{\lambda_1}{\lambda_2} \times \frac{1}{1 + (n_1/n_2)(\lambda_1/\lambda_2)}.$$

In this instance, it was wished to test the null hypothesis  $H_0: \lambda_1 = \lambda_2$  versus  $H_1: \lambda_1 \neq \lambda_2$ —that is, assuming the observed number of suicide deaths have a Poisson distribution, the rate of incidence in the two populations is the same.

Under the null hypothesis

$$p\left(\frac{\lambda_1}{\lambda_2}\right) = p(1) = \frac{n_1}{n_2} \times \frac{1}{1 + (n_1/n_2)}$$

and the  $p$ -value is given by

$$2 \times \min \left\{ P\left(X_1 \geq k_1 | k, p(1)\right), P\left(X_1 \leq k_1 | k, p(1)\right) \right\}$$

where

$$P\left(X_1 \geq k_1 | k, p(1)\right) = \sum_{i=k_1}^k \binom{k}{i} p(1)^i (1 - p(1))^{k-i}.$$

If the calculated  $p$ -value was less than 0.05, the difference in rates was deemed to be statistically significant.

## Sensitivity analysis

### Population estimates as at 30 June and exposure

Exposure to the risk of suicide was calculated for the ex-serving population. Overall, SMRs were produced for this study group using both populations estimated as at 30 June as an approximation for time at risk and the actual time at risk. There was no substantial difference in SMRs produced using these two methods.

It was not possible to calculate the population time at risk for serving full time and reserve study populations, or the Australian general population. As a result, for consistency, all SMRs reported throughout are calculated using populations estimated as at 30 June as an approximation of time at risk.

### Age groups and reference periods

SMRs were also calculated using 10-year age groups and aggregated over 5-year intervals. Results were reproduced using all possible combinations of these groupings: 5-year age groups with 3-year aggregation, 5-year age groups with 5-year aggregation, 10-year age groups with 3-year aggregation, and 10-year age groups with 5-year aggregation. The key findings were consistent in all approaches.

Using 5-year aggregations increased the number of statistically significant findings, but reduced the number of time points in the trend, and reduced the responsiveness of the analysis to any changes that may have resulted from interventions. Standardising the data by 5-year age groups and aggregating over 3-year periods represented the most effective balance between accurate and robust comparisons, based on small numbers and reporting changes over time.

### All identified deaths and NDI-identified deaths

The analyses described in this section were repeated using all available fact of death and cause of death information (including information sourced from the DSD and PMKeyS). The PMKeyS data set included 45 deaths that could not be confirmed through linkage to the NDI. Location of death information (where available) indicated a large proportion of these were overseas deaths. Results of sensitivity analyses to include these deaths in SMR calculations were consistent with the findings based only on the NDI-derived fact and cause of death information.

Restricting the analysis to NDI-derived deaths provided the most robust and accurate comparison as cause of death on both the NDI and the NMD were sourced from the same file (Cause of Death Unit Record File), and a second source of information on suicide deaths was not available for the general Australian population.

## A4 Modelling suicide risk

Logistic regression was used to determine which characteristics were important in predicting death due to suicide.

### The model

The logistic regression model is expressed as an equation that estimates the probability of the event of interest and is of the form:

$$\log\left(\frac{p}{1-p}\right) = \beta^T x$$

Where

- $p$  is the probability of observing the event of interest (death due to suicide)
- $\beta$  is the vector of  $m$  parameter coefficients (one coefficient for each level of each categorical variable, one for each continuous variable and one for the intercept, minus the number of categorical variables)
- $x$  is the vector of covariates.

The regression analysis provides estimates of the effects of each of the variables included in the model while controlling for the effects of the other variables included in the model. The LOGISTIC procedure of the SAS/STAT 12.1 component, run on Base SAS version 9.3, was used to produce odds ratios and CIs.

## Odds ratios

Odds ratios are a commonly presented result from logistic regression. They are calculated for the logistic regression model. The odds ratio is a relative measure that compares the odds of people in a particular group experiencing an event (for example, death due to suicide), with the odds of people in another group experiencing the same event. The odds of an event occurring are defined as:

$$\text{Odds} = \frac{\text{Probability of event occurring}}{\text{Probability of event not occurring}} = \frac{p}{1 - p}$$

The odds ratio is then defined as:

$$\text{Odds ratio} = \frac{\text{Odds for people in group 2}}{\text{Odds for people in group 1}}$$

An odds ratio of 1 means that the odds of the event occurring is equal in both groups. An odds ratio of greater than 1.0 means that the odds of the event occurring is higher for people in group 2 than in group 1. Conversely, an odds ratio of less than 1 means that odds of the event occurring is less for people in group 2 than in group 1. More specifically, an odds ratio of 2.0 means that the odds of the event occurring for people in group 2 are 2 times as high as than the odds for people in group 1.

## Testing model assumptions

Before fitting the model, certain model assumptions were tested to ensure that relationships between explanatory variables were not unduly affecting the results.

Logistic regression assumes independence between the explanatory variables (Dobson 2002). However, it is expected that some of the variables collected by Defence are highly correlated, which indicates they are not independent. Another effect of including highly correlated explanatory variables in a logistic model is that the standard errors of the parameter estimates for those variables are likely to become large, making the variables appear to have a weak effect individually.

Correlations between explanatory variables were examined. For example, there was an expectation that age would be highly correlated with length of service. High correlation can be defined as being greater than 0.70 or less than -0.70. This was proven to be the case, with a Spearman's  $\rho$  correlation score greater than 0.80 (Table A4.1). Despite length of service being correlated with age, it was decided to keep the variable length of service in the final model given that the crude rates suggested it was a predictor of suicide. As well, models were tested including length of service instead of age, and with age included instead of length of service. Goodness-of-fit tests performed on these models showed that a model

including both length of service and age was indeed the best fit for the data (see the section headed 'Model checking' that follows for detail on the goodness-of-fit test used).

The correlation matrix also indicated that there is correlation between age and operational service ( $\rho = 0.71$ ).

The variable operational service was removed from the model, given the high correlation ( $\rho = 0.71$ ). Further to this, the crude rates suggest that there was no statistically significant difference in suicide rates between those with operational service compared with those with no operational service.

**Table A4.1: Correlation matrix of the relationships between the explanatory variables proposed to be used in the suicide modelling**

Characteristic	Age (years)	Operational service	Rank	Length of service (years)	Discharge reason	Service	Time since service (years)
Age (years)	1.00	0.71	-0.29	0.80	0.26	0.24	0.29
Operational service	0.71	1.00	-0.21	0.71	0.24	0.19	0.29
Rank	0.29	0.21	1.00	0.25	-0.09	-0.07	0.04
Length of service (years)	0.80	0.71	-0.25	1.00	0.22	0.26	0.04
Discharge reason	0.26	0.24	-0.09	0.22	1.00	0.21	0.11
Service	0.24	0.19	-0.07	0.26	0.21	1.00	0.02
Time since service (years)	0.29	0.29	0.04	0.04	0.11	0.02	1.00

## Model checking

Most of the tests for goodness-of-fit of a model are carried out by analysing residuals. However, such an approach is not feasible for a binary outcome as is the case here (death due to suicide or not). Hosmer and Lemeshow (1989) proposed a test statistic for this situation, which they demonstrated, through simulation, is distributed as a Chi-square with degrees of freedom ( $n - 2$ ) where  $n$  is the number of groups. The null hypothesis of this test is that the model fits the data; the alternative is that the model does not fit the data. The statistic is derived by partitioning the model population into 10 equally sized groups, based on order of predicted probabilities from lowest to highest. For each group, the observed and the expected number of events are determined and compared. If the model explains the data well, the Hosmer and Lemeshow goodness-of-fit statistic will be small, providing evidence for the null hypothesis.

The Hosmer and Lemeshow goodness-of-fit statistic is presented for the fitted model in Table A4.2. The null hypothesis of this test is that the model fits the data; the alternative is that the model does not fit the data. Since the  $p$ -value = 0.50 (Table A4.2), the null hypothesis can be accepted and it can be concluded that the model fits the data. That is, the model cannot be significantly improved by adding non-linearities and/or interactions. However, there are almost certainly other factors associated with death due to suicide for which information was not available for this study.



**Table A4.2: Logistic regression results: Hosmer and Lemeshow (1989) goodness-of-fit statistic**

Group	Number	Suicide death		Not a suicide death	
		Observed	Expected	Observed	Expected
1	7,846	3	1.48	7,843	7,844.52
2	8,019	1	3.18	8,018	8,015.82
3	7,735	7	4.68	7,728	7,730.32
4	8,095	5	7.56	8,090	8,087.44
5	7,855	8	8.28	7,847	7,846.72
6	7,666	13	10.62	7,653	7,655.38
7	7,753	15	14.46	7,738	7,738.54
8	7,711	17	21.84	7,694	7,689.16
9	7,794	36	31.70	7,758	7,762.30
10	6,813	49	50.21	6,764	6,762.79

**Test result: Chi-squared = 7.34 with 8 degrees of freedom and p-value = 0.50**

## A5 Classifications

The PMKeyS data underpinning this study were extracted on 10 April 2016. This extract provided a snapshot of a number of demographic and service-related characteristics of ADF personnel as at this date, including rank, service, operational service status, employment status and service banding. A number of extra characteristics were then derived from this information in the original extract including age, service status, length of service, time since discharge and vital status. For consistency, derived characteristics were also calculated as at 10 April 2016.

The classifications used for reporting are described in Box A5.1. Further detail on how service status, rank and reason for discharge were derived from the PMkeyS data is included in the following sections.

### Box A5.1: Classifications used in this report

**Length of service:** The time between the date of hire and date of separation (discharge) from the ADF. Analysis by length of service is presented for four broad groups: less than 1 year (<1), 1–<5 years, 5–<10 years, and 10 years or more (10+).

**Operational service:** 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.

(continued)

### **Box A5.1 (continued): Classifications used in this report**

**Operational service (continued):** Individuals with at least one type of operational service are counted in 'Any'; those with no operational service are counted in 'None'. The study's scope includes those discharged from the ADF after 1 January 2001. While discharged at this time, individuals may have had operational service at any time before this during their career. Only operational service since 1 January 1999 has been consistently identified across these four broad categories. Before this time, only warlike service was identified. To ensure comparability, analysis of operational service includes only those personnel hired on or after 1 January 1999.

*Note:* Under the VEA, the definition of 'operational service' differs significantly from how it is defined and presented in this report. To ensure all operations could be included in this study, the term 'operational service' was deemed the most appropriate. There are no changes to the legislative and policy definitions of the term 'operational service' under the VEA.

**Rank:** One's position in the ADF operational hierarchy. Analysis by rank is presented for two broad groups:

- commissioned officer
- all ranks other than commissioned officer.

See Appendix Table A5.1 for a full list of ADF ranks included in these groups.

**Reason for discharge:** The main reason recorded for a person's separating (discharging) from the ADF. Analysis by reason for discharge is presented for two broad groups:

- *voluntary discharge*—includes voluntary redundancies and resignations
- *involuntary discharge*—includes 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).

See table A5.2 for a full list of inclusions in each of these categories.

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

**Service status groups:** The three broad groups describing the nature of an individual's employment with the ADF, namely:

- *servicing full-time ADF personnel:* those serving in a permanent/regular capacity (usually full time) 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
- *reserve ADF personnel:* those rendering service (or available for service) in the Naval Reserve, Army Reserve or Air Force Reserve, and those in the standby (or inactive) reserve for each service at the time of data extract, 10 April 2016
- *ex-servicing ADF personnel:* those who rendered service in any of the servicing full time or reserve forces on or after 1 January 2001 and who were discharged from the ADF after 1 January 2001.

**Time since discharge:** The period between separation (discharge) from the ADF and death for ex-servicing personnel who have died. Analysis by the time since discharge is presented for three broad groups: less than 1 year (<1 year), 1 to less than 6 (1–<6) years and 6 to less than 13 (6–<13) years.

## Rank

The PMKeyS data were used to group people by rank—based on advice received from Defence—using the *Rank* variable. Any rank beginning with an ‘O’ was included in the group ‘commissioned officers’. Any rank beginning with an ‘E’ was included in the group ‘all ranks other than commissioned officer’. Table A5.2 provides a list of all ranks included in these groupings.

**Table A5.1: Grouping of rank using the PMKeyS Rank variable**

Service	Rank	Rank
Army	E00	Recruit
Navy	E00	Recruit
Air Force	E00	Aircraftman/woman Recruit
Army	E01	Private Trainee
Navy	E01	Seaman
Air Force	E01	Aircraftman/woman Trainee
Army	E02	Private
Navy	E02	Seaman
Air Force	E02	Aircraftman/woman
Army	E03	Private Proficient
Navy	E03	Able Seaman
Air Force	E03	Leading Aircraftman/woman
Army	E04	Lance Corporal
Army	E05	Corporal
Navy	E05	Leading Seaman
Air Force	E05	Corporal
Army	E06	Sergeant
Navy	E06	Petty Officer
Air Force	E06	Sergeant
Army	E07	Staff Sergeant
Army	E08	Warrant Officer Class 2
Navy	E08	Chief Petty Officer
Air Force	E08	Flight Sergeant
Army	E09	Warrant Officer Class 1
Navy	E09	Warrant Officer
Air Force	E09	Warrant Officer
Army	E10	Regimental Sergeant Major–Army
Navy	E10	Warrant Officer of the Navy
Air Force	E10	Warrant Officer–Air Force
Air Force	E51	Airmen Under Training

(continued)

**Table A5.1 (continued): Grouping of rank using the PMKeyS Rank variable**

<b>Service</b>	<b>Rank</b>	<b>Rank</b>
Army	O00	Officer Cadet
Navy	O00	Midshipman
Air Force	O00	Officer Cadet
Army	O01	Second Lieutenant
Navy	O01	Acting Sub Lieutenant
Air Force	O01	Pilot Officer
Army	O02	Lieutenant
Navy	O02	Sub Lieutenant
Air Force	O02	Flying Officer
Army	O03	Captain
Navy	O03	Lieutenant
Air Force	O03	Flight Lieutenant
Army	O04	Major
Navy	O04	Lieutenant Commander
Air Force	O04	Squadron Leader
Army	O05	Lieutenant Colonel
Navy	O05	Commander
Air Force	O05	Wing Commander
Army	O06	Colonel
Navy	O06	Captain
Air Force	O06	Group Captain
Army	O07	Brigadier
Navy	O07	Commodore
Air Force	O07	Air Commodore
Army	O08	Major General
Navy	O08	Rear Admiral
Air Force	O08	Air Vice-Marshal
Army	O09	Lieutenant General
Navy	O09	Vice Admiral
Air Force	O09	Air Marshal
Army	O10	General
Air Force	O10	Air Chief Marshal
Navy	O10	Admiral

## Reason for discharge

The *last\_termination\_reason* variable in the PMKeyS data was used to group people by two broad reasons for discharge: voluntary or involuntary. Table A5.2 shows how the values for the *last\_termination\_reason* variable were allocated to the two groups.

**Table A5.2: Grouping of reasons for discharge using the PMKeyS *last\_termination\_reason* variable**

Voluntary	Involuntary
APS resignation	Appointment cancelled
Discharge	Appointment terminated
Discharged in absence	Discharged
Discharge—open ended engagement	Discharged—unqualified
Elective	Dismissed
Military—Failed to enlist <sup>(a)</sup>	Marriage
Military—In absence	Medically unfit <sup>(b)</sup>
Military—Resignation	Military—Below fitness standard
Military—Voluntary redundancy	Military—Civil offence
Military—Withdrawal within 90 days of enlistment	Military—Disciplinary
Optional	Military—False statement on enlistment
Own requirement	Military—Irregular enlistment <sup>(a)</sup>
Regulation instrument 088-4-5	Military—Management initiated retirement
Resigned	Military—Medically unfit for service <sup>(b)</sup>
Voluntary redundancy	Military—Retention not in service interest
	Military—Training failure
	Military—Unsuitable for service (Defence personnel regulation 87-1-e)
	Not in interest
	Not required
	Physical standard
	Physically unfit
	Separated in service interest (Defence personnel regulation 70-SR)

(a) Excluded from data set where length of service was less than 1 year.

(b) Included in the 'Involuntary discharge for medical reasons' group.

## Service status

The PMKeyS data were used to group people by service status using the *employment\_status* and *service\_type\_banding* variables. It is important to note that service status is identified as at the time of death for deceased personnel, or as at the data extract date (10 April 2016). If the *employment\_status* was 'Terminated', they were included in the ex-serving group. If the *employment\_status* was 'Active', 'Suspended' or 'Deceased' and *service\_type\_banding* was 'Regular', 'CFTS' or 'Gap Year', they were included in the serving group. If the *employment\_status* was 'Active', 'Suspended' or 'Deceased' and *service\_type\_banding* was 'Active Reserve' or 'Inactive Reserve', they were included in the reserve group. Table A5.3 provides a summary of these groupings.

**Table A5.3: Classification of service status groups**

Employment_status	Service_type_banding				
	Regular	Continuous full-time service	Active reserve	Inactive reserve	Gap year
Active	Serving full time	Serving full time	Not serving full time (Reserve)	Not serving full time (Reserve)	Serving full time
Suspended	Serving full time	Serving full time	Not serving full time (Reserve)	Not serving full time (Reserve)	Serving full time
Deceased	Serving full time	Serving full time	Not serving full time (Reserve)	Not serving full time (Reserve)	Serving full time
Terminated	Not serving full time (ex-serving)	Not serving full time (ex-serving)	Not serving full time (ex-serving)	Not serving full time (ex-serving)	Not serving full time (ex-serving)

## A6 Data storage and record retention

Data provided and created for this study are stored as per AIHW information security protocols. No third parties (including DVA) have access to any identified data. Any data provided to DVA by the AIHW are in aggregated and de-identified form and stored in accordance with DVA's security processes and procedures.

Data stored and analysed at the AIHW are protected under the *Privacy Act 1988* and the *Australian Institute of Health and Welfare Act 1987*. The AIHW is subject to the *Public Service Act 1999* and the APS Code of Conduct. As well, it has issued formal Guidelines for the Custody of Institute Data as a further measure to ensure data protection.

The AIHW performs data linkage projects on a separate secure private network to which only Data Integration Services Centre (DISC) staff and the Systems Manager have access. Dedicated DISC infrastructure capabilities replicate the hardware already used with success on other large data integration projects across the AIHW. This environment is separate from any other AIHW systems. The AIHW connects, via the Intra Government Communications Network, to an internet gateway provider accredited by the Australian Signals Directorate; the AIHW's internet gateway is certified to the PROTECTED level. DISC projects are undertaken on a separate secure network not connected to the internet.

The AIHW uses best practice technology, procedures and policies to protect its information and communication technology assets. A layered system of security is in place, with different technologies and techniques used at different levels. In line with the Australian Government Protective Security Policy Framework:

- passwords are changed regularly
- accounts are locked out after three failed attempts

- Operating System patching of desktops, networking equipment and servers is done in line with Australian Signals Directorate guidelines
- application software updates are tested and applied as soon as practical after release
- access to the data centre is controlled by swipe card
- the network has a state-of-the art firewall to protect against external intrusion, beyond which the accredited gateway has its firewalls
- anti-virus software is constantly updated
- regular backups are taken, including rotation to a secure off-site storage facility
- desktops have been hardened to prevent users from installing software or tampering with the system.

These security measures are backed up by an auditing regime, based around tightly controlled separate information domains (staging, linking, and consolidation domains) that exist for each stage of creating the project data. Each project in each information domain is in a separate storage location, with access limited by user (different users in different information domains for separation requirements).

This architecture determines who can access what data at any time, and access is therefore predetermined and logged. Work logs of basic user and time/date information are generated when code is run against these data and are stored as part of the audit trail.

In summary, access is provided to individuals for each stage of a project. This allows the AIHW to determine and log all access rights to the data throughout the process. At the completion of the project, and in line with the data retention date, the AIHW uses sdelete (Microsoft) to remove all files relating to a project from the hard disk. In line with DISC data retention/backup cycle procedures, data are overwritten on a 4-weekly cycle. Data are encrypted as part of the archival process using Commvault.

## **A7 Privacy principles and ethics approval**

This study is conducted under strict privacy guidelines and the oversight of organisational ethics committees.

### **Privacy principles**

The *Privacy Act 1988* sets out 13 Australian Privacy Principles that govern agencies of the Australian Government in their collection, storage, use, disclosure and management of data containing personal information. The Privacy Act permits the handling of health information for health and medical research purposes in certain circumstances, where researchers are unable to seek individuals' consent. This recognises the need to protect health information from unexpected uses beyond individual health care as well as the important role of health and medical research in advancing public health.

The Privacy Commissioner has approved two sets of legally binding guidelines, issued by the National Health and Medical Research Council. Researchers must follow these guidelines when handling health information for research purposes without individuals' consent. The guidelines also assist Human Research Ethics Committees (HRECs) in deciding whether to approve research applications. The guidelines are produced under sections 95 and 95A of the Privacy Act, detailing procedures that HRECs and researchers must follow when personal information is disclosed from an Australian Government agency for medical research purposes, and providing a framework for HRECs to assess proposals to handle

health information for health and medical research (without individuals' consent). They ensure that the public interest in the research activities substantially outweighs the public interest in the protection of privacy.

### **Ethics approval**

The AIHW Ethics Committee, the DVA Human Research Ethics Committee and the Australian Defence Human Research Ethics Committee accepted that the public interest in the research activities of this project substantially outweighs the public interest in the protection of privacy, and approved the study pursuant to Section 95 of the Privacy Act.



# Appendix B: Data sources and classifications

## B1 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 the estimates run that included 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 persons per year, respectively, the ex-serving population in the analysis set starts at zero (0) on 1 January 2001 and increases by around 5,000 persons 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 suicide 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 2016b).

### Defence Suicide Database

Defence has maintained a database of suspected or confirmed deaths due to suicide of personnel serving full time since 1 January 2000. Suspected or confirmed suicide deaths are included on the database only on the advice of the ADF Investigative Service. Cases are assigned as a 'confirmed' suicide on receipt of a coronial finding of suicide.

### National Death Index

The NDI, housed at the AIHW, contains information on all Australian registered deaths since 1980. This information includes 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 included cause of death coded by the ABS. This is the same 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 years of death (2014 and 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% 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 compared with the NDI-linked ADF service status groups. This is expected to have minimal impact on results.

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 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. Defence provided the AIHW with an extract from the PMKeyS of 200,499 records of people with ADF service on or after 1 January 2001 up to the point of data extract (10 April 2016).

## B2 Classifications

### International Classification of Diseases

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 10th revision (ICD-10).

## Appendix C: Statistical tables

**Table C1: Crude rate of suicide death (per 100,000 population), ADF populations compared with Australian men, 2002–2015**

Population	Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
				Lower	Upper		
<b>ADF population</b>							
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
<b>Australian men</b>							
	17–70	22,773	21.8	21.6	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 population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C2: Age-specific rate (per 100,000 population) of suicide death by broad age group, ADF populations and all Australian men, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Serving</b>						
18–29	40	12.2	8.7	16.6	Yes	Lower
30–49	n.p.	9.5	6.4	13.7	Yes	Lower
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Reserve</b>						
18–29	15	11.2	6.3	18.5	Yes	Lower
30–49	35	13.1	9.1	18.3	Yes	Lower
50–69	10	9.5	4.6	17.5	Yes	Lower
<b>Ex-serving</b>						
18–29	55	33.6	25.3	43.7	Yes	Higher
30–49	88	28.7	23.0	35.4	No	..
50–69	11	9.6	4.8	17.2	Yes	Lower
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–49	10,899	25.5	25.0	26.0	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C3: Age-specific rate (per 100,000 population) of suicide death by fine age group, ex-serving and all Australian men, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Ex-serving</b>						
18–24	25	37.2	24.1	54.9	Yes	Higher
25–29	30	31.1	21.0	44.3	No	..
30–34	27	27.0	17.8	39.3	No	..
35–39	24	28.7	18.4	42.7	No	..
40–44	20	29.2	17.8	45.0	No	..
45–49	17	31.5	18.4	50.5	No	..
50–84	11	9.4	4.7	16.9	Yes	Lower
<b>Australia</b>						
18–24	2,828	18.8	18.1	19.5	..	..
25–29	2,356	21.7	20.8	22.6	..	..
30–34	2,683	24.9	23.9	25.8	..	..
35–39	2,707	25.3	24.4	26.3	..	..
40–44	2,870	26.5	25.5	27.5	..	..
45–49	2,639	25.4	24.4	26.4	..	..
50–84	8,418	19.4	19.0	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C4: Crude rate of suicide death (per 100,000 population), ADF populations, men, 2007–2009 to 2013–2015**

ADF population	Years		
	2007–2009	2010–2012	2013–2015
<b>Number of suicides</b>			
Serving	14	16	16
Reserve	17	12	13
Ex-serving	28	42	60
<b>Total</b>	<b>59</b>	<b>70</b>	<b>89</b>
<b>Crude suicide rate (deaths per 100,000)</b>			
Serving	9.8	10.5	10.9
Reserve	15.4	10.4	10.8
Ex-serving	23.8	25.9	29.2

Source: AIHW analysis of linked PMKeyS–NDI data 2007–2015.

**Table C5: Crude rate of suicide death (per 100,000 population), ex-serving men aged 18–29 and 30–84, 2007–2009 to 2013–2015**

Age group (years)	Years		
	2007–2009	2010–2012	2013–2015
<b>Number of suicides</b>			
18–29	9	14	18
30–84	19	28	42
<b>Total</b>	<b>28</b>	<b>42</b>	<b>60</b>
<b>Crude suicide rate (deaths per 100,000)</b>			
18–29	23.3	32.0	42.5
30–84	24.0	23.7	25.8

Source: AIHW analysis of linked PMKeyS–NDI data 2007–2015.

**Table C6: Crude rate of suicide in the ADF service groups combined and ex-serving, women, by age, 2002–2015**

Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
<b>All service groups combined</b>					
18–29	10	8.5	4.1	15.7	No
30–69	9	4.6	2.1	8.8	No
<b>Ex-serving women</b>					
All ages	11	9.9	5.0	17.8	No

(a) Refers to a statistically significant difference between the ADF population group and Australian women of the same age.

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

**Table C7: Comparative rate of suicide or all causes death, ADF populations compared with all Australian men, 2002–2015**

Cause of death/ ADF population	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Suicide</b>						
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	..
<b>All-cause mortality</b>						
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

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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

**Table C8: Comparative rate of suicide, ADF populations compared with all Australian men, by broad age, 2002–2015**

Population/ Age group (years)	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Serving</b>						
18–29	40	0.61	0.44	0.83	Yes	Lower
30–49	n.p.	0.37	0.25	0.54	Yes	Lower
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Reserve</b>						
18–29	15	0.56	0.31	0.92	Yes	Lower
30–49	35	0.51	0.36	0.72	Yes	Lower
50–69	10	0.49	0.24	0.91	Yes	Lower
<b>Ex-serving</b>						
18–29	55	1.68	1.26	2.18	Yes	Higher
30–49	88	1.13	0.90	1.39	No	..
50–69	11	0.50	0.25	0.89	Yes	Lower

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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

**Table C9: Comparative rate of suicide death, ex-serving men compared with all Australian men, by fine age group, 2002–2015**

Age group (years)	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
18–24	25	1.98	1.28	2.92	Yes	Higher
25–29	30	1.43	0.97	2.04	No	..
30–34	27	1.09	0.72	1.58	No	..
35–39	24	1.13	0.73	1.69	No	..
40–44	20	1.10	0.67	1.70	No	..
45–49	17	1.24	0.72	1.99	No	..
50–84	11	0.49	0.24	0.87	Yes	Lower

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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

**Table C10: Comparative rate of suicide death, ex-serving men, compared with all Australian men, 2007–2009 to 2013–2015**

Year	Number	SMR	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
2007–2009	28	1.05	0.70	1.52	No
2010–2012	42	1.16	0.84	1.57	No
2013–2015	60	1.27	0.97	1.63	No

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

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

**Table C11: Comparative rate of suicide death, men serving full time, compared with all Australian men, 2007–2009 to 2013–2015**

Year	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
2007–2009	14	0.44	0.24	0.75	Yes	Lower
2010–2012	16	0.49	0.28	0.80	Yes	Lower
2013–2015	16	0.49	0.28	0.79	Yes	Lower

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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

**Table C12: Comparative rate of suicide death, men in the reserves, compared with all Australian men, 2007–2009 to 2013–2015**

Year	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
2007–2009	17	0.68	0.39	1.08	No	..
2010–2012	12	0.47	0.24	0.82	Yes	Lower
2013–2015	13	0.47	0.25	0.80	Yes	Lower

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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



**Table C13: Comparative rate of suicide death, ex-serving men 18–29, compared with all Australian men, 2007–2009 to 2013–2015**

Year	Number	SMR	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
2007–2009	9	1.18	0.54	2.23	No	..
2010–2012	14	1.71	0.94	2.87	No	..
2013–2015	18	2.20	1.31	3.48	Yes	Higher

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

(b) The direction of the difference when compared with an age-matched population of Australian men.

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

**Table C14: Comparative rate of suicide death, ex-serving men 30–84, compared with all Australian men, 2007–2009 to 2013–2015**

Year	Number	SMR	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
2007–2009	19	1.00	0.60	1.56	No
2010–2012	28	1.00	0.66	1.45	No
2013–2015	42	1.07	0.77	1.45	No

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

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

**Table C15: Crude rate of death from suicide per 100,000 population, ex-serving men, by service, 2002–2015**

Service	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
Navy	30	28.8	19.5	41.2	No
Army	103	27.3	22.3	33.1	No
Air Force	21	19.8	12.3	30.3	No

(a) Refers to a statistically significant difference between the three service groups.

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

**Table C16: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, Navy, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
<b>Navy</b>					
18–29	10	36.3	17.4	66.8	No
30–39	12	36.2	18.7	63.2	No
40–69	8	19.0	8.2	37.5	No
<b>Australia</b>					
18–29	5,184	20.0	19.5	20.6	..
30–39	5,390	25.1	24.4	25.8	..
40–69	11,817	22.0	21.6	22.4	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

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

**Table C17: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, Army, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Army</b>						
18–29	37	29.8	21.0	41.1	Yes	Higher
30–39	35	27.5	19.1	38.2	No	..
40–49	n.p.	38.9	25.6	56.6	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C18: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, Air Force, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Air Force</b>						
18–29	n.p.	64.9	28.0	128.0	Yes	Higher
30–49	10	18.2	8.7	33.4	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–49	10,899	25.5	25.0	26.0	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C19: Crude rate of death from suicide (per 100,000 population), ex-serving men, by rank, 2002–2015**

Rank	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
Commissioned officer	11	10.5	5.2	18.8	..	..
All ranks other than commissioned officers	143	29.7	25.0	34.9	Yes	Higher

(a) Refers to a statistically significant difference between the commissioned officer rank and all ranks other than commissioned officers.

(b) The direction of the difference when compared with the commissioned officer rank.

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

**Table C20: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, all ranks other than commissioned officers, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>All ranks other than commissioned officers</b>						
18–29	52	34.8	26.0	45.7	Yes	Higher
30–39	49	29.9	22.1	39.6	No	..
40–49	n.p.	34.3	23.8	47.9	No	..
50–69	n.p.	11.5	5.0	22.7	No	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C21: Crude rate of death from suicide per 100,000 population, ex-serving men, by operational service, 2002–2015**

Operational service	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
Any operational service	11	29.7	14.8	53.1	..
No operational service	72	33.9	26.5	42.7	No

(a) Refers to a statistically significant difference between those with any operational service and those with no operational service.

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

**Table C22: Age-specific rate of death from suicide (per 100,000 population), ex-serving men with no operational service, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>No operational service</b>						
18–29	46	35.8	26.2	47.7	Yes	Higher
30–39	n.p.	35.3	22.4	53.0	No	..
40–49	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C23: Crude rate of death from suicide (per 100,000 population), ex-serving men, by length of service, 2002–2015**

Length of service (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<1	39	45.6	32.4	62.3	Yes	Higher
1–<5	40	28.6	20.4	39.0	No	..
5–<10	24	25.8	16.5	38.3	No	..
10+	51	19.0	14.1	25.0	..	..

(a) Refers to a statistically significant difference when compared with the 10+ years of service group.

(b) The direction of the difference when compared with the 10+ years of service group.

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

**Table C24: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, less than 1 year length of service, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>Less than 1 year of service</b>						
18–29	27	45.5	30.0	66.3	Yes	Higher
30–39	n.p.	48.9	23.4	89.9	No	..
40–49	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C25: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, 1 to less than 5 years of service, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
<b>1 to less than 5 years of service</b>					
18–29	23	29.6	18.8	44.5	No
30–39	n.p.	32.6	18.6	53.0	No
40–49	n.p.	n.p.	n.p.	n.p.	..
<b>Australia</b>					
18–29	5,184	20.0	19.5	20.6	..
30–39	5,390	25.1	24.4	25.8	..
40–49	5,509	25.9	25.3	26.6	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

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

**Table C26: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, 5 to less than 10 years of service, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
<b>5 to less than 10 years of service</b>					
18–29	n.p.	19.9	6.5	46.4	No
30–39	16	30.3	17.3	49.2	No
40–49	n.p.	n.p.	n.p.	n.p.	..
<b>Australia</b>					
18–29	5,184	20.0	19.5	20.6	..
30–39	5,390	25.1	24.4	25.8	..
40–49	5,509	25.9	25.3	26.6	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

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

**Table C27: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, 10 or more years of service, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>10+ years of service</b>						
30–39	9	14.7	6.7	27.9	No	..
40–49	31	32.8	22.3	46.5	No	..
50–69	11	10.1	5.1	18.1	Yes	Lower
<b>Australia</b>						
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

**Table C28: Crude rate of death from suicide (per 100,000 population), ex-serving men, by reason for discharge<sup>(a)</sup>, 2002–2015**

Population/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(b)</sup>	Direction of difference <sup>(c)</sup>
			Lower	Upper		
Voluntary	72	19.4	15.2	24.5	..	..
Involuntary	74	46.9	36.8	58.9	Yes	Higher
Medical involuntary	38	69.2	49.0	94.9	Yes	Higher
Non-medical involuntary	36	35.0	24.5	48.4	Yes	Higher

(a) Excludes men who had a contractual/administrative reason for discharge.

(b) Refers to a statistically significant difference when compared with the voluntary group.

(c) The direction of the difference when compared with the voluntary group.

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

**Table C29: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, by reason for discharge<sup>(a)</sup>, 2002–2015**

Discharge type/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(b)</sup>	Direction of difference <sup>(c)</sup>
			Lower	Upper		
<b>Voluntary</b>						
18–29	28	29.1	29.1	19.3	No	..
30–39	n.p.	17.2	17.2	10.5	No	..
40–49	21	25.6	25.6	15.9	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Medical — involuntary discharge</b>						
18–29	n.p.	48.6	21.0	95.8	Yes	Higher
30–39	18	88.3	52.3	139.6	Yes	Higher
40–49	10	83.7	40.1	153.9	Yes	Higher
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Non-medical — involuntary discharge</b>						
18–29	18	38.4	22.7	60.6	Yes	Higher
30–39	12	39.1	20.2	68.4	No	..
40–49	n.p.	33.0	10.7	77.1	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..
50–69	6,308	19.4	18.9	19.8	..	..

(a) Excludes men who had a contractual/administrative reason for discharge.

(b) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(c) The direction of the difference when compared with Australian men of the same age.

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



**Table C30: Crude rate of death from suicide (per 100,000 population), ex-serving men, by time since discharge, 2002–2015**

Time since discharge	Number	Rate	CI		Statistically significant <sup>(a)</sup>
			Lower	Upper	
TSD: <1 year	23	32.5	20.6	48.8	No
TSD: 1–<6 years	86	29.2	23.3	36.0	No
TSD: 6–<13 years	45	21.6	15.7	28.8	..

TSD = time since discharge.

(a) The direction of the difference when compared with those discharged for between 6 and <13 years.

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

**Table C31: Age-specific rate of death from suicide (per 100,000 population), ex-serving men, by time since discharge, 2002–2015**

Time since discharge/ Age group (years)	Number	Rate	CI		Statistically significant <sup>(a)</sup>	Direction of difference <sup>(b)</sup>
			Lower	Upper		
<b>TSD: &lt;1 year</b>						
18–29	11	35.2	17.6	63.1	No	..
30–39	5	28.1	9.1	65.6	No	..
40–49	n.p.	43.3	14.1	101.0	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>TSD: 1–&lt;6 years</b>						
18–29	36	34.5	24.1	47.7	Yes	Higher
30–39	27	31.6	20.8	46.0	No	..
40–49	18	32.0	19.0	50.6	No	..
50–69	5	10.3	3.4	24.1	No	..
<b>TSD: 6–&lt;13 years</b>						
18–29	8	28.3	12.2	55.9	No	..
30–39	19	24.7	14.9	38.6	No	..
40–49	n.p.	27.5	15.1	46.2	No	..
50–69	n.p.	n.p.	n.p.	n.p.	..	..
<b>Australia</b>						
18–29	5,184	20.0	19.5	20.6	..	..
30–39	5,390	25.1	24.4	25.8	..	..
40–49	5,509	25.9	25.3	26.6	..	..
50–69	6,308	19.4	18.9	19.8	..	..

TSD = time since discharge.

(a) Refers to a statistically significant difference between the ADF population group and Australian men of the same age.

(b) The direction of the difference when compared with Australian men of the same age.

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

# Glossary

**ADF personnel:** Serving and ex-serving members of the Australian Defence Force; does not include civilian personnel employed by the Department of Defence.

**age-specific rate:** A rate for a specific age group. The numerator and denominator relate to the same age group.

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

**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.

**correlation:** The strength of an association between variables is given by a value between  $-1$  and  $1$ , where stronger relationships are indicated by values further away from  $0$ . High correlation can be defined as being greater than  $0.70$  or less than  $-0.70$ .

**crude suicide rate:** The number of suicide 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.

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

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

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

**odds ratio:** The proportional change in odds of a certain result that would occur when moving between the two categories of a predictor variable, if all other factors are held constant. For example, if the odds ratio between *all ranks other than commissioned officers* and *commissioned officers* is  $2.2$ , this means that the particular outcome (such as death due to suicide) has  $2.2$  times the odds for *all ranks other than commissioned officers* than for *commissioned officers*, if all other factors (such as service) are held constant.

**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'.

**p-value:** The probability that an observed difference has arisen by chance alone.

**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.

**reason for discharge:** The main reason recorded for a person's separating (discharging) from the Australian Defence Force. Analysis by reason for discharge is presented for two broad groups: voluntary discharge—includes voluntary redundancies and resignations; 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 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.

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

**service status:** The broad nature of an individual's employment with the Australian Defence Force, namely: serving full time, reserve 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 comparison of the suicide death rates for the Australian Defence Force populations with the Australian population, adjusting for differences in age structure. An SMR of 1.0 indicates similar rates for each population. An SMR of greater than 1.0 indicates that the ADF population has a higher rate than the Australian population, and an SMR of less than 1.0 indicates that the ADF population has a lower rate than the Australian population.

**statistical significance:** A statistical measure indicating how likely the observed difference is due to chance alone. Rates are deemed to be statistically significantly different 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 an asterisk, or described as being 'significantly higher'/'significantly lower'.

**time since discharge:** The period between separation (discharge) from the ADF and death for ex-serving personnel who have died. The period between separation and extract date (10 April 2016) for those alive at the extract date.

# References

- ABS (Australian Bureau of Statistics) 2016a. Causes of death, Australia, 2015. ABS cat. no. 3303.0. Canberra: ABS.
- ABS 2016b. Australian demographic statistics, June 2016. ABS cat. no. 3101.0. Canberra: ABS.
- Adena MA, Cobbin DM, Fett MJ, Forcier L, Hudson HM, Long AA et al. 1985. Mortality among Vietnam veterans compared with non-veterans and the Australian population. *Medical Journal of Australia* 143:541–4.
- AIHW (Australian Institute of Health and Welfare) 2011. Principles on the use of direct age-standardisation in administrative data collections: for measuring the gap between Indigenous and non-Indigenous Australians. Data linkage series no. 12. Cat. no. CSI 12. Canberra: AIHW.
- AIHW 2016. Incidence of suicide among serving and ex-serving Australian Defence Force personnel 2001–2014. Cat. no. PHE 212. Canberra: AIHW.
- AIHW 2017a. GRIM (General Record of Incidence of Mortality) books 2014: Suicide. Canberra: AIHW. Viewed 18 August 2017, <<https://www.aihw.gov.au/reports/life-expectancy-death/grim-books/contents/grim-books>>.
- AIHW 2017b. Incidence of suicide among serving and ex-serving Australian Defence Force personnel 2001–2015: in brief summary report. Cat. no. PHE 213. Canberra: AIHW.
- AIHW 2017c. MORT (Mortality Over Regions and Time) books: Remoteness area, 2010–2014. Canberra: AIHW. Viewed 10 August 2017, <<https://www.aihw.gov.au/reports/life-expectancy-death/mort-books/contents/mort-books>>
- AIHW: Harrison JE & Henley G 2014. Suicide and hospitalised self-harm in Australia: trends and analysis. Injury research and statistics series no. 93. Cat. no. INJCAT 169. Canberra: AIHW.
- AISRAP (Australian Institute for Suicide Research and Prevention) 2016. Suicidal behaviour and ideation among military personnel: Australian and international trends. Summary report prepared for the Department of Veterans' Affairs. Canberra: Department of Veterans' Affairs. Viewed 3 August 2017, <<https://www.dva.gov.au/health-and-wellbeing/research-and-development/health-studies/suicidal-behaviour-and-ideation-among>>.
- Blackburn D 2016. Transitioning from military to civilian life: examining the final step in a military career. *Canadian Military Journal* 16:53–62.
- Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH & Gundlapalli AV 2017. Non-routine discharge from military service: mental illness, substance use disorders, and suicidality. *American Journal of Preventive Medicine* 52:557–65.
- Bruce ML 2010. Suicide risk and prevention in veteran populations. *Annals of the New York Academy of Sciences* 1208:98–103.
- Defence (Australian Government Department of Defence) 2017a. Defence Community Organisation: leaving the ADF. Canberra: Defence. Viewed 3 August 2017, <<http://www.defence.gov.au/DCO/Transition/Default.asp>>.
- Defence 2017b. Defence health: post-traumatic stress disorder. Canberra: Defence. Viewed 10 October 2017, <<http://www.defence.gov.au/health/healthportal/PTSD.asp>>.

- Dobson A 2002. *An introduction to generalized linear models*. 2nd edn. Boca Raton: Chapman & Hall/CRC.
- Dunt D 2009. *Independent study into suicide in the ex-service community*. Canberra: Department of Veterans' Affairs. Viewed 3 August 2017, <<https://www.dva.gov.au/health-and-wellbeing/research-and-development/health-studies/independent-study-suicide-ex-service>>.
- DVA (Department of Veterans' Affairs) 2013. *Veteran mental health strategy: a ten year framework 2013–2023*. Canberra: DVA. Viewed 3 August 2017, <<http://at-ease.dva.gov.au/veterans/files/2013/06/Veteran-Mental-Health-Strategy.pdf-V050613.pdf>>.
- Fellegi P & Sunter A 1969. A theory for record linkage. *Journal of the American Statistical Association* 64:1183–210.
- Fett MJ, Nairn JR, Cobbin DM & Adena MA 1987. Mortality among Australian conscripts of the Vietnam conflict era. II. Causes of death. *American Journal of Epidemiology* 125:878–84.
- Forbes D, O'Donnell M, Brand R, Korn S, Creamer M, McFarlane A et al. 2016. The long term mental health impact of peacekeeping: prevalence and predictors of psychiatric disorder. *British Journal of Psychiatry Open* 2:32–7.
- Hamilton M 2011. *The use of alcohol in the Australian Defence Force: report of the Independent Advisory Panel on Alcohol*. Canberra: Defence. Viewed 3 August 2017, <<http://www.defence.gov.au/PathwayToChange/Docs/UseOfAlcohol/>>.
- Harrex WK, Horsley KW, Jelfs P, Van Der Hoek R & Wilson EJ 2003. *Mortality of Korean War veterans: the veteran cohort report. A report of the 2002 retrospective cohort study of Australian veterans of the Korean War*. Cat. no. DVA P977. Canberra: Department of Veterans' Affairs.
- Hoffmire C, Kemp JE & Bossarte RM 2015. Changes in suicide mortality for veterans and nonveterans by gender and history of VHA service use, 2000–2010. *Psychiatric Services* 66:959–65.
- Hosmer D & S Lemeshow 1989. *Applied logistic regression*. New York: Wiley.
- JSCFADT (Joint Standing Committee on Foreign Affairs, Defence and Trade) 2015. *Review of the Defence Annual Report 2013–14*. Canberra: Joint Standing Committee on Foreign Affairs, Defence and Trade. Viewed 3 August 2017, <[http://www.aph.gov.au/Parliamentary\\_Business/Committees/Joint/Foreign\\_Affairs\\_Defence\\_and\\_Trade/2013-14\\_Defence\\_AR/Report](http://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Foreign_Affairs_Defence_and_Trade/2013-14_Defence_AR/Report)>.
- Kang HK, Bullman TA, Smolenski DJ, Skopp NA, Gahm GA & Reger MA 2015. Suicide risk among 1.3 million veterans who were on active duty during the Iraq and Afghanistan wars. *Annals of Epidemiology* 25:96–100.
- Kapur N, While D, Blatchley N, Bray I & Harrison K 2009. Suicide after leaving the UK armed forces—a cohort study. *PLOS Medicine* 6:e26.
- Katz IR, McCarthy JF, Ignacio RV & Kemp J 2012. Suicide among veterans in 16 states, 2005 to 2008: comparisons between utilizers and nonutilizers of Veterans Health Administration (VHA) services based on data from the National Death Index, the National Violent Death Reporting System, and VHA administrative records. *American Journal of Public Health* 102:S105–S110.
- Knapik JJ, Marin RE, Grier TL & Jones BH 2009. A systematic review of post-deployment injury-related mortality among military personnel deployed to conflict zones. *BMC Public Health* 9:231–53.

- Krishnamoorthy K & Thomson J 2004. A more powerful test for comparing two Poisson means. *Journal of Statistical Planning and Inference* 119:23–35.
- Kunde L, Kölves K, Kelly B, Reddy P & De Leo D 2017. Pathways to suicide in Australian farmers: a life chart analysis. *International Journal of Environmental Research and Public Health* 14:352–67.
- Martin E 2000. Characteristics of the future battlefield and deployment. In: National research council board on environmental studies and toxicology (ed.). *Strategies to protect the health of deployed U.S. forces: assessing health risks to deployed U.S. forces—workshop proceedings*. Washington, DC: National Academy Press, 24–34.
- McCarthy JF, Bossarte RM, Katz IR, Thompson C, Kemp J, Hannemann CM et al. 2015. Predictive modeling and concentration of the risk of suicide: implications for preventive interventions in the US Department of Veterans Affairs. *American Journal of Public Health* 105:1935–42.
- NMHC (National Mental Health Commission) 2017. Review into the suicide and self-harm prevention services available to current and former serving ADF members and their families. Final report: findings and recommendations. Report prepared for the Minister for Veterans' Affairs and Defence Personnel and the Minister for Health. Viewed 31 March 2017, <[http://www.dva.gov.au/sites/default/files/publications/health/Final\\_Report.pdf](http://www.dva.gov.au/sites/default/files/publications/health/Final_Report.pdf)>.
- Phoenix Australia 2017. Resources: trauma research. Melbourne: Phoenix Australia. Viewed 3 August 2017, <<http://phoenixaustralia.org/wp-content/uploads/2015/03/Phoenix-Research-Epidemiology.pdf>>.
- Przyborowski J & Wilenski H 1940. Homogeneity of results in testing samples from Poisson series. *Biometrika* 31:313–23.
- Rolland-Harris E, Whitehead J, Matheson H & Zamorski MA 2015. Report on suicide mortality in the Canadian Armed Forces (1995 to 2014). Surgeon General Health Research Program, Surgeon General Document Number SGR-2015-005. Viewed 25 January 2017, <<http://publications.gc.ca/site/eng/9.808552/publication.html#>>.
- Sim M, Clarke D, Forbes A, Glass D, Gwini S, Ikin J et al. 2015. Australian Gulf War Veterans' Follow Up Health Study: technical report 2015. Melbourne: Monash University. Viewed 16 February 2017, <<http://www.dva.gov.au/consultation-and-grants/research-and-development/health-studies/australian-gulf-war-veterans-follow>>.
- Skegg K, Firth H, Gray A & Cox B 2010. Suicide by occupation: does access to means increase the risk? *Australian and New Zealand Journal of Psychiatry* 44:429–34.
- Tehan, the Hon. D 2017. Government action on NMHC review. Media release by Minister for Veterans' Affairs, Minister for Defence Personnel. 31 March. Canberra. Viewed 27 July 2017, <<https://www.minister.defence.gov.au/minister/dan-tehan/media-releases/government-action-nmhc-review>>.
- Van Hooff M, McFarlane AC, Davies CE, Searle AK, Fairweather-Schmidt AK, Verhagen A et al. 2014. The Australian Defence Force Mental Health Prevalence and Wellbeing Study: design and methods. *European Journal of Psychotraumatology* 5:23950.
- Wilson EJ, Horsley KW & van der Hoek R 2005. Australian Vietnam Veterans Mortality Study 2005. Cat. no. P1055b. Canberra: Department of Veterans' Affairs.

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## Related publications

This report, *Incidence of suicide among serving and ex-serving Australian Defence Force personnel: detailed analysis 2001–2015*, is part of an ongoing study. Preliminary and summary results of this study have already been published and can be downloaded for free from the AIHW website <<https://www.aihw.gov.au/reports-statistics/population-groups/veterans/reports>>. The website also includes information on ordering printed copies. Any future related publications will also be made available through the website.

The following AIHW publications relating to current and former Australian Defence Force personnel, including the preliminary and summary results of this study, might be of interest:

- AIHW (Australian Institute of Health and Welfare) & DVA (Commonwealth Department of Veterans' Affairs) 1999. Morbidity of Vietnam veterans, executive summary: a study of the health of Australia's Vietnam veteran community. Cat. no. PHE 21. Canberra: AIHW.
- AIHW & DVA 2001. Morbidity of Vietnam veterans: multiple sclerosis and motor neurone disease in Vietnam veterans, supplementary report 3. Cat. no. PHE 31. Canberra: AIHW.
- AIHW 2001. Morbidity of Vietnam veterans: adrenal gland cancer, leukaemia and non-Hodgkin's lymphoma, supplementary report 2. Cat. no. PHE 28. Canberra: AIHW.
- AIHW 2002. Health care usage and costs: a comparison of veterans and war widows and widowers with the rest of the community. Cat. no. PHE 42. Canberra: AIHW.
- AIHW 2003. Cancer incidence study 2003: Australian veterans of the Korean War. Cancer series. Cat. no. PHE 48. Canberra: AIHW.
- AIHW: Bowler E & Peut A 2006. Veterans on Community Aged Care Packages: a comparative study. Aged care series no. 9. Cat. no. AGE 46. Canberra: AIHW.
- AIHW, Lloyd J & Anderson P 2008. Veterans' use of health services. Aged care series no. 13. Cat. no. AGE 51. Canberra: AIHW.
- AIHW 2009. Third study of mortality and cancer incidence in aircraft maintenance personnel: a continuing study of F-111 Deseal/Reseal personnel 2009. Cancer series no. 45. Cat. no. CAN 41. Canberra: AIHW.
- AIHW 2016. Fourth study of mortality and cancer incidence in aircraft maintenance personnel: a continuing study of F-111 Deseal/Reseal personnel 2016. Cancer series no. 99. Cat. no. CAN 98. Canberra: AIHW.
- AIHW 2016. Incidence of suicide among serving and ex-serving Australian Defence Force personnel 2001–2014. Cat. no. PHE 212. Canberra: AIHW.
- AIHW 2017. Incidence of suicide among serving and ex-serving Australian Defence Force personnel 2001–2015: in brief summary report. Cat. no. PHE 213. Canberra: AIHW.
- Harrex WK, Horsley KW, Jelfs P, Van Der Hoek R & Wilson EJ 2003. Mortality of Korean War veterans: the veteran cohort report. A report of the 2002 retrospective cohort study of Australian veterans of the Korean War. Cat. no. DVA P977. Canberra: Department of Veterans' Affairs.



This report examines the incidence of suicide among serving and ex-serving Australian Defence Force personnel in 2001–2015, and identifies characteristics that may be associated with suicide risk. Ex-serving men aged 18–29 have a higher suicide rate compared with Australian men of the same age. Ex-serving men of all ages who were medically discharged, or discharged in ranks other than commissioned officer, were at higher risk of suicide than their peers.

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