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Suicide among emergency and protective service workers: A retrospective mortality study in Australia, 2001 to 2012

A. Milner[a,*], K. Witt[c], H. Maheen[b] and A.D. LaMontagne[b]
[a]*Centre for Health Equity, Melbourne School of Population and Global Health, University of Melbourne, Melbourne, Victoria, Australia*
[b]*Work, Health, & Wellbeing Unit, Centre for Population Health Research, School of Health & Social Development, Deakin University, Geelong, Victoria, Australia*
[c]*Turning Point, Monash University, Fitzroy, Victoria, Australia*

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Abstract.
BACKGROUND: Emergency and protective services personnel (e.g., police, ambulance, fire-fighters, defence, prison and security officers) report elevated levels of job stress and health problems. While population-level research is lacking, there has been some research suggesting suicide rates may be elevated in emergency and protective services.
OBJECTIVES: This paper compares suicide rates between emergency and protective services occupational groups over a 12-year period (2001–2012) in Australia.
METHOD: Labour force data was obtained from the 2006 Australian Census. Suicide data was obtained from the National Coroners Information System (NCIS). Negative binomial regression was used to estimate the association between suicide and employment as an emergency or protective service worker (including prison and security officers) over the period 2001–2012, as compared to all other occupations. Information on suicide method was extracted from the NCIS.
RESULTS: The age-adjusted suicide rate across all emergency and protective service workers was 22.4 (95% CI 19.5 to 25.2) per 100,000 in males and 7.8 in females (95% CI 4.6 to 11.00), compared to 15.5 per 100,000 (95% CI 15.2 to 15.9) for males and 3.4 (95% CI 3.2 to 3.6) for females in other occupations. The highest risk by subgroup was observed among those employed in the defence force, prison officers, and ambulance personnel. The major method of death for all occupational groups was hanging.
CONCLUSIONS: Our results clearly highlight the need for suicide prevention among emergency and protective service occupations.

Keywords: Intentional self-harm, emergency service worker, police, ambulance, fire-fighter, military

1. Introduction

Although active employment is a protective factor against suicide, emerging research suggests that employees in certain occupations are at an increased risk of suicide as compared to both the general population and the general working population [1]. There has been longstanding interest, for example, in suicide occurring among emergency and protective service occupations such as police [2], defence [3] and medical professionals [4, 5]. However, evidence about whether these occupational groups have elevated suicide rates compared to other occupations is mixed.

*Address for correspondence: Dr. Allison Milner, Centre for Health Equity, Melbourne School of Population and Global Health, University of Melbourne, 207 Bouverie Street, Melbourne 3010, Australia. Tel.: +61 3 9035 9875; E-mail: Allison.milner@deakin.edu.au.

A 2003 meta-analysis of 101 samples on police suicide found the mean suicide rate of 19.3 suicides per 100,000 police personnel was lower than population rate of 25.2 per 100,000 [6]. Rates varied widely between the studies included in this meta-analysis, with higher rates associated with studies conducted over shorter time periods (i.e., <10 years), studies from Europe or North America, and those of regional rather than federal or metropolitan police forces.

Recent work suggests that although the suicide rate amongst active-duty military personnel has been historically lower than rates amongst comparable members of the general population [3], the suicide rate in this occupational group has doubled over the past decade, surpassing the civilian rate in some [7] but not all [8] countries. Thus, it appears that the timing and context of the study may contribute to variability in overall rates of suicide.

There has been comparatively limited attention paid to other emergency and protective professionals, such as ambulance personnel, fire-fighters, and prison and security officers. Studies on these occupations groups have mainly focused on cancer and other forms of mortality [9–11] or mental health outcomes [12, 13]. One of the few studies is a Norwegian cross-sectional study [14] which found that ambulance personnel report similar levels of suicidal thoughts, serious suicide ideation, and suicide attempts as other health professional occupations and the general population.

In Australia, there have been concerns over increasing rates of suicide in other emergency and protective services employees such as those above; particularly among ambulance personnel and fire-fighters [15]. However, at present, there have not been any published studies on suicide rates in these occupations. Further, there has been little investigation of suicide methods, despite suggestions that ready access to lethal means, such as firearms in protective services and defence employees [16, 17] and potent medicinal drugs in medical personnel [4, 18], may be associated with an increased risk of completed suicide in these occupational groups.

The aim of this paper is to address these knowledge gaps with an overview of suicide rates among emergency and protective service workers (including ambulance, fire-fighters, police and prison/security officers, and defence force personnel) in Australia over a 12-year period (2001 to 2012), and to compare these rates to all other occupational groups. We provide a description of the methods these employees used to end their lives because we aim to assess the degree to which access to lethal means may explain any observed elevated suicide rates in these occupational groups.

2. Method

2.1. Study design

The study design is a retrospective case-series, utilising data from the Australian National Coroners Information System (NCIS) and focused on suicide in emergency and protective services (i.e., ambulance, fire-fighters, police and prison/security officers, and defence force personnel) from 2001 through 2012. Ethical approval for this study was granted by the Justice Human Research Ethics Committee (Victoria) (CF/12/15778) and the Deakin University Human Research Ethics Committee (2015-161).

2.2. Data source

NCIS is a national internet-based data storage and retrieval system for Australian coronial cases. NCIS is utilised by coroners, government agencies, and researchers to identify cases for death investigation and to monitor external causes of death in Australia. Prior to this, researchers relied on mortality data provided by the Australian Institute of Health and Welfare, which has limited information on suicide cases. NCIS provides basic demographic information, as well as employment status and occupation at the time of death, collected from coronial files. We classified suicide methods according to the International Classification of Disease – 10th revision (ICD-10) within method specific codes X60-X84 (Chapter 10) [19]. Each NCIS case includes a police "text" description of the circumstances and background of the case, as well as coronial findings, autopsy and toxicology reports.

2.3. Data quality

Delays in the coronial process mean that the suicide data available in NCIS is under-reported from the year 2013 onwards. As the system was established in 2000, the data quality for the year 2001 is poor. Aside from system issues, data on suicide may be under-reported due to differences in how suicide is determined by different coroners and between states [20]. Regardless of these issues, NCIS offers the best available information on suicide mortality in the country and

has been used to compile the official death statistics released by the Australian Bureau of Statistics.

Population data by occupational group was obtained from the Australian Bureau of Statistics (ABS) for the 2006 census period [21], which was used because it formed the mid-point of the time period examined in this study. Detailed data on occupation is only available for the census periods, which occur every five years. This data was coded according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) by 10-year age groups (20–29 years, 30–39 years, 40–49 years, 50–59 years, 60–69 years, 70 years and over) and gender. As emergency and service personnel are usually over 20 years of age, we excluded those persons younger than 20.

2.4. Eligibility and data extraction

All cases officially recorded as intentional self-harm between the years 2001 to 2012 were extracted. Cases were excluded if unemployed at the time of death, if employment status was unknown or occupational information was missing, or if under 20 years of age at the time of death. After data screening, 10,422 suicide cases were eligible for inclusion in our analyses.

2.5. Coding of emergency and protective service workers

Occupational information was coded according to the Australian and New Zealand Standard Classification of Occupations to the four digit level. Information on the coding procedure utilised for this study can be found in Supplementary File 1. Occupations classified at the secondary ANZSCO level 44 "Protective Service Workers" (defence force, fire-fighters, police, and prison and security officers) and those classified as "Ambulance officers and paramedics" (code 4111) were designated as cases for the purposes of this study. Controls were those individuals who were employed in any other occupation at the time of death.

2.6. Analysis

Male and female suicide rates per 100,000 persons were calculated for emergency and protective service workers using 2006 population census data [21], which was applied to each year of suicide data. The 2006 census was chosen because this was the median point of the years under study. As explained above, yearly data is not available on labour force composition by occupation. Rates were age-standardised using the Australian standard population (2001) [8]. We calculated the age-standardised rates for all other occupations using the same method. We assessed the frequency of suicide methods and tested for significant differences using the chi-square statistic. The broad suicide methods analysed included: carbon monoxide & other gases (ICD-10 X66, X67); self-poisoning (ICD-10 X60-X69); hanging and suffocation (ICD-10 X70); firearms (ICD-10 X72, X73, X74); and other methods (ICD-10 X74-X97).

Comparing rates of suicide in these occupations to rates in members of the general population is problematic given the inclusion of persons who are unemployed or 'not in the labour force' (retired, not working due to sickness or caring responsibilities), which would include an overrepresentation of mentally ill persons [22]. Hence, the reference category for comparison in this study is people employed in all other occupations.

Negative binomial regression models were used to investigate Rate Ratios (RRs) in suicide in emergency and protective service occupations compared to other occupations (reference). Negative binomial was chosen over Poisson regression following the identification of over-dispersion in the regression models. The regression model controlled for age group and gender. Coefficients were transformed into Rate Ratios (RRs) to aid interpretation.

3. Results

Table 1 displays the age and sex of suicide within emergency and protective service workers. Most suicides in these occupational groups occur among men, particularly for defence and prison security officers, and most occur in the middle (30–39 years) or younger (20–29 years) age groups.

The overall age-adjusted suicide rate in emergency and protective service workers over the period 2001 to 2012 was 22.4 (95% CI 19.5 to 25.2) per 100,000 in males and 7.8 in females (95% CI 4.6 to 11.0). The age-adjusted suicide rates among those in all other occupations was 15.5 per 100,000 (95% CI 15.2 to 15.9) for males and 3.4 (95% CI 3.2 to 3.6) among females.

Hanging was the most common suicide method across all occupations, apart from police, where firearms were the most commonly used method

Table 1
Suicide by age and sex (number and percent of cases), other occupations and emergency and protective service workers, Australia, 2001 to 2012

	Other occupations % (n = 10,109)	Ambulance % (n = 29)	Defence % (n = 56)	Fire-fighters % (n = 25)	Police % (n = 51)	Prison % (n = 152)
Male	84.16	82.76	92.86	96.00	84.31	94.74
Female	15.84	17.24	7.14	4.00	15.69	5.26
20–29 yrs	20.58	10.34	51.79	0.00	5.88	18.42
30–49 yrs	55.73	72.41	44.64	84.00	78.43	56.58
50 and over	23.69	17.24	3.57	16.00	15.69	25.00

Table 2
Suicide methods in other occupations and emergency and protective service workers, Australia, 2001 to 2012

	Other occupations % (n = 10,109)	Ambulance % (n = 29)	Defence % (n = 56)	Fire-fighters % (n = 25)	Police % (n = 51)	Prison % (n = 152)
Carbon monoxide & other gases	16.55	17.24	12.9	20.00	10.2	17.01
Hanging and suffocation	50.52	44.83	69.35	48.00	32.65	53.74
Firearms	7.9	10.34	3.23	12.00	36.73	12.24
Self poisoning	12.81	17.24	4.84	8.00	6.12	10.88
Other	12.22	10.34	9.68	12.00	14.29	6.12

Table 3
Negative binomial regression model comparing suicide in emergency and protective service workers to the suicide rate in all other occupations, rate ratios with 95% confidence intervals 2001 to 2012

	Suicides (n)	Population (n)* 2006	Adjusted RR	95% Conf. Int.	p value
Occupations					
Other occupations	10109	8225221	1		
Ambulance personnel	29	9078	2.02	1.40, 2.93	<0.001
Defence	56	9689	3.27	2.50, 4.28	<0.001
Fire-fighters	25	10829	1.20	0.81, 1.78	0.363
Police	51	44029	0.70	0.53, 0.93	0.011
Prison and security officers	152	50468	1.81	1.54, 2.12	<0.001
Age					
20–29 years	2143	1827362	1		
30–39 years	2894	2056787	1.20	1.10, 1.31	<0.001
40–49 years	2933	2188151	1.17	1.07, 1.28	<0.001
50–59 years	1837	1692950	0.95	0.86, 1.04	0.274
60–69 years	570	521168	0.85	0.76, 0.96	0.008
70+ years	45	62896	0.52	0.39, 0.71	<0.001
Gender					
Male	8795	4520548	1		
Female	1627	3828766	0.22	0.21, 0.24	<0.001
Year	10422	8349314	1.00	0.99, 1.01	0.566

Notes: 95% Conf. Int. = 95% Confidence intervals (lower, upper); RR = Rate ratios; p value = significance value 95%. *Population data was used from the year 2006 as the median point of the years under study. This was applied to each year of suicide data to calculate the adjusted RRs.

(n = 18, 36.73%) (Table 2). Inhalation of carbon monoxide and other gases was the next most common method. Compared to all other occupations, police (n = 18, 36.73%), prison and security officers (n = 18, 12.24%), and ambulance (n = 3, 10.34%) were more likely to use firearms to end their lives. Only a small proportion of defence force personnel used firearms (n = 1, 1.79%). A larger proportion of ambulance personnel used self-poisoning than other occupations (n = 5, 17.24%). Other methods which made up between six and 15% of methods used across the occupational groups comprised drowning, jumping in front of a moving object or from a height, cutting, electrocution, and fire and other explosives. A chi-square test revealed significant differences between occupational groups by suicide method ($x^2(20) = 77.27$, $p < 0.001$).

Results of the negative binomial regression can be seen in Table 3. After controlling for age, sex, and year, ambulance personnel had an RR of 2.02 (95% CI

1.40, 2.93) compared to other occupations. Defence employees had particularly elevated suicide rates (RR 3.27, 95% 2.50, 4.28) compared to other occupations. It was apparent that prison officers (RR 1.81, 95% CI 1.54, 2.12) were at a heightened risk of suicide over this period, while police suicide rates were not significantly higher than other occupational groups (RR 0.70, 99% CI 0.53, 0.93). Fire-fighters had a non-significant elevated rate of suicide compared to other occupations (RR 1.20, 95% CI 0.81, 1.78).

4. Discussion

Suicide rates in emergency service and protective service workers were significantly higher as a group than other occupations over a 12-year period (2001–2012) in Australia. Males in this group had rates 1.4 times as high as in other occupational groups, while females in emergency service and protective services had rates that were close to twice as high. Rates were highest amongst ambulance personnel and defence force employees. In contrast to previous work [6], suicide rates amongst police personnel were not significantly higher than other occupational groups in this study. Similar to suicide in the general population [23], hanging was the most common method, and the age-distribution of suicides occurred in younger and middle aged groups.

While there is no doubt a complex set of reasons for elevated suicide rates within these occupations, it is possible that the male dominated nature of emergency and protective service work plays some role. Population data indicates that there were over five times as many males employed in emergency and protective service occupations as females [21]. Further, the vast majority of suicides in these occupational groups were by males. The nature and characteristics of emergency and protective service work reinforces traditionally male gender norms and behaviours, comprised of characteristics such as stoicism (a man must not express his suffering), autonomy (a man must solve his problems alone, without the help of others), success (a man must succeed in all he undertakes), and aggressiveness (a man must be able to act aggressively, if need be) [24]. The influence of these gendered behaviours has long been seen to be risk factor for suicide, compounded by stigma and poor help seeking behaviour [24]. The smaller absolute proportion, but markedly higher, elevation of odds ratios for females might be explained by gender role conflict and their minority status comparative to men [25]. At the same time, we acknowledge the small number of females in the sample, which may raise the possibility of spurious findings.

Rates of post-traumatic stress [26, 27] and high alcohol use [28, 29] are reported to be higher in these occupations than the general population. These may be contributory factors, considering both PTSD and alcohol have been cited as risk factors for suicide [30].

Exposure to adverse psychosocial job stressors represent risk factors for mental health problems in several of these occupations and are a potential influence on suicide. For example, a cross-sectional study on police in Norway found perceptions of high job pressure and lack of support was associated with anxiety and depressive symptoms [31].

Research on ambulance personnel suggests these workers experience greater job stress than other occupations [11]. Further, adverse work related factors such as bullying and emotional exhaustion were independent predictors of suicide ideation [14]. Other studies have reported that adverse working conditions are associated with poorer mental and physical health in emergency services [12, 13, 25]. These factors may contribute to the risk of suicide amongst these occupational groups.

While hanging was the most common method overall, police and prison/security officers frequently used firearms to end their lives, while ambulance personnel were more likely to use self-poisoning than other occupations. This may be connected to their greater ability to access lethal methods in the course of their work, and familiarity about how to use these methods. For example, ambulance personnel have relatively higher levels of exposure to drugs, but also have greater knowledge of how to treat self-poisoning (either intentionally or unintentionally) than other occupational groups. These factors may explain the high rates of suicide among ambulance personnel and aligns with past research on doctors [5], although we would acknowledge that in the present study there was a relatively low frequency of deaths by self-poisoning by ambulance personnel. In contrast to previous studies in the USA that have found that those in the army were more likely to use firearms to end their lives, [16] we did not find that those in the defence force were more likely to use firearms. We are unsure of why this may be the case, and would encourage further research on this finding. We would note that there has been limited research on prison and security officers [15, 16].

Our results highlight the need for prevention efforts among emergency and protective service occupa-

tions. We would suggest that suicide prevention efforts take an integrated approach to addressing suicide in these occupations, which would include addressing work-related stressors, access to lethal means, stigma about disclosing thoughts of suicide, as well as ensuring people at-risk are able to access help should they need it [32].

5. Limitations

Reliance on official suicide data from the NCIS represents a limitation of this study due to the possibility of under-reporting. This was particularly problematic in the initial years during which NCIS was established but may be an ongoing problem. Other possible problems include the miscoding of occupation by police collecting information on occupation or in the coding process, which may have occurred despite independent coding by two researchers and the use of a structured approach to the classification. Notwithstanding these issues, this study has a number of strengths, including the use of the best available quality population-level data on suicide, and coverage across an entire national population over a twelve-year period.

6. Conclusion

This study demonstrates that emergency and protective services are at elevated risk of suicide as compared to other occupational groups. Ambulance personnel, those employed in the defence force, and prison officers were particularly at risk. The vast majority of suicides occurred in males. There was a diverse range of suicide methods used in suicide cases. Suicide prevention efforts are needed for these at-risk groups.

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Conflicts of interest

The authors report no conflict of interest.

Ethical standards

Ethical approval for this study was granted by the Justice Human Research Ethics Committee (Victoria) (CF/12/15778) and the Deakin University Human Research Ethics Committee (2015-161).

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