TITLE: Suicide among nursing home residents in Australia: A national population-based retrospective analysis of medico-legal death investigation information.

Running head: Suicide among nursing home residents in Australia

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Key words: suicide; nursing home; coroners; medical examiners; prevention

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Key points:

- This is the first national population-based study of suicide among nursing home residents in Australia and the largest study of its kind globally.
- The study identified 141 nursing home residents who had died from suicide in Australia between 2000 and 2013, the majority of whom were male and had a diagnosis of depression.
- Major life stressors contributing to suicide included health deterioration; isolation and loneliness; and maladjustment to nursing home life.
- This research contributes to the growing international knowledge-base on identified risk factors and highlights priorities for future research.

ABSTRACT

Objectives: Suicide among nursing home residents is a growing public health concern, currently lacking in empirical research. This study aims to describe the frequency and nature of suicide among nursing home residents in Australia.

Methods: This research comprised a national population-based retrospective analysis of suicide deaths among nursing home residents in Australia reported to the Coroner between July 2000 and December 2013. Cases were identified using the National Coronial Information System, and data collected from paper-based coroners' records on individual, incident, and organizational factors, as well as details of the medico-legal death investigation. Data analysis comprised univariate and bivariate descriptive statistical techniques; ecological analysis of incidence rates using population denominators; and comparison of age and sex of suicide cases to deaths from other causes using logistic regression.

Results: The study identified 141 suicides among nursing home residents, occurring at a rate of 0.02 deaths per 100,000 resident bed days. The ratio of deaths from suicide to deaths from any other cause was higher in males than females (OR=3.56, 95%CI=2.48-5.12, $p<0.001$). Over half of the residents who died from suicide had a diagnosis of depression ($n=93$, 66.0%); and had resided in the nursing home for less than 12 months ($n=71$, 50.3%). Common major life

stressors identified in suicide cases included: health deterioration (n=112, 79.4%); isolation and loneliness (n=60, 42.6%); and maladjustment to nursing home life (n=42, 29.8%).

Conclusions: This research provides a foundational understanding of suicide among nursing home residents in Australia, and contributes important new information to the international knowledge-base.

INTRODUCTION

Suicide among older adults residing in nursing homes is an emergent public health concern.

Older adults have one of the highest age-specific suicide rates (per 100,000 persons) in Australia (12.9) and other countries around the world (including 16.5 in the United States (US) and as high as 25.5 in Japan among persons aged 70 years and older ¹). Currently, one in twenty (3-6%) older adults aged 65 years and older reside in a nursing home in Australia and the US^{2,3}, however this is expected to dramatically increase with the ageing global population expected to reach 2.1 billion by 2050 ^{4,5}. Australia's aged care system is currently ranked 17th out of 96 countries ⁶, with less than 1% (~17 billion AUD) of Australia's gross domestic product (GDP) spent on aged care services ⁷.

Nursing home residents may be at risk of suicide due to their greater physical, emotional, and psychiatric care needs. In addition to physical co-morbidities, almost half of the nursing home resident population has a diagnosis of depression^{8,9}. In contrast, nursing home residents may have reduced ability and opportunity to suicide due to physical limitations and 24 hour care and supervision. Epidemiological research in this population and setting is vital for understanding the distribution and determinants of suicide among nursing home residents, and informing development of effective prevention strategies.

There is currently a paucity of research investigating suicide among nursing home residents¹⁰. Existing research is mostly from the US and limited to identifying individual risk factors (such as depression^{11,12}; physical health decline^{11,13}; admission to the nursing home in the last 12 months¹¹), and describing the most common methods of suicide; hanging^{12,14,15} or fall from height^{14,15}. Only two studies, conducted 25 years apart, have examined organisational factors associated with higher risk of suicide (including high staff turnover rate; <\$100 per day bed cost; religious or fraternal ownership¹³; better performance on quality indicators¹⁶; and larger facility size^{13,16}. Considering the institutional nature of nursing homes, there is a conspicuous lack of research examining organisational and systemic factors associated with suicide in this setting.

This research aims to describe the frequency and nature of suicide among nursing home residents in Australia. Specifically, to examine individual, incident, and organizational factors associated with suicide among nursing home residents, and describe the medico-legal death investigation of such deaths.

METHOD

Study design

A national population-based retrospective analysis of routinely collected mortality data was conducted to examine suicide among nursing home residents in Australia reported to the

Coroner between 2000 and 2013. The cohort of suicide deaths was drawn from a broader cohort of all deaths among nursing home residents reported to a Coroner in Australia during the same study period. The study design also included an ecological aspect in that nursing home resident population level data was obtained to provide denominator information for estimation of suicide rates. This study was conducted and reported in accordance with the guidelines for Reporting of studies Conducted using Observational Routinely-collected Data (RECORD)¹⁷.

Setting

The setting included all Australian jurisdictions, comprising six states and two territories. Australia's population of adults aged over 65 years increased from 2.3 to 3.3 million between 2000 and 2013, comprising 12.3% and 14.4% of the population respectively^{18,19}. During this time, the nursing home resident population increased from 140,000 persons living in 2,900 facilities in 2000²⁰, to 180,000 residents living in 2,700 facilities in 2013²¹. In Australia, nursing home facilities are referred to as Residential Aged Care Services (RACS) and comprise both high and low care facilities as well as those providing specialized dementia or psychogeriatric care. Other aged care services such as hospice, palliative care, and community or home care packages are classified and funded separately and not accredited as RACS.

Case identification

Cases were identified via a search of the National Coronial Information System (NCIS). NCIS is an internet based data storage and retrieval system of coroners investigations in Australia (www.ncis.org.au) containing coded and free-text information on the deceased, the incident, cause of death and medico-legal reports (police summary of circumstances, toxicology and autopsy report and coroner's finding) where available²². One researcher (LB) conducted a broad search to identify all deaths reported to the coroner between 1 July 2000 and 31 December 2013 where the incident location was coded as any of the four classifications relating to aged care services: nursing home; home for the elderly or retirement village; hospice, palliative, or respite care; or residential care facility, and the coroner's investigation was completed as of 31st December 2014.

Inclusion criteria

Cases were included if a) the deceased was a permanent or temporary resident of an accredited nursing home at the time of the incident; and b) the death was determined to be a suicide. A database of nursing homes accredited by the Australian Aged Care Quality Agency (AACQA) was compiled from annual lists published online (and archived) by the Department of Health. The street address of the incident location for the death was matched to the street address of accredited nursing home to verify the deceased was a nursing home resident. For the purpose of this study, suicide was defined as death from external causes where a coroner: (a) determined the death to be the result of intentional self-harm; or (b) was unable to make a

determination on intent, yet the circumstances were considered by two members of the research team (BM & LB) to be consistent with suicide (e.g. verbal or written indications by the person that they intended to take their own life; or evidence of previous suicide attempts²³). Individuals that did not meet either of the inclusion criteria following initial file review were excluded from the study.

Data collection

Information contained in the NCIS was supplemented by data collected from the paper-based coronial record, which included witness statements; and medical or nursing notes (among other documents). A single researcher (BM) attended each State or Chief Coroner's Office to review the coronial file for identified cases. Data was collected on variables including: the deceased's demographic information; individual risk factors including: physical and mental health issues; relationship factors; potential stressors; suicidal behaviour including prior attempts and expression of intent; incident-level variables including date, time, location and method of suicide; organisational variables relating to the nursing home; and details of the coronial investigation into the death. Subjective variables such as potential stressors were coded from free-text information and were determined by the authors based on the coroner's determination and accumulation of evidence (see Appendix 1). Data items were entered directly into a Microsoft Excel spreadsheet.

Data analysis

Incident rates per 100,000 bed days (the number of days each available bed was occupied by a resident) and rate ratios were calculated using nursing home resident population data obtained from the Australian Institute of Health and Welfare (AIHW)²⁴. Data items were coded and entered into IBM Statistics SPSS.22 and a series of univariate and bivariate descriptive statistical analyses performed. Continuous variables were summarised using mean and standard deviation (SD) if the distribution was approximately normal, while for non-normally distributed information median and interquartile range (IQR) were used. Individual factors were cross-tabulated by age (in ten-year bands) and sex, while incident level factors were cross-tabulated by method of suicide with Chi square analysis performed to test for associations. Histograms were produced to show the distribution of time between admission to nursing home and suicide or previous attempt (Figure 1 & 2), and non-parametric tests were used to test difference in distribution of time across subgroups of residents. Comparative data from coroner's investigations of nursing home resident deaths from other causes was available for a limited number of variables including: sex and age of the deceased. This was used to conduct logistic regression analysis to obtain odds ratios (OR), confidence intervals (CI), and to test statistical significance (defined as a p-value <0.05).

Ethics

This study was approved by the Victorian Institute of Forensic Medicine Research Advisory Committee (RAC 014-14), and the Department of Justice Human Research Ethics Committee (CF/14/17569), and registered with the Monash University Human Research Ethics Committee (CF15/157 – 2015000077). A written request for access to coroners' records for identified cases was approved by each State or Chief Coroner.

RESULTS

In Australia between 2000 and 2013, over 21,000 deaths among nursing home residents were notified to a coroner. Of these, 3,289 (~15%) were from external causes. This study identified 141 suicides among nursing home residents (4.3% of external cause deaths). Nine of these deaths (6.4%) were researcher-defined as suicide after being reclassified from their original coding in NCIS as unlikely to be known (n=3); undetermined (n=2); natural (n=2); and unintentional (n=2). Compared to all other cause deaths, suicides occurred at a rate of 0.018 per 100,000 resident bed days (CI=0.015-0.021). Males and younger residents had the highest rates (Table 1).

Individual factors

Most residents who died from suicide were male (n=97, 68.8%). The ratio of deaths from suicide to deaths from any other cause was greater for males than females (OR=3.56, CI=2.48-5.12, p<0.001). The age of suicide cases ranged from 44 to 97 years, with a median of 81 years

(IQR=73-87). The ratio of deaths from suicide to deaths from any other cause decreased with each year increase in age (OR=0.95, CI=0.94-0.97, $p<0.001$), and this reduction can be seen by age groups in Table 1.

Table 2 shows the potential individual risk factors by demographic characteristics (age and sex) of residents who died from suicide. Three quarters of suicide cases had at least one diagnosed mental illness ($n=107$, 75.8%), most commonly mood disorders including depression ($n=93$, 66.0%, CI=58.2-73.8). Only a small number of suicide cases ($n=25$, 17.7%) were diagnosed with an organic disorder such as dementia (Table 2). Most suicide cases had at least one physical health condition ($n=122$, 86.5%), almost three quarters of whom had two or more health systems affected by disease ($n=88$, 72.1%). Physical impairments were also common among residents who died by suicide ($n=87$, 61.7%).

The duration of residence in the nursing home among the deceased ranged from one day to 30 years, and was unknown in 14 cases. Approximately half ($n=71$, 50.3%) of residents who died from suicide had resided in the nursing home for less than 12 months (Figure 2). The overall distribution of duration of residence (measured by number of months) was positively skewed, with a median of 9 months (IQR=3-23). Duration of residence was similar for male and female suicide cases.

Over one third (n=55, 39.0%) of suicide cases had previously attempted suicide. For 33 (71.7%) cases, their most recent attempt occurred prior to admission to the nursing home (median 5 months, IQR=1-24), whereas for 13 (28.3%) cases, their most recent suicide attempt was post admission (median=3 months, IQR=1-8). Figure 1 shows most attempts occurred proximate (12 months pre or post) to the date of admission to the nursing home when this date was known (n=33/46, 71.7%).

There was evidence in the coroners finding or medical records the deceased had expressed suicidal intent in over half of the suicide cases (n=74, 52.5%). Of these, the most common form of expression was through implicit verbal statements (n=33, 44.6%). A higher proportion of the female cases (72.5%) expressed their intent to suicide compared to males (48.4%) although this may be a chance finding (p=0.10).

Major life stressors (Table 2) identified in suicide cases in nursing home residents included: health deterioration (n=112, 79.4%, CI=0.72-0.85); isolation and loneliness (n=60, 42.6%, CI=34.5-50.8); and maladjustment to nursing home life (n=42, 29.8%, CI=22.3-37.4).

Incident factors

The most common methods of suicide were hanging (n=45, 31.9%), fall from height (n=24, 17.0%), and plastic bag asphyxia (n=20, 14.2%) (Table 3). Suicides by hanging often involved the use of an item of clothing or items tied together, such as a dressing gown belt, scarf, or

shoelaces (n=17, 37.8%); an electrical cord (n=9, 20.0%); piece of rope (n=8, 17.7%); or thin piece of cord, twine or string (n=6, 13.3%) as a ligature. Common ligature points included shower curtain and support rails (n=14, 31.1%); bedroom, bathroom or wardrobe doors (n=12, 26.7%); and assistive bars over bed (n=7, 15.6%). Hanging was also the most common method among residents aged <75 (n=12, 32.4%).

Table 3 also shows falls from height most commonly occurred from a communal area balcony (n=10, 41.7%), from the deceased's bedroom window or balcony (n=5, 20.8%), or at a location outside the facility (n=5, 20.8%). Where the height of the fall was reported (n=13, 54.1%), the median distance was 2.2 floors above ground (~7.5 metres). Suicide by plastic bag asphyxia occurred in the deceased's bedroom in all but one death (n=19, 95.0%), and this method was most common among residents aged 85-94 years (n=12, 80.0%).

Just under half of all suicides occurred in the deceased's bedroom (n=63, 44.7%). In addition to suicide by plastic bag asphyxia, this location was common for electrocution (n=4, 66.7%), drug toxicity (n=7, 58.3%), and hanging (n=21, 46.7%). Approximately one quarter occurred outside of the facility (n=34, 24.1%), including all transport-related suicides (n=5), and most suicides by drowning (n=12, 80.0%) and firearm (n=2, 66.7%). Proportionally, suicides most commonly occurred in the summer months between December and February (n=45, 31.9%), and during the afternoon nursing shift from 2pm-10pm (n=58, 41.1%).

Organisational factors

Proportionally, suicides most commonly occurred in larger facilities (n=82, 58.2%), providing low care services only (n=64, 45.4%), with religious ownership (n=40, 28.4%) or private (n=39, 27.7%), and located in metropolitan areas (n=104, 73.8%). However, the suicide rates per 100,000 bed days did not differ substantially across nursing home types (see Appendix 2), hence these results are inconclusive.

Medico-legal death investigation

A full autopsy (including internal examination of the body) was conducted in 66% of cases (n=93), and toxicological analysis was conducted in most cases (n=125, 88.7%). A coronial inquest (public hearing) into the death was only held in a very small number of cases (n=6, 4.3%). Recommendations were made by a coroner in one case (in relation to police procedures when responding to drowning deaths) and in four cases the coroner made other non-binding comments in relation to prevention.

DISCUSSION

Summary of findings

This research identified 141 suicides among nursing home residents in Australia between 2000 and 2013 (0.02 per 100,000 bed days). Based on an average resident population of 160,000

residents per year, this equates to an incidence rate of 6.29 per 100,000 person-years. This is lower than the rate of 34.8 per 100,000 person years previously reported by Menghini¹¹. The variance may be explained by geographic and temporal differences between this and the earlier study conducted in a single county in the United States between 1981 and 1997. The number of suicides among nursing home residents is small considering the high rates of suicide among older adults in the general population. It is unclear whether this is due to underreporting or misclassification of suicides in this population, or if nursing home residents are at lower risk of suicide compared to community-dwelling older adults due to their physical or cognitive disabilities and the institutional nature of the nursing home environment. Regardless, any resident death from suicide is traumatic for the affected residents, family, and staff, and is potentially preventable.

More males died from suicide than females and at a higher proportion (68.8%) than found in previous studies (~60%)^{11,12,15,16,25}. This is consistent with the high rate of suicide among older male adults in the general population^{1,23}, yet is surprising considering nursing home residents are predominantly females (70%) and exposed to the same environmental factors. This research also found younger residents (<65 years) have higher odds of dying from suicide compared to older age groups. This was unexpected given most nursing home residents are aged 85 years and older, and the high rate of suicide among the oldest old (85+ years) in the community²³. However, possible explanations for this may include that some suicide methods

such as hanging require physical strength more likely to be possessed by younger residents, and that the risk of other types of deaths (including other external causes such as falls) increase with age, meaning older residents may be more likely to die from other causes compared to their younger counterparts. This finding highlights the need for further research on these subpopulations to understand differences in risk factors and identify avenues for prevention.

Health deterioration was identified as a major life stressor among nursing home residents who died from suicide. This is further supported by findings regarding residents' mental and physical health. As expected, most residents who died by suicide had a diagnosis of depression (66.0%) although this is somewhat lower than the 75% reported in previous studies^{11,12}. Each of the previous studies included access to the complete medical record for all individuals who died from suicide; hence the prevalence of depression is likely underreported in the current study. Interestingly, despite the high prevalence of dementia in the nursing home population (over 50% of residents)²⁶, only 17.7% of residents who died from suicide had a diagnosis of dementia. This could indicate that dementia was under-diagnosed or under-detected in this cohort of suicide deaths, as it is also estimated to be in the general population²⁷, although this is probably less likely in a nursing home setting. However, this finding is consistent with studies reporting low suicide risk among people with dementia^{28,29}, suggesting that dementia patients may be unable to formulate intent or implement the means to suicide due to their cognitive impairment³⁰. A large proportion of residents had at least one (86.5%) physical health

diagnosis, often with multiple comorbidities and physical impairments. This is consistent with recent review findings that functional disability and some types of physical illness are associated with suicidal behaviour among older adults³¹. Physical health decline has also been identified as a potential risk factor for suicide in the nursing home setting¹¹⁻¹³. This highlights the importance of assisting residents to optimally manage physical health conditions, and address psychological responses to physiological ageing.

Maladjustment to nursing home life was also identified as a major life stressor (29.8%). This is reflected in findings concerning duration of residence and proximity of previous suicide attempts to admission. For example, this research found 50% of residents who died from suicide had resided in the nursing home for less than 12 months. This is consistent with the aggregate results from a recent systematic review¹⁰, despite earlier mixed findings^{11,12,14}. Furthermore, over one-third of residents in this study had previously attempted suicide. This is similar to previous research reporting 33-38% of residents who died from suicide had a documented history of suicidal behaviour^{11,12}. This research also found most previous attempts occurred within 12 months (pre and post) date of admission to the nursing home. The 12-month period immediately preceding^{16,32} and following³³ admission to a nursing home is recognised as a particularly stressful transition period for older adults and may represent a high-risk period for suicide. While the average length of stay in a nursing home is approximately 2-3 years³⁴, the first 12 months of residency represents a difficult time for new residents

adjusting to a multitude of changes in their life³⁵. Additional support should be provided to residents during this time to help orient them to their new surroundings and to make the transition to life in care as smooth as possible.

Hanging and falling from height were the most common methods of suicide among nursing home residents. This also aligns with previous findings from nursing home populations internationally¹⁰, and common suicide methods among older adults in the community^{36,37}. Interestingly, plastic bag asphyxia was the third most common method in the Australian nursing home population and yet internationally only one suicide by this method was previously described²⁵. These common methods of suicide reflect more accessible means in a nursing home setting. Less common forms of suicide in this population often involved less accessible means such as cutting, electrocution, transport, and firearms, despite firearms being a common method of suicide among community dwelling older adults^{36,38}. Although access to means of suicide may already be restricted in a supervised nursing home setting, means prevention in nursing homes requires further consideration. This may include physical barriers to prevent falls from height³⁹; and the elimination of hanging points. The latter has been achieved in other institutional settings⁴⁰, but may not be feasible in the nursing home setting where fixed furnishings such as rails are required to assist with resident movement. Prevention efforts may be better focused on improving the overall atmosphere and conditions of the nursing home to improve residents' quality of life⁴¹. Location and time of suicides in nursing homes have not

previously been described¹⁰ but have implications for nursing home policy and procedures. A large proportion of suicides occurred in the resident's bedroom and in the afternoon or evening hours, and one quarter of residents died from suicide while on day leave or extended leave away from the nursing home. Presumably, this is where and when residents were likely to have access to means of suicide with less frequent supervision.

Strengths and limitations

This is the first population-based national study of suicide among nursing home residents to be conducted in Australia and comprises the largest number of suicide deaths ever examined in this population globally. This research includes a review of the paper-based coroner's investigation file providing in-depth information on the circumstances of the death and the nursing home environment not available elsewhere. The limitations of NCIS as a data source for public health research have been described in detail elsewhere⁴², but include potential underreporting of deaths, misclassification, missing information, and inconsistencies in data across jurisdictions. The determination of information from these brief reports is subject to the interpretations of the authors and coroners. For instance, it must be assumed that someone felt isolated or lonely or was having difficulties adjusting to the nursing home unless the individual explicitly stated these things in writing. Comparative data on other cause deaths (not subject to full review of the paper-based file) was only available for a limited number of variables (sex, age, and organizational variables).

Future research

Future research should seek to estimate the population-based prevalence of suicides among nursing home residents using comparable measures reflecting the dynamic nature of the nursing home population. While this research examined some organisational factors rarely discussed in the literature, further research focusing on environmental factors and systemic issues is required to identify opportunities for prevention. The examination of the medico-legal death investigation found suicides in this cohort were comprehensively investigated. The proportion of cases that proceeded to inquest was reflective of the overall rate of inquests (~5%)⁴³, however recommendations for prevention were only made in one case. This represents a missed opportunity for coroners to influence aged care policy and raise public awareness suicide among older adults. This is also an important area of inquiry for future research to strengthen our understanding of how society responds to suicide in this population and setting.

Conclusion

This novel research provides a foundational understanding of the frequency and nature of completed suicide among nursing home residents in Australia. It also contributes to the growing international knowledge-base on identified risk factors and highlights priorities for future research. This information is vital in developing appropriate prevention strategies

specific to the older population and institutional setting, and improving policy and practice to reduce these preventable and tragic deaths.

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TABLES

Table 1: Suicide among nursing home residents in Australia (2000-2013) by sex and age

		Suicides		Occupied bed days (2000-2013)	Rate (per 100,000 bed days)	Rate Ratio (RR)	95% CI	p value	Other cause deaths		Odds Ratio (OR)	95% CI	p value
		n	%						n	%			
Sex													
	Female	44	31.2	556,779,178	0.01	1	-	-	12,933	62	1	-	-
	Male	97	68.8	226,320,601	0.04	5.42	(3.76-7.93)	<0.001	7,927	38	3.56	(2.48-5.12)	<0.001
Age (years)													
	<65	15	10.6	30,612,564	0.05	2.34	(1.22-4.23)	0.01	709	3.4	1	-	-
	65-74	22	15.6	67,696,739	0.03	1.55	(0.90-2.61)	0.09	1,541	7.4	0.69	(0.35-1.37)	0.29
	75-84	51	36.2	243,783,973	0.02	1	-	-	6,574	31.5	0.39	(0.21-0.70)	<0.001
	85-94	49	34.8	371,946,079	0.01	0.63	(0.42-0.95)	0.02	10,064	48.2	0.24	(0.13-0.44)	<0.001
	95+	4	2.8	69,060,424	0.01	0.28	(0.07-0.75)	<0.001	1,972	9.5	0.1	(0.03-0.31)	<0.001
Total		141	100	783,099,779	0.018		(0.015-0.021)		20,860	100			

Table 2: Individual factors for suicide among nursing home residents in Australia (2000-2013) by age and gender

	Gender				Age (years)										Total	
	Female		Male		<65		65-74		75-84		85-94		>95			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Presence of mental health diagnoses																
Yes	36	82	71	73	12	80	20	91	38	75	34	69	3	75	107	76
Mood disorders (including depression)	33	75	60	62	8	53	18	82	32	63	32	65	3	75	93	66
Neurotic and stress-related disorders	12	27	14	14	3	20	7	32	9	18	5	10	2	50	26	18
Organic disorders (including dementia)	8	18	17	18	1	7	4	18	11	22	9	18	-	-	25	18
Schizophrenic and delusional disorders	7	16	12	12	4	27	6	27	3	6	5	10	1	25	19	14
Substance use related disorders	2	5	7	7	2	13	4	18	3	6	-	-	-	-	9	6
Behavioural syndromes	2	5	4	4	2	13	2	9	1	2	1	2	-	-	6	4
Other	4	9	2	2	4	27	1	5	-	-	1	2	-	-	6	4
None	5	11	15	16	1	7	2	9	6	12	10	20	1	25	20	14
Unlikely to be known	3	7	11	11	2	13	-	-	7	14	5	10	-	-	14	10
Presence of physical health diagnoses																
Yes	35	80	87	90	13	87	21	96	42	82	42	86	4	100	122	87
Diseases of the circulatory system	23	52	50	52	4	27	11	50	27	53	27	55	4	100	73	52
Diseases of the musculoskeletal system	18	41	33	34	7	47	8	36	15	29	20	41	1	25	51	36
Diseases of the nervous system	7	16	24	25	5	33	8	36	10	20	7	14	1	25	31	22
Endocrine, nutritional and metabolic diseases	9	21	20	21	2	13	8	36	8	16	10	20	1	25	29	21
Diseases of the genitourinary system	5	11	19	20	1	7	2	9	11	22	9	18	1	25	24	17
Neoplasms	4	9	24	25	2	13	5	23	8	16	12	25	1	25	28	20
Diseases of the digestive system	5	11	15	16	2	13	4	18	11	22	2	4	1	25	20	14
Diseases of the respiratory system	8	18	16	17	3	20	7	32	9	18	4	8	1	25	24	17
Other (e.g. infectious and skin diseases)	5	12	5	5	3	20	-	-	-	-	6	12	1	25	10	7

No	2	5	4	4	-	-	-	-	4	8	2	4	-	-	6	4
Unlikely to be known	7	16	6	6	2	13	1	5	5	10	5	10	-	-	13	9
Physical impairments																
Yes	28	64	59	61	10	67	10	46	31	61	34	69	2	50	87	62
Mobility	25	57	41	42	10	67	7	32	22	43	26	53	1	25	66	47
Visual	8	18	18	19	1	7	4	18	8	16	11	22	2	50	26	18
Hearing	7	16	17	18	1	7	1	5	9	18	11	22	2	50	24	17
Speech	2	5	4	4	1	7	2	9	2	4	1	2	-	-	6	4
None	6	14	9	9	1	7	4	18	5	10	5	10	-	-	15	11
Unlikely to be known	10	23	29	30	4	27	8	36	15	29	10	20	2	50	39	28
Previous suicidal behaviour																
Previous suicide attempt	18	41	37	38	8	53	12	55	22	43	12	25	1	25	55	39
<6 months prior to fatal incident	4	9	15	16	2	13	4	18	7	14	6	12	-	-	19	14
>6 months prior to fatal incident	13	30	19	20	6	40	6	27	13	26	6	12	1	25	32	23
Previous self-harming behaviour	14	32	11	11	6	40	4	18	6	12	8	16	1	25	25	18
Active	6	14	4	4	3	20	3	14	2	4	2	4	-	-	10	7
Indirect or passive	8	18	7	7	3	20	1	5	4	8	6	12	1	25	15	11
Suicidal ideation	21	48	36	37	6	40	15	68	14	28	20	41	2	50	57	40
Intent expressed																
Yes	29	66	45	46	6	40	12	55	27	53	25	51	4	100	74	53
Explicit verbal intent	7	16	12	12	1	7	3	14	7	14	7	14	1	25	19	14
Implicit verbal intent	15	34	18	19	2	13	5	23	9	18	16	33	1	25	33	23
Explicit written intent	13	30	13	13	2	13	4	18	9	18	9	18	2	50	26	18
Implicit written intent	6	14	14	14	2	13	5	23	8	16	5	10	-	-	20	14
None	11	25	48	50	7	47	9	41	21	41	22	45	-	-	59	42

Unlikely to be known	4	9	4	4	2	13	1	5	3	6	2	4	-	-	8	6
Stressors																
Health deterioration	35	80	77	79	13	87	20	91	41	80	35	71	3	75	112	79
Isolation/loneliness	15	34	45	46	7	47	7	32	24	47	19	39	3	75	60	43
Admission to nursing home	12	27	30	31	2	13	12	55	18	35	9	18	1	25	42	30
Moving rooms or facilities	4	9	11	11	1	7	5	23	3	6	6	12	-	-	15	11
Substance abuse	4	9	10	10	3	20	6	27	4	8	1	2	-	-	14	10
Financial issues	5	11	9	9	-	-	1	5	7	14	4	8	2	50	14	10
Exposure to suicide	5	11	5	5	1	7	2	9	3	6	4	8	-	-	10	7
Other (e.g. abuse; legal; sexuality/gender issues)	9	20	11	11	3	20	4	19	5	10	8	16	-	-	20	14
Total	44	100	97	100	15	100	22	100	51	100	49	100	4	100	141	100

Table 3: Incident factors relevant to suicide among nursing home residents in Australia (2000-2013) by method of suicide

		Hanging		Fall from height		Plastic bag asphyxia		Drowning		Overdose/ poisoning		Stabbing/ cutting		Other*		Total	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex																	
	Female	10	22.2	7	29.2	10	50	3	20	7	58.3	2	22.2	5	31.3	44	31.2
	Male	35	77.8	17	70.8	10	50	12	80	5	41.7	7	77.8	11	68.8	97	68.8
Age																	
	<65	4	8.9	-	-	-	-	1	6.7	4	33.3	3	33.3	3	18.8	15	10.6
	65-74	8	17.8	3	12.5	1	5	1	6.7	4	33.3	1	11.1	4	25.0	22	15.6
	75-84	14	31.1	12	50	7	35	7	46.7	1	8.3	3	33.3	7	43.8	51	36.2
	85-94	17	37.8	8	33.3	12	60	5	33.3	3	25	2	22.2	2	12.5	49	34.8
	95+	2	4.4	1	4.2	-	-	1	6.7	-	-	-	-	-	-	4	2.8
Location																	
	Deceased's bedroom	21	46.7	5	20.8	19	95	-	-	7	58.3	5	55.6	6	37.5	63	44.7

	En-suite bathroom	14	31.1	-	-	-	-	-	-	2	22.2	2	12.5	18	12.8
	Facility balcony	-	-	10	41.7	-	-	-	-	-	-	-	-	10	7.1
	Elsewhere within facility	7	15.6	3	12.5	-	-	1	6.7	1	8.3	-	-	12	8.5
	Outside facility	3	6.7	5	20.8	-	-	12	80	4	33.3	2	22.2	8	50.0
	Unlikely to be known	-	-	1	4.2	1	5	2	13.3	-	-	-	-	4	2.8
Day of week															
	Monday	8	17.8	5	20.8	5	25	1	6.7	4	33.3	2	22.2	3	18.8
	Tuesday	9	20	3	12.5	2	10	3	20	2	16.7	1	11.1	3	18.8
	Wednesday	4	8.9	3	12.5	3	15	3	20	1	8.3	2	22.2	3	18.8
	Thursday	4	8.9	4	16.7	4	20	2	13.3	3	25	1	11.1	1	6.3
	Friday	8	17.8	4	16.7	3	15	2	13.3	1	8.3	-	-	1	6.3
	Saturday	6	13.3	3	12.5	1	5	3	20	1	8.3	1	11.1	3	18.8
	Sunday	6	13.3	2	8.3	2	10	1	6.7	-	-	2	22.2	2	12.5
Holiday period															
	No	31	68.9	19	79.2	15	75	12	80	10	83.3	8	88.9	10	62.5
	Yes	14	31.1	5	20.8	5	25	3	20	2	16.7	1	11.1	6	37.5
Season															
	Spring (Sep-Nov)	11	24.4	6	25	8	40	3	20	1	8.3	3	33.3	3	18.8
	Summer (Dec-Feb)	14	31.1	8	33.3	7	35	6	40	3	25	1	11.1	6	37.5
	Autumn (Mar-May)	9	20	4	16.7	3	15	1	6.7	6	50	-	-	4	25.0
	Winter (Jun-Aug)	11	24.4	6	25	2	10	5	33.3	2	16.7	5	55.6	3	18.8
Time of day by nursing shift															
	Morning (7am-1:59pm)	14	31.1	8	33.3	1	5	8	53.3	5	41.7	3	33.3	4	25.0
	Afternoon (2pm-9:59pm)	19	42.2	8	33.3	9	45	6	40	5	41.7	2	22.2	9	56.3
	Night (10pm-6:59am)	12	26.7	8	33.3	10	50	1	6.7	2	16.7	4	44.4	3	18.8

Total	45	100	24	100	20	100	15	100	12	100	9	100	16	100.0	141	100

*Other includes electrocution (n=6), transport-related (n=5), firearm (n=3), self-removal of trachea tube (n=1), and self-injection of insulin (n=1).

FIGURE LEGENDS

Figure 1: Time between admission to nursing home and previous attempt among nursing home residents in Australia (2000-2013)

NB: Cases were excluded from the above figures if date of previous attempt or date of admission to the nursing home was unknown.

Figure 2: Time between admission to nursing home and death from suicide among nursing home residents in Australia (2000-2013)

NB: Cases were excluded from the above figures if date of previous attempt or date of admission to the nursing home was unknown.

Appendix 1: Definitions and classifications

Standard classification systems were used for variable definitions wherever possible, including: the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)¹ for mental health issues; the International Classification of Diseases, Tenth Revision (ICD-10)² for physical health issues; and the International Classification of Impairments, Disabilities, and Handicaps (ICIDH)³ for physical impairments. These classifications were applied by a single researcher (BM) at the point of data collection and entry. Themes for potential stressors and definitions for explicit and implicit intent were adapted from the Victorian Suicide Register (VSR)⁴. Major life stressors were determined based on the relevant circumstances of the death in the coroner's finding; content of suicide notes where available; or other substantial corroborated evidence contained in the coroners file. These classifications were applied by one researcher (BM) and cross-checked by a senior researcher (LB).

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC; 2013.
2. World Health Organization. *ICD-10 : international statistical classification of diseases and related health problems*. 2nd (10th revision) ed. Geneva; 2004.
3. World Health Organization. *International Classification of Impairments, Disabilities, and Handicaps* 2nd ed. Geneva; 2001.
4. Bugeja L, Milner, A., Pirkis, J. *Identification and analysis of health service use and pathways to health service contact amongst persons who died from suicide in Victoria, 2009-2010: Final report*. Beyond Blue;2015.

Appendix 1: Organisational factors relevant to suicide among nursing home residents in Australia (2000-2013)

		Suicides		Nursing homes		Available bed days	Suicide rate	Rate Ratio (RR)	95% CI	p value
		n	%	n	%	(2000-2013)	(per 100,000 bed days)			
Size										
	Small (1-20)	4	2.8	167	6.1	12,289,550	0.03	2.61	(0.70-6.94)	0.095
	Medium (21-60)	52	36.9	1260	46.1	279,322,820	0.02	1.49	(1.03-2.14)	0.026
	Large (>60)	82	58.2	1307	47.8	657,641,670	0.01	1	-	-
Care level										
	Low care only	64	45.4	995	36.4	256,026,330	0.03	1.95	(1.25-3.10)	0.002
	High care only	31	22	783	28.6	241,769,430	0.01	1	-	-
	Both low and high care	45	31.9	956	35	451,458,280	0.01	0.78	(0.48-1.27)	0.283
Ownership										
	Private	39	27.7	787	28.8	300,278,930	0.01	1	-	-
	Religious	40	28.4	729	26.7	252,786,590	0.02	1.22	(0.76-1.94)	0.382
	Charitable	24	17	458	16.8	166,902,820	0.01	1.11	(0.64-1.89)	0.690
	Community based	22	15.6	430	15.7	128,368,310	0.02	1.32	(0.75-2.28)	0.302
	State & local government	13	9.2	288	10.5	86,435,650	0.02	1.16	(0.57-2.22)	0.635
Location										
	Non-metropolitan area	37	26.2	1085	39.7	305,358,270	0.01	1	-	-
	Metropolitan area	104	73.8	1649	60.3	643,895,770	0.02	1.33	(0.91-2.00)	0.130
Total		141	100	2734	100	949,254,040	0.02			

NB: There are some missing data for size, care level, and ownership variables as information was not available in every case.

Time between admission to nursing home and previous suicide attempt (n=46)

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Duration of residence in nursing home (years)

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