

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE

# HAZARD

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UNINTENTIONAL INJURY AMONG  
OLDER RESIDENTS OF AGED  
CARE FACILITIES IN VICTORIA:

A REPORT OF HOSPITAL ADMISSIONS  
FROM 2007/08 TO 2016/17





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Victorian Injury Surveillance Unit (VISU)  
[www.monash.edu/muarc/visu](http://www.monash.edu/muarc/visu)  
Monash University Accident Research Centre (MUARC)

# UNINTENTIONAL INJURY AMONG OLDER RESIDENTS OF AGED CARE FACILITIES IN VICTORIA: A REPORT OF HOSPITAL ADMISSIONS FROM 2007/08 TO 2016/17

This edition of Hazard is focused on unintentional injury hospital admissions occurring among Victorians aged 65 years and over who live in residential aged care facilities on a permanent or respite basis. Injury-related admissions data were extracted from the Victorian Admitted Episodes Dataset (VAED) for the period 2007/8-2016/17. The primary criteria for extraction was that the admission source was coded as a transfer from a 'Residential aged care facility'. Findings related to ten-year trends and three-year patterns in hospital admissions are presented to provide an insight into injury admissions over time and a snapshot of the current state of injury admissions amongst residents of aged care facilities in Victoria. To better understand current trends and expected future burden of injury among Victorian aged care residents, background information is provided on residential aged care in Victoria as well as recent trends in residential aged care occupancy and population ageing.









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# EXECUTIVE SUMMARY

This edition of *Hazard* explores the incidence of unintentional injury-related hospital admissions that occurred among permanent and respite residents of aged care facilities, aged 65 years and over, in Victoria for the period 2007/8 to 2016/17. Specific attention is given to: the ageing population and trends in use of residential aged care services; injuries among residents with dementia (as recorded upon hospital admission and coded within the VAED); and injury outcomes, in particular in-hospital death.

## Residential aged care trends (10 years)

Over the ten-year period from 2007/8 to 2016/17, the population of Victorians aged 65+ years increased by 3.3% per year from 695,162 to 929,214 persons. During this time, the annual number of Victorian residential aged care bed days used increased by 1.9% per year, from 14.3 to 16.9 million. The number of occupied residential aged care bed days *per population aged 65 years and over in Victoria* steadily decreased over the ten-year period by an average of 1.4% per year. A decrease in the number of residential aged care bed days per population was observed for males and females, in each of the three age groups (65-74, 75-84 and 85 years and over). Females used more residential aged care bed days than males (annual average of 11.0 vs. 4.6 million, respectively) but this female/male difference was less pronounced in residential bed day use *per population* (annual average of 25.2 vs. 12.6, respectively).

## Residential aged care injury admission trends (10 years)

A total of 14,896 unintentional injury-related hospital admissions among residents of aged care facilities were observed over the ten-year period, and 64.8% (n=9,659) of admissions were accounted for by residents aged 85+ years. Females accounted for 70.6% (n=10,518) of admissions but admission rates per 100,000 residential aged care bed days were similar for males and females (9.5 vs. 9.6 respectively). Trends in residential aged care injury admission rates over time fluctuated, possibly due to the Victorian hospital admission policy change in 2012 (Department of Health, 2012). In an effort to filter out this effect, only admissions of two or more days were selected: the results showed a statistically significant decrease in *injury admissions per population* for females aged 75-84 and 85 years and over; injury admissions per male population and *injury admission rates per bed days* for males and females increased slightly but the changes were not statistically significant.

## Residential aged care injury admission patterns (3 years)

During the most recent 3-year period from 2014/15 to 2016/17, fractures accounted for 40.6% (n=2,014) of the 4,961 injury admissions among residents of aged care facilities. Females accounted for 68.3% of injury admissions and the most common age group was 85-94 years (57.1%, n=2,834 admissions). A diagnosis of dementia was present in 10.5% (n=521) of *injury admission records* as recorded in the VAED. It is possible for an individual to have dementia but the diagnosis is not noted in the admission record. Therefore this figure is likely to be an underestimate. The majority of injuries occurred within the residential aged care facility (71.8%, n=3,563) although among the 521 admissions with dementia recorded, the proportion was even higher (79.1%, n=412).

Fractures were more common among those with a recorded diagnosis of dementia (54.7%, n=285) compared to those with no recorded diagnosis of dementia (38.9%, n=1,729). The lower extremities were the most common region of injury, accounting for 34.2% (n=1,699) of hospital admissions. Among those without

dementia, the most common region of injury was the head, face and neck (33.0%, n=1,464) whilst those with a diagnosis of dementia suffered injuries most commonly to the lower extremities (50.3%, n=262).

The most common types of injury for which residents of aged care facilities were admitted were fractures of the hip and thigh (18.2%, n=901), and open wounds to the head (12.4%, n=613). Fractures to the hip and thigh were much more common among those with a diagnosis of dementia compared to those without a diagnosis of dementia (38.0% vs. 15.8%) but open wounds to the head displayed the opposite pattern; those with a diagnosis of dementia were less likely to be admitted with wounds to the head compared to those without a diagnosis of dementia (6.1% vs. 13.1%, respectively).

The majority of injuries among residents of aged care facilities were the result of falls (87.9%, n=4,363). Falls accounted for a similar proportion of injury admissions among those with and without a recorded diagnosis of dementia (88.1% v 87.9%, respectively). However, choking/suffocation related admissions, the second most common cause of admission, were relatively more common among those with a diagnosis of dementia (3.1%, n=16) than among those without (1.1%, n=50).

## Burden of residential aged care injury admissions (3 years)

Of the 188 deaths in hospital, the majority occurred amongst aged care residents who did not have a diagnosis of dementia (84.6%, n=159). However, a statistically significantly higher proportion of patients with dementia died in hospital compared to those without dementia (5.6% versus 3.5%). Among those who died, the injuries were commonly hip and thigh fractures (30.9%, n=58) and intracranial injury (12.2%, n=23); 6.4% of admissions for hip and thigh fractures resulted in in-hospital death, while the figure for intracranial injuries was 12.7%; both much higher than the 0.4% in-hospital deaths overall among injury-related hospital admissions of aged care residents.

In the three-year period 2014/15 to 2016/17, hospital beds were occupied for 22,694 days for injury-related admissions among aged care residents. An analysis of the length of stay showed that 52.3% (n=2,597) of admissions resulted in the utilisation of fewer than two bed days. The breakdown by age showed that as age increased, stays of <2 days become more common, increasing from 49.0% of all stays among those aged 65-74 years to 55.3% of all stays among those aged 95+ years.

An estimated total of \$23.4 million AUD in hospital costs was spent on residential aged care injury related admissions over the period 2014/15-2015/16 (the most recent year of costs data was not available). The patterns of estimated costs of hospital admissions were consistent with patterns observed for length of stay: 56.7% (\$13.2 million AUD) of costs of hospital admissions were associated with those aged 85-94 years.

Complications that occurred in hospital were determined using the Classification of Hospital Acquired Diagnoses (CHADx): 27% (n=1353) of injury admissions had at least one complication recorded during hospital stay. The five most commonly recorded specific complication types were alterations to mental state (n=249, 5.0%), hypotension (n=203, 4.1%), constipation (n=203, 4.1%), electrolyte disorders without dehydration (n=195, 3.9%) and all other falls (n=153, 3.1%).

# RECOMMENDATIONS

## Ageing population and trends in residential aged care utilisation

1.

The rate of population ageing appeared to be greater than the increase in residential aged care bed-days in Victoria, 2007/8 to 2016/17. This is likely due to a trend for older people to remain in their own home, potentially with paid or informal care provided. This points to a need for State-and Federal-funded investigations into injury among older people receiving care in their own home.

## Primary injury prevention

2.

Among those in residential aged care, injury-related hospital admission frequency and rate (calculated per aged care bed-days) were highest in the 85 year and over age group. This group should therefore be the particular focus of injury prevention efforts.

3.

Falls were the most common cause of injury admissions, and hip fractures and head injuries were the most commonly encountered injury types. Furthermore, these injury types were also most commonly associated with in-hospital death among those admitted from residential aged care in relation to an injury. *Falls prevention and post-fall management* should therefore remain the main focus of injury prevention efforts in residential aged care, as mandated by the Department of Health and Human Services' Standardised Care Processes and Aged Care Quality Standards.

## Prevention of in-hospital complications

4.

In-hospital falls were a relatively common complication among those admitted from residential aged care. The number of in-hospital falls can be reduced: hospital-based prevention efforts should be targeted at those admitted from residential aged care as falls are relatively frequent in this population.

5.

Alteration to mental state (such as delirium) was the most common type of complication among aged care residents admitted to hospital because of an injury. Delirium is known to be a common complication in older hospitalised patients, and those admitted from residential aged care are particularly at risk and available interventions should be used to target this population on admission.

6.

Arrhythmia and hypotension were other relatively common complications occurring during a hospital stay: addressing and preventing this may contribute to in-hospital falls prevention. Furthermore, these may also contribute to falls in residential aged care. These conditions are treatable and can be diagnosed non-invasively. It is recommended that additional standardised care processes be developed by the Department of Human Services and Centre for Evidence Based Care to target these issues in Residential Aged Care, to reduce the occurrence of these complications.

## Aged care residents with dementia

7.

Among aged care residents with dementia, choking and suffocation were relatively common causes of injury-related hospital admission. Furthermore, these were also a relatively common cause of in-hospital death among those with dementia. This highlights the need to develop and/or implement choking and suffocation preventive guidelines/ standards particular to this group, and incorporate them into standard care as part of the Department of Health and Human Services' Aged Care Quality Standards. A comprehensive and vital set of recommendations regarding choking have also been outlined in Ibrahim (2017).

## Data quality issues

8.

Activity code is/remains poorly specified, with 78.5% of cases coded as 'Unspecified' activity performed when the injury occurred. For VISU to develop recommendations for injury prevention, the VAED injury data is vital. It is recommended that hospitals receive feedback from the Department of Health and Human Services (DHHS) to improve the specificity of activity coding, for these purposes.

9.

The mechanism involved in falls was often unspecified. In order for injury prevention strategies to be properly devised and implemented, it is crucial to identify as much detail as possible. It is recommended that the hospitals receive feedback from DHHS, to document the mechanism of falls so that this can be coded. This may involve improving or better use of transfer notes from residential aged care.

10.

The proportion of injury-related hospital admissions where the person was recorded as suffering from dementia was likely to be an underestimate. According to the Department of Health (2017a), 50% of persons in residential aged care have a diagnosis of dementia; this figure is far greater than the 10.5% of cases found within the VAED. In order to better tailor injury prevention interventions for residents of aged care facilities with dementia, it is important that all cases are correctly identified and coded. It is recommended that hospitals receive feedback from the Department of Health and Human Services (DHHS) to improve the recording of dementia comorbidity.

# INTRODUCTION

## Aged Care organisation and structure in Australia

In 2016/17, aged care provided various forms of support to approximately 1.3 million Australians aged 65 years and over (Department of Health, 2017a). The aged care system is subsidised by the Federal Government, which spent \$17.1 billion on aged care in the 2016/17 financial year (Department of Health, 2017a). This edition of *Hazard* focuses on hospital admissions resulting from unintentional injuries sustained within one particular form of care; residential aged care facilities in Victoria. Although residential aged care accommodates only 23% of individuals receiving any form of aged care service, of the \$17.1 billion spent on aged care by the Australian Government, 69.6% (\$11.9 billion) was spent on residential aged care (Department of Health, 2017a).

The aged care system in Australia, and Victoria, is well developed and features a range of options for older individuals with various levels of physical and mental capabilities. Whilst this edition of *Hazard* will focus solely on residential aged care facilities, a brief overview of each of the different types of care follows.

*Residential aged care* refers to public and private facilities where older people can live when they are no longer able to adequately care for themselves, perform activities of daily living, or maintain personal health. Individuals living in residential aged care facilities have been formally assessed by an appointed Aged Care Assessment Team as requiring a higher level of care than can be provided in their home and in cases where it is deemed necessary, may be provided with 24 hour care. Several alternatives are also available.

*Retirement villages* are the most commonly known type of out of home care. Retirement villages are campus-like multi-unit complexes which occupy spacious grounds and often include recreational and medical facilities. The lifestyle within retirement villages is independent (although some assistance can be provided) but the design accounts for accessibility features such as ramps instead of stairs, hand rails in the bathrooms, and emergency call buttons.

For individuals whose needs can be accommodated in the community and in their own dwelling, without the need for placement in a residential aged care facility, *home care* can be provided. The Federal Government provides two different programmes that come under this umbrella: the Commonwealth Home Support Programme (CHSP) and the Home Care Packages Programme (HCP). The CHSP is a basic level of home help which can provide services to help an older person in the home and community. The aim is to assist the individual in living at home for as long as they are able. The care can include assistance with transportation, domestic work, home maintenance and modification (often to bathrooms and entryways), meals, nursing care, and allied health services. The HCP provides co-ordinated packages of care which are individually tailored and includes four stratified levels: Home Care Level 1, which supports people with basic needs, to Home Care Level 4, which supports people with high care needs. Because these packages are individually tailored and are subject to the principles of consumer directed care, clients have a some choice in what care and services are received, and how the funding allocated to them is spent.

The fourth type of aged care is *flexible care*. Flexible care includes four sub-types and caters for older people for whom traditional forms of home and residential care may not be appropriate. Transition care is a program which runs for up to 12 weeks, designed to help older persons rehabilitate after an injury or episode of ill-health rather than entering residential care. Similarly, Short-Term Restorative Care is an eight-week programme which aims to assist older persons who have had a health issue to remain at home rather than be admitted to hospital for a longer period of time.

The Multi-Purpose Services (MPS) Programme provides integrated health and aged care specific services in rural and remote communities where individuals may not have easy access to hospitals or aged-care homes. The Innovative Care Programme is a legacy program to which no further places or funding are being allocated. This programme involved pilot projects providing care outside of the standard services. This program is largely defunct with no new places or funding being provided. However, flexible care continues to be provided through the National Aboriginal and Torres Strait Islander Flexible Aged Care Programme (NATSIFAC). NATSIFAC allocates and funds culturally appropriate flexible aged care for Indigenous Australians in rural and remote areas.

## Regulation of Aged Care funding and care recipients' rights

The Federal government provides a significant level of funding to aged care as required under the Aged Care Act (1997). Under the Act, the Federal Government has sole responsibility for funding (except in Western Australia) care to those aged 65 years and older. The Australian Government provides approximately 95% of all funding for residential aged care, approximately \$11.9 billion in 2016/17, \$3.1 billion of which was allocated to Victoria (Department of Health, 2017a). Nominal daily fees are also paid by residents; generally amounting to 85% of the aged pension received by the individual. Whilst this amount is a daily maximum set by the Australian Government, the providers may elect to charge less at their discretion. Other fees are also payable in some circumstances. Care fees and accommodation fees may be charged but both are means tested. If any residents require extra services that are not usually provided then additional fees may be charged.

In addition to regulations regarding funding and operation of the aged care system, a charter of rights also exists to protect the rights of those entering aged care. Known as the Charter of Care Recipients' Rights and Responsibilities, this document protects the recipient from having their rights impinged upon whilst they are living in residential care (Aged Care Act, 1997). Some of the key points contained within the charter include: full and effective use of personal, civil, legal, and consumer rights; full information about his or her state of health and available treatments; the right to dignity and respect, and to live without exploitation, abuse or neglect; personal privacy; ability to continue in his or her cultural and religious practices, and to keep the language of his or her choice, without discrimination; to be involved in the activities, associations and friendships of his or her choice, both within and outside the residential care service; and many other items.

## Residential Aged Care capacity and occupancy trends

The aged care system is also influenced by supply and demand for places. The Aged Care Act (1997) outlines the requirements for assessments and allocation of places and funding to the service providers that deliver the services and accommodation to clients. In 2016/17, there were 53,277 operational residential aged care places in Victoria which, at 30 June 2017, accommodated 47,218 permanent residents. This represents a ratio of 80.7 operational places in residential aged care per 1,000 population aged 70 years and over (Department of Health, 2017b). The overall ratio of allocated and operational places (not limited to residential aged care) in Australia have been fairly stable over time. At the end of the 2015/16 financial year the Australian Government had a stated aim of reaching an overall aged care operational place ratio of 125 per 1,000 people by 2021-22. According to the Australian Institute of Health and Welfare (2014), while an ageing population may influence this target somewhat, the primary reason for increasing the operational target is to assign funds, should they be needed. Planning ratios do not necessarily reflect demand. The ratio is realistically a cap and if the ratio means there is excess supply then it is practically irrelevant (Australian Institute of Health and Welfare, 2014). The actual ratio for all forms of care was 113.2 per 100,000 at 30 June 2016, up from 111.5 per 100,000 at 30 June 2015. However, due to home care reforms in February 2017, the ratio reported at 30 June 2017 was significantly lower as home care places were no longer defined within 'operational places'. Looking solely at operational place ratios for *residential aged care* within Victoria, over the past five years, the ratio of places per 100,000 relevant population has progressed as follows: 85.2 in 2013, 84.1 in 2014, 83.3 in 2015, 81.8 in 2016, and 80.7 in 2017. This represents a minor, but consistent, reduction each year (Department of Health, 2013, 2014, 2015, 2016, 2017b). *Operational aged care* places have therefore been stable over time but operational *residential aged care* places, in 2017, were 94.7% of what they were in 2013. Additionally, data is also reported on respite care. Residential aged care (and home care) can be utilised on a respite basis which entails the same level and type of care, but provided for a temporary period of time. According to the Department of Health (2017a), in 2016/17 there were 75,291 people admitted to residential aged care facilities for respite care. It is important to consider this population as its own entity as the circumstances for care are often different to those in permanent care.

One of the primary reasons for the observed decrease in the operational place ratio is that, whilst Australia's population is ageing rapidly, residential aged care utilisation is increasing more slowly in comparison, due to older people staying at home for longer and utilisation of care alternatives that enable this (Department of Health, 2017a). For example, rates of community care package utilisation among those aged 65 years and over have risen sharply between 2000 and 2015 amongst both males and females. Despite this, the ageing population still creates increasing demand on the residential aged care system. At 30 June 2017, 15% (3.8m) of the Australian population was aged 65 years and over; this is expected to rise to 18% (5.2m) by 2027 (Department of Health, 2017a). Whilst individual assessments determine access to residential aged care facilities rather than age itself, as the number of people in older age groups increases, so does the number of individuals likely to require aged care. For example, as of 30 June 2017, 16% of all 85-89 year olds were users of residential aged care. According to population estimates and projections for growth and ageing (Australian Bureau of Statistics, 2013), this equates

to 49,472 people and if the proportion remains steady at 16%, then by 2028, the figure will be 69,552, significantly increasing the financial demand on residential aged care providers and government funds. Another factor resulting in increased demand on the aged care system is the increasing number of people affected by dementia (Australian Institute of Health and Welfare, 2014; Department of Health, 2017a). Dementia is characterised by an impairment in cognitive functioning, frequently related to memory loss, but it can also affect perception, language and activities of daily living. As of 30 June, 2017, approximately 50% of people in residential aged care had a recorded diagnosis of dementia (Department of Health, 2017a). In 2017, there were an estimated 365,000 Australians living with dementia and that figure is expected to rise to 900,000 by 2050. The prevalence of dementia in those aged 65 and over is 10%, and for those aged 85 years and over, 30% (Department of Health, 2017a).

## Injuries in Residential Aged Care

Given the vulnerability of the residential aged care population, a number of studies have investigated external causes of mortality and injury among older people in residential aged care. In a study of premature deaths among those in aged care, Ibrahim et al. (2017) found that 81.5% (n=2,679) of premature deaths over the period 2000/01-2012/13 were the result of falls. Almost 60% of fall-related deaths occurred among residents aged 85-94 years. Furthermore, over the study period, rates of all external cause related deaths among those in aged care increased from 3.8 to 12.7 per 100,000 aged 65 years or older (this is an estimate made by adding the reported rates for falls with the 'external cause (other)' rates reported by Ibrahim et al. 2017). Ibrahim et al. (2017) noted that the figures reported are likely to underestimate the problem of premature deaths occurring in aged care. With regard to research into non-fatal injuries it has been reported that among the general population 10% of all hospital bed days among those aged 65 years and older are accounted for by falls (Australian Institute of Health and Welfare, 2017). According to the most recent figures available from the Australian Institute of Health and Welfare (2017), 1.4 million days of care were provided to persons aged 65 years and over due to fall related injuries in 2012/13. Within residential aged care, the rate of falls for those aged 65 years and over was 9,037 per 100,000 Australian population, approximately five times the rate of fall-related injury hospitalisations among the same age group in the general community (Australian Institute of Health and Welfare, 2017). A study conducted by Russell, Clapperton, Vu, and Day (2015) found that rates of fall-related hospitalisations among people living in residential aged care facilities had significantly increased over the period 2003/4 to 2011/12. Furthermore, the results showed that the rate of serious injuries (defined by the ICD Injury Severity Score) as a result of falls had increased significantly over the same time period.

With regard to the health and safety of persons in residential aged care facilities, the Department of Health and Human Services (DHHS) and the Australian Centre of Evidence Based Care developed 16 Standardised Care Processes (SCPs) to target risk areas. These SCPs include guidelines for risks such as choking, delirium, and falls. These processes are subject to regular review in order to best reflect current research-based evidence. Furthermore, the accreditation standards for residential aged care facilities includes eight items pertaining to the physical environment and safe systems to ensure that care recipients live in a safe environment designed to promote a high quality of life. Beginning on July 1, 2019, a new set of Aged Care Quality Standards are proposed to replace the current accreditation standards.





## AIMS OF THIS EDITION OF HAZARD

Although falls and choking are the most common causes of injuries among residents of aged care facilities, and older persons generally, this edition of *Hazard* will focus on all types of injuries sustained by residents of aged care facilities. In order to do so, this edition of *Hazard* aims to:

- Demonstrate patterns and trends of injury in residents of aged care facilities between 2007/08 and 2016/17, Victoria, which resulted in hospital admission
- Place the trends in residential aged care injuries into context, by summarising trends in population ageing and residential aged care utilisation and providing injury rates per population as well as per residential aged care population
- Provide insight into the mechanism and types of injuries which are most likely to occur (e.g. falls)
- Compare injury related hospitalisation patterns among residents with and without dementia
- Provide recommendations for injury prevention in the population of residents of aged care facilities

Residential aged care injury hospitalisation data used in this report was extracted from the Victorian Admitted Episode Dataset (VAED) which is held by the Victorian Injury Surveillance Unit (VISU), and provided to VISU by the Department of Health and Human Services (DHHS). Data on residential aged care bed usage was provided by the Australian Institute of Health and Welfare National Aged Care Data Clearinghouse (2018).

# RESIDENTIAL AGED CARE INJURY ADMISSION TRENDS (10 YEARS)

To understand and interpret trends in hospital-treated injury among residents of aged care in Victoria, we need to first have an understanding of population growth and ageing, and trends in residential aged care use. The following sections of this report therefore summarise population growth by age group for those aged 65+ years in Victoria, 2007/8 to 2016/17, followed by an overview of bed-day use of residential aged care in Victoria, and an overview of unintentional hospital-treated injuries among residents of aged care. The latter is presented as the *number of admissions* as well as the *admission rate per population* and the *admission rate per residential aged care bed days*. Data on residential aged care bed usage was provided by the Australian Institute of Health and Welfare National Aged Care Data Clearinghouse (2018).

## Victorian population aged 65+ years

An overview of the Victorian population aged 65 years and over during the 10-year period from 2007/8 to 2016/17 is provided in Table 1. Overall, the population of those aged 65+ years in Victoria increased by an average of 3.3% per year. Population growth by age group is shown in more detail in Figure 1 (males) and Figure 2 (females). The average annual population increase was 3.6% among males and 3.0% among females aged 65+ years (Table 1). The greatest proportional population increase was observed among males aged 85+ years with an average increase of 5.9% per year.

Table 1

### Victorian population and Victorian residential aged care occupancy, 2007/8-2016/17

	Population		Residential aged care		Residential aged care use per population	
	Average annual population (x1,000)	Annual change in population (%)	Average annual bed days (x100,000)	Annual bed day change (%)	Average bed days per population	Annual change, rate per population (%)
Male						
65-74	210.4	4.11	6.6	2.86	3.15	-1.20
75-84	117.7	2.14	16.2	0.69	13.77	-1.42
85+	37.6	5.88	23.3	4.78	62.05	-1.03
Total	365.6	3.64	46.1	3.04	12.62	-0.58
Female						
65-74	221.5	4.02	6.9	2.55	3.14	-1.41
75-84	145.3	1.17	29.6	-0.67	20.35	-1.82
85+	69.5	3.52	73.3	2.13	105.53	-1.34
Total	436.2	2.98	109.9	1.38	25.18	-0.70
Grand Total	801.9	3.28	156.0	1.87	19.46	-1.36

Note: All reported annual changes (population, bed days, bed days per population) were statistically significant at  $p < 0.0001$  with exception of grand total annual bed day change with  $p < 0.05$ . For statistical testing, Poisson models were used with population offset where relevant; models were adjusted for age group and sex.



Figure 1

Male population by age group, Victoria, 2007/8-2016/17

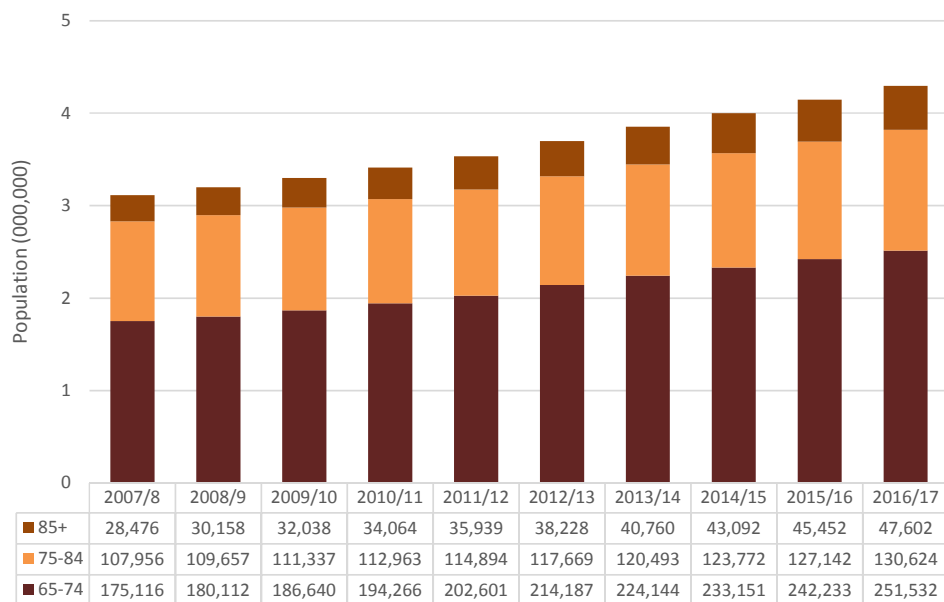
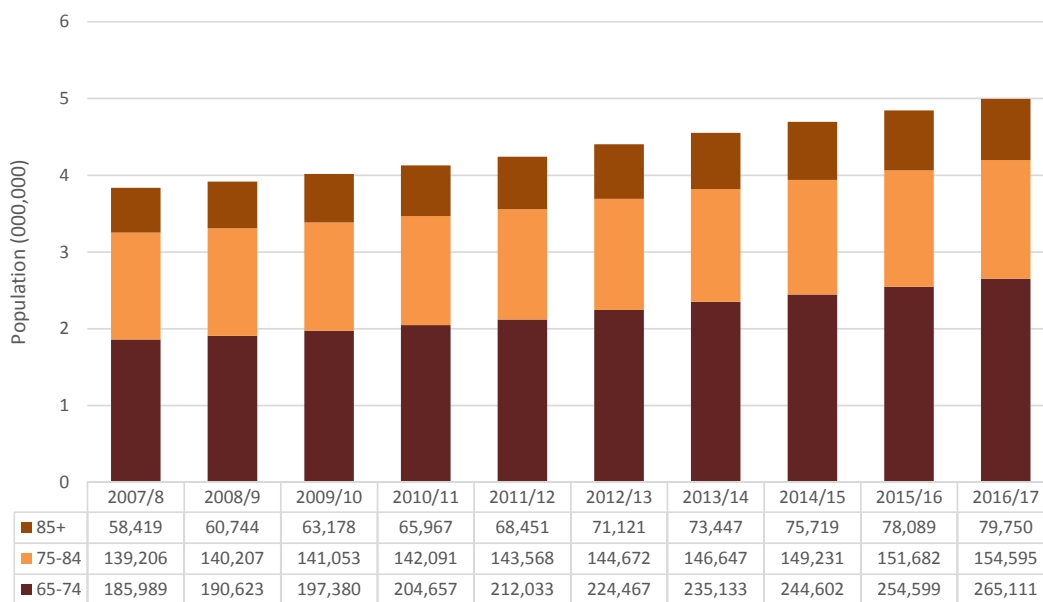


Figure 2

Female population by age group, Victoria 2007/8-2016/17



## Use of residential aged care by Victorians aged 65+ years

Residential aged care bed days during the period from 2007/8 to 2016/17 are also summarised in Table 1. The numbers of residential aged care bed days by age group are shown in more detail in Figure 3 (males) and Figure 4 (females). Aged care residency over the ten-year period was greater among females than males (109.9 vs. 46.1 bed days x100,000 used by females vs. males, respectively). This discrepancy is most pronounced in the older age groups: among those aged 85+ years, the number of residential aged care bed days by females was over three times the number of bed days by males (73.3 vs. 23.3 x100,000 respectively). Overall, the annual number of residential aged care bed days used increased by an average of 1.9% per year during this period: 3.0% increase in male occupied bed days and 1.4% increase in female occupied bed days (Figure 3 and Figure 4). Rates of aged-care occupancy increased among almost all age groups in males and females. The one exception to this was the female 75-84 year age group which experienced a slight (but statistically significant) decline in bed occupancy over the ten-year period dropping from approximately 3.1 million residential aged care bed days in 2007/8 to approximately 2.9 million in 2016/17: an average rate change of -0.7% per year.

Figure 3

Male residential aged care (RAC) bed days by age group, Victoria, 2007/8-2016/17

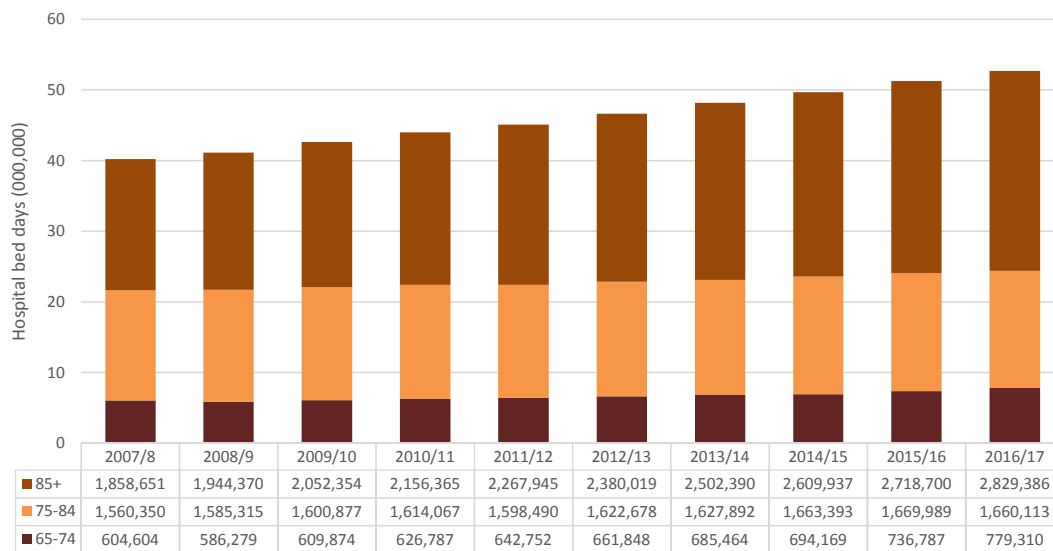
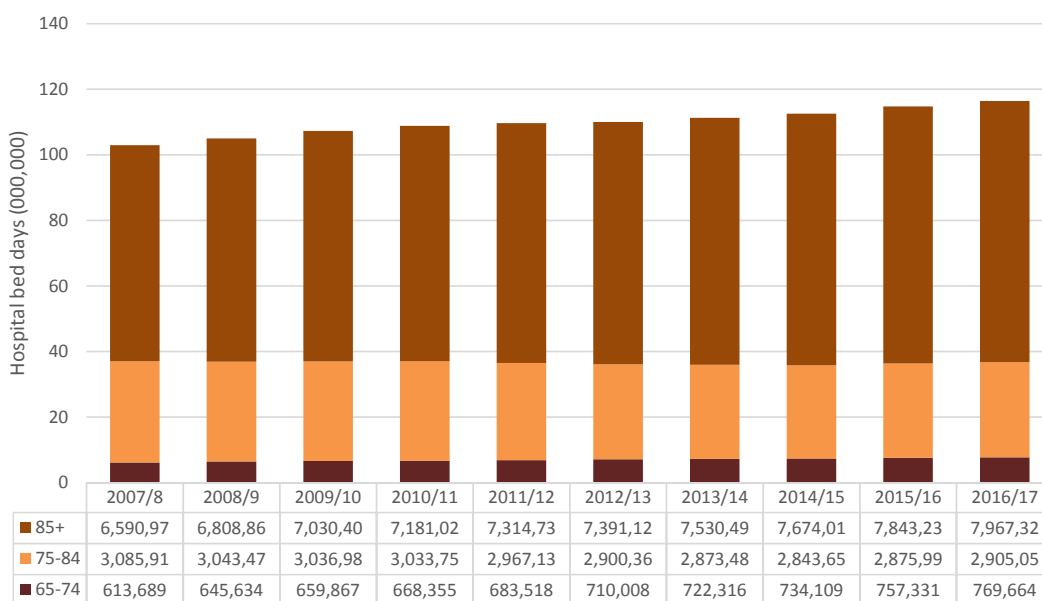




Figure 4

## Female residential aged care (RAC) bed days by age group, Victoria, 2007/8-2016/17



Residential aged care bed days calculated in proportion to the Victorian population aged 65 years and over, by age group and sex, is also shown in Table 1. The average residential aged care bed occupancy per population was highest amongst the 85+ year age group for both males (62.1 bed days per population) and females (105.5 bed days per population). Although the numbers of residential aged care bed days per population were higher among females than males in the 75-84 and 85+ year age groups, the difference was less pronounced than the female/male-difference observed in the *absolute number* of residential aged care bed days (Table 1). In other words, the overrepresentation of females in residential aged care is partly explained by the overrepresentation of females in older age groups in the Victorian population.

More detailed year-by-year overviews of residential aged care use per population are provided for each age group in Figure 5, Figure 6 and Figure 7. Overall, residential aged care bed days per population steadily decreased over the ten-year period; there was an average decrease of 1.4% per year. The largest decrease was seen among females aged 75-84 years: an average annual decrease of 1.8% (from 22.2 bed days per population in 2007/8 to 18.8 in 2016/17). In fact, while the total number of residential bed days has increased over time, aged care utilisation expressed in bed days per population experienced a decrease over the ten-year period, in each of the three age groups, for both males and females.

Figure 5

Residential aged care bed day use per population by sex, 65-74 years, Victoria, 2007/8-2016/17

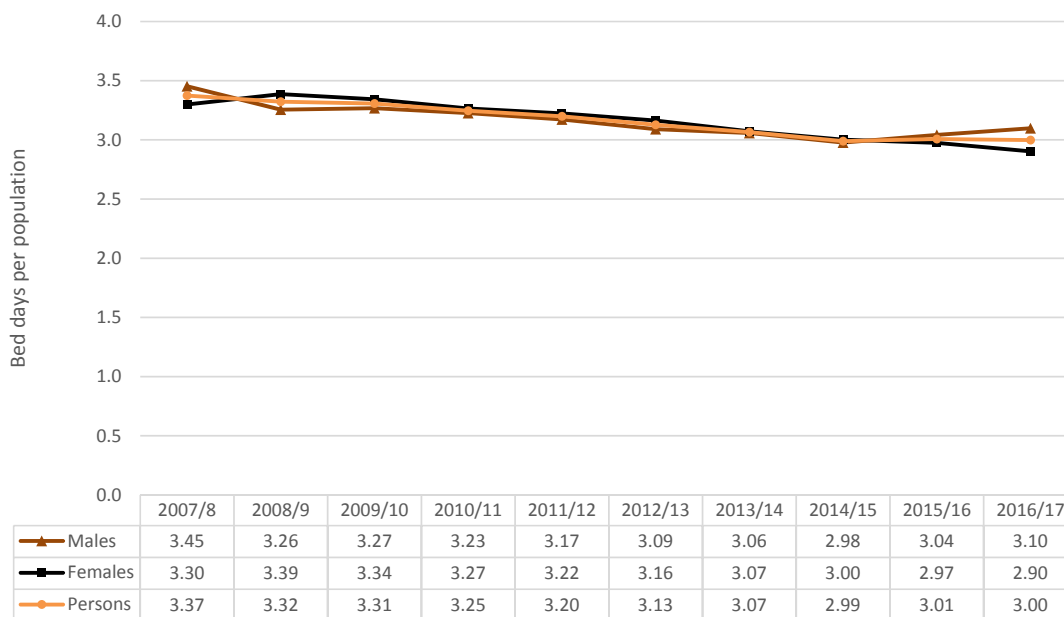


Figure 6

Residential aged care bed day use per population by sex, 75-84 years, Victoria, 2007/8-2016/17

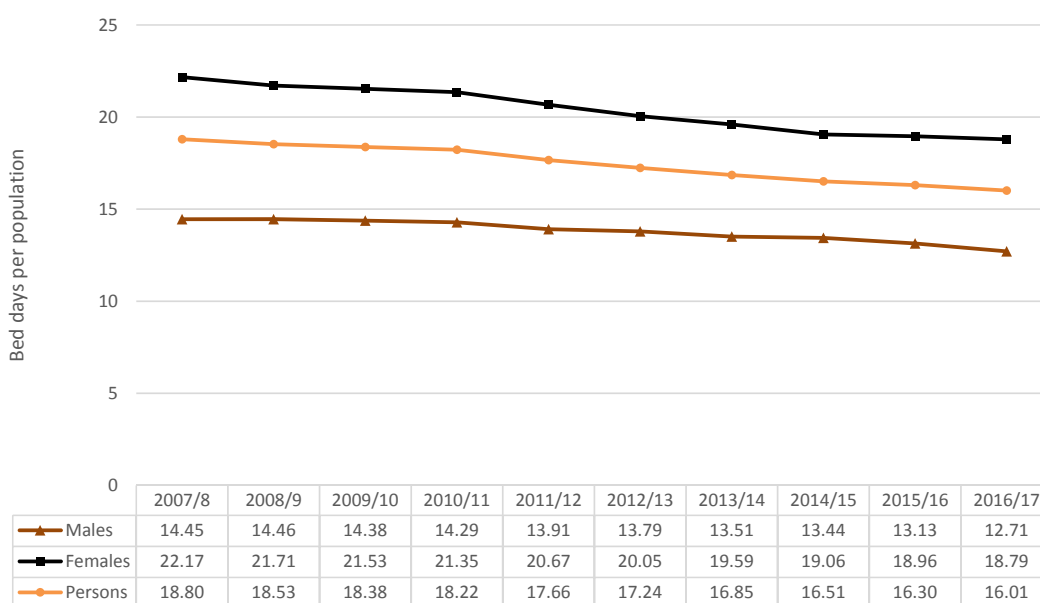
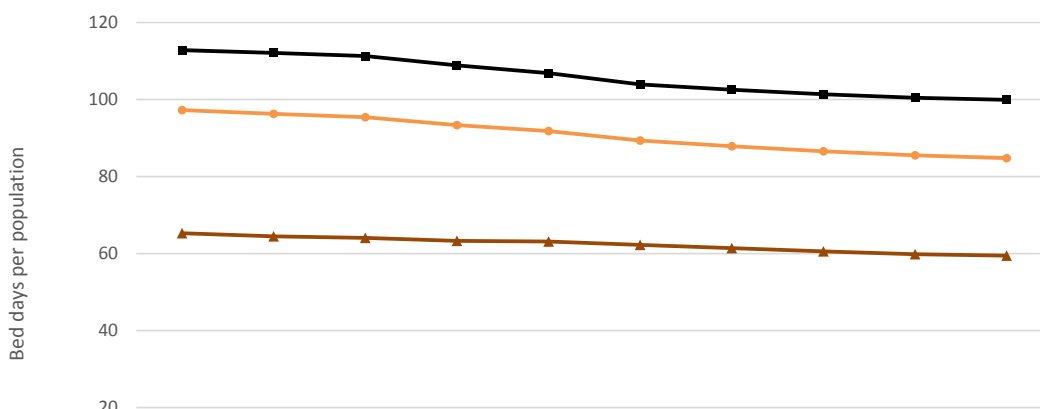






Figure 7

Residential aged care bed day use per population by sex, 85+ years, Victoria, 2007/8-2016/17



	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
—▲— Males	65.27	64.47	64.06	63.30	63.11	62.26	61.39	60.57	59.81	59.44
—■— Females	112.82	112.09	111.28	108.86	106.86	103.92	102.53	101.35	100.44	99.90
—●— Persons	97.24	96.29	95.39	93.34	91.80	89.36	87.85	86.56	85.49	84.78

## Injury-related hospital admissions among those living in residential aged care

Hospital admissions data were extracted from the Victorian Admitted Episodes Dataset (VAED) for the years 2007/08 to 2016/17 for patients aged 65 years or over who were residents of an aged care facility. Initially, cases were selected if the admission was recorded as a transfer from a residential aged care facility (admissions source is N - "Transfer from aged care residential facility") and the injury was coded as unintentional (external cause code in the range V00-X59). To identify injury cases an inclusive method was used: cases were selected if they did *not* have a medical injury (i.e. complications of medical or surgical care) as the first occurring external cause code or the first occurring injury code. Case selection was not limited to community injuries (ICD 10 AM range S00-T75 or T79) in the first diagnosis code as is done in general. This was in order to capture cases related to causes such as choking, falls etc. that tend to have a non-community injury code in the first diagnosis code. Dementia status was identified using ICD-10-AM diagnosis codes in the range F00-F03. The use of the label 'non-dementia' refers to all cases where dementia was not reported to the VAED. It is possible that some cases where no diagnosis of dementia was recorded may have included an individual with dementia. The analysis includes both permanent residents and temporary/respite residents of aged care.

An overview of the frequency and rate of injury-related hospital admissions among aged care residents in Victoria, 2007/8 to 2016/17 is provided in Table 2. Over the ten-year study period, there was an annual average of 1,490 hospital admissions for unintentional injury amongst residents of aged care facilities in Victoria. In this ten-year period, the lowest number of admissions was observed in 2007/8 (n=1,063) and the peak of 1,857 was observed in 2016/17. Females were over-represented, accounting for 70.6% (n=10,518) of injury admissions.

Table 2 provides the injury admission rate *per Victorian population* as well as *per residential aged care bed-days* in Victoria. Individuals aged 85 years and over accounted for approximately two-thirds of admissions (64.8%, n=9,659). Those aged 85+ years also had the highest average *rates* of injury-related hospital admissions, when calculated as rate per population (796 and 1,047 admissions annually per 100,000 population for males and females, respectively) and when calculated as rate per bed-days (10.2 and 9.9 admissions annually per 100,000 bed-days for males and females, respectively).

There were more than twice as many injury-related hospital admissions for females than males residing in aged care in Victoria, during the 10-year period (10,518 vs. 4,378). This was also reflected in the injury admission rate per population (241 vs 120 admissions per 100,000 population for females vs. males). The injury admission rate per residential aged care bed-days, however, was similar for males and females (9.5 vs. 9.6 for males vs. females) (Table 2). The difference between the absolute counts and rates is because females are over-represented in residential aged care.

Table 2

Unintentional residential-aged care injuries resulting in hospital admission: admission frequency and rate, Victoria, 2007/8-2016/17

		Rate per Victorian population		Rate per Victorian residential aged care bed days	
	Admissions* (n)	Average annual rate (admissions* per 100,000 population)	Annual change in rate (%)	Average annual rate (admissions* per 100,000 bed days)	Annual change in rate (%)
Male					
65-74	495	23.53	0.68	7.47	1.90
75-84	1,498	146.22	4.52	9.25	6.03
85+	2,385	796.19	4.62	10.22	5.71
Total	4,378	119.74	4.94	9.49	5.55
Female					
65-74	567	25.60	2.69	8.14	4.17
75-84	2,677	184.25	1.25	9.05	3.13
85+	7,274	1046.79	2.77	9.92	4.17
Total	10,518	241.10	2.32	9.57	3.93
Grand Total	14,896	185.77	3.02	9.54	4.44

\*Injury-related hospital admissions among residential aged care residents. NOTE: statistical testing of a linear trend is not meaningful given the fluctuations over time, as shown in figures below. The rate of change presented here is denoted in grey and must be interpreted with caution as these do not necessarily signify a significant linear increase.

Over the ten-year period there was an average of 186 hospital admissions *per 100,000 population*. Trends in injury-related hospital admission rates per population are shown in Figure 8, Figure 9 and Figure 10. Rates of hospital admissions per population appeared to increase over time among all age groups for both males and females. Rates fluctuated over time, however, in the absence of a steady linear trend, formal statistical trend analysis was not conducted. The average annual changes presented in Table 2 (grey font) need to be interpreted with caution.

Figure 8

Hospital admissions for unintentional injury per 100,000 population by sex, 65-74 years, Victoria, 2007/8-2016/17

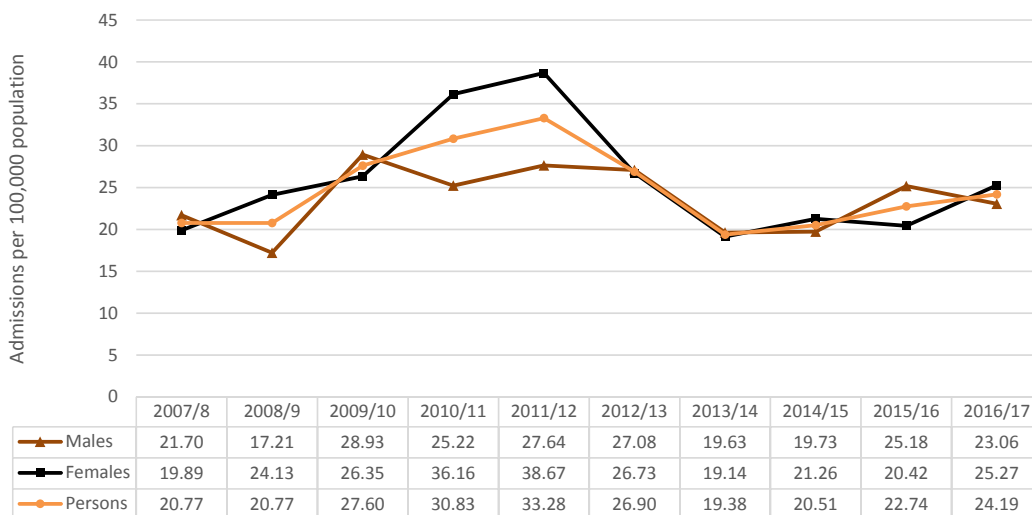


Figure 9

Hospital admissions for unintentional injury per 100,000 population by sex, 75-84 years, Victoria, 2007/8-2016/17

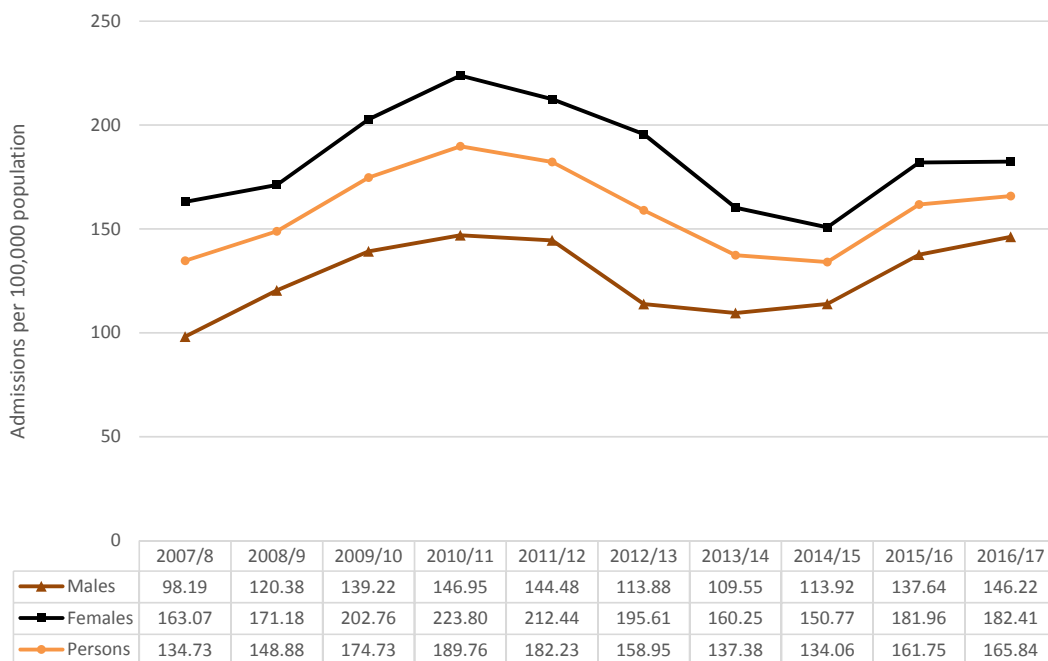
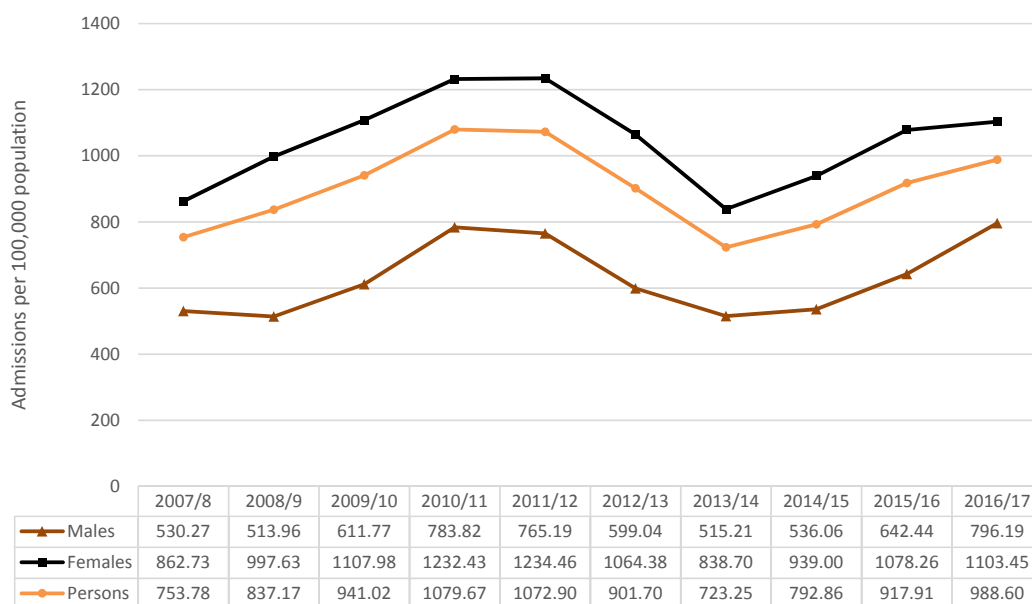




Figure 10

Hospital admissions for unintentional injury per 100,000 population by sex, 85+ years, Victoria, 2007/8-2016/17



Over the ten-year period there was an average of 9.5 injury admissions *per residential aged care occupancy* (i.e., per 100,000 aged care bed days). The highest average annual rates of injury admissions per residential aged care occupancy were observed among males and females aged 85+ years (10.2 vs. 9.9, respectively) (Table 2). Injury-related hospital admission rates per residential aged care bed days are shown in Figure 11, Figure 12 and Figure 13. Injury admission rates per aged care occupancy appeared to increase over time among all groups for both sexes. Again, rates fluctuated over time, and in the absence of a steady linear trend, formal statistical trend analysis was not conducted. The average annual changes presented in Table 2 (grey font) need to be interpreted with caution.

Figure 11

Hospital admissions for unintentional injury per 100,000 residential aged care bed days by sex, 65-74 years, Victoria, 2007/8-2016/17

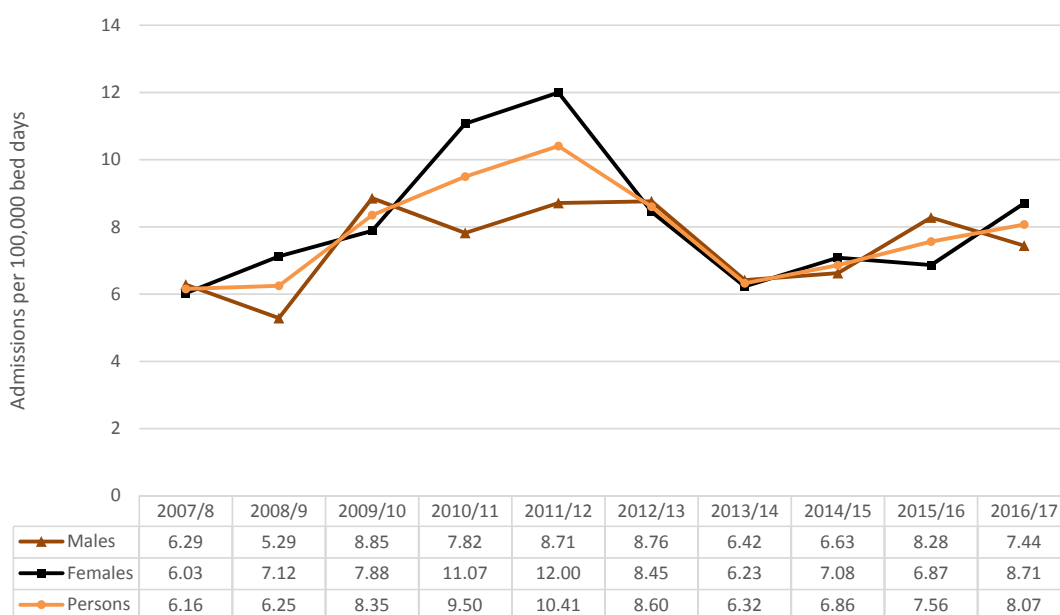


Figure 12

Hospital admissions for unintentional injury per 100,000 residential aged care bed days by sex, 75-84 years, Victoria, 2007/8-2016/17

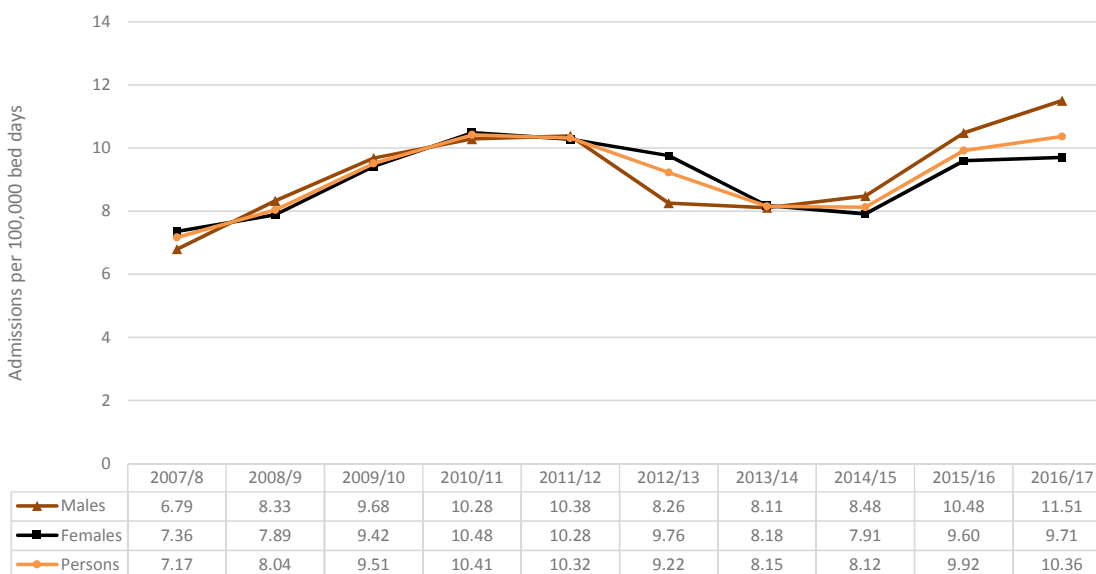
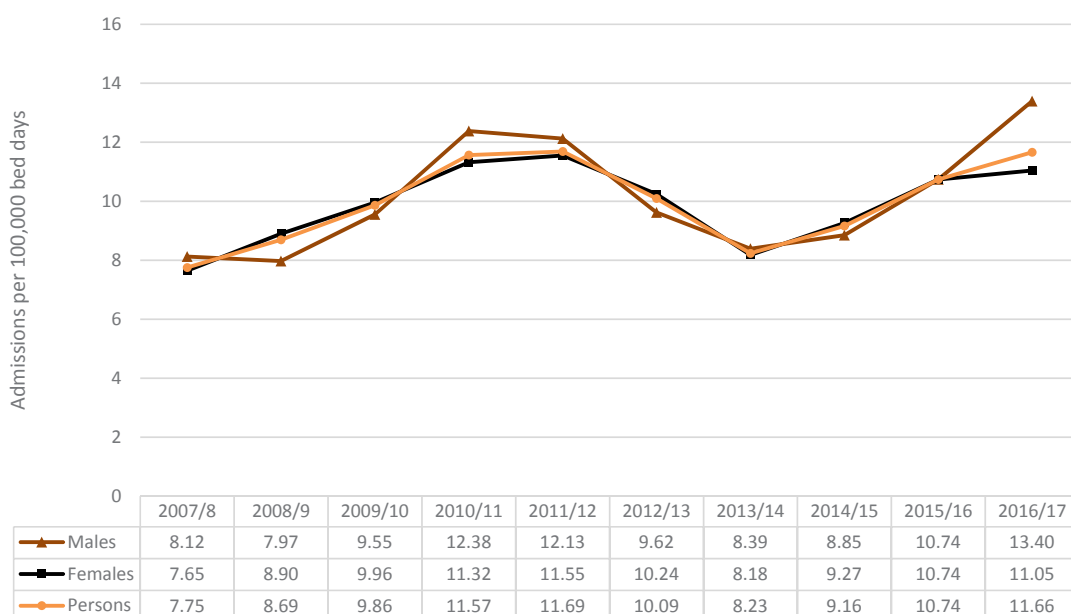


Figure 13

Hospital admissions for unintentional injury per 100,000 residential aged care bed days by sex, 85+ years, Victoria, 2007/8-2016/17





The fluctuation in injury admission rates presented in the above figures may have been influenced by the Victorian hospital admission policy change of 2012. Prior to July 2012, Emergency Department (ED) stays of longer than four hours could be categorised as a hospital admission in Victoria. In July 2012 the Victorian Hospital Admission Policy changed significantly so that episodes of care delivered entirely within a designated ED or urgent care centre could no longer be categorised as an admission regardless of the amount of time spent in the hospital. This has had an effect on observed trends in injury admissions: immediately following the policy change, the overall number of admissions decreased. However, subsequently there has been a substantial increase in Short Stay Observation Unit admissions in Victoria. In an effort to filter out policy change-driven fluctuations, only cases with two or more bed days, over the ten-year period, were selected: these are less likely to be affected by the 2012 admission policy change or the subsequent increase in Short Stay Observation Unit admissions. The results are presented in Appendix C, Table 15 and Figure 15 - Figure 20. The graphs show very little fluctuation in rates suggesting that the direct and indirect effects of the 2012 hospital admission policy change have been adequately filtered: however, the number of admissions included in the analysis has also decreased. There were no statistically significant injury admission trends with the exception of a decrease in the rate of injury admissions from residential aged care per population ('Grand Total'), and among females aged 75-84 years and 85 years and over (Table 2).



# RESIDENTIAL AGED CARE INJURY ADMISSION PATTERNS (3 YEARS)

Over the three-year period 2014/15-2016/17, there were a total of 4,961 hospital admissions for unintentional injury among residents of aged care facilities in Victoria (Table 3). This edition of Hazard focuses solely on unintentional injury. The number of hospital admissions occurring as a result of intentionally caused injuries over the three year period 2014/15-2016/17 was relatively small (n=30). Hospital admissions resulting from intentionally caused injuries and injuries of undetermined intent combined contributed only 0.5% of all incident admissions among residents of aged care facilities in Victoria over the study period.

Table 3

Unintentional injury admissions by year, demographics and recorded dementia status, Victoria, 2014/15-2016/17

	N	%
Year		
2014/15	1406	28.3
2015/16	1698	34.2
2016/17	1857	37.4
Sex		
Male	1574	31.7
Female	3387	68.3
Age (years)		
65-74	336	6.8
75-84	1290	26.0
85-94	2834	57.1
95+	501	10.1
Geographic region		
Melbourne Metropolitan	3598	72.5
Regional/Rural Victoria	1327	26.8
Interstate/Overseas/Unknown	36	0.7
Dementia*		
Dementia diagnosis recorded	521	10.5
No dementia diagnosis recorded	4440	89.5
Total	4961	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

Females accounted for 68.3% (n=3,387) of admissions which is approximately consistent with the male to female ratio in residential aged care (as shown in Table 1). The most frequently admitted age group was 85-94 years, accounting for 57.1% (n=2,834) of admissions. Relatively few 65-74 year olds were admitted for injury (6.8%, n=336) but this breakdown is representative of the overall population of individuals in residential aged care (Table 1). Residents of the metropolitan Melbourne area accounted for 72.5% (n=3,598) of injury admissions. A diagnosis of dementia was identified in the admission record in 10.5% (n=521) of the injury admissions. All future references to 'non-dementia' refer specifically to the absence of a dementia diagnosis within the hospital admission record; an individual may have dementia without it being recorded during admission.

Table 4

## Unintentional injury admissions by injury type and dementia status, Victoria, 2014/15-2016/17

Type of Injury	Total		Non-dementia		Dementia*	
	N	%	N	%	N	%
Fracture	2014	40.6	1729	38.9	285	54.7
Open wound	926	18.7	861	19.4	65	12.5
Superficial injury	608	12.3	552	12.4	56	10.7
Intracranial injury	181	3.6	164	3.7	17	3.3
Dislocation, sprain & strain	115	2.3	109	2.5	6	1.2
Injury to muscle & tendon	36	0.7	*	*	*	*
Foreign body	33	0.7	*	*	*	*
Systemic poisoning/toxic effects	31	0.6	*	*	*	*
Eye injury – excl. foreign body	26	0.5	*	*	*	*
Other effects of external cause/complications/late effects	21	0.4	*	*	*	*
Injury to internal organs	13	0.3	*	*	*	*
Burns	7	0.1	*	*	*	*
Injury to nerves & spinal cord	*	*	*	*	*	*
Complications of surgical & medical care NEC†	*	*	*	*	*	*
Other & unspecified injury	743	15.0	697	15.7	46	8.8
Missing injury code	199	4.0	169	3.8	30	5.8
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03. †Admissions with primary external cause code indicating medical or surgical cause were excluded; in the final sample, cases with injuries coded as complications of surgical and medical care were therefore rare.

Overall, the most common type of injury was fractures (40.6%, n=2,014) (Table 4). Fractures accounted for a greater percentage of injuries among those with dementia (54.7%, n=285) compared to those without dementia (38.9%, n=1,729). Conversely, only 12.5% (n=65) of injuries among residents with dementia were open wounds compared to 19.4% (n=861) among those without a diagnosis of dementia. These findings could also suggest a higher admission threshold for aged care residents with dementia vs. those without.

Table 5

## Unintentional injury admissions by main body region injured and dementia status, Victoria, 2014/15-2016/17

Body site injured	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Lower extremity	1699	34.2	1437	32.4	262	50.3
Head/face/neck	1567	31.6	1464	33.0	103	19.8
Upper extremity	747	15.1	685	15.4	62	11.9
Trunk	677	13.6	618	13.9	59	11.3
Body region not relevant	54	1.1	49	1.1	5	1.0
Multiple body regions	*	*	*	*	*	*
Missing injury code	199	4.0	169	3.8	30	5.8
Unspecified body region	*	*	*	*	*	*
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

The lower extremities (34.2%, n=1,699) and the head, face and neck (31.6%, n=1,567) were commonly injured body regions (Table 5). Whilst the injured body sites for those without a reported diagnosis of dementia closely mirrored the overall residential aged care injury admissions, injuries to the lower extremities accounted for a relatively large percentage of injuries among those with a reported diagnosis of dementia. Among those with dementia, injuries to the lower extremities accounted for 50.3% (n=262) of all injuries compared to 32.4% (n=1,437) among those without a diagnosis of dementia. Among those with a diagnosis of dementia, head, face and neck injuries accounted for 19.8% (n=103) of admissions compared to 33.0% (n=1,464) among those without a diagnosis of dementia. A detailed breakdown of injury location revealed that the specific commonly injured locations were the head (30.2%, n=1,499) and hip and thigh areas (24.9%, n=1,233) (Table 6). Head injuries accounted for 31.6% (n=1,402) of admissions among those with no recorded diagnosis of dementia, compared to 18.6% (n=97) of admissions among those with dementia. Hip and thigh injuries accounted for 43.4% (n=226) of the admissions of those with dementia, compared to 22.7% (n=1,007) for those without a recorded diagnosis.

Considering a combination of injury type and the body region injured, fractures of the hip and thigh were the most common injuries resulting in hospital admission, accounting for 18.3% (n=901) of injury admissions among aged care residents (Table 7). The second most common injury was open wounds to the head, which accounted for 12.4% (n=613) admissions among residents of aged care. A breakdown by record of dementia diagnosis showed that both groups were most commonly admitted for fractures of the hip and thigh (15.8% for non-dementia admissions vs. 38.0% for those with dementia) followed by open wounds to the head (13.1% for non-dementia admissions vs. 6.1% for those with dementia).



Table 6

## Unintentional injury admissions by detailed body site injured and dementia status, Victoria, 2014/15-2016/17

Body site injured - Detailed	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Head	1499	30.2	1402	31.6	97	18.6
Hip & thigh	1233	24.9	1007	22.7	226	43.4
Abdomen, lower back, lumbar spine & pelvis	405	8.2	367	8.3	38	7.3
Knee & lower leg	381	7.7	353	8.0	28	5.4
Shoulder & upper arm	339	6.8	314	7.1	25	4.8
Elbow & forearm	297	6.0	271	6.1	26	5.0
Thorax	241	4.9	222	5.0	19	3.6
Wrist & hand	109	2.2	99	2.2	10	1.9
Ankle & foot	80	1.6	73	1.6	7	1.3
Neck	66	1.3	60	1.4	6	1.2
Body region not relevant	54	1.1	*	*	*	*
Foreign body - respiratory tract	14	0.3	*	*	*	*
Foreign body - alimentary tract	14	0.3	*	*	*	*
Multiple body regions	*	*	*	*	*	*
Foreign body - eye	*	*	*	*	*	*
Foreign body - ear	*	*	*	*	*	*
Foreign body - genitourinary tract	*	*	*	*	*	*
Burn - upper limb	*	*	*	*	*	*
Burn - lower limb	*	*	*	*	*	*
Missing injury code	199	4.0	169	3.8	30	5.8
Unspecified body region	17	0.3	17	0.4	0	0.0
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

Table 7

Five most common unintentional injury admissions by injury and body site<sup>#</sup>, Victoria, 2014/15-2016/17

Injury	Total		Non-dementia		Dementia*	
	N	%	N	%	N	%
Fracture - Hip & thigh	901	18.3	703	15.8	198	38.0
Open wound - Head	613	12.4	581	13.1	32	6.1
Superficial injury - Head	381	7.7	350	7.9	31	5.9
Fracture - Abdomen, lower back, lumbar spine & pelvis	259	5.3	230	5.2	29	5.5
Fracture - Shoulder & upper arm <sup>1</sup>	200	4.1	185	4.2	15	2.8
Intracranial injury - Head <sup>2</sup>	181	3.6	164	3.7	17	3.3

\*Dementia cases identified using ICD-10-AM codes F00-F03

<sup>#</sup>Table shows the top five injuries for each group to highlight potential areas for intervention and percentages shown are reflective of the proportion of all injury admissions, not limited to those admissions presented in the table<sup>1</sup>Fifth most common injury among 'non-dementia' cases<sup>2</sup>Fifth most common injury among 'dementia' cases

An overview of the cause of injury, as captured in the ICD-10-AM coding, is given in Table 8. As expected, the majority of injuries among residents of aged care facilities were the result of falls (87.9%, n=4,363) (Table 8). The breakdown into those with and without a recorded diagnosis of dementia revealed that a similar proportion (88.1% v 87.9%, respectively) of each population were admitted due to fall related injuries. A breakdown of the type of falls showed that 45.3% of falls (n=1,976) were coded as 'unspecified fall', whilst the most common specified types of falls were 'other fall on same level' (22.1%, n=966) and 'same level, from slipping, tripping, stumbling' (16.8%, n=735). The next most commonly recorded specified cause was 'hit, struck, crush' which accounted for 1.9% (n=96) of classifications. However, among those with a diagnosis of dementia, choking and suffocation related injuries were the second most common specified cause (3.1%, n=16), greater than the proportion of choking and suffocation related injuries (1.1%, n=50) among those with no recorded diagnosis of dementia.

Table 8

#### Unintentional injury admissions by cause of injury and dementia status, Victoria, 2014/15-2016/17

Cause of Injury	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Fall	4363	87.9	3904	87.9	459	88.1
Hit/struck/crush	96	1.9	88	2.0	8	1.5
Choking/suffocate	66	1.3	50	1.1	16	3.1
Overexertion and/or strenuous movements	31	0.6	*	*	*	*
Poisoning	31	0.6	*	*	*	*
Transport	22	0.4	22	0.5	0	0.0
Foreign body - natural orifice	20	0.4	*	*	*	*
Fires/burns/scalds	11	0.2	*	*	*	*
Natural/environmental/animals	6	0.1	6	0.1	0	0.0
Cutting/piercing	*	*	*	*	*	*
Machinery	*	*	*	*	*	*
Other specified unintentional	14	0.3	14	0.3	0	0.0
Unspecified	292	5.9	265	6.0	27	5.2
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

An analysis of the place where the injury occurred revealed that although residing in aged care facilities, residents still sustained injuries in other locations. As expected, the majority of injuries did occur within the residential institutions (71.8%, n=3,563) (Table 9). Less than 1 in 10 injuries (8.3%, n=414) were classified as occurring at 'home' although this could be a result of residential institutions being classified as 'home' in these cases. Though the numbers were relatively small, residents of aged care facilities were also injured in locations such as schools or public buildings (health service areas in this instance) (6.5%, n=321) and on roads, streets, and highways (1.2%, n=62). Among those with dementia, 79.1% (n=412) of injuries occurred within the residential institution, a higher proportion than those without dementia (71%, n=3,151). This could be due to individuals with dementia being less likely to visit other locations.

Table 9

## Unintentional injury admissions by location of incident and dementia status, Victoria, 2014/15-2016/17

Location	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Residential Institution	3563	71.8	3151	71.0	412	79.1
Home	414	8.3	399	9.0	15	2.9
School, public buildings	321	6.5	263	5.9	58	11.1
Road, street & highway	62	1.2	*	*	*	*
Trade & service area	35	0.7	35	0.8	0	0.0
Sports & athletic areas	7	0.1	*	*	*	*
Other specified places	23	0.5	23	0.5	0	0.0
Unspecified places	536	10.8	503	11.3	33	6.3
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

On overview of the activity at the time of injury, as coded in the admissions data, is provided in Table 10. In a large proportion of cases, the activity being performed at the time the injury occurred was coded as 'unspecified' (78.5%, n=3,456) (Table 10). The most common specified activity type was 'vital activities' e.g., sleeping, eating etc. (16.9%, n=837). Vital activities were the most common activity being performed at the time of injury for individuals with dementia (13.6%, n=71) and without dementia (17.3%, n=766). The high proportion of data coded as 'unspecified' makes it difficult to draw any conclusions regarding the links between activity and the risk of injury.

Table 10

## Unintentional injury admissions by activity being performed and dementia status, Victoria, 2014/15-2016/17

Activity	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Unspecified	3892	78.5	3456	77.8	436	83.7
Vital activities, resting, eating, sleeping	837	16.9	766	17.3	71	13.6
Other specified	123	2.5	112	2.5	11	2.1
Other types of work-unpaid	51	1.0	51	1.1	0	0.0
Leisure	33	0.7	*	*	*	*
Sports	17	0.3	*	*	*	*
Activity code not required	*	*	*	*	*	*
Working for income	*	*	*	*	*	*
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03

As expected, residents of aged care facilities were most commonly discharged to an aged care facility (59.5%, n=2,952) after an episode of care. In almost a quarter of cases (23.5%, n=1,168), the individual was discharged to a private residence or accommodation (Table 11); n.b. 'private residence' includes supported residential facilities. As with the location of injury above, it could be that this coding occurred partially due to the individual's residence being coded to private accommodation (i.e. home) when in fact they were discharged to an aged care facility. Alternatively, an individual may have been discharged to a private residence if they were in an aged care facility as part of respite care.



Table 11

## Unintentional injury admissions by separation type and dementia status, Victoria, 2014/15-2016/17

Separation Type	Total		Non-dementia		Dementia	
	N	%	N	%	N	%
Separation and transfer to aged care residential facility	2952	59.5	2647	59.6	305	58.5
Separation to private residence/ accommodation	1168	23.5	1042	23.5	126	24.2
Separation and transfer to acute hospital/ extended care	643	13.0	580	13.1	63	12.1
Statistical Separation	166	3.3	145	3.3	21	4.0
Separation and transfer to Transition Care bed based program	24	0.5	*	*	*	*
Left against medical advice	*	*	*	*	*	*
Separation and transfer to mental health residential facility	*	*	*	*	*	*
Total	4961	100.0	4440	100.0	521	100.0

\*Dementia cases identified using ICD-10-AM codes F00-F03



OVER THE PERIOD 2014/15-2016/17, 188 RESIDENTS  
OF AGED CARE FACILITIES DIED IN HOSPITAL DURING  
AN INJURY-RELATED ADMISSION.

# BURDEN OF RESIDENTIAL AGED CARE ADMITTED INJURIES (3 YEARS)

## Deaths in hospital

Over the period 2014/15-2016/17, 188 residents of aged care facilities died in hospital during an injury-related hospital admission. This represents 0.4% of the residential aged care injury admissions in this three-year period. Of the 188 deaths, 57.4% (n=108) occurred among females and 63.3% (n=119) were aged 85-94 years. Sixty-eight (36.2%) people died in the same hospital admission following an injury to the hip and thigh area, whilst a further 42 (22.3%) died following injuries to the head. A total of 102 deaths (54.3%) occurred among residents of the Melbourne metropolitan region. The majority of deaths (84.6%, n=159) occurred amongst residents who did not have a diagnosis of dementia reported. A corollary of this is that 3.5% of the 4,440 injury admissions for those without a recorded dementia diagnosis resulted in death, compared with 5.6% of those with a diagnosis of dementia. In other words, among those with dementia, a statistically significantly higher proportion of patients died in hospital.

The injuries resulting in death most commonly impacted upon the lower extremities (43.6%, n=82) and head, face, and neck (26.1%, n=49). Almost half were fractures (48.9%, n=92) whilst intracranial injuries and open wounds each accounted for 12.2% (n=23) of deaths. The majority of injuries with death occurring in the same episode were caused by falls (80.9%, n=152) with a smaller proportion due to suffocation or choking (7.4%, n=14). An inspection of the most common injuries resulting in death, a combination of the nature of the injury sustained and the body region affected, revealed that fractures to the hip and thigh region accounted for the largest proportion of deaths (30.9%, n=58) followed by intracranial injuries (12.2%, n=23). In-hospital death was relatively common among the 901 cases admitted with hip and thigh fractures: 58 of 901, 6.4%. This percentage is much higher than that of in-hospital deaths overall (188 of 4,961, 0.4%). Among those with a diagnosis of dementia, 7.6% (15 of 198) of cases involving admission for hip and thigh related injury resulted in death, whilst the proportion for those without a diagnosis of dementia in their admission record was 4.8% (53 of 901). The second most common injury resulting in death, intracranial injuries, was the fifth most common cause of admission among those with a recorded diagnosis of dementia but was not among the top five causes of admission for all injuries among residential aged care residents or the sub group of residents with no recorded diagnosis of dementia. Overall, there were 181 admissions due to intracranial injury among residents of aged care facilities, of which 12.7% resulted in death. Again this is much higher than the overall percentage of injury admissions leading to in-hospital deaths (0.4%).

## Length of stay and direct costs

Length of stay refers to the number of days the admitted person was kept in hospital. Statistical admissions and transfers are usually retained for this analysis to ensure that the entire episode of care is captured. However, in the current study, the admission source variable was used to identify and select those admitted from residential aged care. Therefore, it is likely that a number of residential aged care injury admissions with a (subsequent) admission source code relating to transfers and statistical admissions were excluded. The subtotals and totals presented regarding length of stay are therefore an underestimate. This caveat also applies to the analysis of costs.

Hospital beds were occupied for 22,694 days for injury-related admissions among aged care residents. Two thirds (67.6%, n=15,339) of total bed days were accounted for by females (Figure 14). This is representative of the admissions breakdown by sex; females accounted for 68.3% of admissions. Broken down by age group, the greatest disparity between males and females was observed among the 85-94 year bracket, where hospital beds were occupied by males for 3,476 days compared to 8,278 days for females. While this was the largest disparity in terms of actual numbers, *proportionally*, the overrepresentation of females was even greater in the 95+ year age group where females accounted for approximately five times as many bed days as males. Taking into account the fact that women are overrepresented among residents of aged care facilities, 10.8% (n=1,663) of bed days among women were accounted for by those aged 95+ years while among men, the proportion accounted for by those aged 95+ years is 4.6% (n=342).

An analysis of the length of stay showed that 52.3% (n=2,597) of admissions resulted in the utilisation of fewer than two bed days (Table 12). Similarly, the breakdown by sex showed that males and females experienced a similar proportion of stays fewer than 2 days (51.9%, n=817 vs. 52.5%, n=1,780 respectively). This result is also reproduced among longer stays; males and females were equally likely to experience stays of 2-7 days (30.1%, n=474 vs. 30.1%, n=1,021 respectively) with similar patterns repeated for stays of 8-30 days and 31+ days (Table 12). Overall, only minor variations in length of stay existed between males and females within any age group. For example, inspecting stays of fewer than 2 days and comparing males and females within any age group shows a difference of less than 1%.

The breakdown by age showed that as age increased, stays of <2 days become more common, *increasing from* 49.0% of all stays among 65-74 year to 55.3% of all stays among those aged 95+ years. This may be due to the frailty of older people; it may be considered better not to unnecessarily prolong the stay of older people and to limit exposing them to potential complications such as delirium, confusion and disorientation associated with an unfamiliar environment.



Figure 14

Summed length of hospital admission stay (days) by age and sex, Victoria, 2014/15-2016/17

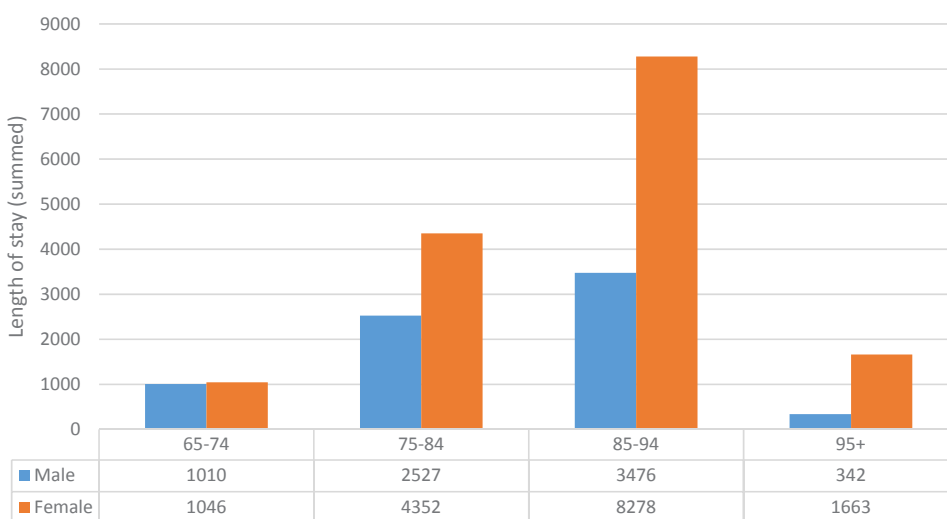


Table 12

Grouped length of stay by age and sex, Victoria, 2014/15-2016/17

	<2 days (row %)	2-7 days (row %)	8-30 days (row %)	31+ days (row %)	Total
Male					
65-74	80 (48.2)	53 (31.9)	*(*)	*(*)	166
75-84	263 (51.9)	135 (26.6)	102 (20.1)	7 (1.4)	507
85-94	415 (52.1)	252 (31.6)	121 (15.2)	9 (1.1)	797
95+	59 (56.2)	34 (32.4)	*(*)	*(*)	105
Male Total	817 (51.9)	474 (30.1)	263 (16.7)	21 (1.3)	1575
Female					
65-74	85 (49.7)	41 (24.0)	*(*)	*(*)	171
75-84	391 (49.9)	223 (28.5)	152 (19.4)	17 (2.2)	783
85-94	1086 (53.3)	642 (31.5)	294 (14.4)	16 (0.8)	2038
95+	218 (55.1)	115 (29.0)	*(*)	*(*)	396
Female Total	1780 (52.5)	1021 (30.1)	547 (16.1)	40 (1.2)	3388
Persons					
65-74	165 (49.0)	94 (27.9)	*(*)	*(*)	337
75-84	654 (50.7)	358 (27.8)	254 (19.7)	24 (1.9)	1290
85-94	1501 (52.9)	894 (31.5)	415 (14.6)	25 (0.9)	2835
95+	277 (55.3)	149 (29.7)	*(*)	*(*)	501
Grand Total	2597 (52.3)	1495 (30.1)	810 (16.3)	61 (1.2)	4963

The hospital costs presented here are aggregate figures based on estimations of the financial costs incurred by hospitals for an episode of care. Estimates are based on the average cost (adjusted by age and sex) for particular injury codes. The costs data presented below covers the period 2014/15-2015/16 as the most recent year of data was not available at the time of publication. An estimated total of \$23.4m AUD in hospital costs was spent on residential aged care injury related admissions (Table 13) of which 69.0% (\$16.1m AUD) was accounted for by females, a figure consistent with the proportion of injury admissions accounted for by females (68.3%). The patterns of direct costs of hospital admissions were consistent with patterns observed for length of stay; 56.7% (\$13.2m AUD) of costs of hospital admissions were associated with those aged 85-94 years. A breakdown by sex revealed the following differences between males and females:

- Among females, 68.8% (\$9.5m AUD) of costs were attributed to the 85-94 year age group, whilst for males 52.0% (\$3.7m AUD) was attributed to the same age group,
- Among males, 32.3% of costs were spent on injury admissions among the 75-84 year age group olds and among females the figure was 25.4%.

Table 13

#### Cost of unintentional injury admissions by age and sex, Victoria, 2014/15-2015/16

	Males		Females		Persons	
	AU\$	%	AU\$	%	AU\$	%
Age Groups						
65-74	794,547	11.0	826,058	5.1	1,620,605	6.9
75-84	2,335,320	32.3	4,092,760	25.4	6,428,080	27.6
85-94	3,762,859	52.0	9,479,903	68.8	13,242,762	56.7
95+	339,993	4.7	1,730,790	10.7	2,070,784	8.8
Total	7,232,719	100	16,129,512	100	23,362,231	100

## In-hospital complications

Complications that occurred in hospital were determined using the CHADx method: The Classification of Hospital Acquired Diagnoses (Jackson, Michel, Roberts, Jorm, & Wakefield, 2009). This method involves identifying diagnoses with a 'complications' prefix (C prefix) and grouping them into broad categories composed of more specific groups. The broad categories are presented in Table 14: overall, more than one in four (n=1353, 27%) injury admissions had at least one complication recorded during hospital stay. This is considerably higher than the overall complication rate of 6.25%, reported for Victorian inpatients in 2005-06; however, a relatively high rate is expected for this relatively old and frail patient group. Multiple complications were common with the total sum of complications being 2.5 times the number of persons with at least one complication (3388 complications in 1353 persons). The most common groups were cardiovascular complications (7.4% of admissions), metabolic disorders (7.0% of admissions) and gastrointestinal complications (6.4% of admissions). Notably, accidental injuries, which are injuries that are flagged as having arisen during hospital stay, were also common: these were recorded in 4.7% of admissions.

Table 14

### Complications in the unintentional injury-related hospital admissions among residential aged care residents

	Number of complications*	Number of persons with at least one complication	
		N	%
CHADx 1 Intra and post procedural complications	77	74	1.5%
CHADx 2 Adverse drug events	108	79	1.6%
CHADx 3 Accidental injuries	306	235	4.7%
CHADx 4 Specific infections	56	54	1.1%
CHADx 5 Cardiovascular complications	420	367	7.4%
CHADx 6 Respiratory complications	270	242	4.9%
CHADx 7 Gastrointestinal complications	346	315	6.4%
CHADx 8 Skin conditions	229	199	4.0%
CHADx 9 Genitourinary complications	352	306	6.2%
CHADx 10 Hospital-acquired psychiatric states	333	294	5.9%
CHADx 11 Early pregnancy complications	0	0	0%
CHADx 12 Labour, delivery & postpartum complications	0	0	0%
CHADx 13 Perinatal complications	0	0	0%
CHADx 14 Haematological disorders	140	138	2.8%
CHADx 15 Metabolic disorders	419	346	7.0%
CHADx 16 Nervous system complications	24	22	0.4%
CHADx 17 Other complications	308	250	5.0%
CHADx total	3388	1353	27.3%

CHADx= The classification of Hospital Acquired Diagnoses (Jackson et al., 2009) \*Sum of all flagged complications; one admission can contain more than one complication flag

Based on the number of persons affected, the ten most common specific types were:

1. Alterations to mental state (n=249, 5.0%: CHADx 10.4 )
2. Hypotension (n=203, 4.1% : CHADx 5.6)
3. Constipation (n=203, 4.1% : CHADx 7.4)
4. Electrolyte disorders without dehydration (n=195, 3.9%: CHADx 15.2)
5. All other falls (n=153, 3.1%: CHADx 3.3)
6. Cardiac arrhythmias, conduction disturbances & abnormal heart beat (n=139, 2.8%: CHADx 5.3)
7. Urinary retention (n=116, 2.3%: CHADx 9.3)
8. Acute lower respiratory infections (including influenza & pneumonia) (n=113, 2.3%: CHADx 6.3)
9. Dehydration/volume depletion (n=105, 2.1% : CHADx 15.1)
10. Other hospital-acquired anaemia (n=103, 2.1%: CHADx 14.1)

The most common specific group, alterations of mental state, consists of those with delirium ('not induced by alcohol and other psychoactive substances'), somnolence, stupor, coma (unspecified), disorientation, amnesia and hallucination. Delirium is a serious condition affecting a person's mental ability and awareness of their environment. It can be triggered by a range of factors including illness, medication, infection, dehydration or pain.

Hypotension was also common (4.1%), as were cardiac arrhythmias (2.8%). Both these conditions can lead to falls (due to syncope). In-hospital falls were relatively common: these were recorded in 3.1% of admissions.





... OVERALL, MORE THAN ONE IN FOUR (N=1353, 27%)  
INJURY ADMISSIONS HAD AT LEAST ONE COMPLICATION  
RECORDED DURING HOSPITAL STAY.

# DISCUSSION

Over the ten-year period from 2007/8-2016/17 the number of injury-related hospital admissions of aged care residents increased from 1,063 in 2007/8 to 1,857 in 2016/17. The overall population of persons aged 65 years in Victoria has also increased over this time period, as has the residential aged care facility bed occupancy. There is no substantial evidence of an increase in the rate of injury admissions per population or the rate of injury admissions per residential aged care bed days. This indicates that the ageing population is likely to be the primary driver for increased residential aged care bed days and the concomitant increase in aged care injury admissions. In the ten-year period analysed, injury risk in residential aged care (per exposed person) did not increase, as evidenced from analysis of the VAED.

Residential aged care bed-days as a proportion of the older population decreased over time during the ten-year period from 2007/8 to 2016/17 in Victoria. Based on the observed decrease in residential aged care bed days per population, it may be inferred that, assuming the same pattern continues, residential aged care use and associated injury-related hospital costs will not increase as rapidly as the trend in population ageing. This, however, is speculative and depends on a range of unmeasured factors such as future criteria for selection into aged care, aged care availability, trends in home care alternatives, health of older persons and injury prevention in residential aged care.

## Effects of Population Ageing

The number of hospital injury admissions among residents of aged care facilities in Victoria has increased over the ten-year period 2007/8-2016/17. The primary underpinning of this increase is the ageing population of Australia. By 2027, the Department of Health (2017) expects the number of Australians aged 65 years and over to increase from the current 15% of the total population (3.8m) to 18% (5.2m). A breakdown by age group shows that the population of 65-74 year olds will increase from 8.6% to 9.2%, the population of 75-84 year olds will increase from 4.6% to 6.1%, and the population of those aged 85 years and over will increase from 2.0% to 2.3%. Whilst the overall number of hospital admissions and hospital bed days are increasing, the rates of aged care occupancy per population have decreased. As Australia's population continues to age, the increase in people aged 65 years and over creates an increased demand on the residential aged care system. Whilst it is not age per se that dictates demand in the aged care system, with more individuals aged 65 years and over, unless the proportion of those assessed as needing care drops, the overall numbers in all forms of aged care will continue to grow over time. For example, in 2011/12 there were 167,009 people in permanent residential aged care in Australia. This increased to 178,713 in 2016/17, an increase of 7%. Although there is a greater tendency for older people to live at home for longer (Australian Institute of Health and Welfare, 2015a), the actual number of people in residential aged care, and therefore the number of hospital admissions, is likely to continue to grow.

One care arrangement which will be of critical importance in the future, given the predicted increased demand on the aged care system, is informal care. According to a report commissioned by Carers Australia and conducted by Deloitte Access Economics (2015), approximately 1 in 8 Australians (2.86 million) are providing informal care. The report focuses on the perspective of carers and does not specify the number of individuals aged 65+ years being cared for. However, what this report does indicate is that without informal care, the demand for formal care would be even greater and if not for informal carers, the aged care system would not be able to meet the demand. Familial informal care provided by a partner or child has been shown to promote staying at home rather than entering formal aged care (residential or otherwise) (Temple, Jukic, & Dow, 2017) although this may depend on the reasons for informal care use and whether or not it was a personal choice or determined by financial constraints (Deloitte Access Economics, 2015). Due to the ageing population and increased demand on the aged care system, informal care is a resource upon which Australians will become increasingly dependent and informal carers will need support in order to continue performing this role. It is important to determine what major vulnerabilities exist within the home with regard to injury risk factors for those receiving informal care, along with gaining knowledge of the rate of injury, and types of injury most likely to occur. Understanding injury among those receiving informal care now, will assist with preventing the number of injuries among receivers of informal care as that population grows over the coming decades.



## Injuries and Effects of Dementia

Approximately one in ten (10.5%,  $n=521$ ) injury-related hospital admissions among residents of aged care facilities had a recorded diagnosis of dementia. Falls, the most common cause of injury overall, were equally likely to be the cause of injury for those with and without a recorded diagnosis of dementia. It is worth noting that falls accounted for almost 90% of injury admissions in both groups, which highlights the importance of continued commitment to falls prevention.

Some noteworthy patterns emerged upon inspection of the nature of injuries suffered, and the body region affected, when comparing those with and without a recorded diagnosis of dementia. Fractures accounted for a greater proportion of injuries among those with a recorded diagnosis of dementia compared to those without (54.7% vs. 38.9%, respectively). This is likely indicative of the relationship observed between osteoporosis and dementia (K.-H. Chang et al., 2014; Downey et al., 2017) and does not necessarily indicate that residents of aged care facilities with dementia are at greater risk of fracture due to risk exposure within the facility.

Another notable result was the difference between the two sub-groups with regard to head injuries; among those with no recorded diagnosis of dementia, head injuries accounted for 31.6% of cases, compared to 18.6% amongst those with dementia. This finding contrasts with previous research which observed higher rates of head-related injury among those with dementia compared to those without dementia, concluding that among people aged 65 years and over, those with dementia were 14% more likely to be admitted for head-related injuries (Harvey, Mitchell, Brodaty, Draper, & Close, 2016). Harvey et al. (2016) focused solely on hospital admissions due to falls but it is unlikely that this difference in methodology could explain such a contrasting result given falls accounted for 90% of injury admissions in the current study. What is more likely to explain these differences in findings is that Harvey et al. (2016) focused on the entire population of people aged 65 years and over whilst this edition of *Hazard* is limited to residents of aged care facilities. A person with dementia with a head injury may be more likely to be treated without being admitted to hospital if they reside in an aged care facility where they will continue to be monitored and cared for by trained staff.

In contrast to head injuries, hip and thigh injuries accounted for 43.4% ( $n=226$ ) of admissions of those with dementia, compared to 22.7% ( $n=1,007$ ) for those without a recorded diagnosis of dementia. This finding is consistent with previous research on fractures in those with dementia which found that 35.7% of admissions among those with a diagnosis of dementia were due to hip fractures, compared to 20.2% for those without a recorded diagnosis of dementia. After adjusting for demographic variables and comorbidities, those with dementia were 58% more likely to be admitted to hospital for fractures (Harvey et al., 2016).

Whilst only 10.5% of injury admissions were accounted for by individuals with dementia, this population accounted for 24.2% of choking/suffocation related admissions. As dementia progresses it can affect the regions of the brain responsible for chewing and the swallowing reflex. This suggests that those with a diagnosis of dementia are at greater risk when exposed to choking and suffocation hazards, the most common of which include eating (C.-C. Chang & Roberts, 2008).

Among those with a diagnosis of dementia reported, a larger proportion of injuries occurred within the residential facility itself compared with those without a diagnosis. However, this is likely due to the fact that individuals with dementia leave the facility far less commonly and would require supervision when doing so. Therefore there is less opportunity and risk of being injured outside of the facility. Given that approximately 50% of people in residential aged care had a recorded diagnosis of dementia (Department of Health, 2017), the overall proportion of injury related admissions accounted for by individuals with dementia gives an indication that these individuals are exposed to different and fewer risks compared to those without dementia. Alternatively, it may also indicate that greater vigilance is exercised by residential aged care facility staff in caring for these individuals or that these individuals are simply less likely to be admitted to hospital when they are injured. As the number of older people with dementia is expected to rise over time (Department of Health, 2017a) a continued focus on individuals with dementia will be required.

## Deaths

Similarly to the study conducted by Ibrahim et al. (2017), which found that 81.5% ( $n=2,679$ ) of all premature deaths were the result of falls over the period 2000/01-2012/13, the results of this study showed that 80.9% of in-hospital deaths following an injury-related admission were due to falls. In both studies, choking/suffocation was also the second leading cause of death. The largest proportion of deaths were a result of injuries impacting the hip and thigh area (36.2%,  $n=68$ ) and the most common type of injury was fractures (48.9%,  $n=92$ ) which demonstrates the vulnerability of the population in question, especially considering that almost two-thirds of deaths (63.3%,  $n=119$ ) were among those aged 85-94 years.

Among residents of aged care facilities admitted to hospital for injury, in-hospital death was most common among those admitted with fractures of the hip and thigh, accounting for 30.9% ( $n=58$ ) of deaths. Considering this in the context of the total number of admissions for hip and thigh injuries ( $n=901$ ), 6.4% of hip and thigh injury admissions resulted in death: a very high proportion considering the overall 0.4% in-hospital deaths. This highlights the importance of falls prevention and other measures to reduce the incidence of hip and thigh fractures in residential aged care. Overall, given that there is an increased rate of falls in residential aged care facilities (Australian Institute of Health and Welfare, 2017), and that the leading cause of deaths among residents of aged care facilities is falls, special attention is required to ensure that the risk of falls in minimised, and the impact of falls is reduced as much as possible.

Intracranial injury admissions were the second most common injury admissions among residents of aged care facilities that resulted in death: intracranial injury admissions accounted for 12.2% of deaths ( $n=23$ ) and 12.7% ( $n=23$ ) of the total admissions for intracranial injury ( $n=181$ ) resulted in death. From this, we can conclude that while intracranial injuries accounted for a smaller proportion of the total number deaths among residents of aged care facilities admitted to hospital compared to hip and thigh related injuries, admissions for intracranial injury were more likely to result in death. Prevention of intracranial injury in residential aged care can be multifactorial including falls prevention, but also medication monitoring to prevent susceptibility to syncope, loss of balance and excessive bleeding.

# RECOMMENDATIONS

## Ageing population and trends in residential aged care utilisation

1.

The rate of population ageing appeared to be greater than the increase in residential aged care bed-days in Victoria, 2007/8 to 2016/17. This is likely due to a trend for older people to remain in their own home, potentially with paid or informal care provided. This points to a need for State-and Federal-funded investigations into injury among older people receiving care in their own home.

## Primary injury prevention

2.

Among those in residential aged care, injury-related hospital admission frequency and rate (calculated per aged care bed-days) were highest in the 85 year and over age group. This group should therefore be the particular focus of injury prevention efforts.

3.

Falls were the most common cause of injury admissions, and hip fractures and head injuries were the most commonly encountered injury types. Furthermore, these injury types were also most commonly associated with in-hospital death among those admitted from residential aged care in relation to an injury. *Falls prevention and post-fall management* should therefore remain the main focus of injury prevention efforts in residential aged care, as mandated by the Department of Health and Human Services' Standardised Care Processes and Aged Care Quality Standards.

## Prevention of in-hospital complications

4.

In-hospital falls were a relatively common complication among those admitted from residential aged care. The number of in-hospital falls can be reduced: hospital-based prevention efforts should be targeted at those admitted from residential aged care as falls are relatively frequent in this population.

5.

Alteration to mental state (such as delirium) was the most common type of complication among aged care residents admitted to hospital because of an injury. Delirium is known to be a common complication in older hospitalised patients, and those admitted from residential aged care are particularly at risk and available interventions should be used to target this population on admission.

6.

Arrhythmia and hypotension were other relatively common complications occurring during a hospital stay: addressing and preventing this may contribute to in-hospital falls prevention. Furthermore, these may also contribute to falls in residential aged care. These conditions are treatable and can be diagnosed non-invasively. It is recommended that additional standardised care processes be developed by the Department of Human Services and Centre for Evidence Based Care to target these issues in Residential Aged Care, to reduce the occurrence of these complications.

## Aged care residents with dementia

7.

Among aged care residents with dementia, choking and suffocation were relatively common causes of injury-related hospital admission. Furthermore, these were also a relatively common cause of in-hospital death among those with dementia. This highlights the need to develop and/or implement choking and suffocation preventive guidelines/ standards particular to this group, and incorporate them into standard care as part of the Department of Health and Human Services' Aged Care Quality Standards. A comprehensive and vital set of recommendations regarding choking have also been outlined in Ibrahim (2017).

## Data quality issues

8.

Activity code is/remains poorly specified, with 78.5% of cases coded as 'Unspecified' activity performed when the injury occurred. For VISU to develop recommendations for injury prevention, the VAED injury data is vital. It is recommended that hospitals receive feedback from the Department of Health and Human Services (DHHS) to improve the specificity of activity coding, for these purposes.

9.

The mechanism involved in falls was often unspecified. In order for injury prevention strategies to be properly devised and implemented, it is crucial to identify as much detail as possible. It is recommended that the hospitals receive feedback from DHHS, to document the mechanism of falls so that this can be coded. This may involve improving or better use of transfer notes from residential aged care.

10.

The proportion of injury-related hospital admissions where the person was recorded as suffering from dementia was likely to be an underestimate. According to the Department of Health (2017a), 50% of persons in residential aged care have a diagnosis of dementia; this figure is far greater than the 10.5% of cases found within the VAED. In order to better tailor injury prevention interventions for residents of aged care facilities with dementia, it is important that all cases are correctly identified and coded. It is recommended that hospitals receive feedback from the Department of Health and Human Services (DHHS) to improve the recording of dementia comorbidity.



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# APPENDIX A: DATA SOURCES AND CASE SELECTION

## Hospital Admissions

Hospital admissions data were extracted from the Victorian Admitted Episodes Dataset (VAED), which records all admissions to public and private hospitals in the state of Victoria. The VAED includes demographic, clinical and administrative details for every admitted episode of care occurring in these hospitals. The coding in the VAED conforms to the definitions in the National Health Data Dictionary (NHDD) (Australian Institute of Health and Welfare, 2015b). The clinical details include 40 diagnosis codes that include injury and external cause information coded according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM). Injury records were identified as those with an ICD-10-AM injury code (S00-T98) or external cause code (U50-Y98, excluding U78-U88 (codes for special purposes) in any one of these 40 diagnosis codes. Initial case selection was limited to hospital admissions between 01 July 2014 and 30 June 2017 for patients aged 65 years or over. Cases with an admission source equal to "N" (Transfer from aged care residential facility) were selected as residents of aged care facilities. Cases were further selected if they were unintentional injuries, i.e., first external cause code in the range V00-X59. Repeat admissions (day-treatments for the same injury within a course of 30 days, with an admission type indicating it was a "planned" admission) were excluded.

To identify injury cases an inclusive method was used: cases were selected if they did *not* have a medical injury (i.e. complications of medical or surgical care) as the first occurring external cause code or the first occurring injury code. The cases selected included permanent residents of aged care facilities and residents of a temporary/respite nature. Case selection was not limited to community injuries (ICD 10 AM range S00-T75 or T79) in the first diagnosis code as is done in general. This was in order to capture cases related to causes such as choking, falls etc. that tend to have a non-community injury code in the first diagnosis code.

Dementia status was identified using ICD-10-AM diagnosis codes in the range F00-F03. These codes cover a broad spectrum including dementia in Alzheimer's disease (F00) and vascular dementia (F01) as well as dementia which occurs as part of diseases classified elsewhere in the ICD-10-AM (such as dementia in multiple sclerosis, epilepsy, and vitamin B12 deficiency). The use of the label 'non-dementia' refers only to the absence of dementia in the hospital admission record. It is possible that some records where no diagnosis of dementia was recorded may have included an individual with dementia.

When calculating estimates of hospital treatment costs and length of stay, to provide a more accurate estimate of the burden of injury, statistical admissions and transfers would normally be included. However, as the primary method of extraction involved selection using admission source codes (see above), statistical admissions and transfers could not be systematically included. Therefore, an analysis of costs and length of stay are not necessarily indicative of complete episodes of care and may be an underestimate. Furthermore, at the time of publication, costs data for the 2016/17 financial year were not available, so costs analysis involved only 2014/15 and 2015/16 data.

The Service and Funding Projects Branch of the Victorian Department of Health and Human Services (DHHS) supplied VISU with costs data sourced from the Victorian Cost Data Collection (VCDC). The Department of Health conducts an annual collection of cost data via the VCDC and this data forms the basis for the cost data which is submitted to the National Hospital Cost Data Collection (NHCDC) and managed by the Independent Hospital Pricing Authority (IHPA).

Cost data collected through the VCDC can be broken by cost bucket components to understand resource consumption across health service areas (e.g. allied health, Emergency Department, critical care unit, intensive care unit, imaging, medical and surgical supplied, nursing, pathology, pharmacy, theatre).

Australian Refined Diagnosis Related Groups (AR-DRGs) provide a clinically meaningful way of relating the types of patients treated in a hospital to the resources required by the hospital. The Department of Health supplied average costs per AR-DRG (inpatient episodes from the VCDC) to be applied to the VISU-held VAED. The costs provided were stratified by age group and sex and include both direct and indirect costs of treating patients.

# APPENDIX B: ANALYSIS METHODS

Residential aged care injury rates per 100,000 population were calculated using ABS population data for Victorians in the corresponding years of injury. Population data was sourced from the Australian Bureau of Statistics, Australian Demographic Statistics (2017). Residential aged care injury rates (per residential aged care bed day occupancy) were calculated using AIHW residential aged care occupancy data in the corresponding year of injury (Australian Institute of Health and Welfare, 2018). Residential aged care occupancy rates per 100,000 population were calculated using ABS population data (Australian Bureau of Statistics, 2017) in the corresponding year of occupancy, with residential occupancy data from the Australian Institute of Health and Welfare (2018). The average annual change in rates were calculated using the Microsoft Excel RATE function which is expressed as, "RATE(nper,pmt,pv,fv)" where 'nper' refers to the number of periods of change, 'pmt' refers to constant additions or subtraction within each period, 'pv' is the starting value, and 'fv' is the final value.

All comparisons drawn within the results section were tested for statistical significance using  $\chi^2$  in IBM SPSS 24 and were significant at a level of  $p < .05$  or stricter.

Trend analysis: rates of Victorian hospital admissions per population and per residential aged care bed days were modelled using Poisson models, as trends in the annual number of events, with the log of the Victorian population or the log of residential aged care bed days as offset. All models were adjusted for age group and sex, where possible (i.e. unless the analysis was limited to a single age group or sex). The analyses were conducted using the PROC GENMOD procedure in SAS V9.4. Modelling is only used to test statistical significance of the trend in rate: if the rate fluctuated non-linearly without demonstrating a consistent up or downward trend, Poisson modelling was not carried out.

# APPENDIX C: ADDITIONAL TRENDS TABLES AND FIGURES

The table and figures below contain information relating to hospital admissions of two days or longer for injury occurring among residents of aged care facilities, aged 65+ years, in Victoria between 2014/15 and 2016/17. These analyses were conducted to inspect the data whilst mitigating the effect of hospital admissions policy changes introduced in 2012.

Table 15

Unintentional residential-aged care injuries resulting in hospital admissions of 2+ days: admission frequency and rate, Victoria, 2007/8-2016/17

		Rate per Victorian population		Rate per Victorian residential aged care bed days	
	Admissions* (n)	Average annual rate (admissions* per 100,000 population)	Annual change in rate (%)	Average annual rate (admissions* per 100,000 bed days)	Annual change in rate (%)
Male					
65-74	269	12.79	-2.68	4.06	-1.50
75-84	764	64.94	1.17	4.72	2.63
85+	1,221	324.90	0.18	5.24	1.23
Total	2,254	61.65	0.91	4.88	1.50
Female					
65-74	309	13.95	-1.89	4.44	-0.49
75-84	1,423	97.94	-2.11(†)	4.81	-0.30
85+	3,561	512.46	-1.04(\$)	4.86	0.31
Total	5,293	121.33	-1.40(‡)	4.82	0.15
Grand Total	7,547	94.11	-0.78(‡)	4.84	0.59

\*Injury-related hospital admissions of two or more days, among residential aged care residents. † $p < 0.05$ ; ‡ $p < 0.01$ ; \$ $p < 0.001$ ; | $p < 0.0001$

Figure 15

Hospital admissions of 2+ days for unintentional injury per 100,000 population by sex, 65-74 years, Victoria, 2007/8-2016/17

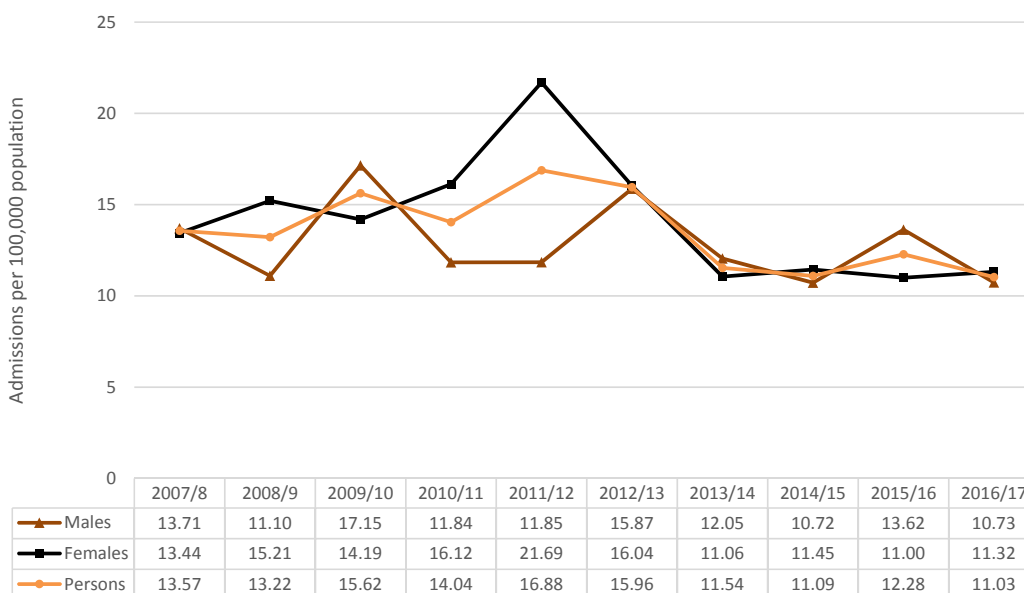


Figure 16

Hospital admissions of 2+ days for unintentional injury per 100,000 population by sex, 75-84 years, Victoria, 2007/8-2016/17

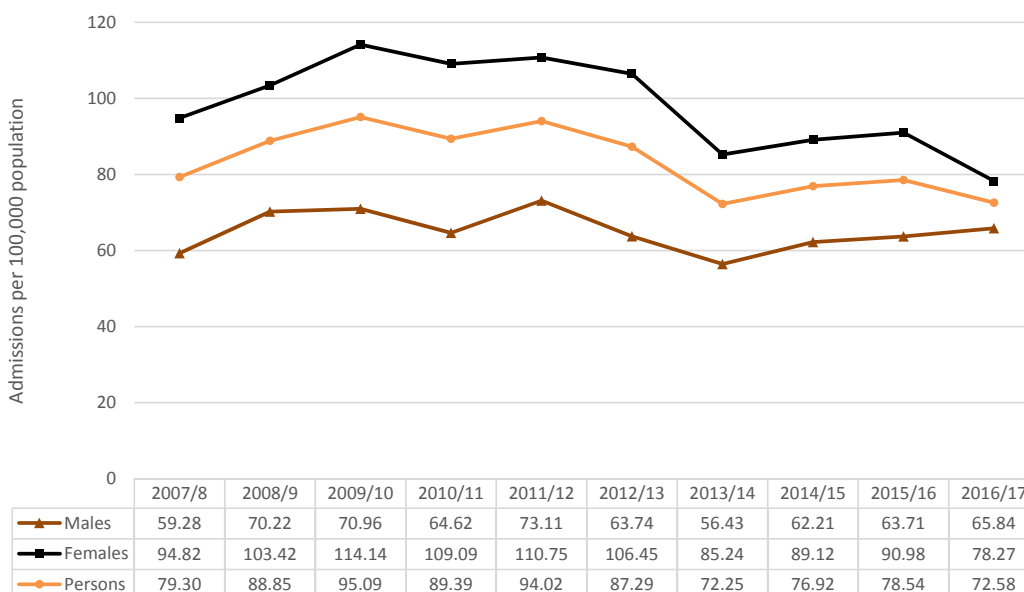




Figure 17

Hospital admissions of 2+ days for unintentional injury per 100,000 population by sex, 85+ years, Victoria, 2007/8-2016/17

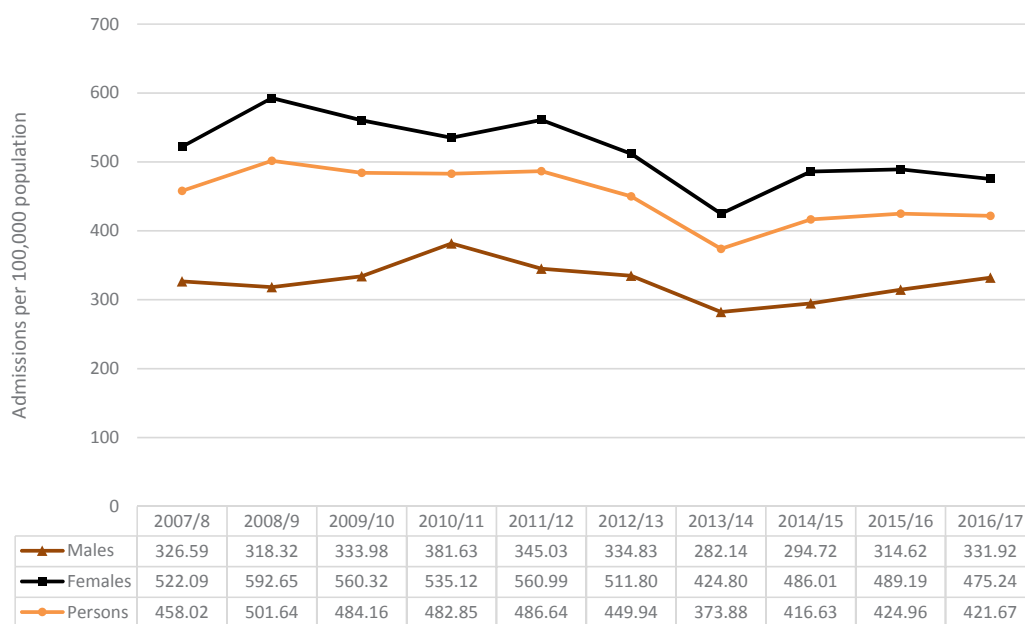


Figure 18

Hospital admissions of 2+ days for unintentional injury per 100,000 residential aged care bed days by sex, 65-74 years, Victoria, 2007/8-2016/17

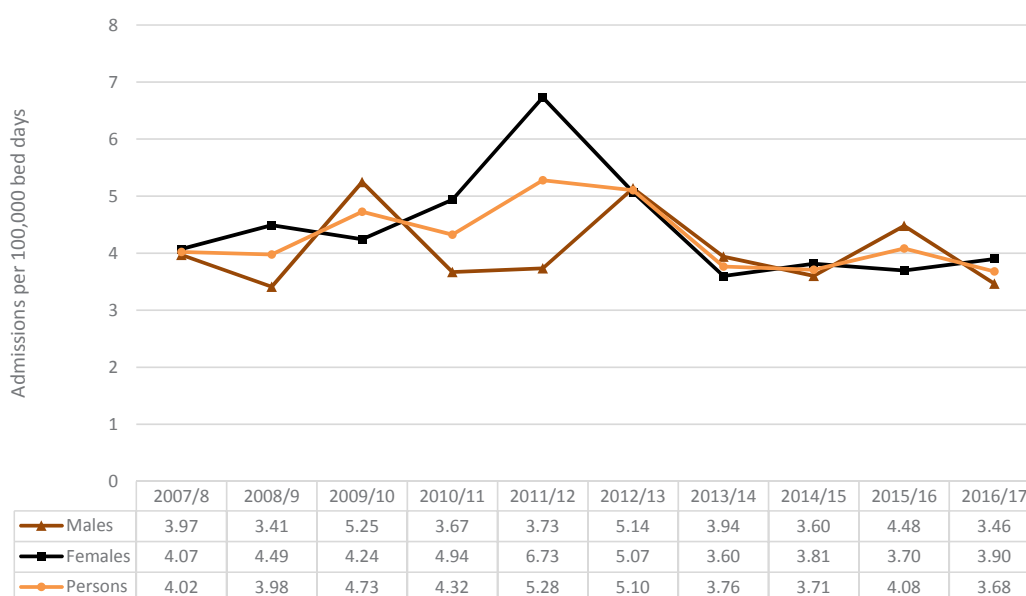


Figure 19

Hospital admissions of 2+ days for unintentional injury per 100,000 residential aged care bed days by sex, 75-84 years, Victoria, 2007/8-2016/17

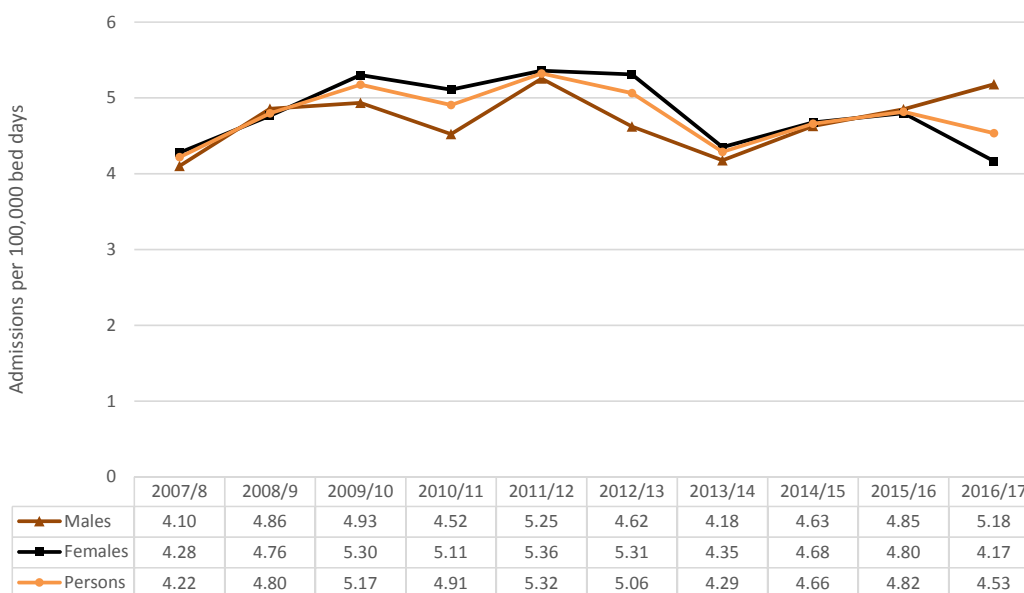
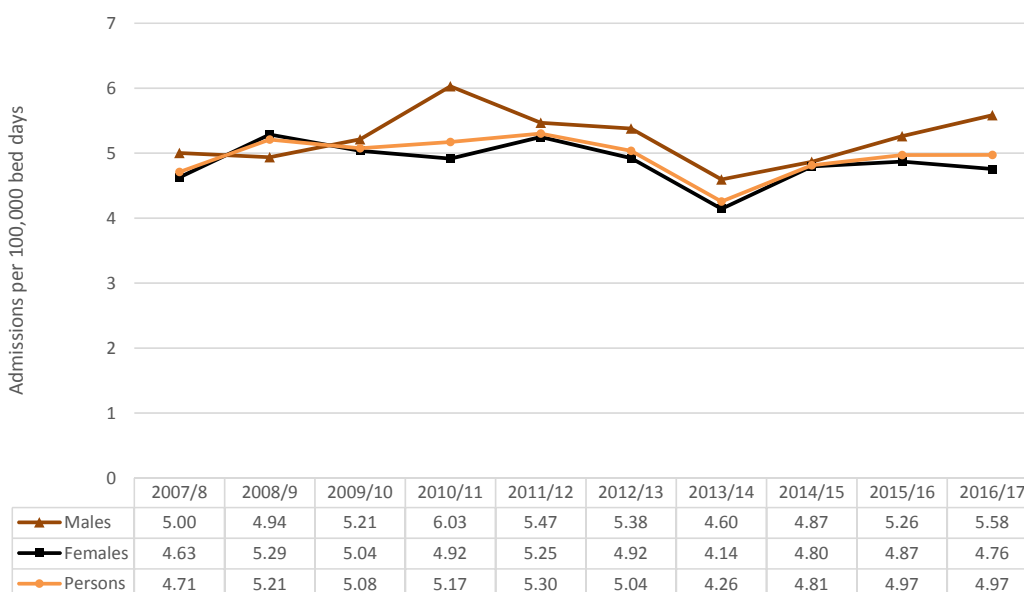


Figure 20

Hospital admissions of 2+ days for unintentional injury per 100,000 residential aged care bed days by sex, 85+ years, Victoria, 2007/8-2016/17





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[www.monash.edu/muarc/visu](http://www.monash.edu/muarc/visu)

**VAED includes all Victorian public and private hospitals**

## How to access VISU data

VISU collects and analyses information on injury problems to underpin the development of prevention strategies and their implementation. VISU analyses are publicly available for teaching, research and prevention purposes. Requests for information can be lodged via the data request form on the VISU website or by contacting the VISU office by phone.

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