MONASH University
Accident Research Centre

# THE RELATIONSHIP BETWEEN SLIPS, TRIPS AND FALLS AND THE DESIGN AND CONSTRUCTION OF BUILDINGS

Funded by
Australian Building Codes Board

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**Title and sub-title:**
The relationship between slips, trips and falls and the design and construction of buildings


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**Sponsoring Organisation(s):**
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**Abstract:**
**Aim**

Monash University Accident Research Centre was commissioned by the Australian Building Codes Board (ABCB) to undertake a study of the incidence of slips, trips and falls and their relationship to the design and construction of buildings. The objective of this study was to review and analyse Australian fall injury and fatality data and the international scientific literature in order to ascertain whether the existing requirements of the BCA provide an acceptable minimum standard of safety relating to the incidence of slips, trips and falls in buildings for the community.

**Methods**

Slip, trip and fall injuries were examined across three levels of severity: emergency department presentations (without admission), hospital admissions, and deaths. Through a preliminary analysis of state, national and international data and as identified in similar studies conducted internationally, the most prevalent hazards and harms related to slips, trips and falls and the design and construction of buildings were identified. Accordingly, the literature review focused on the design and construction of stairs and steps, access to and falls from heights, other building features identified as particular hazards such as balconies, verandahs/porches and flooring surfaces, the particular vulnerability of the old and young to these hazards (with an emphasis on aged care and health service areas) and the resultant economic and societal costs of these falls.

An expert panel including the project researchers, ABCB and Federal Government representation, and representation of the building, architectural and design industries and aged care providers was convened and informed the final recommendations of the study.

**Results**

The major building structural and design components identified as being associated with fall injuries in this study were flooring surfaces, stairs, windows, balconies, verandahs and, indirectly, guttering and roofs in residential settings. As shown by the epidemiological data in this study, many of the victims of fall injuries in buildings are from vulnerable populations, particularly the elderly, the sick and children.

This report contains a review of all relevant literature available for the primary structural and design building components outlined above, a thorough analysis of Australian national injury and fatality data pertaining to falls in buildings, estimates of the economic costs of

these hospitalisations and deaths and wide ranging recommendations for improvements to the Building Code of Australia.

The total average annual frequency of deaths and hospitalisations respectively, for falls in buildings in Australia were 343 and 105,968 for the period July 2002 – June 2005. The estimated annual cost for these deaths was $250 million, and $1.28 billion for hospital admissions, excluding indirect costs.

This compares with 110 deaths and 3,300 injuries in one year in Australia related to fires. As for falls, other factors (such as alcohol and cigarettes in the case of fires) may contribute to the chain of events resulting in fire related injury. Also, while property damage may add to the cost of fires, the research and development investment in fire related injury prevention may be disproportionate to that directed at fall injury prevention.

While changes to building design and construction could prevent many fall injuries, particularly the generic effects of inadequacies in protection against falls from heights and falling onto a hard surface, other factors also contribute to the chain of events that result in injuries falls.

Beyond a categorical analysis, it was beyond the scope of this study to analyse death and hospital data with regard to the details of non-building related trip hazards, for example, the removal of which might have prevented initiation of the fall. Co-morbidities and frailties associated with vulnerable populations probably contributed to a substantial proportion of the falls studied here, or the consequences of the falls. However, it can be argued that these community members are equally entitled to a safe environment as the more physically robust members of society. Accordingly they should be protected by the BCA and innovation in safe building design and construction.

**Conclusion**

Slips, trips and falls in buildings constitute a large and costly public health problem, which is expected to grow in coming years due to the ageing of the Australian population and the increase in housing density, with associated trends to multi-storey dwellings. Although falls and injuries in buildings may be caused by a combination of factors including the design and construction of buildings, many potential solutions lie with the building industry and its regulators. Others with responsibility include the residential and community aged care sectors, the health sector, Standards makers and those responsible for death and injury data systems and research funding. Given the enormous cost of the problem, investment in effective preventative solutions is imperative.

**Key Words:**
Slip, trip, fall, injury, building



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# Preface

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This project forms an important first step in understanding the dimensions of the problem and costs of falls in buildings in Australia. The depth and breadth of the research that was achievable was substantially enhanced by the placement of Victorian Public Health Training Scheme Fellow, Ms Mary Kelly at MUARC. Mary worked full time on this project for a total of 4 months, in addition to the originally contracted research team.

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# EXECUTIVE SUMMARY

## INTRODUCTION

Monash University Accident Research Centre was commissioned by the Australian Building Codes Board to undertake a study of the incidence of slips, trips and falls and the design and construction of buildings.

Falls are a neglected but substantial hazard and have long been identified as a major injury problem in the epidemiological data. Globally falls are the 2$^{nd}$ largest cause of unintentional injury death after road traffic injuries, with an estimated 391,000 people dying due to falls annually worldwide, though this figure is probably an under-estimate. In Australia, there are over 500 fatal falls recorded by the Australian Bureau of Statistics every year and over 110,000 hospital admissions for falls in buildings annually nationwide.

This compares with 110 deaths and 3,300 injuries in one year in Australia (Productivity Commission 2006) related to fires. As for falls, other factors (such as alcohol and cigarettes in the case of fires) may contribute to the chain of events resulting in fire related injury. Also, while property damage may add to the cost of fires, the research and development investment in fire related injury prevention may be disproportionate to that directed at fall injury prevention.

Adults over the age of 70 years, and in particular women, have higher mortality rates due to falls than younger people and the increasing incidence of fatality with advancing age is evidenced world wide. In both Australia and the United States, approximately 75% of fall fatalities are aged 65 years and over and falls account for approximately 10.9% of all hospital bed days. These frequencies represent an over-representation by a factor of approximately six for this age group. In Europe, men over 65 years are over-represented in fatality figures by a factor of at least four and women over 65 years by at least a factor of six. In the UK, both men and women over 75 years are shown to be particularly vulnerable, and over-represented in fatalities by a factor of eight and ten respectively. Despite lower mortality rates for falls than adults, children carry the largest fall injury burden with nearly 50% of the total number or disability adjusted life years lost worldwide to falls occurring in children under the age of 15 years.

### Specific Objectives

(a) To determine the actual risk contribution of 'slips, trips and falls' in buildings, which are a direct result of any number of relevant factors including:

   i. building design;
   ii. building construction;
   iii. obstacles not forming part of the structure that create a trip hazard;
   iv. the presence or absence of surface contaminants (water, oil or grease);
   v. the intrinsic condition of the person suffering the injury; and
   vi. the number of persons exposed to each particular hazard.

(b) Ascertain the level of risk in building classes (relevant to the BCA) in order to establish whether the inherent level of risk is acceptable.

(c) Identify and prioritise the incidence, frequency or severity of slips, trips and falls in relation to the design and construction of buildings in Australia.

(d) Identify the age group most at risk of incurring injury from slips, trips and falls in buildings in Australia.

(e) Provide information regarding the cost of slips, trips and falls, that would directly support a cost/benefit analysis of any proposed amendments to the BCA resulting from the research.

The major building structural and design components identified as being associated with fall injuries in this study were flooring surfaces, stairs, windows, balconies, verandahs and, indirectly, guttering and roofs in residential settings. As shown by the epidemiological data in this study, many of the victims of fall injuries in buildings are from vulnerable populations, particularly the elderly, the sick and children. This study excluded the construction phase of buildings and intentional injuries.

The intrinsic condition of the person suffering the injury may influence both a higher risk of falling and the severity of the subsequent injury. Similarly step and trip hazards which are unrelated or indirectly related to the building design and construction may contribute to the initiating event leading the fall injury. However, the bottom line is that the injury is caused by landing on a hard surface that does not absorb or attenuate the energy exchange that results in the injury. Building design and construction developments have the potential to prevent many of these fall injuries in vulnerable populations.

## RESULTS

### Frequency and causes of falls in buildings in Australia

- Fall related hospital separations that most likely occurred in buildings account for 59.1% (n = 317,905) of all fall related hospital separations for the period 2002/03 – 2004/05. The average annual frequency for hospitalised falls in buildings over this three year period was 105,968.
- The major causes of building fall hospital separations in rank order were:
    - Slips, trips and stumbles on the same level (29.2%)
    - Other fall on same level (20.6%)
    - Fall involving bed (6.6%)
    - Fall on and from stairs and steps (6.0%)
    - Combined falls from heights (including fall on and from ladder, fall from out of or through building or structure and other fall from one level to another) (5.8%)
    - Fall involving chair (3.9%)
- The cause of the fall was not specified in 25.2% of hospital separations.

### Increases in frequency

- Overall, fall injuries in buildings increased by 14.2% over the three year period 2000/01-2004/05.

- Falls coded as "other fall on same level" and stair and step fall injuries displayed the largest proportional increases of fall in buildings separations. The former increased by 25.2% between 2002/03 – 2004/05, and the latter increased by 17.2% across all age groups during the dame period.
- Stair and step fall injuries also increased by 22.3% among those aged 65 years and over during this time.

**Age**

- Persons 65 years and over accounted for 73.3% of all hospital separations for falls occurring in buildings, with persons aged 75 years and over accounting for 61.2 % of all hospital separations for falls occurring in buildings.
- Those 85 years of age and over accounted for almost 30% of all hospital separations due to falls occurring in buildings nationally between 2002/3 and 2004/05.
- Children under 9 years of age account for 5.3% in the home and have the highest proportion of slip, trip and fall injuries sustained in buildings of any broad age group under 65 years.

**Gender**

- Females constituted 64.7% of hospital separations for falls in buildings from 2002/03 to 2004/05, while males accounted for 35.3% of hospital separations over the same period.

**Location**

- The most common place of occurrence (location) was the home, which accounted for 62.0% of separations.
- The next most common places of fall occurrence were aged care facilities (16.2 %), health service areas (11.3%), schools (2.9%) and cafés, hotels and restaurants (1.9%).
- While slip, trip and fall injuries in all buildings have increased by 14.2% overall between 2002-03 and 2004-05, and home based slip, trip and fall injuries have increased by 16% across all age groups during this period; fall injuries in the home sustained by those aged 65 years and over have increased by 18.5% over the same time.

**Hazardous building features and the Building Code of Australia**

- The most common hazards associated with building construction and design, as identified from the scientific literature and national injury and death data, are:

- The non-attenuating and non-absorptive nature of many residential and institutional floor surfaces, particularly in wet areas and around beds in health service and aged care facilities.
- A lack of a definitive measurement or requirement for slip resistance of flooring surfaces in the *Building Code of Australia 2007*.
- The wide range of allowed stair riser/going measurements and the often insufficient illumination found in many domestic stairways.
- The lack of regulation for the accessing of heights for the purpose of residential maintenance, and the continuing need to access these heights.
- The *BCA* allowance of verandahs or projections from buildings of up to 1000mm in height without the provision of a balustrade.
- The *BCA* provision that window guards are not necessary in domestic settings for windows less than four metres in height.
- The allowance of climbable barriers for balconies, verandahs, porches and stair balustrades located up to four metres above the ground or floor.
- The possible absence of hand rails for stairways in domestic dwellings.
- The possible inadequate height of balustrades to prevent toppling-over in today's taller population.

**Nature of injuries and most frequently injured body regions**

- Injuries to the hip and lower limb (28.2%) and injuries not specified by body region (27.5%) are most prominent.
- Injuries to the shoulder and upper limb constitute 16.1% of included fall separations and head injuries account for 13.4% of fall injuries occurring in buildings.
- Fractures accounted for the highest proportion of slip, trip and fall injuries included in the study, totalling 63.1% of all injuries incurred from falls in buildings between 2002-03 and 2004-05.

**Fatal falls in buildings**

- The National Coroners Information System (NCIS) reports 1713 fatalities due to falls in buildings over the five year period 2001-2005, and Australian Bureau of Statistics reports a total of 1832 over this time period. This report's focus is on the NCIS fatality data as it contains greater detail than the equivalent ABS data.
- The NCIS reports that those aged 65 years and over account for 71.3% of all fall fatalities in buildings in Australia.

## COST OF SLIPS, TRIPS AND FALLS IN BUILDINGS

The method used for calculating the cost of a hospital bed day in this report is based on the cost per casemix-adjusted separation as used in the Australian Institute of Health and Welfare publication *Australian Hospital Statistics* and is described in Chapter 10. According to the AIHW *Hospital Statistics 2005-2006*, the average length of stay for acute public hospital separations is 3.7 days, and the average cost per separation calculated according to the above formula is $3,698.

Given that the average acute public hospital separation cost is $3,698 and the average acute public hospital length of stay is 3.7 days, it has been determined that for the purpose of this analysis $999.46 is the average cost of an acute public hospital bed per day. This is a conservative estimate given that previous Australian studies have assigned values of up $6500 per fall related emergency department attendance for people aged over 65 years (who account for almost 75% hospital bed days) (Hendrie, Hall et al. 2003)

- There was a total of **3,386,231** acute public hospital bed days resulting from falls most likely occurring in buildings for the years 2002-2005.
- Using the formula described above, and applying a conservative estimate of an average cost per bed day of **$999.46**, the total acute public hospital expenditure on falls most likely occurring in buildings over this time period is estimated at **$3,384,40,435.26 ($3.4 billion).**
- The average annual cost is $1,128,134,145($1.3billion)
- Those aged 65 years and over account for almost **92%** of acute public hospital costs per bed day. The total cost of bed days occupied by those in this age group due to falls most likely occurring in buildings is estimated at **$3,112,093,561** ($3.1 billion)

**Most costly injuries**

***Hip and thigh fractures***

- Among separations where injury nature was specified, injuries to the hip and thigh were most prevalent, and generally lead to longer periods of hospitalisation. Across all age groups injuries to the hip and thigh were responsible for a total of **694,544** acute public hospital bed days over the time covered by this analysis at an estimated total cost of **$694,168,946.20.**
- Of all acute public hospital bed days resulting from injuries to the hip and thigh, almost 90% of these are fractures. According to this analysis, the estimated total cost of fractures of the hip and thigh resulting from falls most likely occurring in buildings from 2002-2005 is **$622,562,634.50**

***Most costly injury locations***

- There was an estimated **1,871,722** accumulated bed days for home fall injury during 2002/03-2004/05. The total estimated cost of home-fall building related separations for this time is **$1,870,711,270.00**.
- Although falls in health service areas constitute 11.2% of building related fall injury, the accumulated acute public hospital bed days required claims a much greater portion of the total health care cost. Falls in health service areas cost an estimated total of **$822,874,407.70** for 2002-2005, representing 24.3% of the total cost for building related fall injury separations.
- Falls in aged care facilities cost a total **$493,905,147.10**, representing 14.6% of the total building related fall injury expense for the period included in this analysis.

### *Cost of fall fatalities*

The current assigned economic value of a life used in this study is $729,727.90. (PWC 2003)

- The total estimated cost of fatalities included in the NCIS database of closed coroner's cases for falls related to buildings from 2001 – 2005 is **$1,250,023,892**.
- Over this time, building fall related fatalities referred to the coroner have increased 24.5% (n = 76). This represents a cost increase of **$55,459,320.40**.
- Males account for 57.6% of building fall related fatalities included in the NCIS for the years 2001-2005. This constitutes a total cost of **$720,241,437.30**.
- Female deaths from building related falls account for 42.4% of these deaths, and a total cost of **$529,782,455.40** over this time.
- Building fall related fatalities in the home (52.4%) and in hospitals or health service areas (30.9%) were the most costly. The combined cost of all home fall deaths in the period covered here is estimated at **$655,295,654.20** and the total cost of all health service and hospital deaths (including nursing homes in this instance) is **$386,755,787.00**.

## RECOMMENDATIONS

### Recommendations for stair and step geometry

- It is recommended that the ABCB consider narrowing the wide range of geometrical going and riser combinations currently allowed by BCA 2007 for non-spiral stairways from 115 to 190mm for risers and 240mm to 355mm for goings, to a riser/going combination of approximately 178mm x 280mm.
- Particular attention should be paid to narrowing the acceptable lower range of measurements for stair goings, as up to 80% of stair and step injuries have been shown in the international literature and national data to occur during descent and insufficiently narrow goings are a major cause of mis-steps during descent.
- These recommendations are made with particular relevance to Class 1 and 10 residential buildings as the majority of stair fall injuries and fatalities occur in the home.

### Recommendations for the provision, design and optimal height of handrails and balustrades

- It is recommended that the BCA be amended to require handrails for stairs in all domestic dwellings.
- It is recommended that the ABCB consider raising the minimum stairway handrail height from 865mm as it currently stands in BCA 2007, to a height over 900mm (preferably 910-920mm) as has been shown to be the optimum height for the widest user demographic.
- This recommendation is of particular importance considering the rapidly increasing centre of gravity of the Australian population, and the substantial injury and fall prevention benefits shown by previous studies to be provided by correctly positioned handrails.

- The adequacy of current standards, codes and regulations that govern the design and installation of verandah balustrades are particularly deserving of attention in future reviews of the BCA.
- Of primary concern is the current BCA regulation that verandahs of less than 1000mm in height do not require a railing or balustrade. As shown in this study, falls from a height of less than one metre (as are the majority of verandah falls in Australia) can have severe injury consequences and are easily preventable through the provision of non-climbable barriers of a sufficient height.

### Recommendations for slip resistance of flooring surfaces

- It is recommended that the ABCB include a thorough definition of slip resistance in future editions of the BCA, rather than referring to the definition included in Standards Australia Handbook HB 197:2005. This definition should also include factors other than the dry coefficient of friction measurement deemed appropriate by the above Standard and should include other environmental factors that may increase a surface's slipperiness.
- It is recommended that manufacturers and retailers provide comparative information on slip resistance, and the slip resistive properties of different flooring surfaces, to consumers for consideration before purchase.
- Alteration of the BCA should be considered to require the installation of slip-resistant surfaces in the internal wet areas and external pedestrian areas of all new homes and renovated homes, and that the Local Government and Shires Associations of NSW initiative, whereby certificates of occupancy are only issued to buildings where all flooring surfaces meet the recommendations on slip resistance of pedestrian surfaces as outlined in the revised Standards Australia Handbook HB 197:2005 is adopted and regulated nationally (Gunatilaka 2005).

### Trip hazards

- It is recommended that a provision to recess or "rebate" structural trip hazards such as door frames, shower door frames and other structural trip hazards in new or renovated domestic dwellings be considered for future editions of the BCA.

### Falls from heights

- It is recommended that the ABCB, the building industry, local councils and other stake holders investigate the possibility of limiting or removing the need to attain heights for domestic maintenance purposes. This could potentially be achieved through the provision of features such as hinged gutters and gutter guards, or through the subsidisation of skilled trades' people for those vulnerable to fall from height injury.
- The BCA should consider a provision for the required installation of window guards at second storey height in all domestic dwellings, irrespective of whether they exceed four metres in height. We also note that the current BCA requirement of window guards for heights over four metres offers substantial potential for injury, particularly in comparison with the stringent guard requirements in place for windows of any height opening to provide access to domestic swimming pool areas.
- All balcony, stair and verandah balustrades, irrespective of height above ground level, should be of non-climbable design and adequate height to prevent toppling-over.

### Aged Care Facilities and Health Service Areas

- Given the high proportion of falls suffered by older persons, and the high proportion of these that occur in aged care facilities, particularly around beds and in bathrooms, the installation of force attenuating surfaces in the immediate vicinity of beds in aged care facilities is recommended.
- It is recommended that the Department of Health and Ageing conduct a cost/benefit analysis based on the immediate and ongoing public health burden resulting from bed and bathroom falls in aged care facilities to determine the economic benefit of this suggested installation.
- It is recommended that new or renovated aged care facilities feature recessed or "rebated" door frames, shower door frames and other structural trip hazards now present in many facilities.

### Data recommendations

- Attention is required to case capture for fall related fatalities in both the ABS and NCIS data sets.
- It is also recommended that greater consistency be developed between the NCIS and ABS fatality data sets, with particular reference to the very large number of unspecified cause/mechanism and location values found in both datasets.
- Measures should be taken by all state and territory Health Departments to improve the quality of hospital admissions data with regard to mechanism, activity and place of occurrence for all fall injuries.
- It is recommended that states which collect emergency department injury surveillance data pay greater attention to the collection of accurate narrative data as this would allow easier identification of hazards and faster implementation of targeted prevention strategies.

### Recommendations for continuing and future research

- It is recommended that the ABCB undertake an in depth study of the building related fall fatality data available through the National Coroners Information System, including both level one and two analyses of all recent (within 5 years) fatal falls in buildings in Australia, and a thorough analysis of the available narrative data and related information for each case.
- An in depth follow up study on balcony falls in Australia is suggested to fully explore the mechanism of these falls – including climbing, height and gaps in balustrades and railings.
- Research is required to investigate the capacity of new technology flooring (or underlay material) to attenuate the level of energy generated in falls to a level below the fracture threshold for hip fractures. This research would need to select only materials with the capacity to meet other aspects of the BCA with regard to fire, hygiene and other relevant standards.
- It is recommended that cost/benefit modelling be done on a range of potential interventions for a range of possible effects.

### Recommendations for dissemination

- It is recommended that an Australasian workshop be held in early 2008 to present the findings of this research to stakeholders and to discuss the implementation of the research recommendations.
- That the study report be provided to Standards Australia and its “Safety in House Design” Committee to inform the current preparation of their revised guide.
- The research should be published in the scientific literature.
- Media releases should be prepared at the time of the workshop or the publication of the results in the scientific literature.

## CONCLUSION

Slips, trips and falls in buildings constitute a large and costly public health problem, which is expected to grow in coming years due to the ageing of the Australian population and the increase in housing density, with associated trends to multi-storey dwellings. Although falls and injuries in buildings may be caused by a combination of factors including the design and construction of buildings, many potential solutions lie with the building industry and its regulators. Others with responsibility include the residential and community aged care sectors, the health sector, Standards makers and those responsible for death and injury data systems and research funding.

Given the enormous cost of the problem, investment in effective preventative solutions is imperative.

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# CHAPTER 1 INTRODUCTION

## 1.0 BACKGROUND

The economic, societal and personal costs associated with building related injuries are considerable and increasing in rate in some cases. However, in view of the potentially high implementation costs that may result from any change in building regulations, it is important that changes are based on strong evidence, including careful problem definition, and that adequate attention is paid to the development of cost-efficient solutions.

A number of studies have identified slips, trips and falls in buildings as the leading cause of serious injuries related to the design and construction of buildings. (Gunatilaka, Clapperton and Cassell, 2005; Ashe and Ozanne-Smith, 2005; Raw et al, 2000; Raw et al, 2001). This report investigates the relationship between slips, trips and falls and the design and construction of buildings.

A report considered at the 2003 Australian Building Codes Board (ABCB) National Technical Summit indicated that, based on available information, it was not possible to determine the actual contribution to risk by any number of relevant factors, including:

- building design (or building component),
- obstacles not forming part of the structure,
- the presence or absence of surface contaminants,
- the intrinsic condition of the person suffering the injury, and
- the number of people exposed to each particular hazard

The ABCB commissioned the Monash University Accident Research Centre (MUARC) to investigate these issues. A centre of Monash University, MUARC was established in 1987 in recognition that injury is prevented through scientific methods and a commitment to implement and sustain change.

As Australia's largest research institute specialising in the study of injury prevention and safety science, MUARC aims to challenge and support citizens, governments and industries to eliminate serious health losses due to injury. The Centre was designated as a World Health Organisation Collaborating Centre for Violence, Injuries and Disabilities in 2005.

This study aims to provide information to assist in determining the actual contribution of these factors.

## 1.1 PROJECT OBJECTIVES

To ascertain whether existing requirements of the Building Code of Australia (BCA) provide an acceptable minimum standard of safety relating to the incidence of slips, trips and falls in buildings for the community.

**Specific Objectives**

(f) To determine the actual risk contribution of 'slips, trips and falls' in buildings, which are a direct result of any number of relevant factors including:

   i. building design;
   ii. building construction;
   iii. obstacles not forming part of the structure that create a trip hazard;
   iv. the presence or absence of surface contaminants (water, oil or grease);
   v. the intrinsic condition of the person suffering the injury; and
   vi. the number of persons exposed to each particular hazard.

(g) Ascertain the level of risk in building classes (relevant to the BCA) in order to establish whether the inherent level of risk is acceptable.

(h) Identify and prioritise the incidence, frequency or severity of slips, trips and falls in relation to the design and construction of buildings in Australia.

(i) Identify the age group most at risk of incurring injury from slips, trips and falls in buildings in Australia.

(j) Provide information regarding the cost of slips, trips and falls, that would directly support a cost/benefit analysis of any proposed amendments to the BCA resulting from the research.

## 1.2 DEFINITIONS

### Fall

A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level (World Health Organization 2005). The term 'fall' used in this report includes slips, trips and falls unless otherwise stated.

### Injury

An internationally accepted and long standing definition of injury by Haddon is 'damage to the body caused by (acute) exchanges with environmental energy that are beyond the body's resilience' (Ozanne-Smith and Williams 1995).

### Classification of fall injuries

Fall-related hospitalisations and deaths analysed for this report are classified using codes from the International Statistical Classification of Diseases and Related Health Problems (ICD 10). The ICD 10-AM is an Australian modification of the international classification of specific conditions and groups of conditions determined by an internationally representative group of experts who advise the World Health Organization, which publishes a complete list periodically (Last 1995).

## 1.3 REPORT OVERVIEW

The study methods are described in chapter 2. Chapter 3 provides an overview of fall injury mortality, morbidity and burden globally and in Australia. Burden of disease is commonly described by Disability Adjusted Life Years (DALYs). DALYS are a measure of the burden of disease on a defined population and are claimed to be a valid indicator of population health. DALYs are based on adjustment of life expectancy to allow for long-term disability as estimated from official statistics (Last 1995).

Fall injury biomechanics are also outlined in chapter 3. Subsequent chapters, 4 – 8, review the scientific literature on important aspects of falls in buildings. The most recently available Australian data on fall injuries in buildings is described in chapter 9, supplemented by Victorian data, as an example of state non-fatal data, and where national data is not available, such as longer term trends and non–admitted hospital treated falls. Chapter 10 examines the costs of building fall related injury and fatality and chapter 11 examines the evidence base available from current data and scientific literature on which to base attribution of the contribution of building design and structure to fall injuries. The outcomes of the deliberations of an expert panel and consequent recommendations are discussed in chapter 12, and recommendations for the prevention of slips, trips and falls and future research are found in chapter 13.

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# CHAPTER 2 METHODS

## 2.0 DATA COLLECTION AND ANALYSIS

Slip, trip and fall injuries were examined across three levels of severity: emergency department presentations (without admission), hospital admissions, and deaths. Data analysis for slip, trip and fall injuries in Victoria was conducted using the Victorian Emergency Minimum Dataset (VEMD), which includes all presentations to Victorian public hospitals with twenty-four hour emergency departments, and the Victorian Admitted Episodes Dataset (VAED) which includes all admissions to these hospitals. Admitted cases were excluded from the VEMD datasets to avoid duplication.

Overview VEMD and VAED (ICD 10 AM) data analysis covered the 6-year period 1999/2000-2004/2005. A more detailed analysis was then confined to the most recent 3 year period (2002/3-2004/5) when coding improvements allowed better identification of building related falls.

National deaths data was obtained from the National Coroners Information System for the 5 year period 2001-2005. In order to be consistent with hospital data analysis, detailed analysis covered the 3-year period 2002/3-2004/5.

This MUARC held Victorian data was analysed to determine the overall extent and pattern of slip, trip and fall injury and to determine the possible contribution of building design and construction to these injuries. The final dataset for analysis was determined as the result of an iterative process between MUARC and the ABCB to best represent aspects of buildings that fall within the jurisdiction of the ABCB. Aggregated national slip, trip and fall injury data (covering the same time period as the Victorian data) was obtained from the National Injury Surveillance Unit at Flinders University and analysed comparatively with the Victorian data. National death data was obtained from the National Coroners Information System (NCIS 2001-2005) following ethical approval by the Victorian Department of Justice and the Australian Bureau of Statistics. The presence of intrinsic conditions in the person suffering the injury was investigated for all hospital admitted fall injuries in Victoria for the period 2002/3-2004/5. External names of injury and co-morbidities (including intrinsic factors) were coded according to the ICD-10, with the exception of the VEMD and NCIS data which used comparable, but more detailed data systems.

## 2.1 LITERATURE REVIEW

Through a preliminary analysis of state, national and international data and as identified in similar studies conducted internationally, the most prevalent hazards and harms related to slips, trips and falls and the design and construction of buildings were identified.

It was determined in consultation with the ABCB that the areas of focus for the literature review would be: all aspects of the design and construction of stairs and steps, access to and falls from heights, other building features identified as particular hazards such as balconies, verandahs/porches and flooring surfaces, the particular vulnerability of the old and young to these hazards (with an emphasis on aged care and health service areas) and the resultant economic and societal costs of the above outlined hazards.

Extensive keyword, author and journal title searches were conducted across numerous databases including Medline, The Cochrane Library, EMBASE and CINAHL. The full texts of all relevant articles were retrieved and have been reviewed.

## 2.2 HAZARDS AND HARMS RATING SYSTEM

A proposed rating system, based on British Housing Health and Safety Rating System (HHSRS) Operating Guidance (2004) has been developed to allow assessment of all the main potential housing related hazards. As the range of potential housing hazards have differing characteristics, the Rating System uses a formula to generate a numerical score which allows comparison of the full range of hazards. Whatever the hazard, the higher the score, the greater the risk.

For this formula, weightings have been given to the four Classes of Harm used by the HHSRS, the weightings reflecting the severity of incapacity resulting from the harm. The formula also uses the likelihood of a potentially harmful occurrence expressed as a ratio (eg. 1 in 100), and the spread of possible harm outcomes expressed as a percentage.

This Rating system was originally developed for application to individual home assessments. The intention of the present ABCB/MUARC study was to modify, extend and apply this method to:

- a wider range of buildings
- populations of buildings
- separately factor the estimated contribution of the building design and structure into the safety rating formula (currently contained in the likelihood estimate).

### 2.2.1 Classes of Harm

The Classes of Harm used for the HHSRS and proposed for this study are based on the top four Classes of Harm as identified in *A Risk Assessment Procedure for Health and Safety in Buildings* (Raw et al 2000). While this work identified seven Classes of Harm, only the top four are used for the purposes of the HHSRS as these are harms of sufficient severity that they will either prove fatal or require medical attention and, therefore, are likely to be recorded in hospital admissions or GP records. A complete list of harms and their classes, as modified by MUARC for specificity to injury, is at Appendix 1.

**Examples of injuries for each of the Classes of Harm**

**Class 1 -Extreme**

- Death
- Permanent paralysis below the neck
- Malignant lung cancer
- Permanent loss of consciousness
- 80% or more burn injuries

**Class 2 - Severe**

- Stroke
- Loss of a hand or foot
- Serious fractures
- Serious burns
- Loss of consciousness for days

**Class 3 - Serious**

- Loss of a finger
- Malignant but treatable skin cancer
- Fractured skull
- Severe concussion
- Serious puncture wound
- Severe burns to hands

**Class 4 - Moderate**

- Occasional severe discomfort.
- Chronic skin irritation
- Some benign tumours
- Broken finger
- Slight concussion
- Moderate cute to the face or body
- Severe bruising to body.

Weightings were given to the four Classes of Harm used by the HRRS, the weightings reflecting the severity of incapacity resulting from the harm. The four Classes of Harm adopted were based on those developed previously by the BRE (Raw et al 2000). The formula also uses the likelihood of a potentially harmful occurrence expressed as a ratio (e.g. 1 in 100), and the spread of possible harm outcomes expressed as a percentage.

MUARC expressed concerns about the list of Harms and their Classes, as these are not standard categories (although such categorizations do exist e.g. the Abbreviated Injury Scale), and they do not appear to have undergone validation. Some of the categories are specific, such as simple fracture of jaw, whereas others are vague, such as serious blisters on face and hands (which could be due to burns or skin disease). There are important omissions such as drowning and near-drowning, and some types of poisoning, though these are not necessarily relevant to the current ABCB/MUARC study.

### 2.2.2 Likelihood of Occurrence

*Causes:* - The potential sources of the hazard are discussed to help determine to what extent the contribution to a hazard can be attributed to dwelling features and to human behaviour or other factors, such as increased vulnerability due to co-morbidity. This should assist in assessing whether the deficiencies identified could mean that the likelihood or spread of harms deviates from the averages for the particular age and type of dwelling.

*Relevant matters affecting likelihood and harm outcome:* - A check-list of dwelling features which may affect the likelihood and the severity of the outcome is given. In many cases the same features can affect both the likelihood and the severity of the outcome. Where different dwelling features affect the likelihood and spread of harm outcomes, the lists are given separately. (See Appendix 2)

### 2.2.3 Hazard Formula & Generating a Hazard Score

Three sets of figures are used to generate a hazard score, these are;

a) a weighting for each Class of Harm reflecting the degree of incapacity to the victim resulting from the occurrence.

b) the likelihood of an occurrence involving a member of a vulnerable group, expressed as a ratio. This information is gathered from a variety of existing data sources, or from individual inspections.

c) the spread of possible harms resulting from an occurrence, expressed by percentage for each of the four Classes of Harm.

| Class of Harm & Weighting | | Likelihood 1 in | Spread of Harms (%) | | | Product |
|---|---|---|---|---|---|---|
| 1<br>10,000 | ÷ | 1/L | x | $O_1$ | = | $P_1$ |
| 2<br>1,000 | ÷ | 1/L | x | $O_2$ | = | $P_2$ |
| 3<br>300 | ÷ | 1/L | x | $O_3$ | = | $P_3$ |
| 4<br>10 | ÷ | 1/L | x | $O_4$ | = | $P_4$ |
| | | | | | | |
| | | | | Hazard Score | | $= P_1 + P_2 + P_3 + P_4$ |

**Example Hazard Rating 1**

Assessment of a fall out of a window to ground floor room.

- Likelihood - 1 in 18
- Spread of harm outcomes
    - Class 1 – 0% death judged very unlikely
    - Class 2 – 10% chance of serious fractures
    - Class 3 – 31.6% chance of severe concussion

- Class 4 – 58.4% chance of severe bruising

**Example Hazard Rating – 1**

| Class of Harm Weighting | | Likelihood 1 in | | Spread of Harms (%) | | Product |
|---|---|---|---|---|---|---|
| **1**<br>10,000 | ÷ | **18** | **x** | **O** | **=** | **0** |
| **2**<br>1,000 | ÷ | **18** | **x** | **10** | **=** | **556** |
| **3**<br>300 | ÷ | **18** | **x** | **31.6** | **=** | **527** |
| **4**<br>10 | ÷ | **18** | **x** | **58.4** | **=** | **32** |
| | | | | | | |
| | | | | **Hazard Score** | | **= 1,115** |

**Example Hazard Rating 2**

Assessment of a fall out of a window to fifth floor room.

- Likelihood - 1 in 180
- Spread of harm outcomes
    - Class 1 – 46.9% chance of death
    - Class 2 – 31.6% chance of serious fractures
    - Class 3 – 21.5% chance of severe concussion
    - Class 4 – 0% severe bruising very unlikely

**Example Hazard Rating – 2**

| Class of Harm Weighting | | Likelihood 1 in | | Spread of Harms (%) | | Product |
|---|---|---|---|---|---|---|
| **1**<br>10,000 | ÷ | **180** | **x** | **46.9** | **=** | **2,606** |
| **2**<br>1,000 | ÷ | **180** | **x** | **31.6** | **=** | **176** |
| **3**<br>300 | ÷ | **180** | **x** | **21.5** | **=** | **36** |
| **4**<br>10 | ÷ | **180** | **x** | **0** | **=** | **0** |
| | | | | | | |
| | | | | **Hazard Score** | | **= 2,817** |

### 2.2.4 The Hazard Bands

The numerical Hazard Score can appear too specific. It can also falsely imply that the score is a precise statement of risk, rather than a representation from the data (or from housing inspections). Hazard Bands have been devised to avoid emphasis on what may appear to be a precise numerical Hazard Score, and also provide a simple means for handling the potentially wide range of scores. There are ten Hazard bands, with Band J being the safest, and Band A being the most dangerous.

| Band | Hazard Score Range |
|---|---|
| A | 5,000 or more |
| B | 2,000 to 4,999 |
| C | 1,000 to 1,999 |
| D | 500 to 999 |
| E | 200 to 499 |
| F | 100 to 199 |
| G | 50 to 99 |
| H | 20 to 49 |
| I | 10 to 19 |
| J | 9 or less |

### 2.2.5 In consultation with the ABCB it was decided not to apply the Hazards and Harms rating System in this study for a number of reasons:

(1) The HHSRS scores are not based on standard categorisations (such as ICD) and severity coding systems (such as the Abbreviated Injury Scale).

(2) The HHSRS is designed for application to individual buildings rather than to populations of buildings or mass databases.

## 2.3 REFERENCES


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## 2.4 EXPERT PANEL

The expert panel played an essential role in this project, and met in Melbourne on November 22nd, 2007. The expertise of the panel members (see appendix 4) provided regulatory, industry, architectural and design insights which informed the final recommendations of the study. Membership was decided by the ABCB and MUARC and would be expected to include the project researchers, ABCB representation and Federal Government representation, and representation of the building, architectural and design industries and aged care providers.

The researchers presented and discussed the key findings of the study with the panel, whose suggestions and recommendations are outlined in chapter 12.

# CHAPTER 3 LITERATURE REVIEW: OVERVIEW OF FALLS IN BUILDINGS

## 3.0 INTRODUCTION

This literature review is presented in a number of sections. This chapter presents background information on falls and fall related injury, and information on biomechanical forces involved in fall injury. For the most part it focuses on falls in general, particularly in those over 65 years of age, and is not specific to falls in buildings. The following chapters review the literature on the major themes identified by the project as important in the relationship between slips, trips and falls and the design and construction of buildings.

## 3.1 FALL RELATED HOSPITALISATIONS AND DEATHS IN AUSTRALIA

### 3.1.0 Injury and falls related mortality and morbidity globally

Falls are a neglected but substantial issue and have long been identified as a major injury problem in the epidemiological data. Globally falls are the 2nd largest cause of unintentional injury death after road traffic injuries, with an estimated 391 000 people dying due to falls in 2002 (World Health Organization 2007). High–income countries accounted for a quarter of all fatal falls with Europe and the Western Pacific region combined accounting for nearly 60 percent of the total number of fall-related deaths globally (World Health Organization 2007).

Adults over the age of 70 years, and in particular women, from all areas of the world have higher fall-related mortality rates due to falls than younger people (World Health Organization 2007). The increasing incidence of fatality with advancing age is evidenced world wide and is detailed by Pauls (1991). In the United States, approximately 75 percent of fall fatalities occur to people aged 65 and older (National Safety Council 1989, cited in Pauls 1991), suggesting over-representation by a factor of approximately six. In Europe, men over 65 are over-represented in fatality figures by a factor of at least four and women over 65 by at least a factor of six. In the UK, both men and women over 75 are shown to be particularly vulnerable, and over-represented in fatalities by a factor of eight and ten respectively.

Despite lower mortality rates for falls than adults, children have the largest burden with nearly 50 percent of the total number or disability adjusted life years (DALYs) lost worldwide to falls occurring in children under the age of 15 years (World Health Organization 2007).

## 3.2 INJURY AND FALLS RELATED DEATHS IN AUSTRALIA

In Australia, 9,924 injury deaths occurred in 2003-2004. Unintentional falls accounted for 30 percent of all community injury deaths during this time (Henley et al. 2007). Many of these fall related fatalities sustained fractures, with 80 percent of falls fatalities in 2003-2004 incurring at least one fracture (2,366 persons) and almost 73 percent (1,716 persons) incurring hip fractures (Henley et al. 2007) (see also chapter 9).

### 3.2.1 Injury and falls – children in Australia

Injury and poisoning is the leading cause of death and a major cause of disability among Australian children 0-14 years of age (Australian Institute of Health and Welfare 2005). In Australia, 65,651 children aged 0-14 years were hospitalized in 2002-2003 due to injury. The most common external cause of hospitalization for injury in children aged 0-14 years in 2002-2003 was a fall related injury, with a rate of 628.1 per 100,000, with children aged 5-9 years of age having the highest hospitalisation rate for falls at 654.6 per 100,000 (Australian Institute of Health and Welfare 2005).

The injury death rate for Australian children aged 0-14 years for falls was 0.2 per 100,000 in 2001-2003, with 20 children dying due to fall related incidents in this time period (Australian Institute of Health and Welfare 2005).

## 3.3 FALLS AND FALL RELATED INJURIES IN OLDER PERSONS

Due to a combination of the high rate of fatalities in older persons related to fall injuries and the increasing proportion of older people in the population, further information on the epidemiology of falls and fall related injury follows.

### 3.3.1 Ageing population

The numbers of fatalities due to fall related injuries in older persons is expected to increase due to rises in the proportion of older persons. The United Nations estimates that by the year 2050 the number of older persons worldwide will for the first time in history exceed the number of younger persons, and that persons aged over 60 years will represent 21 percent of the world population, compared to only 10 percent in the year 2000. (UN, DESA 2002)

At a national level, the Australian Bureau of Statistics (ABS) population data shows that for the year ending June 2004, the number of Australians aged 65 years and over reached 2.6 million (Australian Bureau of Statistics 2004). This figure is projected to rise to between seven and nine million in 2051 (Australian Bureau of Statistics 2004). Whereas older people comprised 13 percent of the Australian population in 2004, the projected proportion by 2051 is 24 percent (Australian Bureau of Statistics 2004).

The number of people aged 85 years and over is projected to increase at a faster rate than those aged over 65 years, with the current population estimated to be at just under 300,000 growing to between 1.6 and 2.7 million people in 2051 (Australian Bureau of Statistics 2005). By 2051 the Australian population is expected to increase to between 25 million and 33 million, with about 44% to 48% being older than 50 years (Australian Bureau of Statistics 2005).

### 3.3.2 Incidence of falls in older people

Falls occur frequently in older persons. About 30 percent of persons aged 70 years and over living in the community have been found to fall at least once a year with 19% falling more than once (Luukinen et al. 1994; Kendig et al. 1996). The incidence of falls in older people has been found to vary depending on their type of residential accommodation, with those in residential care falling more than older persons in the community (Luukinen et al. 1994).

### 3.3.3 Proportion of falls resulting in physical injury in older people

Despite older persons falling frequently, injury does not result from all falls. It has been estimated that between 3 and 10 percent of falls in persons aged 65 years or over living in the community result in serious injury (Gillespie 2004).

Two commonly reported indicators of fall related injury are data on hospitalisations and mortality. This type of data represents the tip of the injury iceberg, the most obvious impact of falls being deaths and is relatively easy to collect (World Health Organization 2005). It is important to take into account that many other injuries from falls do occur and are likely not to be captured in these databases. These fall related injuries will be treated by general practitioners, nurses, family and friends or by the individual themselves.

## 3.4 OTHER IMPORTANT CONSEQUENCES OF FALLS IN OLDER PEOPLE

It is also important to note that about 90 percent of falls in older people do not result in serious injury (Gillespie 2004). Falls that do not result in injury may have other major consequences though. Many of these falls are not so easily captured by data but may still result in a significant burden for the elderly and for the community.

One of these consequences is known as a 'fear of falling'. Approximately 30 percent of persons living in the community and aged 65 years or older have a fear of falling (Kendig et al. 1996). Concerns about the risk of falling and the associated avoidance and restriction of activities is suspected as an important psychological variable in the development of physical frailty (Delbaere et al. 2004).

Falls are also a predictor of the likelihood of other events, for example, serious falls in the community are predictive of an increased likelihood of admission to an aged care residential facility in the future (Tinetti 1997).

### 3.4.1 Deaths and death rates in persons aged 65 years and older

In Australia, 2,735 persons aged 65 years or over died due to an unintentional fall in 2003-2004. This represents a rise in numbers of 17 percent from the 2000-2001 figure (Henley, Kreisfeld et al. 2007). This rise has occurred as a consequence of a rise in the numbers of older Australians and is not due to a rise in death rate. The death rate due to unintentional falls for this age group has fallen by 10 percent from 1997-1998 to 2003-2004 (Henley et al. 2007).

### 3.4.2 Hospitalisations due to falls in those aged 65 and over

Although only a small number of falls lead to injury, this results in a large number of hospitalisations. In Australia in 2003-2004, 60,497 fall incidents lead to hospitalisations for persons aged 65 years or over. This equates to an age standardised rate of fall injury incidents leading to hospitalisation of 2,295.3 per 100,000 population (Bradley and Harrison 2007). This rate rises strongly from the age of 75 years and peaks in the 90-94 year age group at 9,653.7 fall injury incidents per 100,000 population.

### 3.4.3 Type of fall related injury in older persons hospitalised

The most common type of fall related injury event requiring hospitalisation of older persons was an injury to the thigh or hip region (33.5 percent). The next largest principal diagnosis was head injuries with 15 percent of hospitalisations recording this type of injury (Bradley and Harrison 2007).

### 3.4.4 The most common type of fractures sustained

Two-thirds of older persons who are hospitalised due to a fall related injury have sustained at least one fracture (Bradley and Harrison 2007). More woman than men sustained fractures, with 70 percent of women and 58% of men sustaining at least one fracture (Bradley and Harrison 2007).

### 3.4.5 Fall related hip fractures in older people

Most hip fractures in Australia occur in older age groups, with 91 percent of hip fractures occurring in persons aged 65 and over and 40 percent occurring in those aged 80 and over (Kreisfeld and Newson 2006). The rise in the proportions of hip fractures with age in Australia, is consistent with the exponential increase in incidence rates with aging that is seen in most developed countries (Melton 1996).

Ninety one percent of all hip fractures in Australia in 2002-2003 were associated with falls and 15,177 hospitalisations occurred in this same year in Australia due to fall related fractured hips in the 65 years or greater age group (Kreisfeld and Newson 2006).

For those aged 65 or over, the fall mechanism for 36 percent of fall related hip fractures was recorded as resulting from falling on the same level from slipping, tripping and stumbling. Of those older persons falling and sustaining hip fractures, 5.2 percent were recorded as a fall involving a bed and 3.7 percent were recorded as a fall on and from stairs and steps. Over 18 percent were recorded as other fall on same level and almost 30 percent recording an unspecified fall (Kreisfeld and Newson 2006).

### 3.4.6 Deaths from fall related hip fractures in older people

Death from hip fractures also occurs mainly in the oldest age groups, with 59 percent in persons aged 85 years and over with 98% of deaths occurring in the 65 years and over age group (Kreisfeld and Newson 2006).

More Australian women died as a consequence of fracturing their hips than men with over 1.7 times as many female cases as male cases, although the rates for women were less than for men with the age adjusted rate for males at 8.0 per 100,000 population compared with 7.6 per 100,000 for females (Kreisfeld and Newson 2006).

Mortality post surgery for hip fracture is high with 18 percent of patients dying within three months of surgery (Freeman et al. 2002), and one in three dying within 12 months of surgery (Keene et al. 1993).

Eighty seven percent of hip fracture deaths were certified by a medical practitioner rather than a coroner. This is in contrast to most other types of injuries where most deaths are certified by the coroner (Kreisfeld and Newson 2006). The way in which hip fracture deaths are treated by coroners in Australia is undergoing change.

### 3.4.7 Trends in hip fractures in older people

The number of hip fractures occurring in Australia is rising and is predicted to continue to increase in the coming years, primarily because most hip fractures occur in the elderly and there is predicted to be a substantial rise in the number of persons aged over 85 years as a consequence of our aging population (Sanders et al. 1999). This rise is expected to correspond with a fourfold increase in hip fractures by 2051 from the 1996 level. This prediction assumes stable age and sex specific incidence rates of hip fractures in the elderly. Care needs to be taken with such predictions though as a number of developed countries are now seeing decreases in the incidence rates of hip fractures in older populations (Kannus 2006; Nymark et al. 2006).

It is hypothesised that the available data significantly underestimates the actual extent of hip fracture hospitalisations and deaths in Australia. It has been suggested that because hip fractures occur mainly in the elderly, who also commonly have co-morbidities, deaths associated with fall related hip fractures are classified as being caused by other factors. This may also be the case with hospitalisations (Sanders et al. 1999).

### 3.4.8 Location of hip fracture events

In Australia in 2002-2003, of the hip fractures in those aged 65 years or over, forty three percent of the incidents occurred in the home and 22 percent of males and 27 percent of females fractured their hip in a residential care facility (Kreisfeld and Newson 2006). Over 9 percent of hip fractures occurred in ‘ a school, other institution and public administrations area and in about 14 percent of cases the incident occurred in an ‘unspecified place of occurrence’ or ‘a place not reported’ (Kreisfeld and Newson 2006).

## 3.5 COSTS AND CONSEQUENCES ASSOCIATED WITH FALL RELATED INJURY IN OLDER PERSONS

The estimated medical cost of injury from accidental falls in Australia in 1993-94 was $806 million (Mathers, Vos, Stevenson 1999). The total annual lifetime cost of Victorian fall injuries for 1993/94 was estimated at $557 million with the cost for medical treatment alone measured at $270 million (Watson and Ozanne-Smith, 1997). Injuries from falls have many costs to the individual, the health care system and to society in general. These include financial, health, social and economic costs. Health costs include: pre-hospital, hospital transfers, acute care, rehabilitation and or residential care costs.

The large number of hospitalisations of older persons with fall related injury results in significant health service utilisation with fall related hospital admissions accounting for 1,246,214 bed-days or 10.9 percent of all hospital bed days in 2003-2004 for persons aged 65 years or over (Bradley and Harrison 2007).

The cost of fall related acute health care episodes alone in Australia for the fall incidents requiring hospitalization in the 65 and over age group was estimated to be $566 million for 2003-2004. This cost does not include the cost of rehabilitation inpatient care (Bradley and Harrison 2007).

A Western Australian study estimated an average health system cost of $6500 per emergency department attendance in the year 2001/2002 for a fall related injury in those aged 65 or over (Hendrie et al. 2003). The main components of the cost were hospital inpatient treatment (52%), high-level residential care (9%), hospital outpatient services (8%), ED presentations (6%); and allied health consultations (5%) (Hendrie et al. 2003).

A report for the National Falls Prevention for Older People Initiative predicted the overall health costs associated with falls for people aged 65 and over in Australia would increase 2.7 times between 2003 and 2051 (Moller 2003).

### 3.5.1 Costs and consequences associated with fall related hip fractures in older persons

Falls related hip fractures impose a heavy cost burden on the community, both in terms of acute care and rehabilitation (Kreisfeld and Newson 2006). Almost all persons who fracture a hip are hospitalised (Keene et al. 1993). The average length of stay for acute care is 10.8 days overall, with the average for those aged 85 and older being 11.2 (Sanders et al. 1999). The average length of stay in rehabilitation is 21 days, with the average length of stay being 22.8 for those aged 85 or older (Sanders et al. 1999).

Consequences of hip fracture may include decreased mobility and the need for increased social support (Keene et al. 1993). In one UK study, of the patients walking unaided prior to the study only 40 percent did so post fracture, with 34% requiring sticks and 23 percent using a walking frame. Twenty eight percent of elderly persons sustaining hip fracture were found to be house bound prior to fracture, rising to 46% after treatment. Fifty four percent of patients were able to do their shopping prior to the fracture with only 33 % able to go shopping 12 months post fracture.

In this same study 80 percent of elderly people who survived a hip fracture were discharged to their own homes and 55 percent of this population remained in their own homes one year later (Keene et al. 1993). That is, less than half of all survivors of hip fracture remained in their own homes one year post fracture.

## 3.6 BIOMECHANICS AND INJURY

Given that injury results from energy exchange to the human body which is greater than the body's tolerance, it is essential to understand the thresholds for significant injuries. With this knowledge it is possible to design environments that absorb or attenuate energy to contain it below serious injury thresholds. These principles are applicable to fall injuries and fall related injury prevention interventions.

Hip fractures in older persons are a major cause of fall morbidity and mortality and will be used to demonstrate the biomechanical considerations in injury causation in the following discussion. Biomechanical factors in hip fracture aetiology include:

- Bone mass density,
- Type of fall,
    - direction
    - velocity
    - height
    - point of contact
- Fracture forces,
- Impact forces,

- Force absorption,
- Force attenuation.

### 3.6.1 Hip fractures in older persons

Hip fractures result from a complex interplay of many factors (Melton 1996). Historically, there was controversy about whether hip fractures were disease or accident-related (Robinovitch et al. 1991), although there was agreement that the two most significant contributors to hip fractures are falls and a reduction in bone density that leads to bone fragility (Meunier 1993).

**Type of fall :** The likelihood of sustaining a fractured hip from a fall is strongly associated with the type of fall (Marshall and Johnell 1996), with falls in a posterolateral direction more likely to be associated with hip fractures (Nankaku 2005).

**Bone mineral density (BMD):** The frequency of hip fractures also increases as bone mineral density declines below ‘a densometric fracture threshold in the proximal femur’ (Robinovitch et al. 1991). Loss of bone density is associated with ageing , with men losing an estimated 38 percent and women an estimated 58 percent of their bone density of the femoral neck over a lifetime (Marshall and Johnell 1996) .

**Femur fracture forces:** When a dynamic load is placed on the bone, much of the kinetic energy must be absorbed by the relatively stiff skeletal structures of the body, resulting in large peak forces which may lead to bone fracture (Maki and Fernie 1990). Through finite element model testing of four femora from two males and two females aged between 55 and 74 years, Keyak (2001) found that for tests conducted to simulate a traumatic fall, the minimum average fracture load was 1.1 kN and the greatest average fracture load was 1.8 kN.

However, a wide range of fracture loads of the proximal femur have been found in various investigations, with fracture thresholds varying from 778 N to 10 kN (Fernandez, PhD Study in-process). Fracture thresholds of older cadaveric femora compiled from experiments in which femora were tested with the shaft at 10° to the horizontal and neck axis internally rotated 15° vary . Under loading rates of 2mm/s average fracture thresholds of 3.5 ± 1.2 kN (73.8 ±7.1 years) and 3.4 ± 1.3 (74 ± 7.4 years) were produced (Courtney et al. 1995).

The two most significant factors, found by fracture threshold investigators, to reduce the average fracture threshold are the direction of the impact and a decrease in bone mineral density. Furthermore, the loading rate of femora plays an important role. Bone is a rate dependant substance that becomes stronger when loaded faster. (Fernandez, PhD Study in-process).

**Impact forces:** Robinovitch and colleagues predicted persons falling from a height of 0.7m experience peak hip impact forces of between 5600N if falling in a muscle relaxed state and 8600 N if falling in the muscle-active state. Impact forces on falling can be reduced by both soft tissue compression and muscle relaxation (Robinovitch et al. 1991) .

**Force attenuation:** The peak forces created when an older person falls and their hip contacts/impacts a hard surface can exceed femoral bone fracture thresholds. Courtney and colleagues found that the impact forces on a hip exceeded the strength of the femora in older persons by approximately 50 percent (Courtney et al. 1994). Robinovitch and colleagues warned that the risk of fracture due to a female falling to the side with a lateral impact on the greater trochanter has the potential to fracture the hip (Robinovitch et al. 1991)

Due to the high impact forces created when older persons fall on their hips and direct contact to the greater trochanter is made, a number of interventions have focused on attenuating impact forces in order to decrease fall related injuries. One of the common interventions used to prevent hip fractures are hip protectors. These are discussed below. Landing surfaces are also important in force attenuation following a fall and are discussed in chapter 8.

**The Hip protector:** Hip protectors are a fall related injury prevention intervention often used by many acute care and residential care facilities. These devices aim to prevent fractures of the greater trochanter of the femur (Rooij 2006) and consist of either foam padding, a dome shaped hard shell or a combination of both. The hip protector is placed over the greater trochanter and usually secured in a special pocket of an undergarment. Kannus and colleagues have showed that the hard shell hip protectors are significantly more effective that the padding types (Kannus et al 1995).

A Cochrane systematic literature review into the effectiveness of hip protectors found the devices did reduce the incidence of hip fractures in older persons living in nursing or residential care, but there was no evidence for the effectiveness of their use in the community (Parker, Gillespie et al. 2005). A further study by Parker and colleagues updating the Cochrane systematic review suggests that previous findings of reductions in the numbers of hip fractures in elderly persons living in nursing or residential care may have been as a result of bias due to the cluster sampling methods used by a number of the studies (Parker et al. 2006).

Parker and colleagues warned of other problems in clinical studies on hip protectors relating to the numerous types of hip protectors and the compliance and acceptance of hip protectors by study participants, and the effect these two factors may have on interpreting evidence from studies (Parker et al. 2006). Another recent systematic review also stated that evidence on the effectiveness of hip protectors is inconclusive using meta-analysis due to the effects of clustering (Olive et al. 2006). Further research is recommended to identify whether hip protectors are an effective intervention (Parker et al. 2006).

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# CHAPTER 4 FALLS ON AND FROM STAIRS AND STEPS

As shown by Pauls (1998), falls outnumber fire related injuries by one or two orders of magnitude and injuries related to stairways outnumber civilian injuries from fire by a factor of approximately 35. Fall-related injuries have also outnumbered injuries related to motor vehicle accidents in the United States for quite some time (Pauls 1998), and in Australia stair and step fall injuries increased by over 70 percent during the decade 1993/4 to 2002/3 (Gunatilaka et al. 2005). In the U.S., Australia and many other countries, falls have been identified as the leading cause of non-fatal injuries and the second leading cause of spinal cord and brain injuries. In the U.S., for falls involving stairways where the location of the stairway is reported, 85% occur in residential settings. The annual cost of stair related falls in the U.S was estimated by Pauls (1998) to be approximately three times that of the annual stair construction cost. Falls account for over 80 percent of deaths possibly associated with building features, and falls on stairs account for over 60% of slip, trip and fall deaths in buildings. Cayless (2001) and Ragg et al.(2000) have both found that stairway falls also lead to increased mortality post hospital-admission over non-stairway falls, with 35 percent of stairway fall patients dying in hospital, compared to 19% of non-stairway fall patients.

Despite this, there has been minimal regulatory agreement on the design and construction of stairs. Slovic (1989) posits that this is because familiar risks, including pervasive risks in homes such as stairs, cause less dread and subsequently less demand for regulation than do unfamiliar less common risks, such as injury from fire or motor vehicle accidents (Slovic 1989, cited in Pauls 1998).

## 4.1 RISK FACTORS

### 4.1.0 Biomechanics

Walking on stairs requires an unusual gait whereby the toe is set down before the heel and involves a high rate of energy expenditure, and several studies have concluded that the risk of major injury per fall on stairs is far greater then that per fall on level surfaces. (Nevitt, Cummings, and Hyde 1991; Honkanen and Smith 1990 cited in Hemenway 1994).

Roys (2001,2002,2004) describes stair geometry in terms of “rise”, “going” and “pitch”. The rise is defined as the vertical distance between two consecutive treads or between a tread and a landing, and is determined from the floor to floor height where the stair is situated. The “going” is the horizontal distance between two consecutive nosings (the part of the tread which overlaps the tread below). The “pitch” is the angle between a line connecting consecutive nosings and the ground. He also asserts that since it is good design to have equally sized steps the floor-to-floor height should be an exact multiple of the rise.

The design, construction and regulation of the stairs present in many single family dwellings are based heavily on tradition, rather than the principals of ergonomics and universal design. Many architects apply a long established rule, first introduced in the 17$^{th}$ century, which states that tread depth should be one step length when walking on a flat surface minus two times the height of the rise (Fitch et al., 1974). This traditional rule is still embedded in many building and fire codes, and Pauls (2002) points out that as a result of this reliance on tradition, **“**huge parts of our economy, that significantly affect our wellbeing and safety, will be increasingly dysfunctional and not adequately responsive to individual and social needs". In experiments testing perceived and actual levels of difficulty among male subject using mechanical stairs, Nagata (1995) found that the traditional formula outlined above cannot be universally relied upon to produce safe tread/rise combinations.

#### *4.1.1.1 Ascent versus descent*

In various studies conducted in the U.S. and U.K., between 73 – 80 percent of stair accidents were found to occur during stair descent (Jackson and Cohen 1995; Templer 1989; Roys and Wright 2003) and the primary causes of such accidents during descent were ranked by Templer as follows; Catching the heel on the stair nosing, the foot slipping off the stair nosing, overstepping: missing the step completely, under stepping: locking the heel against the riser, structural failure, and unintentional use: unaware of presence of steps(s).

There is general agreement in the literature that accidents on ascent, and the resulting injuries, tend to be less severe in nature (Templer 1992). This is because the centre of gravity of the user is slightly forward, so that most falls are relatively small and towards the higher steps. Furthermore, as demonstrated by Boulet and colleagues (1989) through the use of computer fall simulation, a fall during descent could potentially cause the stair user to descend a full flight, hitting steps, the balustrade or the wall on route. For these reasons, broken bones and head injuries are far more common when users fall while descending. The consequences of these forward falls, particularly for the elderly who often negotiate stairs at a reduced speed, is summarised by (Smeesters et al. 2001) thus:

> *"Trips and steps down usually resulted in forward falls, with frontal impacts regardless of gait speed. At fast gait speed, slips and faints also usually resulted in forward falls, with frontal impacts. As gait speed decreased, however, slips usually resulted in sideways or backward falls, with impact on the hip or buttocks, and faints resulted in a greater number of sideways falls, with impact near the hip. Therefore, compared to other disturbances and gait speeds, slipping or fainting while walking slowly was more likely to result in an impact on the hip, suggesting a greater risk for hip fracture. Furthermore, 56% of the impact velocities generated were within one standard deviation of the estimate of the mean impact velocity needed to fracture an elderly femur."*

Through the measurement of the ground reaction force exerted by test subjects stepping on level surfaces, ascending and descending stairs, Stacoff (2005) ascertained that not only are force values exerted during descent approximately 1.49 to 1.6 times the subjects body weight (compared to an exertion of just over one body weight for ascent), but also that step asymmetry increased significantly with steep stair ascent and increased even further with stair descent.

### 4.1.2 Vulnerable populations

According to Raw et al. (2001) slips, trips and falls on stairs account for 24% of fatal and non-fatal accidents in the home, and children and the elderly are most prone to injurious slip, trip and fall incidents.

#### *4.1.2.1 Age*

While the young most often receive cuts and bruises from stair falls in the home environment (Riley, Roys and Cayless 1998), the effect of slips, trips and falls on older people is much greater as they often experience injuries such as hip fractures. Similarly, the elderly are much more likely to suffer death or serious injury in falls regardless of the fall level.

While Pauls (1984) found that stairway accidents occurred mostly to young children and to younger adults aged between 21-25 years, the resulting injuries have been found to have a minimal societal and economic impact compared to injuries resulting from stairway falls suffered by older people. According to Raw et al. (2001) people aged over 65 years account for the vast majority of deaths from stairway falls and half of the serious injuries.

#### *4.1.2.2 Physical decline*

According to Hemenway et al. (1994) the typical stairway injury victim is an elderly woman who is unmarried and living alone. Due to decreased vision and balance, older people are more prone to falling on stairs, and resultant injuries are often significantly more severe due to the decreased bone density inherent with age. Women tend to have a greater incidence of stairway accidents than men (Templer 1992). This is most likely because women, particularly elderly women, have smaller and less dense bones, which may account for their increased incidence of fracture and stair fall injury. Additionally, anecdotal evidence suggests that the level of exposure to home stairways may be greater for women then men (Hemenway et al. 1994) and greater numbers of women than men live into old age, when stairs are likely to become a hazard (QISU 1992).

### 4.1.3 Alcohol

Alcohol is shown as a major contributing factor for falls suffered by younger people, and is reported in the literature as being involved in between 55-60% of falls in buildings for those less than fifty years of age in both the U.K. and Australia. (Cayless 2001;Ragg et al., 2000).

Conversely, the contribution of alcohol to stairway falls suffered by older persons is minimal and environmental and design factors play a much larger role in stairway injuries as age increases.

## 4.2 PREVENTION

Given the increased risk of stairway incident, accident, injury and fatality suffered by older persons as outlined in the literature and detailed above, there has been significant debate as to whether prevention if best achieved through the modification of user behaviour, or the alteration of environmental and design hazards. This debate has substantially affected the way in which design and construction have been regulated. Ulria and Sven (1995) contend that regulatory bodies are often reluctant to address inadequacies in construction and design as “unintentional injuries occurring in the home are regarded as natural consequences of victims’ inappropriate behaviour . . . With this perspective, systematic preventative efforts are not perceived as relevant.” Pauls (1998) laments that the expectation of increased fall prevention through attempted user behaviour modification is flawed in that it requires a consistent and diligent behavioural change, which is impractical and unlikely to occur. Furthermore, Templer (1992) has shown that fault for stair accidents may not necessarily lie with the user as is often claimed, and that the occurrence of stair accidents is increased when certain conditions exist and there is logical proof as to why these conditions are dangerous.

### 4.2.1 Environmental factors

Haslam et al. (2001) designates environmental factors such as poor conditions of stair surfaces, objects on stairs, risers too high or too low, narrow goings, absent or poorly designed handrails, and poor lighting as a primary cause of stairway accidents, particularly among the "young elderly" (aged 65-74 years). This builds upon the position taken by Jackson and Cohen (1995) who hypothesised as a result of an investigation of forty stairway accidents and the stair safety literature that "the greatest problem with accident stairways is not the individual (i.e. user) or external variables, but dimensional inconsistency inherent in some stairways." Here, the authors emphasise that modification of existing home stairways and stricter regulation of the construction of new stairways is the most effective preventive measure, and most likely to lead to a reduction in falls and fall injuries. This thesis is reiterated by (Salter et al. 2006) who conclude that "home hazard reduction is effective if targeted at older people with a history of falls and mobility limitations", and by Tse (2005) who, upon reviewing the available literature regarding home and environmental modifications and falls prevention concluded that "there is some evidence to support the use of environmental modification as a strategy in multidisciplinary/ multifactorial programs targeted to those people with a history of falls."

### 4.2.2 Stair design

The dimensional inconsistency prevalent in the design of many stairs (particularly in private dwellings) has been the focus of much analysis and debate for quite some time. Templer et al. (1985) concluded that, based on the analysis of video footage of stair ascent and descent that the safest stairs would have a maximum 15.2 cm (6") rise and a minimum 27.9 cm (11") tread. Ward and Randall (1967) recommended a tread of 29.2 cm (11.5") for males and 26.7 cm (10.5") for females, and a rise of 17.8 cm (7") for both males and females from a physiological point of view. Irvine et al. (1990) suggested that the optimum rise was 18.3 cm (7.2") and the optimum tread was 27.9 – 30.5 cm (11-12"). According to Irvine, these dimensions were acceptable to both males and females, young and old, and subjects of different physique.

These findings were later reasserted by Nagata (1995) who found that in tests with mechanical stairs, subjects experienced the least difficulty around 30cm tread and 18cm rise and that there were no notable differences between young and elderly subjects. Therefore, a tread/rise combination with the lowest degree of difficulty for all groups can be found around a tread depth of 30cm and a rise of 18cm. Perceived difficulty increases gradually as the measurements deviate from this combination.

As a result of much lobbying, as reported by Pauls (2002), the committees responsible for the new United States *NFPA Building Code* accepted the widely agreed minimum standard described above, the so-called "7-11" stair step geometry in the autumn of 2001 and the standard was mainstreamed and applied to new one and two family dwellings in the U.S. This standard, which has been the U.S. national standard for building usability and accessibility (ANSI A117.1) for decades, now limits risers to a maximum height of 7 inches (178mm) and tread depths to a minimum of 11 inches (280mm), with each measured nosing to nosing (Pauls 2002).

The number of risers in a stairway has been shown to substantially effect the likelihood of an accident occurring. Templer (1992) found that the probability of an accident decreased when the stairways had more than 6 risers. Pauls (1984) affirms this and notes that a failure to notice a one or two riser stairway in a user's path is one of the leading causes of stair accidents.

### 4.2.3 Handrails

This problem is exacerbated by the lack of handrails in many short stairways with only a few risers. Handrails not only steady the stairway user and serve as a disruptive anchor during falls, but also act as important visual clues to indicate changes in elevation. (Templer 1992, Archea et al., 1979). In addition to this, Templer (1992) found that 70% of the accidents he examined occurred on the top or bottom three steps of a stairway. Nearly 60% of those cases occurred on either the last, or second last step.

According to Maki and Fernie, Barlett and Fernie (1985), the functional role of the handrail is to generate a stabilizing reaction force and moment on the body, and handrail height significantly influences the ability of the rail to generate these forces. Through a series of biomechanical tests involving subjects falling on a specially constructed mock stairway, Maki and Fernie demonstrated that a person falling is able to make contact with a handrail very quickly, within 0.5 seconds, and that once handrail contact is made it is nearly always maintained. Of 192 completed trials, there was only one instance where a subject was unable to maintain a grip on the handrail after it was established. Furthermore, subjects fell (defined as contacting the crash pad placed at the bottom of the stairs) in only 8% of valid tests when a handrail was present and in 54% of tests when a handrail was absent. (Maki and Fernie 1998) Through testing the responses of various age groups to handrail heights at three different stairway pitches (33, 41 and 49 degrees) Maki and Fernie ascertained that the most comfortable handrail height for both young and old was 0.91-0.92m, and that biomechanically the most effective height range across all age groups from 0.91m to 1.02 m.

The importance of proper handrail design and use is reiterated by Ishihara et al. (2002), who found that of 2,800 elderly respondents to a questionnaire concerning stair use, 34.2% reported being saved by a handrail when they nearly fell. The same investigation also found that handrails were particularly effective at preventing falls due to sub-standard illumination of stairwells, the effects of which are often exacerbated in the elderly by vision deterioration.

It is important to note that despite the strong evidence regarding the importance of handrails the Building Code does not require handrails for domestic houses.

### 4.2.4 Lighting

Lack of proper lighting in stairways has long been of concern. Carson et al. (1978) found that 95% of the residential stairways had illumination levels below 20 foot-candles, the minimum level recommended for stairways by the Illuminating Engineering Society.

### 4.2.5 Carpeting

The carpeting of stairways has been suggested as a possible means of reducing the severity of injuries resulting from stairway falls, and while thick carpet and underlay may provide some cushioning in the event of a fall, Pauls (1984) asserts that this is counterproductive and ultimately increases the misstep rate. The application of thick external materials such as carpet and padded underlay to stairs results in the loss of tread depth, which is critical to safe stair negotiation, and the use of these materials make the overstepping of a tread much more likely.

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# CHAPTER 5 FALLS FROM HEIGHTS

## 5.0 INTRODUCTION

The majority of falls resulting in injury are from heights of less than one metre. However, falls from heights greater than one metre constitute 9.9 percent of all falls. Of these, approximately 45 percent are sustained in the home environment. In Australia, most of the falls sustained in the home environment occur during leisure activities or work other than working for income. The injuries sustained range from "no detectable injury" to serious head injuries. Of particular concern are the 6.3 percent of fall injuries that involve intra-cranial injuries and the 2.3% with multiple injuries (Mathers 1999).

Although only 10 percent of fall injuries are from heights, these include the majority of severe injuries. Falls from ladders account for a large proportion of the injuries sustained from falls from heights, and internationally falls from ladders rank second only to stairway falls as the most common cause of injurious falls from elevation (Cohen and Lin 1991).

## 5.1 FALLS FROM LADDERS

Data for ladder fall injury, as reported by the Victorian Injury Surveillance Unit, shows that over a two year period (2002/3-2003/4 for hospital-treated injury), there were 5,004 hospital treated ladder injury cases in the state (Cassell and Clapperton 2006). In 2000-2002 in Victoria, for persons > 5 years, there were 106 unintentional deaths from falls > 1 metre, with 16 of these falls from ladders or scaffolds (Cassell and Clapperton 2006).

Injuries resulting from ladder falls are among the most common injuries sustained in both the home and the workplace, with most injuries arising from the need to use ladders for building access and maintenance. Various international studies have reported that between half and two thirds of all ladder fall injuries are not occupationally related (Björnstig and Johnsson 1992, Faergemann and Larsen 2000, Partridge et al. 1998, Faergemann and Larsen 2001), and Australian studies (Tsipouras et al. 2001, Cassell and Clapperton 2006) have recorded a substantially higher rate of nonoccupational injury of 78 percent and 70% respectively. According to Häkkinen (1998) 1-2 percent of occupational injuries in industrialised countries are related to ladders, approximately one of every 2000 persons belonging to the active working population will have a ladder accident while at work each year and some 70% of the serious ladder accidents occur during installation, maintenance and construction operations. Furthermore, among commonly available consumer products, access equipment such as ladders and scaffolding hold the highest level of risk of accidents (apart from electrical cutting equipment) and result in the longest mean duration of incapacity and the highest resultant medical costs following injury (Hayward 1996). According to Partridge et al. (1998), people injured in a nonoccupational setting are generally more likely to fall due to poor or inappropriate ladder placement based in a lack of training such as that received by those who use ladders in a work environment.

A Danish study characterized the injuries but not the factors contributing to non-occupational falls from ladders and scaffolds (Mathers, Vos et al. 199). Another Danish study reported on the mechanism and severity of ladder falls and found tipping or tilting of the ladder while the person on the ladder leant too far sideways, was the main cause of falling (Faergmann and Larsen 2001). Tsipouras' (2001) retrospective analysis of medical records was the first published Australian study that addressed falls from ladders. Data was collected by retrospective analysis of medical records between 1994 and 1997. Of the 163 falls identified, 78 percent were sustained in non-occupational settings and 43% involved ladder instability. Although the study identified a need for strategies to encourage safe ladder use, there were no recommendations for further research aimed at decreasing exposure to ladder use. Another Australian study by Driscoll et al. (2003) investigated fatal injuries resulting from unpaid work at home and found 83% of the deaths were males and that falls from inadequately braced ladders were among the most common causes.

Males account for the vast majority of fall from height injuries (primarily from ladders), in both the home and work environments. Various studies conducted in Australia and internationally have consistently shown that between 81-93% of those presenting to hospital emergency departments for ladder fall related injury are male (O'Sullivan et al. 2004, Tsipouras 2001, Partridge et al. 1998, Faergemann and Larsen 2001, Björnstig and Johnnson 1992, Cassell and Clapperton 2006). A similar consistency can be found among the mean ages of those injuries included in the above studies. O'Sullivan and Partridge both reported a mean age for those seeking treatment of 43 years, Björnstig's mean age was 42 years, and studies of ladder injuries in Australia by Tsipouras and Cassell reported the mean age of the injured as 48 and 47 years respectively. Faergemann and Larsen (2001), whose study specifically addressed nonoccupational ladder and scaffold injuries, found a mean age of 53 years among their subjects.

### 5.1.1 Prevention of ladder falls

An Irish study of the patterns and cost of ladder fall morbidity (O'Sullivan et al. 2004), stresses the importance of investment in preventative measures since the injuries resulting from these falls are expensive to health services. Future preventative strategies could include adequate training in the use of ladders, appropriate use of protective gear and maintenance of ladders in good condition. A UK study which assessed safety devices for leaning ladders (Department of Trade and Industry 1999) was instigated due to the high number of serious injuries involving the use of leaning ladders around the home. The study consisted of a market survey of leaning ladder 'safety' devices, a product appraisal and the role of consumer education and safety standards. Each ladder tested showed some problems and the authors suggest any information or education about ladder 'safety' devices should be linked very closely to general ladder safety. It was also suggested that a General Standard to cover all types of ladder 'safety' devices would be necessary to guide manufactures and consumers. Although over the past few decades the design of ladders has improved, safety instructions are still lacking for private use (Department of Trade and Industry 1999).

## 5.2 FALLS FROM HEIGHTS: NATURE OF INJURY

Extremity fractures are widely reported in the literature as the most common injury arising from falls from heights. However, the specifics of this common finding are quite varied. Some studies have documented the lower extremity as the most commonly injured anatomical region (Lindblad 1988, von Wolf 1989, both cited in O'Sullivan et al. 2004), while others have demonstrated an equal incidence of upper and lower extremity injuries (Muir 1993, Partridge 1998), and others still report the upper extremity as the most injured anatomical region (O'Sullivan et al. 2004).

## 5.3 FALLS FROM HEIGHTS IN DOMESTIC BUILDINGS: CIRCUMSTANCES OF INJURY

In 2005, MUARC completed an ecological study using a prospective case series of fifty people sustaining injuries attributable to falls from greater than one metre around domestic dwellings. In the absence of a pre-determined specific hypothesis regarding factors that contribute to falls around homes, an ecological study was deemed the most appropriate research design. Ninety percent of the fallers were males, with the majority of participants (70%) aged from 40-69 years. The most common building type where the fall occurred was the house (78%), followed by garage/carport (12%). The most common domestic activity at the time of the fall was cleaning (24%), with the roof and the spouting or gutter of the roof being most commonly involved.

The study found the most common distance fallen was 2 or 3 metres including 18 (36%) who fell 2 metres and 17 (34%) who fell 3 metres, with the majority, 28 (56%), landing on concrete. One respondent fell 5 metres. The self-reported height of the fall, from the position of the feet to the landing surface, varied between 0.2 and 7.0 m and the mean fall height was 2.0 m. Males fell, on average, from a significantly greater height than females (2.1 vs. 1.3 m, respectively; $p=.0005$).

The most common method of height attainment was a ladder (82%). A ladder was also the most common structure the respondents fell from (62%), followed by a roof (22%). Roof falls include slipping on wet tiles and falling through plastic sheeting.

Although studies characterizing falls from height around domestic buildings have been conducted, they often include both intentional and unintentional free-fall (Watson and Ozanne–Smith 1997; Mathers and Penm 1999; Mathers, Vos et al. 1999). The MUARC study of domestic falls from heights again reiterated the findings of the Australian and international studies outlined above, and found that 90 percent of the participants were male. The mean age for all respondents in this study was 51 years. By comparison a study of fatal work-related falls from roofs showed a lower mean age of 38.7 years for these victims (Saruda et al. 1995). O'Sullivan et al. (2004) also found the median age for work falls from ladders was 41.5 years.

## 5.4 AGEING

Accessing, and working from heights, becomes more dangerous with ageing due to reduced flexibility, mobility and reaction time, and poorer balance. The greater average age of those suffering fall from height injuries in domestic, non-work settings, indicates a likely increase in these injuries as the world population continues to age.

Australian government policy encourages older Australians to live independently at home for as long as possible. ABS data for 2002-03 show high rates of home ownership among older people (65 years and older), with outright ownership by far the most common tenure type. (ABS 2005). Maintaining their home, and the need to access heights that such maintenance requires, can place older persons at risk of injury (Ashby, Ozanne-Smith and Fox 2007).

## 5.5 PREVENTION OF FALLS FROM HEIGHTS IN DOMESTIC BUILDINGS

Where there is a current need to attain a height for domestic and maintenance tasks, the development of interventions such as gutter guards, hinged gutters, and ladder hooks built-in to the building fabric, and fall guards on roofs, warrant further investigation and potential investment.

The implementation of preventative measures as described above are of particular importance for older persons as performing domestic maintenance from heights becomes increasingly dangerous with age as a result of reduced mobility, flexibility and poorer balance and reaction time. This is evidenced by the fact that, in Australia, those aged between 45 and 74 years account for nearly two thirds of ladder fall injury and middle aged to elderly males account for over ninety percent of ladder fall deaths recently recorded in Victoria.

The increased use of registered well-trained trades' people is also a potential future direction, possibly through subsidized schemes for high risk groups such as older persons.

## 5.6 REMOVAL OF THE NEED TO ACCESS HEIGHTS

As Cassell and Clapperton (2006) point out, the lack of controls and preventative action on falls while working at height (usually from a ladder) in the home environment, where the majority of fatal and serious fall from height injuries occur, contrasts starkly with the strict work at height regulations recently introduced into Victorian workplaces. This lack of regulation in the home environment, coupled with the difficulties of attempting to regulate the frequency and manner in which heights are accessed for the purpose of domestic maintenance, means that removing or limiting the need to attain heights around homes may be the most effective alternative strategy for reducing the fall associated injury rate, severity and cost.

Over eighty percent of fall from height injuries included in Cassell's (2006) analysis of Australian hospital separations occurred in a home environment. As demonstrated by Ashby (2007), design solutions to reduce or prevent the need to access heights to while performing home maintenance should also be investigated and potentially regulated to protect the whole community and to provide protection over the lifetime of the design feature, particularly as the greater average age of those suffering fall from height injuries in domestic, non-work settings indicates a likely increase in these injuries as the world population continues to age.

## 5.7 CHILD FALLS FROM HEIGHT

### 5.7.1 Introduction

Falls are the leading cause of non-fatal child injury in both Australia and internationally. In Victoria, falls represent 41 percent of all child hospitalisations and 42% of child emergency department presentations, with 12% of these presentations being for falls from a height of one metre or more (Ashby and Corbo 2000). In the United States, Lavelle (1998) found that falls accounted for 55% of childhood injury overall. The annual direct health care cost of child falls in Australia has been estimated as greater than $130 million, and in the United States, where three million children require emergency department treatment for fall related injury each year (AAP 2001) and historically 4 percent of child deaths were attributed to falls (Bergner et al. 1971), the annual cost of these injuries in Australia is estimated at close to $1 billion (McClure et al. 2005).

## 5.7.2 Falls from height

### *5.7.2.1 High falls*

Falls from heights are generally regarded as those over one metre, and this is also the basis for the International Classification of Disease categorization of falls. Previous studies conducted both internationally and in Australia, show a high level of consistency regarding the gender breakdown among children sustaining serious injuries as a result of falls from heights. Injuries to male children are shown in the literature to outnumber those to female children by ratios of 1.5:1 to 2:1. (AAP 2001, Lehman 1993, Barker 2004, Bergner 1971, Benoit 2000, Musemeche 1991). In a thorough analysis of age and gender distribution and injury trends, the AAP (2001) found the age distribution of child high fall injuries to be bimodal; pre-school children usually fall from windows, and older boys fall from dangerous play areas, such as rooftops and fire escapes (AAP 2001).

There is also substantial agreement in the literature regarding the mean age of children injured as a result of a fall from height. Benoit et al. (2000) found 83% of all children injured in this way were less than or equal to 4 years of age, and the AAP found an average age of five years among children included in their study, as did Musemeche et al. (1991) and Balut et al. (2002). Although, in contrast to the above, Istre et al. (2003) and Bergener et al. (1971) have both found the mean age of injured children to be between two and three years, and the overall highest rate of paediatric injury to occur in children 0-4 years.

Morbidity from these injuries is significant, in Lehman's study (1993) two thirds of children experienced at least one fracture and more than 30 percent of the children were admitted to the intensive care unit. Istre et al. (2003) recorded a 40% admission rate.

Although Barlow et al. (2004) found no correlation between the age of the injured and the likelihood of survival, various studies (AAP 2001, Demetriades 2005) have shown that children younger than three years are much less likely to incur serious injuries than older children who fall the same distance. Furthermore, the AAP (2001) contends that because younger children have more fat and cartilage and less muscle mass than older children, their bodies are better able to dissipate the energy transferred by the fall. This contention is supported by the increased incidence of spinal injury resulting from falls among older children. Demetriades (2005) found that in children and young adults who experienced a fall, spinal injuries increased more than six times after the age of 15 years. In this study, age was a major factor in determining the incidence of spinal trauma. According to Demetriades, the anatomy of the paediatric spine provides much better protection during major deceleration injuries than in older victims. However, this pattern of injury could also be due to greater exposure to higher energy exchanges.

Most published studies on high falls have also found great consistency in regards to the distance fallen by injured children. Both Lallier et al. (1999) and Musemeche et al. (1991) found that precisely 78 percent of injured children fell from a height of two stories (approximately 20 feet) or less, Istre (2003) found that 75% of injured children fell from the second story, and Lehman (1993) and Benoit (2000) both found that over 70% of children injured by falls fell from this height. Bertocci's (2004) study on the impact of fall height and impact surface on the severity of injury reiterates the findings of several previous studies and asserts that since fall height influences free fall biomechanics it would therefore impact on injury risk. Stone et al. (2000) dispute this and found no correlation between fall height and severity of injury in a study of all recorded paediatric falls from windows in suburban/semi-rural Hamilton County, Ohio.

The most frequently incurred injuries to children from high falls are intracranial injury and fractures. In Barker's (2004) analysis of Queensland data greater than 57 percent of child injuries presenting to hospital following falls from windows and balconies resulted in intracranial injury, and in an eight year retrospective study of paediatric window falls, Beniot (2000) found that 66% of recorded injuries were to the head. According to Park (2004) falls account for more than 35% of the total number of child head injuries. However, Barlow et al. (1983) found fractures exceeded head injuries as the most common injury. Numerous studies (Barlow et al. 1983, AAP 2001) have found that children who fall from three or less stories have a much greater chance of survival. Barlow et al. (1983) found that all children who fell three stories or less survived, and that mortality increased exponentially to 50 percent at a fall from between the fifth and sixth floors. In this New York City based study, the majority of included falls were from high rise public housing and the overall mortality rate was 23 percent.

As shown by Bertocci et al. (2004), the surface onto which a child falls greatly impacts the level of morbidity and possible mortality. As most of the U.S. studies discussed above focus on high level child falls in urban environments such as New York City and Chicago, the most common impact surface is concrete, which results in a much greater incidence of both fractures and head injury. Surfaces such as grass and garden beds, more often found in suburban, semi-rural and rural environments, offer increased protection in the instance of a fall and the positioning of these materials below windows and balconies can greatly reduce the severity of injuries resultant from potential falls.

The seasonal distribution of child fall injury is described by Bergener (1971) as "the most striking epidemiological characteristic of this problem." The cases in his study of child falls in New York City were almost exclusively limited to the northern hemisphere's warmest months from the end of May to mid-September. Furthermore, he found that during the hottest months (June to August) child fall from height deaths account for 29% of the accidental deaths in ages 0-14 and 42% of the accidental deaths in the 0-4 age group. These findings were reiterated by Lehman and Schonfeld (1993) who found that even in the relatively milder climate of Ohio, only 9% of injuries of this kind occurred during the cooler months of December through to February.

Similarly, various studies display uniformity in terms of the most common times of day for paediatric fall injury to occur. Both Istre et al. (2003) and Lehman and Schonfled (1993) found that falls from windows and balconies are clustered around meal times. Istre found that 17% of falls occurred between 11am and 2pm, and 34% occurred between 4pm and 8pm, while Lehman found that 23% occurred between 11am and 2pm and 40% between 4pm and 8pm. The most likely reason for the concentration of incidents at these times is that the parent or supervising adult is distracted by meal preparation and consequently less attentive or less aware of dangerous behaviour.

#### *5.7.2.2 Balconies & Balustrades*

In Australia, where high density multi-level housing has historically been less prevalent than in the United States and Europe, the most common mechanism for children falling from height is a fall from the balcony of a two story single family dwelling. In a study of paediatric high falls in Queensland between 1998 and 2002, Barker (2004) found that falls from balconies accounted for nearly 72% of balcony and window falls from height, and that combined these two mechanisms accounted for over 8% of all child falls from over one metre resulting in emergency department presentation in Queensland. Furthermore, Barker found the peak age for balcony or window falls to be younger than that recorded internationally for all child falls from heights, at 12-36 months with the majority (40%) of falls occurring at age 12-24 months. These falls most often resulted in intracranial injury (52%), followed in frequency by fractures (18%) and superficial injuries (15%).

Istre et al. (2003) found that most balcony falls occur as a result of a child slipping between the balcony rails, rather than climbing over the top of the railing. This finding is supported by the AAP (2001) who state that “widely spaced rails are ineffective barriers because they permit a child’s body to slip through. Virtually all children younger than 6 years can slip through a 6 inch [15.2cm] opening, and none older than 1 year can pass through a 4 inch [10.2 cm] opening.” As a result of these findings all three regional building code organisations in the U.S. have now adopted the minimum four inch spacing requirement for horizontal balcony members, although these horizontal bars are potentially climbable and generally not be to recommended. The AAP has now sought to encourage all local building codes in the U.S. dealing with new construction to conform with the national codes that currently recommend 4 inch openings between vertical (not horizontal) bars.

According to Barker (2004), the U.S. emphasis on the horizontal dimensions of balcony railings neglects the issue of children climbing the railings and toppling over the top. The narrative text descriptions analysed in QISU’s Australian study indicated that the majority of children injured in balcony falls were climbing on a balustrade railing just prior to falling, and that adjacent structures (such as furniture) were often used to gain access to the top of the railing. (Barker 2004) The Victorian Injury Surveillance Unit has reiterated the prevalence of this hazard and has recommended that balustrades should be specifically designed to prevent climbing, with vertical rather than horizontal railings, and that their height should exceed the centre of gravity of the average adult (approximately 1100mm) (Ashby 2000).

The 2007 *Building Code of Australia* requires that a continuous balustrade must be provided alongside all horizontal walkways that are more than 1,000 mm above the level below. This specification has seen little revision since the first uniform *BCA* was introduced in 1988 and does not fully address the changing safety requirements brought about by the trend in Australia towards the construction of larger multi-level single family dwellings. Section 3.9.2.3 (e) of the *BCA* states that “for floors more than 4 m above the surface beneath, any horizontal elements within the balustrade or other barriers between 150 mm and 760 mm above the floor must not facilitate climbing” (BCA 2007). The code does not specify what should be done to prevent climbing and does not detail any minimum construction requirement beyond the above. Additionally, as is pointed out by Barker (2004), the only Australian Standard which refers specifically to balcony safety (AS 1170-2002) is concerned only with the load bearing facility of balcony structures and makes no mention of impeding the climbability of balustrades or of the spacing of balcony railings. There is no Australian Standard for high structures, such as balconies, that specifically addresses child safety. Although AS-4226 1994 recommends that barriers alongside any walkway more than one metre above the level below should be no less than 900mm and no more than 1,100 in height (Caruana 2006) and the *BCA* does specify limitations in the acceptable width of balustrade members for balconies more than one metre from the ground, the recommended limitations on the climbability of balustrade members only become applicable once a balcony is higher than four metres from the level below.

The *BCA* specifies that for balustrades on balconies greater than 1 metre off the ground, any members (vertical or horizontal) should not permit a 125mm sphere to pass between them. While this prevents children from slipping through balustrade members and falling, a horizontal gap of this size does little to discourage climbing. This problem is further exacerbated by design trends which favour the use of horizontal tension wires on the verandahs and balconies of modern homes. These wires, which are typically spaced 85 to 100mm apart, form an easily climbable ladder for toddlers, who are typically "top heavy" and have a tendency to topple head first once on top of a railing (Barker 2004).

While most building codes, both in Australia and internationally, require a maximum gap between horizontal balcony railings, a great deal of older housing stock is not subject to these regulations. For example, in Istre's (2003) study of child balcony falls, none of the inspected railings at fall sites met the regulatory requirement of a maximum gap of four inches (10 cm), and the mean distance between railings was 7.5 inches (19 cm).

#### *5.7.2.3 Verandahs*

The *BCA 2007* defines a verandah as "a permanent, roofed projection from a building, designed to be walked, stood or sat on" (BCA 2007). Currently, the BCA does not require railings or balustrades to be present for a verandah of less than one metre in height. The Code states that "a continuous balustrade or other barrier must be provided along the side of any roof to which public access is provided, any stairway or ramp, any floor, corridor, hallway, balcony, verandah, mezzanine, access bridge or the like and along the side path of any access to a building , if – (i) it is not bounded by a wall; and (ii) its level above the surface, is more than – (A) 4 m where it is possible for person to fall through a openable window, or (B) 1 m in any other case"(BCA 2007)

Despite this provision in the BCA, a large proportion of verandahs in Australian houses have been shown to have either no railings, railings of an insufficient height to prevent falls or easily climbable gaps between members. In a longitudinal cohort study involving 871 families and family homes, Turner et al. (2006) found that 37% of homes across all socio-economic status' had balconies or verandahs above the ground with balustrades less than one metre high, and 48% of vertical balustrades had less than 100mm between vertical rails (Turner et al. 2006).

Furthermore, this minimum height at which a balustrade must be provisioned appears to have been relaxed from previous editions of the BCA, where a balustrade or railing was required at a height of 600mm.

As falls are classified as low or high level for triage purposes, a low-level fall code often dictates less urgency from hospital staff than a fall coded as high-level. This classification scheme has important implications, particularly for pediatric emergency care (Wang et al. 2001). It is currently difficult to ascertain the extent and severity of verandah fall injuries due to this vague nature of emergency department coding. However, In 2006 ICD-10-AM external cause codes were expanded to include the cause "Fall from, out of or through building or structure" with the specific sub-cause "Fall from or through balcony or verandah" (NISU 2006). This expansion of the generic fall code will allow for greater specificity in the future identification of the nature and location of injurious falls.

Due to the abovementioned current data constraints, it is difficult to ascertain the exact frequency of hospital presentation and admission for verandah falls in Australia. MUARC conducted an analysis of Victorian Emergency Minimum Dataset presentation text narratives between 2001 and 2006. This analysis reveals a total of 948 narratives where a fall from a verandah, patio, porch or household decking was specifically mentioned in the text description. Unlike other fall related injury, these falls do not see a substantial increase in frequency with advanced age and also unlike other fall injury categories such as falls from stairs and falls in the home, females do not constitute a large majority of verandah falls. This is likely an indication that the intrinsic health status of the injured person is not a primary determinant of the likelihood of injury. Intracranial injuries and lower limb fractures dominate among these injuries and the overall incidence of verandahs, porches, deckings and patios recorded in VEMD text narrative descriptions has increased by over eighty three percent over the five years included in this analysis. Additionally, sixty four percent of these verandah injuries are coded as falls from a height of less than one metre above ground level.

According to Hellinget al. (1999), low falls can cause significant injuries, particularly and most commonly to the head and spine. Additionally, there is a danger that patients injured in low falls might not be taken to hospital based on the mechanism of injury alone. It has been shown that many low fall patients sustain serious multisystem injuries, even though they are initially stable (Helling et al. 1999) and intracranial injury has been demonstrated as a major source of fall-related death in children and has been shown to be sustained with equal frequency from low-and high-level falls among child populations (Kim et al. 2000). Similarly, in a study of head injury from both low and high-level falls in pre-school children, Park, Cho and Oh (2004) identified sixty-eight cases among which falls accounted for 35.2% of head injuries. There were more boys than girls, and more low-level falls than high-level falls, particularly in the age group 0-3 years. Although more common in high level falls, significant intracranial injuries were also sustained from low-level falls. Calvarial fractures were the most frequent type of head injury and were more common in low level falls than high level falls (Park, Cho and Oh 2004).

Although intracranial injury accounts for the majority of deaths from both high and low level falls, Wang et al. (2001) found that children who suffered low-level falls were at similar risk for intracranial and abdominal injuries compared with those who fell from greater heights. This finding is supported by Murray et al. (2000) who found that “skull fractures were the most frequent injury and were associated with an increase in intracranial injuries in both subgroups. In conclusion low-level falls are associated with significant intracranial injuries. The evaluation of patients sustaining low-level falls should not be limited on the basis of the height of the fall.” (Murray et al. 2000)

The adequacy of current standards, codes and regulations that govern the design and installation of verandah balustrades are deserving of attention in future reviews of the BCA. Of particular concern is the current BCA regulation that verandahs of less than one metre in height do not require a railing or balustrade. As shown above, falls from a height of less than one metre (as are the majority of verandah falls in Australia) can have severe injury consequences and are easily preventable through the provision of non-climbable barriers of a sufficient height.

### *5.7 2.4 Windows*

Istre et al. (2003) in the United States, found that 59 percent of child falls from windows were from bedroom windows and 41% occurred from windows in living rooms. Surprisingly, most falls were from low lying windows within two feet of the floor and not from climbed furniture out of higher windows as was expected. In 76 percent of window fall cases in Istre’s study, a screen was present but detached or broke as the child fell, and in none of the cases was a window guard installed.

There is a great deal of contention regarding the effectiveness of using window screens and guards for the purpose of fall prevention. Most window screens, although easily removable to allow for egress during fires, do not provide a sufficient barrier to prevent falls. Security devices such as fixed window bars, designed to keep intruders out, can also greatly hinder egress or access by fire-fighters in an emergency. The AAP recommends the use of operable guards for windows that can be released or removed without the need for a key or the use of excessive force. Examples of the novel designs of the guards recommended by the AAP include built in bars that appear automatically as the window is raised, guards on a hinge that swing when a pin is released, and a slide out model that requires the simultaneous depression of two pins for removal (AAP 2001).

The "Children Can't Fly" program, initiated by the New York City Department of Health in 1972, after a four year study of child mortality demonstrated that falls from heights represented 12 percent of all accidental deaths in children under 15 in NYC (Barlow et al. 1983). The success of the program, which resulted in the NYC Board of Health amending the Health Code to stipulate that all landlords must provide window guards in apartments where children 10 years old and younger live, was the first of its kind in the U.S. and resulted in a citywide 96 percent decrease in accidental falls through windows from 1972 to 1979, the year in which all landlords were required to fully comply with the window guard regulations (Barlow et al. 1983). There were four basic components of the study and subsequent public campaign:

1) Reporting of falls by hospital emergency rooms and police precincts, followed up by counselling, referral, and data collecting by public health nurses;

2) A media campaign to inform the public and elevate their awareness of the hazards;

3) Community education for prevention through door-to-door hazard identification, counselling by outreach workers, community organisation efforts with schools, tenant groups, clinics, churches, health care providers etc;

4) Provision of free, easily installed window guards to families with young children living in high-risk areas.

In total, more than 16,000 free window guards were provided to approximately 4,200 families each year of the program, with distribution guided by the incidence of reported falls of the previous year, and modified by a weekly reassessment based on the most current evidence of falls in health district areas (Spiegel and Lindaman 1977). Particular emphasis was placed on the city's public housing, which previously accounted for approximately 90% of falls in NYC although it did not make up 90 percent of housing stock. This highlights the association between the incidence of falls and environmental factors such as aging and deteriorating housing (Spiegel and Lindaman 1977). Over thirty years after the introduction of the "Children Can't Fly" program and twenty five years after mandatory compliance, despite having over four times the national average of the population residing in multifamily dwellings with ten or more units, the incidence of injury resulting from falls in buildings in NYC is nearly half that of the U.S. average. (Pressley and Barlow 2005). The success of the "Children Can't Fly" program demonstrates that the most effective approach to reducing these types of injuries is a wide ranging program of physical removal and alteration of hazardous conditions coupled with an extensive community education and awareness campaign.

The American Academy of Pediatrics (AAP 2001) has made several recommendations based on the success of the “Children Can’t Fly” program that would significantly reduce the incidence of children falling from windows, particularly in high density, high rise dwellings. These recommendations include the installation of locks on windows not intended for egress to prevent sliding windows from opening more than 4 inches, opening double hung windows from the top only and the installation of operable window guards on second and higher storey windows (provided such guards comply with local fire regulations.) In addition to reiterating the AAP’s statement on the importance of window guards, Lallier et al. (1999) emphasize the importance of actively involving the medical profession in the development of parental and community education strategies.

The success of regulatory or legislative intervention in reducing child fall from height injuries, coupled with increased community and parental awareness, is demonstrated by the success of the above study and its resulting prevention program. Regulatory and design intervention to remove or limit the possibility of children gaining access to potentially dangerous building features such as unguarded windows or balconies with insufficiently preventative railings or balustrades is most likely to have a lasting, positive impact in reducing the contribution of these particular building features to paediatric fall injury.

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# CHAPTER 6 FALLS IN OLDER PERSONS IN RESIDENTIAL AGED CARE FACILITIES AND HOSPITALS

## 6.1 INTRODUCTION

This section reviews the risk factors for falls in older persons in general and for older persons in residential aged care facilities and acute hospitals. The epidemiology of falls and falls related injury is discussed.

### 6.1.1 Risk factors for falls in older persons

Risk factors associated with falls are frequently divided into intrinsic and extrinsic risk factors (National Ageing Research Institute 2004). Intrinsic factors are those that 'relate to the individual's health and functional status and physical characteristics' whereas extrinsic factors 'relate to an older person's interaction with the environment' (National Ageing Research Institute 2004).

The major intrinsic risk factors for one or more falls or injurious falls among community dwelling older persons are:

- increased aged;
- past history of falls;
- chronic medical conditions such as stroke and Parkinson's disease; multiple medication, and specific medication types such as long acting benzodiazepines and psychotropic medication;
- impaired balance and mobility;
- reduced muscle strength;
- sensory problems, including impaired visual acuity and depth perception, and peripheral neuropathy;
- dizziness;
- impaired cognition;
- depression;
- low levels if physical activity;
- low body mass index and osteoporosis (predictors of fracture risk)
- fear of falling; and
- female gender'
  (National Ageing Research Institute 2004, p.6).

## 6.2 FALLS AND FALL RELATED INJURY IN RESIDENTIAL AGED CARE FACILITIES

### 6.2.1 Incidence of falls in aged care facilities

Older persons living in residential aged care facilities have been found to fall more frequently than older persons living in community dwellings (Luukinen et al. 1994). Falls incidence in residential care populations in Sweden were reported at 1.8 falls per resident per year (Sadigh et al. 2004), with others reporting 1.5 falls per bed per year (Rubenstein 1994). Fall rates have been found to vary with different types of residential care and patient mixes, with higher rates of falls found in dementia units than those in aged care and senior citizen units (Jensen et al. 2002). Jensen et al. (2002) found a fall rate of persons living in a dementia unit to be twice that of people living in a senior citizen's apartment or a residential aged care facility.

### 6.2.2 How many people living in residential aged care facilities in Australia?

In June 2006, there were 166,291 Australians living in residential aged care facilities (Australian Institute of Health and Welfare 2007), an increase from the 161,765 persons in June 2005 (Australian Institute of Health and Welfare 2006). There were 85.6 residential care places per 1000 people over the aged 70 and over in 2006. This equates to 8.67 precent of the Australian population aged 70 years or over.

Higher aged groups have the highest use of residential aged care facilities with those over 85 years of age having the highest rate of 237 persons per 1000 (Australian Institute of Health and Welfare 2006), decreasing to 33.3 per 1000 with the 75-79 years age group. In June 2006, 51.6 percent of the Australian residential aged care population were aged 85 years and over, with 95.6% aged 65 years and over (Australian Institute of Health and Welfare 2006).

Women make up 72 percent of the residential aged care population, with 58% of the female population aged 85 years and over compared with 38% of male residents (Australian Institute of Health and Welfare 2006). Residential aged care facilities refers to what were previously described by the Commonwealth Department of Health and Ageing as nursing homes and aged care hostels (Australian Institute of Health and Welfare 2006).

### 6.2.3 Fall related injury in residential aged care facilities

Two to four percent of falls in residential aged care facilities have been found to result in a fracture (Rubenstein et al. 1994; Sadigh et al. 2004), with about 11 percent of falls found to result in soft- tissue injury, severe lacerations or head trauma (Rubenstein et al. 1994).

The frequency of hip fractures in older persons in residential institutions has been noted to be high in relation to the proportion of the population living in these settings (Kreisfeld and Newson 2006). In 2002-2003, 954 (22 %) males and 3,453 (27%) females aged 65 years and over fractured their hips in a residential care institution (Kreisfeld and Newson 2006). As of June 2004 there were about 5 percent of the population aged 65 years and over residing in aged care facilities (Kreisfeld and Newson 2006).

### 6.2.4 Risk factors associated with residential aged care falls

Intrinsic risk factors for falls in older persons in residential care include: increased age; acute health status, previous history of falls, wandering behaviour, cognitive impairment, maximal drop in post prandial systolic blood pressure, deterioration in activities of daily living performance, reduced lower extremity strength or balance, unsteady gait, independent transfers, use of antidepressant medication and polypharmacy, impaired vision and diabetes mellitus (National Ageing Research Institute 2004).

Extrinsic risk factors for falls in residential care include: relocation between settings and environmental hazards (National Ageing Research Institute 2004).

Research in 1994 suggested that falls in older persons living in residential care facilities are more likely to be caused by intrinsic factors than environmental factors, than falls in community dwelling older persons (Rubenstein et al. 1994). This is due to the frail nature of persons residing in nursing homes. However, this research does not appear to take into account the environmental factors with which energy is actually exchanged to cause the injury.

Most falls that occur in residential aged care facilities are not witnessed (Murray et al. 2007). Activities commonly being undertaken when falls occur include going to the toilet and rising up from sitting, or walking on a flat surface (Jensen et al. 2002). Going to the toilet was the activity found to be associated with 54 percent of falls at night and 19% of falls during the day (Jensen et al. 2002).

Most falls that occur in residential aged care occur in bedrooms (Sadigh, Reimers et al. 2004).

## 6.3 FALLS IN HOSPITALS

### 6.3.1 Introduction

Adverse events in hospital are a major concern for the health system. Large amounts of resources both financial and human are devoted to the consequences of adverse events, which could be used in other areas of health care. Poor patient outcomes and decreases in the quality of life may occur as a consequence of adverse events (Insight Economics Deloitte 2007).

Except for routine reporting of adverse events, such as falls reported in the ICD system, in Australia there is currently no national aggregation of hospital incident reports, although a number of Australian states do collect state-wide incident information (South Australia, New South Wales and Western Australia) (personal communication, Centre of Research Excellence in Patient Safety 2007). In contrast, the UK does have an aggregated hospital incident reporting system. A recent report from the UK Patient Safety Observatory titled “Slips, trips and falls in hospitals’ examined over 200,000 incident reports relating to inpatient falls from September 2005 to August 2006 (National Patient Safety Agency, 2007). Inpatient falls were the most common type of safety incident reported to authorities and made up two-fifths of all patient safety incidents (National Patient Safety Agency 2007).

The report found an average of 4.8 falls for every 1000 hospital bed days (National Patient Safety Agency, 2007). This is the equivalent of 1,260 falls in an 800 acute bed hospital. Other studies have found rates of between 5 falls per 1000 bed days on general wards and up to 18 falls per 1000 bed days in specialist units with vulnerable patients (Oliver, 2006).

In the UK study, falls were directly responsible for 26 patient deaths, 530 hip fractures and about 1000 fractures (National Patient Safety Agency, 2007).

### 6.3.2 What proportion of falls in hospital resulted in injury?

Falls in hospitals that cause hip fractures are relatively common. A recent Danish study investigating 600 hip fractures found that 7.3 percent occurred in hospital (Foss and Kehlet 2005). Elderly patients who fracture their hips in hospitals have poorer outcomes than those who fracture their hip in the community (Murray et al. 2007). It is hypothesised that although community and hospital dwelling persons who fracture their hips have similar co-morbidities, the preoperative health status of persons who fracture their hips in hospitals is poorer than those who sustain their fracture in the community (Murray et al. 2007).

### 6.3.3 Risk factors for falls in hospitals

***6.3.3.1 Intrinsic risk factors*** for falling in a hospital setting include impaired mental status, impaired mobility; history of falls; prescribed medications; special toileting needs; and advanced age (Evans et al. 2001).

Age has been found to be closely correlated with the risk of falling, with older patients falling more frequently than younger patients (National Patient Safety Agency, 2007). This is an important risk factor relevant to hospital patient populations, as older people are bigger users of hospitals than younger persons. On the night of the 30th June 2004, 53 percent (29,000) of persons who were inpatients in Australian hospitals were aged 65 years and over (Karmel et al. 2007).

Male inpatients were found to fall more frequently than female inpatients (National Patient Safety Agency, 2007).

***6.3.3.2 Extrinsic risk factors*** associated with falling in a hospital setting include hospitalisation for greater than 19 days, environmental factors (including ward positions and hazards), time of day, restraints and drugs (Mitchell and Jones 1996; National Ageing Research Institute 2004).

Questions remain unanswered about whether the following components contribute to falls and fractures: bed heights, side of bed where mobility and transfer aids placed, clutter in ambulation pathways, number of turns required during walk (Murray et al. 2007). Knowledge on circumstances of injuries could allow for targeting of fracture prevention strategies (Murray et al. 2007). Murray has suggested that further research into the circumstances leading to fractures may inform future ergonomic strategies.

### 6.3.4 Were the falls witnessed?

Murray et al. (2007) reported that a major limitation of studies attempting to examine fracture injuries related to falls in hospitals and residential aged care facilities are that few are witnessed and elderly people have trouble recalling the circumstances of their fall (Cummings, Nevitt et al. 1988). Only five percent of falls in hospitals in the UK were reported to be witnessed by staff (National Patient Safety Agency 2007). Of 43 hospital acquired hip fractures in persons aged 75 years or older in public hospitals in the Illawarra district of New South Wales, only 12 percent of the falls were witnessed (Murray et al. 2007). Over fifty four percent of the bedroom falls in an older persons assessment, treatment and rehabilitation unit were unwitnessed (Hanger et al. 1999).

### 6.3.5 Where are older persons falling in hospitals?

One small Australian study examined the location of where fall related hip fractures in persons over the age of 75 years were sustained in acute care public hospitals. The main areas identified were: 58 percent of fractures occurred in bedrooms, 20% occurred in the lounge or corridor and 16% occurred in the bathroom or toilets (Murray et al. 2007).

#### *6.3.5.1 Falls associated with beds in acute hospitals*

In hospital most patients' falls occur either from or near the patient's bed. Other common places inpatients fall are in the corridor, bathroom and the toilet (Joanna Briggs Institute for Evidence Based Nursing 2007). In an analysis of 792 falls occurring in an older persons assessment, treatment and rehabilitation unit, 65.9 percent of falls occurred in the bedroom with 80.1% of these falls occurring around the bed (Hanger, Ball et al. 1999).

A UK report estimated 43 631 falls from beds in acute and community hospitals and mental health units in 2005-06 (National Patient Safety Agency, 2007). Over five percent of hip fractures for all age groups recorded a fall from bed as the mechanism of injury in Australia in the year 2002-2003 (Kreisfeld and Newson, 2006). Most of the persons who sustained hip fractures with falls from beds recorded as the mechanism of injury were aged 65 years and over (Kreisfeld and Newson, 2006).

### 6.3.6 Time of day of falls in hospitals

Fifty eight percent of hospital acquired hip fractures in a recent NSW study occurred between 2100 and 0600, with 42 percent of fractures between 0600 to 2100 (Murray, Cameron et al. 2007). Most of the falls in an older persons assessment, treatment and rehabilitation unit occurred between 6 pm and 10 am (Hanger, Ball et al. 1999).

In the NSW study 76 percent of the falls that occurred in the bedrooms occurred at night. The study found that the fractures in elderly people are likely to occur in a bedroom at night, when the patient is attempting to go to the toilet unsupervised (Murray et al. 2007).

The time of day persons fall in acute and residential care is different to the findings for older community dwelling persons in which 70 percent of falls were found to have occurred between 0700 and 2000 hours, with only 9% occurring between 2400 and 0500 (Tinetti et al. 1995).

### 6.3.7 Cause of the fall

Over forty percent of falls in an older persons' assessment, treatment and rehabilitation unit appeared to be a slip (Hanger et al. 1999). About 5 percent of the over 200,000 falls reported on by the National Patient safety Agency in 2007 recorded environmental factors as contributing to the fall (National Patient Safety Agency 2007). One percent of reports nominated wet floors as having contributed to the fall. In these circumstances the floor was usually wet due to the patient's urine (National Patient Safety Agency 2007).

### 6.3.8 Environmental aspects related to falls in the hospital environment

Many aspects of the hospital environment have been postulated as having an impact on the risk of falls or injury.

These include:

- Floor surface, unevenness, how slippery when wet or dry
- Flooring density, including how soft or hard a surface is to land on
- Flooring pattern as this can create and illusion of slope or steps to impaired eyesight
- Lighting, including poor lighting and sudden changes from dim to bright light and the position of light switches
- The design of doors, handrails, toilets and bathrooms
- The line of sight for staff observing patients
- Trip hazards including steps, clutter and cables
- Furniture and medical devices, including beds, trolleys, mattresses, chairs, commodes and wheelchairs.

(National Patient Safety Agency, 2007)

## 6.4 BEDS AND BEDRAILS

### 6.4.1 Beds

#### *6.4.1.1 Hi-low beds*

It has been hypothesized that the difference in heights between staff-working beds, hospital beds in the lowest positions and home beds may be a cause of hospital falls in older persons in hospital (Tzeng and Yin 2006). The height of hospital beds in 'staff-working heights' were found to be about 5-18cm cm higher than home beds. Tzeng and Yin (2006) have suggested that not only may high hospital beds cause falls, but that patients falling from high beds may sustain more serious injuries than those falling from a bed at a lower height. The study recommended nurses maintain hi-low beds at the lower height setting when not attending to patients and that more studies are undertaken in this area.

#### *6.4.1.2 Side rail use*

Bed rails otherwise known as cot sides, side rails and safety sides have been used for many years in health care and residential aged care facilities to prevent people falling from beds (Medicines and Healthcare Products Regulatory Agency 2006). Bedrails have not only been used for safety reasons but also as a method of restraint (Joanna Briggs Institute for Evidence Based Nursing 2007). The safety of these devices has now been questioned as bedrails have been involved with a number of adverse patient events. The effectiveness of the bedrails in preventing falls has also been questioned due to a lack of evidence.

The risk of patient entrapment and death due to bed rail use has been highlighted by a number of international safety authorities in recent years (Joint Commission on the

Accreditation of Healthcare Organizations 2006; Medicines and Healthcare Products Regulatory Agency 2006; U.S. Drug and Food Administration 2006) (Hospital Bed Safety Working Group 2004; Medicines and Healthcare Products Regulatory Agency 2004).

There has not been a randomised trial of bed rail use (O'Keefe 2004) and the literature does not provide evidence of the benefits of bedrail use (O'Keefe 2004).

One study investigating whether decreased bed rail use reduced falls in an older persons assessment, treatment and rehabilitation unit found there was no reduction in fall rates with reduced bedrail use, but there was a reduction in serious injuries especially head injuries associated with falls (Hanger et al. 1999). Other studies have shown no increase in the severity of injury with raised bedrails, but this may have been due to a small sample size of those falling with elevated bedrails (van Leeuwen 2001).

There is a lack of evidence about the effectiveness of bedrail use in stopping falls and about which patients will benefit from the use of bedrails (Joanna Briggs Institute for Evidence Based Nursing 2007). Bedrails do not provide complete protection against falls from beds with one Australian study observing 60 percent of the patients who fell from bed, occurred from beds where the bedrails were up (van Leeuwen 2001). The Joanna Briggs Institute has made no recommendations about the use of bedrails to prevent patients falling due to a lack of evidence on the efficacy of bed rail use (Joanna Briggs Institute for Evidence Based Nursing 2007).

#### *6.4.1.3 Methods used to prevent patient falls and fall related injury when bed rail use is reduced*

The use of floor mats placed beside beds is advocated by some bed safety interventions programs to decrease the likelihood of injury when a patient falls from a bed (Hoffman et al. 2003). The mats are not used by some institutions as they are perceived as a tripping risk to staff and patients.

Force attenuating flooring would not only decrease the risk of fall related injuries on falling, but could also reduce the tripping risk posed by mats placed beside beds.

## 6.5 FOOTWEAR

Inappropriate footwear is a known risk factor for falls. The National Ageing Research Institute (2004) suggests that footwear in hospitals is often inadequate although there is very little published literature on the topic, with one study in sub-acute care identifying 86% of patients with inadequate footwear, with over half wearing slippers (Hill et al. 2002). Conditions of the feet such as foot pain, nail pathology and sensory impairment (for example peripheral neuropathy) also may have in impact on falls risk. No randomised control trials have been conducted evaluating footwear or foot care although one pre-post study did identify reduced falls with the introduction of treaded socks in an aged care residential facility, especially when urinary incontinence was present (National Ageing Research Institute 2004). Future research on interventions to address issues in this area is recommended by the National Ageing Research Institute (2004).

## 6.6 MENTAL STATUS

Impaired cognitive status (acute or premorbid), especially confusion and impaired orientation has been found to be an intrinsic risk factors for falls in older persons in hospital (National Ageing Research Institute 2004). For example, a high proportion of the patients who fell over elevated bedrails were judged to be 'not rational' prior to falling (van Leeuwen 2001). Although many of the older persons hospitalised and living in residential aged care facilities have cognitive impairments, such as dementia, there is little evidence on the effectiveness of interventions to reduce the number of falls and injuries in persons with cognitive impairment in acute care and residential settings (Oliver et al. 2006).

## 6.7 CONTINENCE AND TOILETING

Incontinence and toileting have been suggested in the literature as factors associated with an increased risk of falling amongst older persons in hospital (National Ageing Research Institute 2004). Factors that may increase the risk of falling include: urinary frequency, urgency, and decreased mobility and balance when hurrying to the toilet and preparing for toileting (National Ageing Research Institute 2004). One study providing a toileting intervention for 'high risk' patients revealed significantly fewer falls in the 'at risk' group who were provided with a regular toileting intervention than those who were not provided with the intervention (Bakarich et al. 1997). The National Ageing Research Institute recommends that further investigation into toileting interventions to prevent falls in hospitalised older persons is undertaken.

## 6.8 GAPS IN EVIDENCE

It is possible that health care providers are using injury prevention interventions of uncertain effectiveness (Oliver et al. 2006). If this is the case falls may be costing health care providers in two ways: the cost of injury related falls and the opportunity and financial cost of implementing possibly ineffective interventions.

Gaps in the evidence for interventions for which future research is recommended include the effect of falls and fall related injury of changes or differences in the physical environment of hospitals, medication reviews and the use of alarms (Oliver et al. 2006).

Environmental audits and risk assessments have been suggested as important for identifying risk factors less likely to be seen in incident reports of falls in acute institutions such as spaces between beds, walking routes to toilets, lighting and grab rails (National Patient Safety Agency, 2007).

Like many other areas of public health there is much literature on the magnitude of the public health problem and few high quality reports and studies on the effectiveness of interventions to solve the problem (Lyratzopoulos and Harvey 2006).

Over a decade ago, the main devices that were used as interventions in falls prevention in the older residential care populations were physical restraints and bed rails (Capezuti 2004). As a result of changes in nursing practice and research evidence, interventions now concentrate on non-restraint and the least restrictive methods of falls prevention interventions in order to maintain mobility and dignity, and to prevent frailty in older persons (Capezuti 2004).

With falls intervention programs concentrating on falls reduction, and a realisation that some falls are inevitable in the inpatient and residential environment, it seems clear that is a focus on fall injury reduction is now also required.

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# CHAPTER 7 SLIPPING AND SLIP RESISTANCE

## 7.1 OVERVIEW

Slipping is recorded in injury data as one of the primary causes of falls (Manning 1988, Bentley 1998) and has been estimated to account for approximately 62% of underfoot accidents (Burnfield and Powers 2006). Victorian data shows that for the year 2002/2003 same level falls accounted for half of falls admissions and three-quarters of Emergency Department presentations, and that of the 4,140 same level falls coded to slips, trips and stumble admissions, slips (falls due to slipping on contaminated or polished surfaces) accounted for 42% (n=1200)(Gunatilaka, Clapperton and Cassell 2005). Slips, and the varying slip resistance of different flooring surfaces and other extrinsic factors also play a prominent role in workplace injury. According to the US National Health Interview Survey questionnaire, conducted in 1997, a clear majority of 64% of the work-related falls could be attributed to slipping, tripping or stumbling (Cham and Redfern 2002), and public liability claims show that at least 86% of falls have extrinsic causes that are preventable, with the risks being similar whether at home, at work or in public areas (Bowman, 2000).

## 7.2 HUMAN GAIT & COEFFICIENT OF FRICTION

The relationship between human gait and the incidence of slips and falls has been extensively investigated by Strandberg and Lanshammar (1981), Lanshammar and Strandberg (1983), Perkins and Wilson (1983), Leamon (1988), Leamon and Li (1990), and Myung et al. (1997). The findings of the above studies led to the accepted conclusion that a higher friction could potentially improve slip resistance and therefore reduce the incidence of such slips and falls (Chang 1998, 2001).

During walking, a slip usually occurs when an individual's utilized coefficient of friction (COFu) (also referred to as 'required' coefficient of friction) is greater than the available friction of the foot-floor interface (Burnfield and Powers 2006). Australian/New Zealand Standards define the coefficient of friction as "the ratio of the tangential force required to move a body across a horizontal surface to the vertical load imposed on the surface by the body." (AS 4663 and 4586) Although ground reaction forces at the shoe-floor interface have been extensively studied and are widely recognized as the most critical biomechanical factor in slips (Redfern and Cham 2001), according to Cham (2002), the interaction of human and environmental factors extends beyond the foot-floor interface to the effect of the frictional requirements of various tasks being performed, such as the pushing, pulling and carrying of loads. Therefore, Cham asserts, these factors should also be taken into consideration when determining whether an environment is 'slip-safe'.

## 7.3 TRIBOMETERS & RESISTANCE TESTING

The slip resistance of flooring surfaces is usually measured through the use of a tribometer. Upwards of 50 different portable tribometers have been described in the literature and, in general, the primary purpose of these devices is to measure the dynamic friction (reflected by the force required to keep a sliding object in motion) or static friction (reflected by the force required to initiate motion between an object and the surface on which it is resting) of a surface (Burnfield and Powers 2006). As highlighted by Beschorner et al.(2007), these devices are inherently limited in that testing conditions cannot entirely recreate the impact of the many extrinsic factors such as loading rate, timing, normal force, speed and shoe angle that contribute to, and influence COF measurements and thus also influence the severity of a slipping incident.

An additional shortcoming of the tribometer frequently outlined in the literature is that it fails to properly account for the changes in gait that often result from human perception or anticipation of increased floor surface slipperiness. As Cham and Redfern (2002) have observed, “one of the challenges of biomechanical studies is reproducing the unexpected nature of real-life slipping accidents.” Anticipation of slippery surfaces can lead to significant changes in lower extremity joint moments, a reflection of overall muscle reactions, and substantially alter the outcome of a potential slip incident. Cham and Redfern (2002) found that trials conducted when test subjects were aware a floor’s surface had been lubricated prior to testing produced peak required coefficient of friction (RCOF peak) values that were on average 16-33% lower than those collected during baseline (dry) trials, which substantially reduced slip potential. Even though subjects were asked to walk as normally as possible, this study suggests that significant gait changes are made when there is a potential risk of slipping. Furthermore, Gronqvist (1995) concluded that slip resistance varies considerably according to contact pressure during the normal gait cycle and therefore, average friction readings (such as those given by a tribometer) cannot be relied on to give a decisive measurement of slip resistance. He suggests that an instantaneous coefficient of friction reading may be more relevant, as the time available to achieve a coefficient of friction sufficient to avoid a slip when walking is only a few tenths of a second.

In a later study, Gronqvist (2003) concluded that the results of extensive tribometer tests implied that a minimum friction coefficient of 0.25 was required to prevent a fall on wet floor surfaces, and a minimum measurement to prevent a slip (which may result in a fall) was in the range of 0.30-0.35. However, he also found that a more accurate control of the normal force during testing is needed for actual field use of the test method. (Gronqvist 2003)

## 7.4 BUILDING CODES & STANDARDS

Throughout his extensive writing on matters concerning the measurement and improvement of the slip resistance of flooring surfaces, which he defines as “that property of a surface which denotes its ability to withstand or give protection against a slip.” Bowman (1996) has asserted that there is an inherent risk in relying upon a single slip resistance result to provide an indication of the slip resistance characteristics of a flooring material. He also warns against the importance that researchers and manufacturers alike place on coefficient of friction measurements, stating that successful slip resistance “is a function of a number of parameters, among which the coefficient of friction is only one – albeit probably the most important Bowman (1996). According to Bowman, another issue that delays progress in this area is the terminological vagueness that pervades much of the literature. In summarising the shortcomings of this over-reliance on coefficient of friction measurements to the detriment of many other contributing factors Bowman (1997) states:

> *At best slip resistance is a descriptive term, encompassing all the critical material and human elements that may lead to a slip, and as such should not be used interchangeably with coefficient of friction. Slip resistance is neither a constant nor an intrinsic property of a given surface composition, be it flooring, floor coating or footwear but, instead, varies with texture, wear and contamination.*

*Further, it is an ephemeral characteristic determined by the activities at the time, whether one is walking naturally, walking fast or running, turning sharply, pulling or pushing a load, or going up or down an inclined plane or steps, coupled with the physiological, perceptual and behavioural conditions of the individual. Frequently, it is merely an individual's perception, a subjective, qualitative assessment of the degree to which a particular floor resists the movement of one's shoe across its surface, wherein the coequal contribution of the footwear is either ignored or not even considered.*

The problem described above also extends to the Building Code of Australia. As Bowman (1997) points out, the BCA uses the terms 'non-slip', non-skid' and 'slip resistant' to describe the requirements of various surface finishes, but nowhere does it actually specify what constitutes a non-slip, non-skid or slip resistant surface finish. According to Bowman (2000), authorities often prefer to mandate using abstract terms such as no-slip and slip-resistant, rather than specifying requirements that might be subsequently found to be inappropriate. This is evident in the current Building Code of Australia (BCA 2007), where reference is frequently made to 'slip resistant' and 'non-skid' surfaces, but there is no definition of how these terms are defined within the code. While the BCA does refer to AS/NZS 4586:2004 – Slip resistance classification of new pedestrian surface materials and AS/NZS 4663:2004 – Slip resistance measurements of existing pedestrian surfaces, it does not explicitly define the above terms within the code itself. The above Australian /New Zealand Standards define slip resistance as the "frictional force opposing movement of an object across a surface, usually with reference to the sole or heel of a shoe on a floor", and regards a pedestrian surface as "slip resistive if the available friction is sufficient to enable a person to traverse that surface without an unreasonable risk of slipping."

AS/NZS 4663:2004 regards a coefficient of friction of 0.40 or greater as slip resistant, and states that this measurement constitutes a "moderate to very low notional contribution of the floor surface to the risk of slipping when dry". According to the above Standard, a coefficient of friction less than 0.40 results in a "high to very high notional contribution of the floor surface to the risk of slipping when dry".

## 7.5 AGE & GENDER

As has shown to be the case with most mobility related injury, the risk of slip and fall accidents increases with age. Thomas and Brennan (2000) reported a ten-fold increase in the incidence of falls in the elderly (65+ years) when compared to those aged 16-64 years, despite the elderly generally adopting safer gait styles such as walking more slowly and with smaller step distances, and Lloyd and Stevenson (1992 cited in Moyer) indicated that while slips and trips caused 32 percent of falls for young people, 67% of falls for the elderly were initiated by slips (Moyer 2006). In Victoria, seniors aged 75 years and older have been shown to account for more than 50% of hospital admissions for slip injuries (n=716, 52%), even though this age group accounts for only 10% of ED presentations (n=125). (Gunatilaka, Clapperton and Cassell 2005)

There is also evidence to suggest that not only does the increasing frailty of age lead to an increased risk of slip-related injury, but also that the homes of older persons could, on average, present greater intrinsic slipping hazards. A report on home inspections carried out by Archicentre from January 2000 to August 2002 in 11,264 homes in Melbourne metropolitan and 2,771 homes in rural Victoria occupied by residents over 60 years of age showed that most common structural slip and trip hazards found were shower bases, defective floor finishes, dangerous staircases and obstacles like protruding door thresholds. Unexpectedly, within the homes included in the inspection sample, the percentage of slip and trip hazards was greater in single story homes than multiple story dwellings. (Gunatilaka, Clapperton and Cassell 2005)

As with most slip, trip and fall injury data worldwide, women have been found to be at a substantially higher risk of slip-related injury than men. In the UK women have been found to have an increased relative risk of 2 of having an underfoot accident, compared with men. (Davies 2001) In Australia, during the year to June 2003, females accounted for 75% of slip-related hospital admissions in Victoria (n=1,033) and 57% of ED presentations (n=682) for slips. (Gunatilaka, Clapperton and Cassell 2005). Kemmlert and Lundholm's (2001) study of work related accidents, it was noted that women reported substantially more underfoot accidents than men, and that the gender gap increased with age. Although slip and fall accidents generally have multifactorial causes (Bowman 2000), the effect of holding something and the gender of the injured person appear to be the greatest indicators of risk in relation to underfoot accidents. In one British study based on follow-up interviews of slip injury patients identified through an injury surveillance database, among all patients who reported holding something at the time injury, underfoot accidents accounted for 44.5% of these injuries to women and 16.5% of these injuries to men (Davies et al. 2001).

## 7.6 RECOMMENDATIONS

As well as clearly quantifying factors in addition to the required coefficient of friction which can be used to reliably measure and ensure the safety of a particular flooring surface, there are several recommendations from the literature that could be applied to encourage increased uniformity in regards to both measurements and definitions of slip-resistance. These include the provision of comparative information on slip resistance by manufacturers and retailers to consumers, the development of building codes to require the installation of slip-resistant surfaces in the internal wet areas and external pedestrian areas of all new homes and renovated homes, and the national adoption the Local Government and Shires Associations of NSW initiative whereby certificates of occupancy are only issued to buildings where all flooring surfaces meet the recommendations on slip resistance of pedestrian surfaces as outlined in the revised Standards Australia Handbook HB 197:2005 (Gunatilaka, Clapperton and Cassell 2005).

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# CHAPTER 8 LANDING SURFACES

## 8.1 INTRODUCTION

During a fall, the kinetic energy of the falling body is dissipated upon impact to the floor and the body resulting in the deformation of, soft tissue layers and flooring. Without energy absorbent padding, the majority of this kinetic energy is absorbed by the skeletal structures of the body. This results in the presentation of large peak forces which can often lead to bone fracture (Maki and Fernie 1990). The surface onto which a person lands after a fall can have a substantial impact on the likelihood and severity of injury. Healey (1994) found that among a random sample of 225 accidents among aged care residents, 17% of those who fell onto carpet sustained injuries while 46% of those who fell onto vinyl were injured. Furthermore, the value for a chi-squared test of this sample indicated that there was a less than 1% probability that the reduced rate of injury observed for those who fell on carpet was owing to chance. Carpet, even without underlay, has been shown to provide significantly greater impact attenuation than other, stiffer flooring materials. As would be expected, Maki and Fernie (1990) also found that the addition of an underlay to carpet provided better impact attenuation than carpet alone.

While it has been shown in various studies, and reinforced by the epidemiological data, that fractures are significantly reduced in falls onto surfaces classified as soft (such as grass, loose dirt, or padded carpets) (Nevitt, Cummings and Hudes 1991), these studies predominantly address the issue of child falls from height and do not necessarily address the balance between surface compliance and walking ease, which is of importance for the elderly population in general and of particular importance to those in aged care facilities. Despite this, some studies have attempted to compare flooring types in nursing homes and hospitals, to identify whether the flooring type contributes to the incidence and fracture rate of falls. One study found that wooden carpeted floors resulted in a lower number of fractures (2.31 per 100 falls) than wooden uncarpeted floors (4.14 fractures per 100 falls) and concrete with carpet floors (4.36 fractures per 100 falls) (Simpson et al. 2004). Another study investigating vinyl and carpeted floors was underpowered and did not find a result (Donald et al. 2000).

Surprisingly the research by Simpson et al. (2004) found a lower number of fractures (1.1 per 100 falls) on concrete uncarpeted surfaces than on carpeted concrete. It was suggested by the authors that uncovered concreted surfaces are generally found in bathrooms and toilets, and the way people fall in these areas and the crowded and smaller area of these rooms may have decreased the number of fractures per 100 falls (Simpson et al. 2004).

Investigators researching the aetiology of hip fractures have suggested that the impact forces of falls can exceed the strength of femurs in older individuals by as much as 50 percent (Courtney et al. 1995). The authors suggest that if a comparable reduction in impact force through energy-absorbing floors was in use, this may reduce the prevalence of hip fractures (Courtney et al. 1995)

## 8.2 FLOORING SURFACES

Research into the impact attenuation of various types of floor coverings during simulated falls has been undertaken. Maki and Fernie (1990) tested 13 different types of floor coverings and found that carpet with or without padding underneath provided much greater impact attenuation than stiffer flooring materials such as terrazzo and wood tiles.

Their findings suggest that the floor covering type may change the mean impact force occurring during a fall significantly. This range between the highest and lowest mean impact attenuation during simulated hip impacts on hard to soft flooring was 3.2kN (23%).

This attenuation is a fair proportion of the estimated femur fracture threshold (5 to 25kN), and the authors suggests that many hip fractures may be prevented by use of the appropriate type of floor covering (Maki and Fernie 1990).

Floor coverings were predicted to be less important in the minimisation of wrist fractures or fractures of the humerus due to the importance of energy absorption of soft tissues and body structures during hand impacts (Maki and Fernie 1990).

Simpson and colleagues (2004) also investigated the mechanical properties of a number of types of flooring and found the mean impact attenuation of wooden carpeted floors at 11.9 kN was lower than all other floor types tested. Based on the findings of the research the authors recommended confirmation of the results by further studies and the careful consideration of floor types in institutions caring for the frail aged, particularly since overly soft flooring can effect the balance of an elderly person an may in fact encourage falls. (Simpson et al. 2004).

## 8.3 ENERGY ABSORBING FORCE ATTENUATING FLOOR TECHNOLOGY

New flooring types have been developed for possible use in hospital and residential aged care sectors. Research was found on the properties of the flooring and is described below, although research trialling the use of the new floor technology in acute care and residential facilities could not be found.

The new types of flooring have been designed and developed to remain fairly rigid when walked upon (Casalena et al. 1998) and to 'deform elastically' when fallen upon (Casalena et al. 1998). The aim of the flooring is to 'reduce the peak force on the femoral neck during a lateral fall onto a hip' (Casalena et al. 1998), and to provide a stable walking surface that does not increase the likelihood of falls in comparison to normal flooring (Casalena et al. 1998).

The new types of flooring aim to reduce injury through the use of "energy –absorbing' materials. Kradal ™ is a new energy absorbing flooring technology developed in New Zealand that has been found to reduce mean peak force on impact to 33 percent lower than carpet and underlay over wood (Robertson, Milburn et al. 2006). The Kradal ™ product testing summary suggests the reduction is between 20 to 40 percent (Acme Industries 2007).

Hardness testing using an indenting testing machine and standard test protocols was undertaken on the Kradal product. The hardness testing found that the Kradal composite on a wooden floor indented less than carpet with standard rubber underlay on wood. Robertson et al. (2006) claim that the Kradal ™ provided a superior surface in terms of indentation. No claims are made about the product reducing falls although in concluding the authors do suggest that Kradal used under carpet in long term care facilities and hospitals would be safe, practical and result in a reduction in the rate of hip fractures from falls.

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# CHAPTER 9 NATIONAL DATA ON HOSPITALISATION AND DEATHS DUE TO FALLS IN BUILDINGS

## 9.0 INTRODUCTION

This chapter presents the most recently available Australian data on fall injuries in general to provide a broader context, and fall injuries occurring in buildings that result in hospital admissions and deaths.

This national data is supplemented by Victorian data as an example of more detailed state non-fatal data and where national data is not available such as longer term trends and non-admitted hospital treated cases.

This chapter reports on analyses of data extracted from the following databases:

- Australian Bureau of Statistics (ABS)
- National Injury Surveillance Unit (NISU)
- National Coroners Information System (NCIS)
- Victorian Emergency Minimum Dataset (VEMD) and
- Victorian Admitted Episodes Database (VAED).

**Comparison between Australian Bureau of Statistics and National Coroners Information System fall fatality data**

**Table 9.0.1 All unintentional fall fatalities, Australia, 2001-2005**

| | NCIS | | ABS | |
|---|---|---|---|---|
| | n | % | n | % |
| **State or territory** | | | | |
| Victoria | 679 | *31.1* | 1957 | *26.3* |
| New South Wales | 655 | *30.0* | 2429 | *32.6* |
| Queensland | 403 | *18.4* | 1538 | *20.7* |
| Western Australia | 177 | *8.1* | 665 | *8.9* |
| South Australia | 128 | *5.9* | 430 | *5.8* |
| Tasmania | 86 | *3.9* | 274 | *3.7* |
| Australian Capital Territory | 26 | *1.2* | 98 | *1.3* |
| Northern Territory | 32 | *1.5* | 53 | *0.7* |
| All | 2186 | *100* | 7444 | *100* |
| | | | | |
| **Year of death** | | | | |
| 2001 | 424 | *19.4* | 1348 | *18.1* |
| 2002 | 406 | *18.6* | 1473 | *19.8* |
| 2003 | 408 | *18.7* | 1467 | *19.7* |
| 2004 | 471 | *21.5* | 1534 | *20.6* |
| 2005 | 477 | *21.8* | 1622 | *21.8* |
| All | 2186 | *100* | 7444 | *100* |
| **Age group** | | | | |
| 0-14 | 39 | *1.8* | 39 | *<1* |
| 15-29 | 173 | *7.9* | 177 | *2.4* |
| 30-44 | 208 | *9.5* | 213 | *2.9* |
| 45-59 | 315 | *14.4* | 338 | *4.5* |
| 60-74 | 401 | *18.3* | 732 | *9.8* |
| 75+ | 1047 | *47.9* | 5943 | *79.8* |
| missing | 3 | *0.1* | 2 | *<1* |
| All | 2186 | *100* | 7444 | *100* |

| | NCIS | | ABS | |
|---|---|---|---|---|
| | n | % | n | % |
| | | | | |
| **Gender** | | | | |
| Male | 1399 | *64.0* | 3301 | *44.3* |
| Female | 787 | *36.0* | 4143 | *55.7* |
| All | 2186 | *100* | 7444 | *100* |
| **Cause (ABS)** | | | | |
| same level from slipping, tripping, stumbling | | | 391 | *5.3* |
| on and from stairs and steps | | | 232 | *3.1* |
| other fall on same level | | | 227 | *3.0* |
| from, out of or through building or structure | | | 194 | *2.6* |
| involving bed | | | 126 | *1.7* |
| on and from ladder | | | 93 | *1.2* |
| involving chair | | | 54 | *<1* |
| other fall from one level to another | | | 112 | *1.5* |
| involving other furniture | | | 21 | *<1* |
| involving wheelchair | | | 24 | *<1* |
| on same level -collision with pushing by another person | | | 5 | *<1* |
| while being carried or supported by other persons | | | 3 | *<1* |
| other specified fall | | | 105 | *1.4* |
| unspecified fall | | | 2216 | *29.8* |
| fracture unspecified, reclassified from X59 | | | 3641 | *48.9* |
| All | | | 7444 | *100* |
| | | | | |
| **Mechanism (NCIS)** | | | | |
| Falling/jumping/pushed from a height: < 1m | 399 | *18.3* | | |
| Falling/jumping/pushed from a height: < 1m | 724 | *33.1* | | |
| Falling/stumbling by slipping on same level | 121 | *5.5* | | |
| Falling/stumbling by tripping on same level | 222 | *10.2* | | |
| Other falling/stumbling on the same level | 222 | *10.2* | | |
| Other specified falling/stumbling | 71 | *3.2* | | |
| Unspecified falling/stumbling | 427 | *19.5* | | |
| All | 2186 | *100* | | |
| | | | | |
| **Location** | | | | |
| Home | 885 | *40.5* | 1038 | *13.9* |
| School other institution or pub admin area (includes hospital) | 16 | *0.7* | 203 | *2.7* |
| Residential/Correctional facility | 139 | *6.4* | 520 | *7.0* |
| Trade or service area | 101 | *4.6* | 83 | *1.1* |
| Other specified place | 1029 | *47.1* | 434 | *5.8* |
| Unspecified place | 16 | *0.7* | 5166 | *69.4* |
| All | 2186 | *100.0* | 7444 | *100.0* |

Note: coding differences make comparisons based on cause and location difficult. Data provided as a guide only.

There is a large discrepancy between the total numbers for all fall deaths found in the ABS and NCIS datasets. This is primarily due to recoding of some ABS deaths originally coded to 'exposure to unspecified factor' (n=3641). To enable continuity of trend data, Harrison and Steenkamp (2002) proposed a revised indicator definition of falls that has been followed in this report. This involves transferring those cases classified under X59 'exposure to unspecified factor' in the 'other unintentional' group to the 'falls' group if they have at least one injury code denoting a fracture. This lack of specificity in the original dataset and subsequent recoding makes a comparative analysis of all fall fatalities included in these two datasets difficult, particularly in relation to the location and cause/mechanism of death.

Narrowing down the datasets to the location and cause codes specified for inclusion by the ABCB (see TABLE 9.0.2) produces a total of 1832 unintentional fall fatalities in the ABS data and 1713 in the NCIS data over the same five year period (2001-2005).

The largest discrepancy is in the final year of the analysis, where the ABS has recorded 585 building fall related deaths while the NCIS shows 386.

ABS numbers are higher than NCIS numbers in 5 of the 8 states and territories (Victoria, New South Wales, Tasmania, Australian Capital Territory and Northern Territory) and in 3 of the 5 years (2001, 2004 and 2005).

Although the absolute numbers differ quite substantially between the datasets, the proportion of deaths in each age group is quite similar. For example, 77% of NCIS cases and 82% of ABS cases are persons aged 60 years or more. There is also a very clear pattern in both datasets of deaths increasing as age increases.

Almost 60% of NCIS cases are female compared with half of the ABS cases. Although causes and mechanisms are difficult to compare across datasets as coding inconsistencies exist, some of the data for deaths involving specific items such as beds, chairs and stairs and steps are quite similar and display common trends over time.

Both of these datasets are probably underestimated. Clearly, not all fall related fatalities are reported to Coroners in all states. Particularly, where a fall was not necessarily reported to the Coroner as the primary cause of death, but was a primary instigator of the eventual cause of death (eg Pneumonia). Cases from 2005/06 – 2006/07 are not included in this analysis as many cases from these years are not yet closed and the datasets are incomplete.

Again, inconsistencies in coding make comparison on locations difficult although the home is clearly the most common location for all cases (52% of NCIS cases and 56% of ABS cases).

A more detailed table can be found in Appendix 3 showing data by individual year.

**Table 9.0.2 All unintentional fall fatalities occurring in buildings, Australia 2001-2005**

| | NCIS | | ABS | |
|---|---|---|---|---|
| | n | % | n | % |
| **State or territory** | | | | |
| Victoria | 589 | *34.4* | 700 | *38.2* |
| New South Wales | 496 | *29.0* | 544 | *29.7* |
| Queensland | 297 | *17.3* | 241 | *13.2* |
| Western Australia | 145 | *8.5* | 119 | *6.5* |
| South Australia | 94 | *5.5* | 87 | *4.7* |
| Tasmania | 58 | *3.4* | 99 | *5.4* |
| Australian Capital Territory | 19 | *1.1* | 23 | *1.3* |
| Northern Territory | 15 | *0.9* | 19 | *1.0* |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |
| **Year of death** | | | | |
| 2001 | 310 | *18.1* | 334 | *18.2* |
| 2002 | 309 | *18.0* | 265 | *14.5* |
| 2003 | 319 | *18.6* | 212 | *11.6* |
| 2004 | 389 | *22.7* | 436 | *23.8* |
| 2005 | 386 | *22.5* | 585 | *31.9* |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |

| | NCIS | | ABS | |
|---|---|---|---|---|
| | n | % | n | % |
| **Age group** | | | | |
| 0-14 | 23 | *1.3* | 20 | *1.1* |
| 15-29 | 56 | *3.3* | 53 | *2.9* |
| 30-44 | 111 | *6.5* | 93 | *5.1* |
| 45-59 | 198 | *11.6* | 167 | *9.1* |
| 60-74 | 334 | *19.5* | 289 | *15.8* |
| 75+ | 989 | *57.7* | 1209 | *66.0* |
| Missing | * | * | * | * |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |
| **Gender** | | | | |
| Male | 726 | *42.4* | 924 | *50.4* |
| Female | 987 | *57.6* | 908 | *49.6* |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |
| **Cause (ABS & some NCIS cases)** | | | | |
| same level from slipping, tripping, stumbling | N/A | | 283 | *15.4* |
| on and from stairs and steps | 230 | *13.4* | 192 | *10.5* |
| other fall on same level | N/A | | 180 | *9.8* |
| from, out of or through building or structure | N/A | | 123 | *6.7* |
| involving bed | 116 | *6.8* | 109 | *5.9* |
| on and from ladder | 77 | *4.5* | 63 | *3.4* |
| involving chair | 38 | *2.2* | 48 | *2.6* |
| other fall from one level to another | N/A | | 35 | *1.9* |
| involving other furniture | N/A | | 19 | *1.0* |
| involving wheelchair | N/A | | 18 | *1.0* |
| on same level -collision with pushing by another person | N/A | | * | * |
| while being carried or supported by other persons | N/A | | * | * |
| Unspecified fall | N/A | | 716 | *39.1* |
| fracture unspecified, reclassified from X59 | N/A | | 40 | *2.2* |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |
| **Mechanism (NCIS)** | | | | |
| Falling/jumping/pushed from a height: < 1m | 279 | *16.3* | N/A | |
| Falling/jumping/pushed from a height: < 1m | 465 | *27.1* | N/A | |
| Falling/stumbling by slipping on same level | 111 | *6.5* | N/A | |
| Falling/stumbling by tripping on same level | 190 | *11.1* | N/A | |
| Other falling/stumbling on the same level | 199 | *11.6* | N/A | |
| Other specified falling/stumbling | 59 | *3.4* | N/A | |
| Unspecified falling/stumbling | 410 | *23.9* | N/A | |
| All | 1713 | *100.0* | 1832 | *100.0* |
| | | | | |
| **Location** | | | | |
| Home | 898 | *52.4* | 1030 | *56.2* |
| School other institution or pub admin area (includes hospital) | 546 | *31.9* | 201 | *11.0* |
| Residential/Correctional facility | 146 | *8.5* | 519 | *28.3* |
| Trade or service area | 93 | *5.4* | 82 | *4.5* |
| Other specified place | 24 | *1.4* | 0 | *0.0* |
| Unspecified place | 6 | *0.4* | 0 | *0.0* |
| All | 1713 | *100.0* | 1832 | *100.0* |

Note: coding differences make comparisons based on cause and location difficult. Data provided as a guide only.

This report focuses on the NCIS fall fatality data as it contains much greater detail than the ABS data. The ABS data also lacks the narrative detail provided by the NCIS and suffers from inconsistent coding from year to year.

## Table 9.0.3 State by state comparison- NCIS building fall deaths

| | VIC | | NSW | | QLD | | WA | | SA | | TAS | | ACT | | NT | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % |
| Product | | | | | | | | | | | | | | | | | | |
| Building Component or Fitting | 374 | *63.5* | 304 | *61.3* | 176 | *59.3* | 39 | *26.9* | 24 | *25.5* | 31 | *53.4* | 8 | *42.1* | 6 | *40.0* | 962 | *56.2* |
| Furnishing | 83 | *14.1* | 50 | *10.1* | 23 | *7.7* | 18 | *12.4* | 7 | *7.4* | 4 | *6.9* | 1 | *5.3* | 3 | *20.0* | 189 | *11.0* |
| Ground Surface and Conformations | 47 | *8.0* | 64 | *12.9* | 42 | *14.1* | 44 | *30.3* | 19 | *20.2* | 11 | *19.0* | 7 | *36.8* | 1 | *6.7* | 235 | *13.7* |
| Other and unspecified | 85 | *14.4* | 78 | *15.7* | 56 | *18.9* | 44 | *30.3* | 44 | *46.8* | 12 | *20.7* | 3 | *15.8* | 5 | *33.3* | 327 | *19.1* |
| All | 589 | *100.0* | 496 | *100.0* | 297 | *100.0* | 145 | *100.0* | 94 | *100.0* | 58 | *100.0* | 19 | *100.0* | 15 | *100.0* | 1713 | *100.0* |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| Detailed product | | | | | | | | | | | | | | | | | | |
| Bed | 60 | *10.2* | 26 | *5.2* | 14 | *4.7* | 4 | *2.8* | 5 | *5.3* | 3 | *5.2* | 1 | *5.3* | 3 | *20.0* | 116 | *6.8* |
| Floor | 266 | *45.2* | 127 | *25.6* | 54 | *18.2* | 9 | *6.2* | 4 | *4.3* | 9 | *15.5* | 2 | *10.5* | 0 | *0.0* | 471 | *27.5* |
| Ground surface | 31 | *5.3* | 29 | *5.8* | 34 | *11.4* | 31 | *21.4* | 10 | *10.6* | 6 | *10.3* | 7 | *36.8* | 1 | *6.7* | 149 | *8.7* |
| Stairs steps | 58 | *9.8* | 85 | *17.1* | 54 | *18.2* | 12 | *8.3* | 8 | *8.5* | 9 | *15.5* | 2 | *10.5* | 2 | *13.3* | 230 | *13.4* |
| Other and unspecified | 174 | *29.5* | 229 | *46.2* | 141 | *47.5* | 89 | *61.4* | 67 | *71.3* | 31 | *53.4* | 7 | *36.8* | 9 | *60.0* | 747 | *43.6* |
| All | 589 | *100.0* | 496 | *100.0* | 297 | *100.0* | 145 | *100.0* | 94 | *100.0* | 58 | *100.0* | 19 | *100.0* | 15 | *100.0* | 1713 | *100.0* |

Table 9.0.3 shows:

- in 64% of Victorian cases a building component or fitting was implicated in the fall death; this is higher than the Australian overall proportion (56%) and higher than in every state or territory

- ground surface and conformations were implicated in a further 8% of deaths in Victoria, this was much lower than the overall Australian proportion (14%) and lower than all state and territories except for the Northern Territory (7%).

Table 9.0.3 also shows:

- in 10% of Victorian cases a bed was implicated in the fall death; this is well about the Australian overall proportion (7%) and higher than in every state or territory with the exception of the Northern Territory (20%)

- the proportion of deaths in which the floor was implicated was much higher in Victoria (45%) than Australia overall (28%) and all other states and territories

- the proportion of deaths in which the ground surface was implicated was lower in Victoria (5%) than Australia overall (9%) and all other states and territories

- the proportion of deaths in which stairs and steps were implicated was lower in Victoria (9.8%) than Australia overall (13.4%) and lower than all other states and territories except WA (8.3%) and SA (8.5%).

## 9.1 ANALYSIS OF VICTORIAN DEATHS FROM FALLS OCCURRING IN BUILDINGS: OVERVIEW

The data below includes all fall related deaths occurring in buildings between July 2000 and June 2005 investigated by the Victorian State Coroner and cases completed by December 2006. Cases still open in December 2006 were not able to be included in the data.

Cases were included and excluded based on criteria decided upon in consultation with the ABCB, as outlined in section 9.9.

The coding system for residential aged care for the National Coroners Information System (NCIS) differs from the national hospitalisations coding.

**All Victorian building related fall fatalities**

**Table 9.1.1 Frequency and percentage of deaths related to falls occurring in buildings by age group, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| < 1 | * | * |
| 1-9 | * | * |
| 15-24 | 6 | 1.2 |
| 25-34 | 8 | 1.6 |
| 35-44 | 8 | 1.6 |
| 45-54 | 21 | 4.3 |
| 55-64 | 41 | 8.5 |
| 65-74 | 57 | 11.8 |
| 75+ | 340 | 70.1 |
| Total | 485 | 100.0 |

- The majority (70.1%, n=340) of deaths resulting from falls occurring in buildings were people aged 75 years and over.
- Combined, persons aged 45 and over account for 94.6% (n=459) of deaths resulting from falls in buildings.

**Table 9.1.2 Frequency and percentage of deaths related to falls occurring in buildings by sex, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Female | 216 | 44.5 |
| Male | 269 | 55.5 |
| Total | 485 | 100.0 |

- Males account for 55.5% (N=269) building fall related deaths and females for 44.5% (n=216). These proportions contrast with the non-fatal injury data, where females account for the majority of all fall injury.

**Table 9.1.3 Frequency and percentage of deaths related to falls occurring in buildings by broad activity, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Being nursed or cared for | 209 | 43.1 |
| Domestic duties | 46 | 9.5 |
| Leisure activity | 5 | 1.0 |
| Other specified activity | 63 | 13.0 |
| Resting sleeping eating other personal activity | 86 | 17.7 |
| Unspecified activity | 71 | 14.6 |
| Working for income | 5 | 1.0 |
| Total | 485 | 100.0 |

- Persons "being nursed or cared for" constitute the largest activity group (43.1%, n=209) among building fall related deaths in Victoria.
- Resting, sleeping, eating and other personal activity accounts for 17.7% (n=86) of these fatalities.

**Table 9.1.4 Frequency and percentage of deaths related to falls occurring in buildings by broad location, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Home | 227 | 46.8 |
| Hospital or other health service | 192 | 39.6 |
| Other specified place | * | * |
| Recreation area place mainly for informal recreational activity | * | * |
| Residential or correctional facility (including residential aged care) | 39 | 8.0 |
| School other institution or public administrative area | 6 | 1.2 |
| Trade or service area | 19 | 3.9 |
| Total | 485 | 100.0 |

- Combined, 94.4% (n=458) of fatalities resulting from falls in buildings occurred in the home, a hospital or health service area or a residential or correctional facility (overwhelmingly nursing homes and aged care facilities).
- Of these locations, the home (46.8%, n=227) is the most prominent site, followed by Hospital or other health service area (39.6%, n=192) and residential of correctional facility (8.0%, n=39) respectively.

**Table 9.1.5 Frequency and percentage of deaths related to falls occurring in buildings by specific location, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Boarding house hostel private hotel | * | * |
| Bus or railway station | * | * |
| Caravan mobile home residential | * | * |
| Entertainment drinking place | * | * |
| Flat apartment terrace house | 52 | 10.7 |
| Free standing house | 169 | 34.8 |
| Holiday resort | * | * |
| Home for elderly frail | 26 | 5.4 |
| Hospital | 98 | 20.2 |
| Other specified home | * | * |
| Other specified hospital or other health service | 94 | 19.4 |
| Other specified place | * | * |
| Other specified residential correctional facility | 13 | 2.7 |
| Other specified school other institution or public administrative area | * | * |
| Other specified trade or service area | 8 | 1.6 |
| Primary school public private state | * | * |
| Public administration place | * | * |
| Shop | 6 | 1.2 |
| Unspecified home | * | * |
| Total | 485 | 100.0 |

- Over a third (34.8%, n=169) of fall related deaths occurring in buildings occurred in free standing houses and 10.7% (n=52) occurred in flats, apartments or terrace houses.
- 20.2% (n=98) of these falls leading to deaths occurred in a hospital, 19.4% (n= 94) in another specified health service area, and 5.4% (n=26) in a home for the elderly or frail.

**Table 9.1.6 Frequency of deaths related to falls occurring in buildings by detailed cause group, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| fall:from, out of or through building or structure | 25 | 5.2 |
| fall:involving bed | 54 | 11.1 |
| fall:involving chair | 14 | 2.9 |
| fall:involving other furniture | 7 | 1.4 |
| fall:involving wheelchair | * | * |
| fall:on and from ladder | 22 | 4.5 |
| fall:on and from scaffolding | * | * |
| fall:on and from stairs and steps | 56 | 11.5 |
| fall:other fall on same level | 94 | 19.4 |
| fall:same level from slipping, tripping, stumbling | 9 | 1.9 |
| fall:unspecified fall | 196 | 40.4 |
| fall:while being carried or supported by other persons | * | * |
| Total | 485 | 100.0 |

- The detailed cause of fall was unspecified in largest proportion (40.4%, 196) of fatalities related to falls occurring in buildings, and 19.4% (n=94) were coded as “other fall on same level”.
- 11.5% (n=560) of these fall fatalities occurred on and from stairs and steps, and 11.1% (n=54) of these fatalities involved a person falling out of, falling while getting out of, or falling onto a bed.
- 4.5% (n=22) of these fall fatalities were falls from ladders.

**Table 9.1.7 Frequency and percentage of deaths related to falls occurring in buildings, age group by activity, 2000/01-2004/05, Victoria.**

| | Being nursed or cared for | Domestic duties | Leisure activity | Other specified activity | Resting sleeping eating other personal activity | Unspecified activity | Working for income | Total |
|---|---|---|---|---|---|---|---|---|
| < 1 | * | 0 | 0 | 0 | * | 0 | 0 | * |
| 1-9 | 0 | 0 | 0 | * | 0 | 0 | 0 | * |
| 15-24 | 0 | 0 | * | * | 0 | 0 | * | 6 |
| 25-34 | * | 0 | * | * | * | * | 0 | 8 |
| 35-44 | * | 0 | 0 | * | * | 0 | * | 8 |
| 45-54 | * | * | 0 | 7 | 7 | * | 0 | 21 |
| 55-64 | 5 | * | * | 13 | 9 | 11 | 0 | 41 |
| 65-74 | 17 | 15 | 0 | * | 11 | 8 | * | 57 |
| 75+ | 181 | 28 | * | 31 | 53 | 46 | 0 | 340 |
| Total | 209 | 46 | 5 | 63 | 86 | 71 | 5 | 485 |

- As shown earlier, the vast majority of fatalities resulting from falls in buildings are to middle aged and elderly people, this is particularly evident among those who died from falls sustained while undertaking domestic duties.
- There were no fatalities recorded in Victoria for those aged under 44 years undertaking domestic duties, and 93.5% of fatalities while undertaking domestic duties were aged 65 (n=43) years and over.

**Table 9.1.8 Frequency and percentage of deaths related to falls occurring in buildings by age group by gender, 2000/01-2004/05, Victoria.**

| | Female | Male | Total |
|---|---|---|---|
| < 1 | * | * | * |
| 1-9 | * | 0 | * |
| 15-24 | 0 | 6 | 6 |
| 25-34 | 0 | 8 | 8 |
| 35-44 | 0 | 8 | 8 |
| 45-54 | * | 18 | 21 |
| 55-64 | 10 | 31 | 41 |
| 65-74 | 17 | 40 | 57 |
| 75+ | 183 | 157 | 340 |
| Total | 216 | 269 | 485 |

- Male fatalities substantially exceed female fatalities in all adult age groups except for those aged over 75 years.

**Table 9.1.9 Frequency of deaths related to falls occurring in buildings sex by location, 2000/01-2004/05, Victoria.**

| | Home | Hospital or other health service | Other specified place | Recreation area place mainly for informal recreational activity | Residential or correctional facility (including residential aged care) | School other institution or public administrative area | Trade or service area | |
|---|---|---|---|---|---|---|---|---|
| Female | 84 | 101 | 0 | 0 | 26 | * | * | 216 |
| Male | 143 | 91 | * | * | 13 | 5 | 15 | 269 |
| Total | 227 | 192 | * | * | 39 | 6 | 19 | 485 |

- Males account for 63.0% (n=143) of fall fatalities in the home, while females account for a slight majority of fall fatalities in hospitals and health service areas (52.65, n=101).
- Females also account for 66.6% (n=26) of residential/correctional facilities, the vast majority of which occur in nursing homes and aged care facilities.

**Table 9.1.10 Frequency of deaths related to falls occurring in buildings detailed cause group by sex, 2000/01-2004/05, Victoria.**

| | Female | Male | Total |
|---|---|---|---|
| fall:from, out of or through building or structure | * | 21 | 25 |
| fall:involving bed | 34 | 20 | 54 |
| fall:involving chair | 9 | 5 | 14 |
| fall:involving other furniture | * | * | 7 |
| fall:involving wheelchair | 0 | * | * |
| fall:on and from ladder | 0 | 22 | 22 |
| fall:on and from scaffolding | 0 | * | * |
| fall:on and from stairs and steps | 16 | 40 | 56 |
| fall:other fall on same level | 47 | 47 | 94 |
| fall:same level from slipping, tripping, stumbling | 5 | * | 9 |
| fall:unspecified fall | 94 | 102 | 196 |
| fall:while being carried or supported by other persons | * | * | * |
| | 216 | 269 | 485 |

- Males account for the vast majority of fatalities incurred in circumstances that would usually be associated with home and building maintenance. Males constitute a combined total 91.7% (n=44) of all fall deaths from, out of or through building or structure, on and from ladders and on and from scaffolding in a home environment.
- Males also account for 71.4% (n=40) of deaths from falls on and from stairs and steps.
- "Other falls on same level" are evenly split between genders (50.0%, n=94 each) and males slightly exceed females in terms of fatalities arising from unspecified falls in buildings (52.0%, n=102).

## 9.2 HOME FALL FATALITIES: VICTORIA

**Table 9.2.1 Frequency and percentage of deaths related to falls occurring in the home by age group, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| < 1 | * | * |
| 1-9 | * | * |
| 15-24 | * | * |
| 25-34 | * | * |
| 35-44 | 5 | 2.2 |
| 45-54 | 17 | 7.5 |
| 55-64 | 33 | 14.5 |
| 65-74 | 38 | 16.7 |
| 75+ | 125 | 55.1 |
| Total | 227 | 100.0 |

- As with fatalities related to falls in buildings, fatalities arising from falls in the home are concentrated around those aged over 44 years (93.9%, n=213).

**Table 9.2.2 Frequency and percentage of deaths related to falls occurring in the home by sex, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Female | 84 | 37.0 |
| Male | 143 | 63.0 |
| Total | 227 | 100.0 |

- Males account for almost two thirds of Victorian home fall fatalities in the time period covered by this analysis (63.0%, n=143), this proportion of 7.5% higher than the percentage of all building fall fatalities that are males.

**Table 9.2.4 Frequency and percentage of deaths related to falls occurring in the home by broad activity, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Being nursed or cared for | * | * |
| Domestic duties | 43 | 18.9 |
| Leisure activity | * | * |
| Other specified activity | 48 | 21.1 |
| Resting sleeping eating other personal activity | 67 | 29.5 |
| Unspecified activity | 60 | 26.4 |
| Working for income | * | * |
| Total | 227 | 100.0 |

- “Resting, sleeping, eating or other personal activity” (29.5%, n= 67), “unspecified activity” (26.4%, n=60) and “other specified activity” (21.1%, n=48) account for the majority of home fall fatalities.
- Persons who fell while engaged in domestic duties constitute 18.9% (n=43) of home fall deaths recorded in Victoria between 2000/01-2004/05.

**Table 9.2.5 Frequency and percentage of deaths related to falls occurring in the home by detailed cause group, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Fall:from, out of or through building or structure | 18 | 7.9 |
| Fall:involving bed | 13 | 5.7 |
| Fall:involving chair | * | * |
| Fall:involving other furniture | 5 | 2.2 |
| Fall:involving wheelchair | * | * |
| Fall:on and from ladder | 19 | 8.4 |
| Fall:on and from scaffolding | * | * |
| Fall:on and from stairs and steps | 41 | 18.1 |
| Fall:other fall on same level | 43 | 18.9 |
| Fall:same level from slipping, tripping, stumbling | 6 | 2.6 |
| Fall:unspecified fall | 76 | 33.5 |
| Fall:while being carried or supported by other persons | * | * |
| Total | 227 | 100.0 |

- Over a third (33.5%, n=76) of fall fatalities in the home are cause coded as “unspecified”.
- Same level falls account for 18.9% (n=43) and falls on and from stairs and steps account for 18.1% (n=41) of home fall fatalities.

**Table 9.2.6 Frequency of deaths related to falls occurring in the home, activity by age group, 2000/01-2004/05, Victoria.**

| | < 1 | 1-9 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Being nursed or cared for | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | * |
| Domestic duties | 0 | 0 | 0 | 0 | 0 | * | * | 14 | 26 | 43 |
| Leisure activity | 0 | 0 | * | * | 0 | 0 | * | 0 | 0 | * |
| Other specified activity | 0 | * | * | 0 | * | 5 | 11 | * | 26 | 48 |
| Resting sleeping eating other personal activity | * | 0 | 0 | * | * | 7 | 9 | 11 | 35 | 67 |
| Unspecified activity | 0 | 0 | 0 | 0 | 0 | * | 10 | 8 | 38 | 60 |
| Working for income | 0 | 0 | * | 0 | * | 0 | 0 | * | 0 | * |
| Total | * | * | * | * | 5 | 17 | 33 | 38 | 125 | 227 |

- While 71.8% (n=163) of all home fall fatalities are aged 65 years and over, 93.0% (n=40) of persons suffering fatal falls while undergoing domestic duties are aged 65 years and over.
- In a large percentage of cases (26.4%, n=60) the person's activity at the time of the fatal fall was coded as "unspecified".

**Table 9.2.7 Frequency of deaths related to falls occurring in the home, detailed cause group by age gender, 2000/01-2004/05, Victoria.**

| | Female | Male | Total |
|---|---|---|---|
| fall:from, out of or through building or structure | * | 15 | 18 |
| fall:involving bed | 9 | * | 13 |
| fall:involving chair | 0 | * | * |
| fall:involving other furniture | * | * | 5 |
| fall:involving wheelchair | 0 | * | * |
| fall:on and from ladder | 0 | 19 | 19 |
| fall:on and from scaffolding | 0 | * | * |
| fall:on and from stairs and steps | 11 | 30 | 41 |
| fall:other fall on same level | 26 | 17 | 43 |
| fall:same level from slipping, tripping, stumbling | * | * | 6 |
| fall:unspecified fall | 28 | 48 | 76 |
| fall:while being carried or supported by other persons | * | * | * |
| Total | 84 | 143 | 227 |

- 92.1% (n=35) of fall fatalities from, out of or through a building or structure and on and from ladders or scaffolding in the home are males.
- 73.0% (n=30) of fatalities arising from falls on and from stairs and steps are males. This contrasts with national and Victorian hospital admission data, where females constitute the majority of stair and step fall injuries.

## 9.3 BUILDING RELATED FALL FROM HEIGHTS FATALITIES: VICTORIA

### 9.3.1 Overview

**Table 9.3.1 Frequency and percentage of deaths related to falls from height by age group, 2000/01-2004/05, Victoria**

| | N | % |
|---|---|---|
| 1-9 | * | * |
| 15-24 | * | * |
| 25-34 | 6 | 5.8 |
| 35-44 | 5 | 4.8 |
| 45-54 | 7 | 6.7 |
| 55-64 | 14 | 13.5 |
| 65-74 | 21 | 20.2 |
| 75+ | 47 | 45.2 |
| Total | 104 | 100.0 |

- 81.7% (n=89) of fatal falls from height are suffered by those aged 45 years and over.

**Table 9.3.2 Frequency and percentage of deaths related to falls from height by sex, 2000/01-2004/05, Victoria**

| | N | % |
|---|---|---|
| Female | 20 | 19.2 |
| Male | 84 | 80.8 |
| Total | 104 | 100.0 |

- The proportion of male fatalities (80.8%, n=84) related to falls from height is much greater than for all fatal falls in buildings and fatal falls in the home.

**Table 9.3.3 Frequency and percentage of deaths related to falls from height by broad activity, 2000/01-2004/05, Victoria**

| | N | % |
|---|---|---|
| Being nursed or cared for | 6 | 5.8 |
| Domestic duties | 29 | 27.9 |
| Leisure activity | * | * |
| Other specified activity | 41 | 39.4 |
| Resting sleeping eating other personal activity | 14 | 13.5 |
| Unspecified activity | 8 | 7.7 |
| Working for income | * | * |
| Total | 104 | 100.0 |

- 27.9% (n=29) of fall from height fatalities occurred while the person was undertaking domestic duties, 39.4% (n=41) of these fatalities were coded as being engaged in an "other specified activity".

**Table 9.3.4 Frequency and percentage of deaths related to falls from height by broad location, 2000/01-2004/05, Victoria**

| | N | % |
|---|---|---|
| Home | 79 | 76.0 |
| Hospital or other health service | 5 | 4.8 |
| Other specified place | * | * |
| Recreation area place mainly for informal recreational activity | * | * |
| Residential correctional facility | * | * |
| School other institution or public administrative area | * | * |
| Trade or service area | 14 | 13.5 |
| Total | 104 | 100.0 |

- A large majority of fall from height fatalities (76.0%, n= 79) occur in a home environment. This proportion is significantly greater than the 46.8% (n=227) of all building related fall fatalities that occur in homes.

**Table 9.3.5 Frequency and percentage of deaths related to falls from height by mechanism, 2000/01-2004/05, Victoria**

| | N | % |
|---|---|---|
| Fall through roof | 6 | 5.8 |
| Fall from roof | 11 | 10.6 |
| Fall off balcony | * | * |
| Fall from window | * | * |
| Fall through skylight | * | * |
| Fall from ladder | 22 | 21.2 |
| Fall on/down stairs | 57 | 54.8 |
| Total | 104 | 100.0 |

- Over fifty percent (54.8%, n=57) of included fall from height fatalities were falls on or down stairs.
- Falls from ladders constitute 21.2% (n=22) of these deaths, and falls through roofs account for 10.6% (n=11).

***Activity***

- All fall from height fatalities while undertaking domestic duties included in this analysis are persons aged 45 years and over.

**Table 9.3.6 Frequency of deaths related to falls from height, age group by detailed cause, 2000/01-2004/05, Victoria.**

| | fall:from, out of or through building or structure | fall:on and from ladder | fall:on and from scaffolding | fall:on and from stairs and steps | Total |
|---|---|---|---|---|---|
| 1-9 | * | 0 | 0 | 0 | * |
| 15-24 | * | 0 | 0 | 0 | * |
| 25-34 | * | 0 | 0 | * | 6 |
| 35-44 | * | * | 0 | * | 5 |
| 45-54 | * | * | 0 | * | 7 |
| 55-64 | * | * | 0 | 10 | 14 |
| 65-74 | 6 | 8 | 0 | 7 | 21 |
| 75+ | 6 | 10 | * | 30 | 47 |
| Total | 25 | 22 | * | 56 | 104 |

- Over fifty percent (53.6%, n=30) of deaths resulting from falls on and from stairs and steps are aged 75 years and over.

**Table 9.3.7 Frequency of deaths related to falls from height, location by sex, 2000/01-2004/05, Victoria.**

| | Female | Male | Total |
|---|---|---|---|
| Home | 14 | 65 | 79 |
| Hospital or other health service | * | * | 5 |
| Other specified place | 0 | * | * |
| Recreation area place mainly for informal recreational activity | 0 | * | * |
| Residential correctional facility | * | 0 | * |
| School other institution or public administrative area | * | * | * |
| Trade or service area | * | 11 | 14 |
| Total | 20 | 84 | 104 |

- 76.0% (n=79) of fall from height fatalities occur in the home, and 82.3% (n=65) of these deaths are males.

### 9.4.2 Stairs and Steps Fatalities: Victoria

***Age***

**Table 9.4.1 * Frequency and percentage of deaths related to falls occurring on stairs and steps by age group, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| 25-34 | * | * |
| 35-44 | * | * |
| 45-54 | * | * |
| 55-64 | 10 | 17.9 |
| 65-74 | 7 | 12.5 |
| 75+ | 30 | 53.6 |
| Total | 56 | 100.0 |

- There were no fatalities from falls on and from stairs and steps aged less than 25 years.
- Over eighty percent (83.9%, n=47) of Victorian stair and step fall fatalities are aged 55 years and over.

***Sex***

**Table 9.4.2 Frequency and percentage of deaths related to falls occurring on stairs and steps by sex, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Female | 16 | 28.6 |
| Male | 40 | 71.4 |
| Total | 56 | 100.0 |

- 71.4% (n=40) of stair and step fall fatalities are male, this is substantially higher than the male proportion of all building related fall fatalities (55.5%) but less than that displayed in the analysis of all fall from height fatalities (80.8%).

***Location***

**Table 9.4.3 Frequency and percentage of deaths related to falls occurring on stairs and steps by location, 2000/01-2004/05, Victoria.**

| | N | % |
|---|---|---|
| Home | 41 | 73.2 |
| Hospital or other health service | * | * |
| Recreation area place mainly for informal recreational activity | * | * |
| Residential correctional facility | * | * |
| School other institution or public administrative area | * | * |
| Trade or service area | 9 | 16.1 |
| Total | 56 | 100.0 |

- 73.2% (n=41) of Victorian stair and step fall related fatalities occurred in a home environment, and 16.1% (n=9) occurred in a trade or service area.

***Activity***

- The majority of stair and step fall related fatalities are coded as "other specified activity" (55.4%, n=31).
- 23.2% (n=13) of these deaths are coded as occurring while the person was "resting, sleeping, eating or other personal activity".

***Age by Sex***

- All stair and step fall fatalities aged less than 45 years are males, and there are only a total of three female fatalities under the age of 75 years.

***Location by Age Group***

**Table 9.4.4 Frequency of deaths related to falls occurring on stairs and steps, location by age group, 2000/01-2004/05, Victoria.**

| | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75+ | Total |
|---|---|---|---|---|---|---|---|
| Home | * | * | * | 9 | 6 | 21 | 41 |
| Hospital or other health service | 0 | 0 | 0 | 0 | 0 | * | * |
| Recreation area place mainly for informal recreational activity | 0 | 0 | 0 | 0 | 0 | * | * |
| Residential correctional facility | 0 | 0 | 0 | 0 | 0 | * | * |
| School other institution or public administrative area | 0 | 0 | 0 | 0 | 0 | * | * |
| Trade or service area | * | * | * | * | * | * | 9 |
| Total | * | * | * | 10 | 7 | 30 | 56 |

- Nearly three quarters 73.2% (n=41) of all Victorian stair and step fall related fatalities included in this analysis occurred in the home.

## 9.5 RESIDENTIAL AGED CARE FACILITIES: FALL FATALITIES (NURSING HOMES & HOMES FOR THE ELDERLY)

Due to terminology used by National Coroners Information System (version 1) residential aged care facilities have been divided into two types of facilities for analysis: nursing homes and homes for the elderly.

In the analysis of fatal falls in nursing homes, residential aged care facilities and hospitals, the data aggregated under the location categories of "hospital or other health service" and "residential or correctional facility" in tables 9.30 – 9.43 have been recoded and analysed separately in order provide greater insight into the circumstances surrounding the fatal fall. The categories are as follows:

- Nursing homes are assumed to include all locations coded as "hospital or other health service" with the activity code "being nursed or cared for".

- Other residential aged care facilities are assumed to include all locations coded broadly coded as “residential/correctional facility”, and specifically coded as “home for the elderly, frail”.

- Hospitals are assumed to include all locations broadly coded as “hospital or other health service” and specifically coded as “hospital”.

**Nursing homes**

A total of 94 deaths related to falls occurring in nursing homes were investigated by the Victorian Coroner in 2000/01 to 2004/05. Deaths related to falls in nursing homes accounted for over 19 percent of deaths related to falls occurring in buildings.

***Age***

**Table 9.5.1 Frequency and percentage of deaths related to falls occurring in nursing homes by age group, 2000/01-2004/05, Victoria.**

| Age group | N | % |
|---|---|---|
| 0- 44 | 0 | 0 |
| 45-54 | * | * |
| 55-64 | 0 | 0 |
| 65-74 | * | * |
| 75+ | 89 | 94.68 |
| Total | 94 | 100 |

- Persons aged 75 years and over were 95 percent of deaths related to falls occurring in nursing homes. Persons aged 65 years and over were 99 percent of all deaths.

***Sex***

**Table 9.5.2 Frequency and percentage of deaths related to falls occurring in nursing homes by sex, 2000/01 – 2004/05, Victoria.**

| Sex | N | % |
|---|---|---|
| Female | 51 | 54 .0% |
| Male | 43 | 46.0% |
| Total | 94 | 100.0% |

- Females were 54 percent of all deaths related to falls occurring in nursing homes and males were 46 percent of deaths.

**Table 9.5.3 Frequency of deaths related to falls occurring in nursing homes by age group and sex, 2000/01-2004/05, Victoria.**

| Age group | Female | Male | Total |
|---|---|---|---|
| 0- 44 | 0 | 0 | 0 |
| 45-54 | 0 | * | * |
| 65-74 | * | * | * |
| 75+ | 49 | 40 | 89 |
| Total | 51 | 43 | 94 |

- Females aged 75 years and over were 52 percent (n=49) of all deaths and 96 percent of female deaths.
- Males aged 75 years and over were 43 percent (n= 40) of all deaths and 93 percent of male deaths.

***Cause of fall in nursing homes***

**Table 9.5.4 Frequency and percentage of deaths related to falls occurring in nursing homes by cause, 2000/01-2004/05, Victoria.**

| Cause of fall | N | % |
|---|---|---|
| Fall: involving bed | 17 | 18.1 |
| Fall: involving chair | 6 | 6.4 |
| Fall: involving other furniture | * | * |
| Fall: involving wheelchair | * | * |
| Fall: other fall on same level | 19 | 20.2 |
| Fall: unspecified fall | 49 | 52.1 |
| Total | 94 | 100.0 |

- The cause of the fall was unspecified in over 52% of deaths.
- The most common specified causes of fall related deaths in nursing homes were: fall: other fall on same level (20% n=19), a fall involving a bed (18% n=17), and fall: involving a chair (6% n=6).

***Activity at time of fall in nursing home***

The activity at the time of fall for deaths related to falls occurring in nursing homes in Victoria in 2000/01-2004/05 was 'being nursed or cared for' for all cases (n=94).

**Homes for the elderly**

A total of 26 deaths related to falls occurring in homes for the elderly in 2000/01 to 2004/05 in Victoria were reported to the Victorian Coroner. Deaths related to falls in homes for the elderly accounted for over 5 percent of deaths related to falls occurring in buildings.

*Sex*

**Table 9.5.5 Frequency and percentage of deaths related to falls occurring in homes for the elderly by sex in 2000/01-2004/05, Victoria.**

| Sex | N | % |
|---|---|---|
| Female | 18 | 69.2 |
| Male | 8 | 30.8 |
| Total | 26 | 100.0 |

- Females were 69.0% (n=18) of all deaths related to falls occurring in homes for the elderly and males were 30% (n=8) of deaths.

*Age*

All deaths related to falls occurring in homes for the elderly in 2000/01 to 2004/05 in Victoria were in persons aged 75 years and over (n=26).

- The mean age was 87.9 (standard deviation 5.74) and a minimum age of 76 years and a maximum age of 98 years.
- Mean age for females was 89.7 years and for males 83.8 years.

*Cause of falls in homes for the elderly*

**Table 9.5.6 Frequency and percentage of deaths related to falls occurring homes for the elderly by cause, 2000/01-2004/05, Victoria.**

| Cause of fall | N | % |
|---|---|---|
| Fall: involving bed | * | * |
| Fall: involving chair | * | * |
| Fall: on and from stairs and steps | * | * |
| Fall: other fall on same level | 7 | 26.9 |
| Fall: same level from slipping, tripping and stumbling | * | * |
| Fall: unspecified fall | 12 | 46.2 |
| Total | 26 | 100.0 |

- The cause of the fatal fall was unspecified in over 46% of deaths.
- The most common specified cause of a fall related to deaths in homes for the elderly were: ‘other falls on the same level’ (27% n=7); fall: involving a bed (12% n=3) and fall: involving a chair (8% n=2).

*Activity at time of fall – falls in homes for the elderly*

**Table 9.5.7 Frequency and percentage of deaths related to falls occurring in homes for the elderly, by activity at time of fall, 2000/01-2004/05, Victoria.**

| Activity at time of fall | N | % |
|---|---|---|
| Being nursed or cared for | 12 | 46.2 |
| Resting, sleeping, eating or other personal activity | 9 | 34.6 |
| Unspecified activity | 5 | 19.2 |
| Total | 26 | 100.0 |

- Being nursed or cared for was the activity being undertaken when the fall incident occurred for 46 percent (n=12) of persons. The other major activity being undertaken at the time of the fall incident was ‘resting, sleeping, eating or other personal activity’ (35% n=9).

## 9.6 HOSPITALS FALL FATALITIES: VICTORIA

### 9.6.1 Overview

A total of ninety eight deaths related to falls occurring in hospitals in 2000/01 to 2004/05 in Victoria were reported to the Victorian Coroner. Deaths related to falls in hospitals accounted for over 20 percent of deaths related to falls occurring in buildings.

**Age**

**Table 9.6.1.1 Frequency and percentage of deaths related to falls occurring in hospitals by age group, 2000/01-2004/05, Victoria.**

| Age group | N | % |
|---|---|---|
| < 1 | * | * |
| 1-14 | 0 | 0 |
| 15-24 | 0 | 0 |
| 25-34 | * | * |
| 35-44 | * | * |
| 45-54 | * | * |
| 55-64 | 5 | 5.1 |
| 65-74 | 12 | 12.2 |
| 75+ | 76 | 77.6 |
| Total | 98 | 100.0 |

- Over three quarters of deaths occurred in the 75 years and over age group (78% n=76). Persons aged 65 years and over were 90 percent of all deaths (n=88).
- Mean age of deaths related to falls occurring in hospitals was 78.6 years with a maximum of 98 years and a minimum of 0 years (standard deviation =14.8).

**Sex**

**Table 9.6.1.2 Frequency and percentage of death related to falls occurring in hospitals by gender, 2000/01-2004/05, Victoria.**

| Gender | N | % |
|---|---|---|
| Female | 50 | 51.0 |
| Male | 48 | 49.0 |
| Total | 98 | 100.00 |

- Females accounted for 51.0% of the deaths and males 49%.

**Table 9.6.1.3 Frequency of deaths related to falls occurring in hospitals by age group and sex, 2000/01-2004/05, Victoria.**

| Age group | Female | Male | Total |
|---|---|---|---|
| < 1 | * | 0 | * |
| 25-34 | 0 | * | * |
| 35-44 | 0 | * | * |
| 45-54 | 0 | * | * |
| 55-64 | * | * | 5 |
| 65-74 | 5 | 7 | 12 |
| 75+ | 42 | 34 | 76 |
| Total | 50 | 48 | 98 |

- Females aged 75 years and over were 43 percent (n=42) of all fall related deaths occurring in hospitals and 84 percent of female deaths.
- Males aged 75 years and over were 35 percent (n=34) of all fall related deaths occurring in hospitals and 71 percent of male deaths.

**Cause of fall in hospital**

**Table 9.6.1.4 Frequency and percentage of deaths related to falls occurring in hospitals by cause, 2000/01-2004/05, Victoria**

| Cause of fall | N | % |
|---|---|---|
| Fall: from, out of or through building or structure | * | * |
| Fall: involving bed | 18 | 18.4 |
| Fall: involving chair | * | * |
| Fall: on and from ladder | * | * |
| Fall: on and from stairs and steps | * | * |
| Fall: other fall on same level | 16 | 16.3 |
| Fall: same level from slipping, tripping, stumbling | * | * |
| Fall: unspecified fall | 52 | 53.1 |
| Fall: while being carried or supported by other persons | * | * |
| Total | 98 | 100.0 |

- The cause was unspecified in over 53% of these fatal falls.
- The most common specified cause of falls related to deaths in hospitals was a fall from bed (18% n=18), followed by other falls on the same level (16% n=16) and a fall involving a chair (4% n=4).

**Activity at time of fall**

The activity at the time of fall for deaths related to falls occurring in hospitals in Victoria in 2000/01-2004/05 was 'being nursed or cared for' for all cases (n=98)

## 9.7 FALLS FROM BEDS FATALITIES: VICTORIA

### 9.7.1 OVERVIEW

A total of 54 deaths related to falls from beds in 2000/01 to 2004/05 were reported to the Victorian Coroner. Deaths related to falls from beds in buildings were over 11 percent of deaths related to falls occurring in buildings.

***Age***

**Table 9.7.1.1 Frequency and percentage of deaths in buildings related to falls from bed by age group, 2000/01- 2004/05, Victoria**

| Age group | N | % |
|---|---|---|
| 0- 44 | 0 | 0 |
| 45-54 | * | * |
| 55-64 | * | * |
| 65-74 | * | * |
| 75+ | 48 | 88.9 |
| Total | 54 | 100.0 |

- Eighty nine percent of deaths from falls from beds were persons aged 75 years and over (n= 48). Persons aged 65 years and over were 93 percent of all deaths. No deaths were recorded for persons under the age of 45 years.

**Sex**

**Table 9.7.1.2 Frequency and percentage of deaths related to falls from beds in buildings by sex, 2000/01-2004/05, Victoria**

| Gender | N | % |
|---|---|---|
| Female | 34 | 63.0 |
| Male | 20 | 37.0 |
| Total | 54 | 100.0 |

- Females deaths were 63% (n=34) of all deaths due to falls from beds, with males 37% (n=20) of deaths.

**Table 9.7.1.3 Frequency of deaths related to falls from beds by age group and sex, 2000/01-2004/05, Victoria**

| Age Group | Female | Male | Total |
|---|---|---|---|
| 45-54 | * | 0 | * |
| 55-64 | * | * | * |
| 65-74 | * | 0 | * |
| 75+ | 29 | 19 | 48 |
| Total | 34 | 20 | 54 |

- Females aged 75 years and greater were 54 percent (n=29) of all deaths related to falls from beds and 85 percent of female deaths.
- Males aged 75 years and greater were 35% (n=19) of all deaths related to falls from beds and 95 percent of male deaths.

**Table 9.7.1.4 Frequency and percentage of deaths related to falls from beds occurring in buildings by location of fall, 2000/01-2004/05, Victoria**

| Location of fall | N | % |
|---|---|---|
| Home | 13 | 24.0 |
| Hospital | 18 | 33.0 |
| Nursing Home | 17 | 31.0 |
| Home for the elderly | * | * |
| Residential correctional facility (not home for elderly) | * | * |
| Total | 54 | 100.0 |

- About a third of the deaths (33% n=18) were related to falls from beds in hospitals, 31 percent (n=18) falls from beds in nursing homes and a quarter of deaths (24% n=13) to falls from bed in the home.

**Activity at time of fall- falls from beds**

**Table 9.7.1.5 Frequency and percentage of deaths related to falls from beds in buildings by activity at time of fall, 2000/01-2004/05, Victoria**

| Activity at time of fall | N | % |
|---|---|---|
| Being nursed or cared for | 40 | 74.1 |
| Other specified & unspecified activity | * | * |
| Resting, sleeping, eating, other personal activity | 12 | 22.2 |
| Total | 54 | 100.0 |

- 74% (n=40) of persons were being nursed or cared for at the time of the fall. 22% (n=12) were 'resting, sleeping eating or other personal activity'.

## 9.8 FALL RELATED HOSPITAL SEPARATIONS IN AUSTRALIA

### 9.8.1 Introduction

The following data relates to national hospital utilisations due to fall related hospital admissions. One of the disadvantages of the national hospital utilisation data is that it records events as hospital separations and not as individuals. The data presented in the following section is national hospital separations. It is important to note that hospital separations do not equal fall events, as not all fall events result in injury or hospital admissions. Hospital separations do not directly equate with hospitals admissions either, as the number of hospital separations may be greater than the number of hospital admissions for fall related admissions due to the inclusion of transfers between hospitals in separation data. Hospital separations may also include multiple counting due to re-admissions for the same fall event.

In an attempt to quantify the possible difference between hospital admissions and hospital separations due to inter hospital transfers, the proportion of modes of admissions known to be 'admitted patient transfers' is provided for each type of data category in a box at the beginning of the appropriate sections. Currently no method of excluding readmissions is available for the national data. Overall, the factor by which hospital separations over-represents the actual number of hospitalised fall injury is approximately 10%.

Where data cell counts were less than 5, data has been either collapsed or suppressed (denoted by *) to prevent possible patient identification, and this is noted in relevant tables.

Injury severity has been coded using the International Classification of Diseases-based Injury Severity Score (ICISS). Further information on this code is provided at the end of this chapter.

The information presented in the following sections uses separations coded as other external causes of accidental injury - Falls W00-W19. This data excludes: assault, fall (in) (from): animal, burning building, into fire, into water, machinery, transport vehicle and intentional self-harm. Further information on data and coding is provided at the end of this chapter.

### 9.8.2 Unintentional Fall Related Hospital Separations, Australia, 1999/00-2004/05 (n = 1,018,651)

There was a total of 1,018, 651 fall related hospital separations for the 6 years 1999/00 to 2004/05, an average of 169,775 fall related hospital separations per year. This overview data of all fall separations is presented here to provide a context for falls in buildings (see section 9.8).

### Age and sex distribution

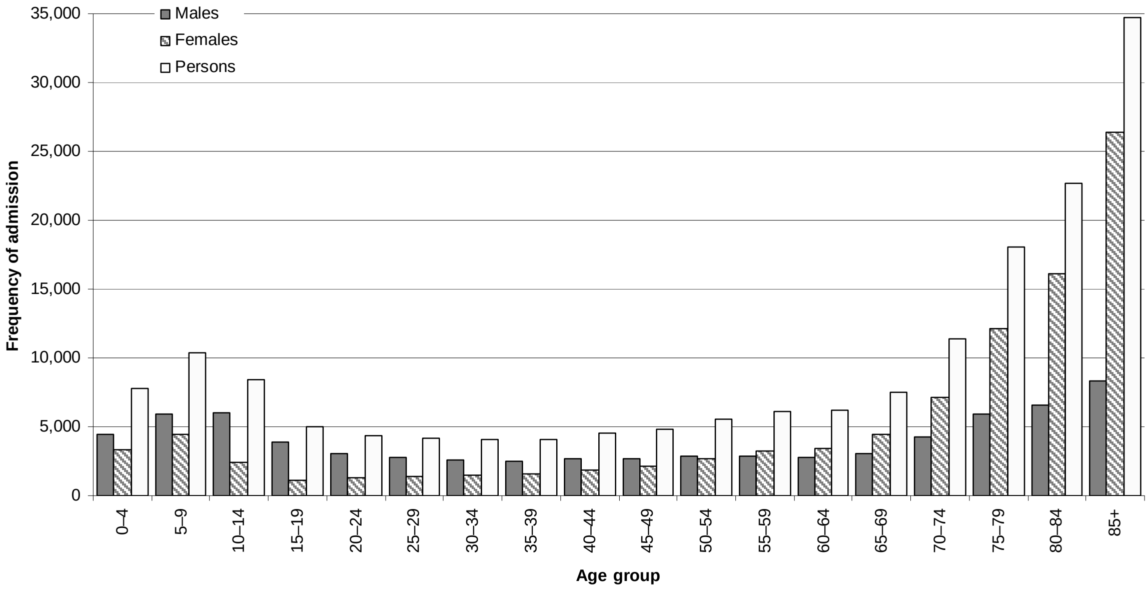



*Figure 9.8.2.1 Annual average frequency of fall related hospital separations by age and sex (5 years groups to 85+), Australia, 1999/00-2004/05.*

***Age***

- Annual average fall related hospital separations increased in each age group over the 60-65 years age group, with annual average separations rising from 7,511 for the age group 65-69 years to 34,739 separations for the group aged 85 years or greater.
- Annual average fall related hospital separations were higher in the 5-9 age group than all other age groups under the age group 70–74 years, with an annual average of 10, 345 fall related hospitalisations for persons aged 5-9 years.

***Sex***

- Annual average fall related hospital separations were higher for males than females in each of the 5 year age groupings from 0-4 to 50-54. This situation was reversed in the 5 year age groupings from 55-59 to 85 +, with annual average fall related hospitalisations in females higher than in males.


| | 0–4 | 5–9 | 10–14 | 15–19 | 20–24 | 25–29 | 30–34 | 35–39 | 40–44 | 45–49 | 50–54 | 55–59 | 60–64 | 65–69 | 70–74 | 75–79 | 80–84 | 85+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Males | 677.8 | 859.4 | 860.4 | 559.5 | 446.1 | 395.9 | 346.7 | 344.1 | 357.6 | 395.7 | 436.9 | 519.7 | 641.2 | 888.3 | 1414.7 | 2559.8 | 4790.7 | 9754.1 |
| Females | 543.6 | 678.6 | 366.3 | 170.7 | 193.0 | 199.8 | 202.0 | 211.2 | 242.2 | 302.8 | 417.8 | 604.3 | 821.0 | 1226.1 | 2155.6 | 4119.2 | 7651.1 | 13948.3 |
| Persons | 612.5 | 771.4 | 619.5 | 369.6 | 321.9 | 298.0 | 273.8 | 277.3 | 299.6 | 349.0 | 427.4 | 561.5 | 730.5 | 1059.8 | 1802.7 | 3429.6 | 6524.4 | 12637.9 |

Age group

*Figure 9.8.2.1 Annual average rate of fall related age specific hospital separations by age and sex (5 year groups to 85+), Australia, 1999/00-2004/05.*

***Age***

- The rate of fall related hospital separations increases sharply from 1059.8 per 100,000 of population in the 65-69 age group to 12637.9 per 100,000 of population for persons aged 85 plus.
- Rates for younger age groups were higher than those for adults less than 65 years of age, with rates over 600 per 100,000 for all 5 year age groupings under 15 years of age.

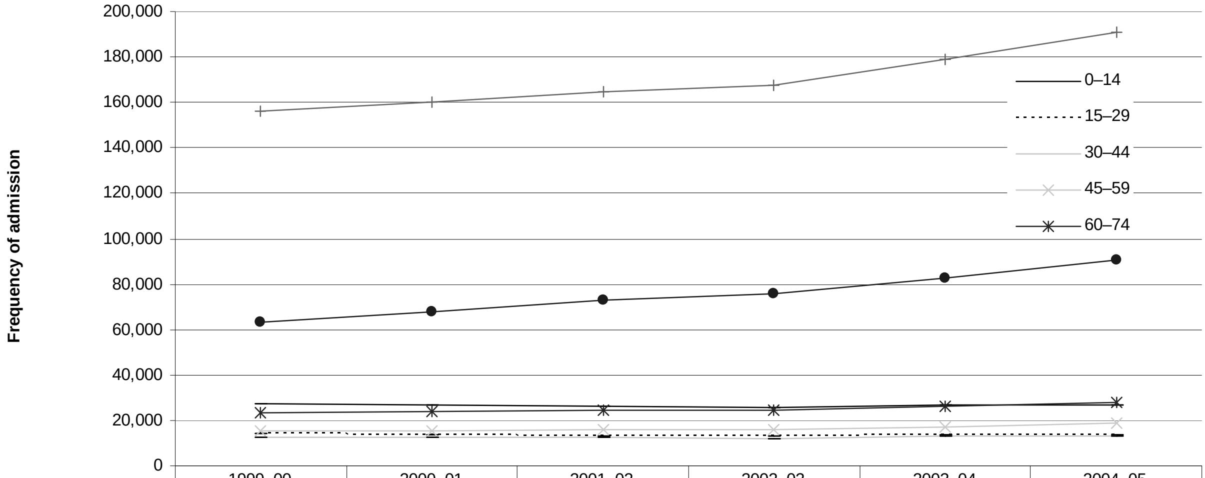
***Sex***

- The sex specific rate per 100, 000 population for fall related hospital separations for all 5 year age groupings under 55 years was higher in males than females, however after the age of 55 the female age specific rates for all 5 year age groupings was higher than males.

### 9.8.3 Trend in the frequency and rate of fall related hospital separations

Trend analysis covers the 6 year period from July 1999 to June 2005. Age adjusted rates (Figure 9.8.3.1) were calculated using direct standardisation, taking the estimated resident population as the Australian population on the 30th June 2001.

### *Frequency*



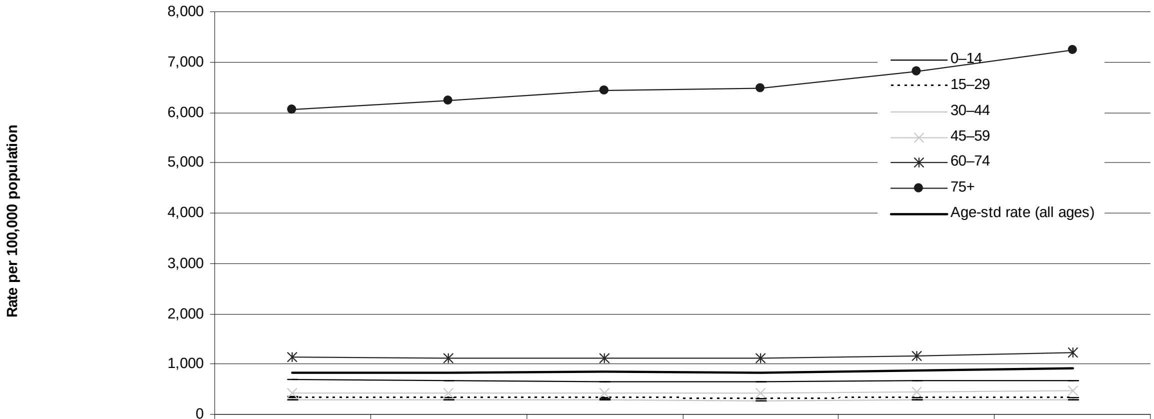

| | 1999–00 | 2000–01 | 2001–02 | 2002–03 | 2003–04 | 2004–05 |
|---|---|---|---|---|---|---|
| 0–14 | 27184 | 26727 | 25976 | 25909 | 26951 | 26816 |
| 15–29 | 14072 | 13400 | 13189 | 12869 | 13415 | 13821 |
| 30–44 | 12501 | 12473 | 12718 | 12230 | 12870 | 13181 |
| 45–59 | 15272 | 15476 | 15954 | 16024 | 17371 | 18595 |
| 60–74 | 23618 | 23960 | 24263 | 24667 | 26041 | 28171 |
| 75+ | 63405 | 67981 | 72836 | 75920 | 82395 | 90392 |
| All ages | 156052 | 160020 | 164937 | 167623 | 179043 | 190976 |

**Year of separation from hospital**

*Figure 9.8.3.1 Trend in the frequency of fall related hospital separations by broad age group, Australia, 1999/00-2004/05*

- The frequency of separations for fall related hospitalisations for all ages increased by 22% (from 156,052 in 1999/00 to 190,976 separations in 2004/05).
- The frequency of separations for fall related hospitalisations increased in the 60-74 age group by 19% (from 23,618 to 28,171) and in the 75+ age group by 43% (from 63,405 to 90,392).

### *9.2.2.2 Rates*




| | 1999–00 | 2000–01 | 2001–02 | 2002–03 | 2003–04 | 2004–05 |
|---|---|---|---|---|---|---|
| 0–14 | 686.4 | 671.9 | 651.5 | 650.2 | 677.0 | 673.8 |
| 15–29 | 346.3 | 330.3 | 324.6 | 315.7 | 326.9 | 333.3 |
| 30–44 | 286.5 | 282.9 | 284.8 | 271.6 | 284.6 | 291.4 |
| 45–59 | 434.7 | 428.2 | 429.2 | 419.8 | 443.7 | 464.8 |
| 60–74 | 1128.9 | 1127.7 | 1121.7 | 1119.5 | 1156.5 | 1218.7 |
| 75+ | 6058.5 | 6237.0 | 6429.8 | 6486.3 | 6810.9 | 7245.3 |
| Age-std rate (all ages) | 833.6 | 835.3 | 840.9 | 837.0 | 875.1 | 913.1 |

**Year of separation from hospital**

*Figure 9.8.3.2 Trend in the rates of fall related hospital separations by broad age group, Australia, 1999/00-2004/05/100,000 population*

- The all ages (age standardised) fall related hospital separations rate increased by 9.6 % over the 6 year period, from 833.6 separations per 100,000 population per year in 1999/00 to 913.1 separations per 100,000 population per year in 2004/05.
- The fall related hospital separation rates for the age specific groups 1-14 years (686.4 to 673.8) and 15-29 years (345.3 to 333.3) decreased slightly with all other age groups rising for the 1990/00-2004/05 time period.

## 9.8.4 Causes of injury

All fall injury related hospital separations

**Table 9.8.4.1 Frequency and percentage of fall related hospital separations ranked by cause, Australia, 1999/00-2004/05 (n=1,018,651)**

| | 1999–00 | 2000–01 | 2001–02 | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|---|---|---|
| Fall on same level from slipping, tripping and stumbling | 43,199 | 46,302 | 48,450 | 43,512 | 44,791 | 47,770 | **274,024** | **26.9%** |
| *Slipping* | NA | NA | NA | 14,869 | 14,766 | 15,833 | **45,475** | **4.5%** |
| *Tripping* | NA | NA | NA | 22,086 | 24,374 | 26,183 | **72,648** | **7.1%** |
| *Stumbling* | NA | NA | NA | 6,519 | 5,651 | 5,754 | **17,929** | **1.8%** |
| Other fall on same level | 14,953 | 16,884 | 21,837 | 26,391 | 30,501 | 33,339 | **143,905** | **14.1%** |
| Fall on and from stairs and steps | 8,450 | 8,769 | 9,133 | 9,448 | 10,156 | 11,197 | **57,153** | **5.6%** |
| Fall involving bed | 6,093 | 6,376 | 6,763 | 7,119 | 7,295 | 7,675 | **41,321** | **4.1%** |
| Other fall from one level to another | 7,360 | 7,281 | 6,943 | 6,221 | 6,145 | 6,473 | **40,423** | **4.0%** |
| Fall involving playground equipment | 6,103 | 5,892 | 6,084 | 6,310 | 6,442 | 6,284 | **37,115** | **3.6%** |
| Other fall on same level due to collision with, or pushing by, another person | 5,667 | 4,952 | 5,108 | 4,916 | 5,410 | 4,792 | **30,845** | **3.0%** |
| Fall involving chair | 4,343 | 4,399 | 4,563 | 4,820 | 5,195 | 5,480 | **28,800** | **2.8%** |
| Fall on and from ladder | 3,989 | 4,119 | 4,217 | 4,058 | 4,428 | 4,744 | **25,555** | **2.5%** |
| Fall from, out of or through building or structure | 4,080 | 3,989 | 4,085 | 4,216 | 4,195 | 4,336 | **24,901** | **2.4%** |
| Fall involving ice-skates, skis, roller-skates or skateboards | 3,784 | 4,164 | 3,249 | 3,087 | 3,382 | 3,449 | **21,115** | **2.1%** |
| Fall from tree | 1,694 | 1,679 | 1,646 | 1,573 | 1,383 | 1,397 | **9,372** | **0.9%** |
| Fall involving other furniture | 970 | 957 | 1,090 | 1,058 | 1,174 | 1,125 | **6,374** | **0.6%** |
| Fall involving wheelchair | 762 | 735 | 793 | 853 | 890 | 996 | **5,029** | **0.5%** |
| Diving or jumping into water causing injury other than drowning or submersion | 474 | 525 | 524 | 453 | 549 | 559 | **3,084** | **0.3%** |
| Fall while being carried or supported by other persons | 469 | 442 | 463 | 549 | 556 | 532 | **3,011** | **0.3%** |
| Fall on and from scaffolding | 354 | 298 | 271 | 327 | 334 | 377 | **1,961** | **0.2%** |
| Fall from cliff | 220 | 217 | 209 | 423 | 407 | 407 | **1,883** | **0.2%** |
| Fall on same level involving ice and snow | 83 | 61 | 50 | 90 | 71 | 64 | **419** | **0.0%** |
| Unspecified fall | 43,005 | 41,979 | 39,459 | 42,199 | 45,739 | 49,980 | **262,361** | **25.8%** |
| **Total** | **156,052** | **160,020** | **164,937** | **167,623** | **179,043** | **190,976** | **1,018,651** | **100.0%** |

Note: Almost 26% of hospital separations were coded as an unspecified fall. The proportions for slipping, tripping and stumbling shown separately are under estimates as these breakdowns were not separately available for 1999/00-2001/02.

The major causes in rank order were:

- Fall on same level from slipping, tripping and stumbling (26.9%)
- Other fall on same level (14.1 %)
- Falls on and from stairs or steps (5.6%)
- Fall involving bed (4.1%)
- Other fall involving fall from one level to another (4.0%)

### 9.8.5 Location (place of occurrence of injury)

All fall injury related hospital separations

***Broad location***

**Table 9.8.5.1 Frequency and percentage of fall related hospital separations by location of injury occurrence (broad), Australia, 1999/00-2004/05**

| | 1999–00 | 2000–01 | 2001–02 | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|---|---|---|
| Home | 58482 | 60392 | 63446 | 63215 | 68594 | 72745 | **386874** | **38.00** |
| Residential institution | 13958 | 9795 | 9538 | 15612 | 18073 | 20091 | **87067** | **9.00** |
| School, other institution & public administration area | 11669 | 19113 | 21678 | 18055 | 17517 | 17751 | **105783** | **10.0** |
| Sports and athletics area | 9185 | 7816 | 7640 | 7078 | 7502 | 7399 | **46620** | **5.0** |
| Street and highway | 5078 | 5628 | 5748 | 6026 | 6012 | 6383 | **34875** | **3.0** |
| Trade and service area | 5295 | 5090 | 5514 | 5384 | 5585 | 6042 | **32910** | **3.0** |
| Industrial and construction area | 2200 | 2072 | 1573 | 1368 | 1401 | 1197 | **9811** | **1.0** |
| Farm | 533 | 469 | 438 | 490 | 403 | 491 | **2824** | **0.0** |
| Other specified place of occurrence | 6057 | 6830 | 6713 | 5301 | 5981 | 5909 | **36791** | **0.40** |
| Unspecified place of occurrence | 43595 | 41880 | 42321 | 44471 | 47811 | 52905 | **272983** | **27.0** |
| Place not reported/not applicable | 0 | 935 | 328 | 623 | 164 | 63 | **2113** | **0.0** |
| Total | **156052** | **160020** | **164937** | **167623** | **179043** | **190976** | **1018651** | **100.0** |

- The location of the fall was unspecified in 27% of all separations. The most common place of occurrence for falls was the home (38%), followed by schools and other institutions and public administration areas (10%), residential institutions (9%) and sports and athletics areas (5%).

### *Specific location of fall related hospital separations of all falls*

**Table 9.8.5.2 Frequency and percentage of fall related hospital separations by specific fall locations of injury occurrence, Australia, 2002/03-2004/05**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Driveway to home | 1065 | 989 | 1020 | **3074** | **0.6%** |
| Other and unspecified place in home | 62097 | 67605 | 71691 | **201393** | **37.5%** |
| Prison | 77 | 75 | 90 | **242** | **0.0%** |
| Juvenile detention centre | 13 | 8 | 7 | **28** | **0.0%** |
| Military camp | 9 | 6 | 13 | **28** | **0.0%** |
| Aged care facilities | 14870 | 17392 | 19260 | **51522** | **9.6%** |
| Other specified residential institution | 463 | 472 | 586 | **1521** | **0.3%** |
| Unspecified residential institution | 177 | 120 | 135 | **432** | **0.1%** |
| School | 4740 | 4769 | 4848 | **14357** | **2.7%** |
| Health Service area | 12161 | 11822 | 11930 | **35913** | **6.7%** |
| Other specified institution and public administrative area | 1153 | 926 | 973 | **3052** | **0.6%** |
| Sporting grounds (outdoor) | 4689 | 5060 | 4817 | **14566** | **2.7%** |
| Sporting hall (indoor) | 579 | 644 | 646 | **1869** | **0.3%** |
| Swimming centre | 155 | 164 | 146 | **465** | **0.1%** |
| Racetrack and racecourse | 62 | 70 | 76 | **208** | **0.0%** |
| Skating rink | 409 | 422 | 422 | **1253** | **0.2%** |
| Skiing | 510 | 416 | 562 | **1488** | **0.3%** |
| Other specified sports and athletic areas | 375 | 396 | 372 | **1143** | **0.2%** |
| Sports and athletic areas, unspecified | 295 | 329 | 358 | **982** | **0.2%** |
| Roadway | 1306 | 1675 | 1744 | **4725** | **0.9%** |
| Sidewalk | 4097 | 3974 | 4274 | **12345** | **2.3%** |
| Cycleway | 15 | 13 | 9 | **37** | **0.0%** |
| Other specified public highway, street or road | 223 | 182 | 220 | **625** | **0.1%** |
| Unspecified public highway, street or road | 381 | 168 | 135 | **684** | **0.1%** |
| Shop and store | 2316 | 2548 | 2711 | **7575** | **1.4%** |
| Commercial garage | 121 | 101 | 111 | **333** | **0.1%** |
| Office building | 113 | 98 | 96 | **307** | **0.1%** |
| Cafe, hotel and restaurant | 1924 | 1982 | 2189 | **6095** | **1.1%** |
| Other specified trade and service area | 774 | 704 | 782 | **2260** | **0.4%** |
| Unspecified trade and service area | 134 | 152 | 153 | **439** | **0.1%** |
| Construction area | 642 | 634 | 571 | **1847** | **0.3%** |
| Demolition site | 10 | 6 | 6 | **22** | **0.0%** |
| Factory and plant | 268 | 347 | 291 | **906** | **0.2%** |
| Mine and quarry | 83 | 95 | 71 | **249** | **0.0%** |
| Shipyard | 19 | 16 | 18 | **53** | **0.0%** |
| Other specified industrial and construction area | 160 | 109 | 93 | **362** | **0.1%** |
| Unspecified industrial and construction area | 186 | 194 | 147 | **527** | **0.1%** |
| Farm | 490 | 403 | 491 | **1384** | **0.3%** |
| Area of still water | 131 | 142 | 148 | **421** | **0.1%** |
| Stream of water | 245 | 305 | 260 | **810** | **0.2%** |
| Large area of water | 211 | 292 | 317 | **820** | **0.2%** |
| Beach | 616 | 666 | 637 | **1919** | **0.4%** |
| Forest | 154 | 190 | 177 | **521** | **0.1%** |
| Other specified countryside | 383 | 548 | 450 | **1381** | **0.3%** |
| Parking lot | 320 | 345 | 429 | **1094** | **0.2%** |
| Other specified place of occurrence | 3240 | 3493 | 3491 | **10224** | **1.9%** |
| Unspecified place of occurrence | 44471 | 47811 | 52905 | **145187** | **27.0%** |
| Place not reported/not applicable | 691 | 165 | 98 | **954** | **0.2%** |
| **Total** | **167623** | **179043** | **190976** | **537642** | **100.0%** |

- The location was unspecified in 27% of separations.
- The most common location was the home (37.5%), followed by residential aged care facility at (9.6%), health service area (6.7%) and school (2.7%).

## 9.9 FALL RELATED HOSPITAL SEPARATIONS OCCURRING IN BUILDINGS

### 9.9.1 Overview of the fall related hospital separations that occurred in buildings, Australia 2002/3-2004/5.

The following data have been selected according to criteria determined in consultation with the ABCB. Instructions were to exclude the following locations: driveway to home, sporting grounds-outdoor, swimming centre, racetrack and racecourse, equestrian facility, sports and athletics area skating rink, sports and athletics area skiing, other specified sports & athletics area, sports and athletics area unspecified, street & highway roadway, street & highway sidewalk, street & highway cycleway, other specified public highway, street, road, unspecified public highway street road, unspecified trade and service area, construct area, industrial & construction area demolition site, industrial & construction area mine & quarry, industrial & construction area oil gas extraction, industrial & construction area shipyard, industrial & construction area power station, industrial & construction area factory and plant, other specified industrial & construction area, unspecified industrial & construction area, farm, area of still water, stream of water, large area of water, beach, forest, desert, other specified countryside, parking lot, other specified place of occurrence, unspecified place of occurrence. Falls from cliffs, playground equipment, trees, ice/ skates/ skis/ roller-skates/ skateboards, on and from scaffolding, diving or jumping into water and same level ice and snow have also been excluded.

**NB:** Admitted patient transfers make up 13.3 % of the total modes of admission in the data on national hospital separations for falls occurring in buildings for the 2002/03-2004/05 years. This results in an over-estimation of actual cases of falls.

### 9.9.2 Trend in the frequency and rate of hospital separations occurring in buildings

***Frequency***

**Table 9.9.2.1 Frequency of fall related hospital separations occurring in buildings, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| Persons | 98,862 | 106,138 | 112,905 | 317,905 |

- The total number of separations for 2002/03 to 2004/05 was 317,905. Annual hospital separations increased by more than 14 percent over a three year period, from 98,862 separations in 2002/03 to 112,905 separations in 2004/05.

**Table 9.9.2.2 Frequency and percentage of fall related hospital separations occurring in buildings separations by year and sex, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 34,832 | 37,333 | 39,999 | 112,164 | 35.3% |
| Females | 64,029 | 68,804 | 72,903 | 205,736 | 64.7% |
| Persons | 98,862 | 106,138 | 112,905 | 317,905 | 100.0% |

- Females accounted for 65 percent of the hospital separations while males accounted for 35 percent of all hospital separations.
- The frequency of male and female fall related hospital separations occurring in buildings increased, in males by 15 percent (from 34,832 hospital separations in 2002/03 to 39,999 in 2004/05) and 14 percent in females (from 64,029 separations in 2002/03 to 72,903 in 2004/05).

***Rates***

**Table 9.9.2.3 Age standardised rates per 100,000 population of fall related hospital separations occurring in buildings by sex, Australia, 2002/03-2004/05**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| Males | 405.1 | 422.4 | 439.5 | 422.8 |
| Females | 541.8 | 567.6 | 585.3 | 565.3 |
| Persons | 489.2 | 511.4 | 528.2 | 510.0 |

- The rate of all ages, all person fall related hospital separations occurring in buildings increased from by 8 percent over the three year period, from 489.2 separations per 100,000 population in 2002/03 to 528.2 separations per 100,000 population in 2004/05.
- The male fall related hospital separation rate increased by 8.5% percent from 405.1 separations per 100,000 population per year in 2002/03 to 439.5 separations per 100,000 population in 2004/05, and the female rate increased  percent from 541.8 separations per 100,000 population in 2002/03 to 585.3 separations per 100,000 population in 2004/05.

### 9.9.3 Age and sex distribution

***Frequency***

**Table 9.9.3.1 *Frequency of fall related hospital separations occurring in buildings by 5 year age groups and sex, Australia, 2002/03-2004/05.**

| | 0–4 | 5–9 | 10–14 | 15–19 | 20–24 | 25–29 | 30–34 | 35–39 | 40–44 |
|---|---|---|---|---|---|---|---|---|---|
| Males | 6,770 | 4,656 | 4,551 | 1,963 | 1,704 | 1,746 | 2,036 | 2,278 | 2,764 |
| Females | 5,292 | 3,474 | 2,250 | 1,251 | 1,450 | 1,629 | 1,992 | 2,204 | 2,591 |
| Persons | 12,062 | 8,130 | 6,801 | 3,214 | 3,154 | 3,375 | 4,028 | 4,482 | 5,356 |

| | 45–49 | 50–54 | 55–59 | 60–64 | 65–69 | 70–74 | 75–79 | 80–84 | 85+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Males | 3,152 | 3,458 | 4,272 | 4,613 | 5,795 | 9,031 | 13,809 | 17,014 | 22,552 | 112,164 |
| Females | 3,191 | 4,110 | 5,587 | 6,294 | 8,702 | 14,698 | 27,828 | 41,094 | 72,097 | 205,736 |
| Persons | 6,343 | 7,568 | 9,859 | 10,907 | 14,497 | 23,730 | 41,637 | 58,109 | 94,650 | 317,905 |

- The frequency of fall related hospital separations occurring in buildings for 5 year age groups between 2002/03-2004/05 is higher in males for all 5 year age groupings under

45 years of age. The frequency of fall related hospitalisations is higher for females than males in all 5 year age groupings after the age of 45.

- The frequency of fall related hospitalisations occurring in buildings peaks in the 85+ age group for both males and females.

**Table 9.9.3.2 Frequency and percentage of fall related hospital separations occurring in buildings by 5 year age groups, Australia, 2002/03-2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| 0–4 | 3,904 | 4,047 | 4,111 | 12,062 | 3.8 |
| 5–9 | 2,722 | 2,778 | 2,630 | 8,130 | 2.6 |
| 10–14 | 2,191 | 2,297 | 2,313 | 6,801 | 2.1 |
| 15–19 | 1,053 | 1,097 | 1,064 | 3,214 | 1.0 |
| 20–24 | 1,033 | 1,060 | 1,061 | 3,154 | 1.0 |
| 25–29 | 1,137 | 1,066 | 1,172 | 3,375 | 1.1 |
| 30–34 | 1,319 | 1,307 | 1,402 | 4,028 | 1.3 |
| 35–39 | 1,457 | 1,511 | 1,514 | 4,482 | 1.4 |
| 40–44 | 1,716 | 1,790 | 1,850 | 5,356 | 1.7 |
| 45–49 | 1,969 | 2,102 | 2,272 | 6,343 | 2.0 |
| 50–54 | 2,441 | 2,525 | 2,602 | 7,568 | 2.4 |
| 55–59 | 2,912 | 3,418 | 3,529 | 9,859 | 3.1 |
| 60–64 | 3,391 | 3,524 | 3,992 | 10,907 | 3.4 |
| 65–69 | 4,408 | 4,744 | 5,345 | 14,497 | 4.6 |
| 70–74 | 7,622 | 8,010 | 8,098 | 23,730 | 7.5 |
| 75–79 | 13,019 | 13,918 | 14,700 | 41,637 | 13.1 |
| 80–84 | 17,583 | 19,370 | 21,156 | 58,109 | 18.3 |
| 85+ | 28,982 | 31,574 | 34,094 | 94,650 | 29.8 |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0 |

- The 85 years plus age group was responsible for almost 30 percent of all hospital separations due to falls occurring in buildings nationally.

- The next largest proportion of hospital separations was in the 80-84 years age group (18%) and in the 75-79 years age group (13%).

- Persons 65 years and over were responsible for 73.3 % of all hospital separations, with persons aged 75 years and over responsible for 61.2 % of all hospital separations.

*Rates*

**Table 9.9.3.3 Age specific rates per 100,000 population of fall related hospital separations occurring in buildings by 6 broad age groups and sex, Australia, 2002/03-2004/05.**

| | 0–14 | 15–29 | 30–44 | 45–59 | 60–74 | 75+ |
|---|---|---|---|---|---|---|
| Males | 260.8 | 86.3 | 105.1 | 185.6 | 581.7 | 3,665.7 |
| Females | 189.3 | 71.5 | 99.6 | 219.5 | 866.9 | 6,493.3 |
| Persons | 226.0 | 79.0 | 102.3 | 202.6 | 726.1 | 5,358.5 |

- The all person fall related hospital separations rate per 100,000 population increases with age after the 0-14 age group and peaks in the 75+ age group.
- Both males and females have very high rates of hospital separations for 2002/03 to 2004/05 in the 75 year plus age group (with males having a rate of 3, 665.7 hospital separations per 100,000 population and females having a rate of 5,358 hospital separations per 100,000 population).

### 9.9.4 Causes of fall related hospital separations occurring in buildings

**Table 9.9.4.1 Frequency and percentage of fall related hospital separations occurring in buildings by cause and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Fall on same level from slipping, tripping and stumbling | 29,629 | 30,527 | 32,534 | 92,690 | 29.2 |
| *Slipping* | 10,523 | 10,470 | 11,300 | 32,293 | 10.2 |
| *Tripping* | 14,186 | 15,738 | 16,931 | 46,855 | 14.7 |
| *Stumbling* | 4,885 | 4,319 | 4,303 | 13,507 | 4.2 |
| Other fall on same level due to collision with, or pushing by, another person | 1,017 | 1,087 | 1,028 | 3,132 | 1.0 |
| Fall while being carried or supported by other persons | 321 | 322 | 276 | 919 | 0.3 |
| Fall involving wheelchair | 603 | 641 | 726 | 1,970 | 0.6 |
| Fall involving bed | 6,793 | 6,965 | 7,291 | 21,049 | 6.6 |
| Fall involving chair | 3,894 | 4,132 | 4,294 | 12,320 | 3.9 |
| Fall involving other furniture | 826 | 904 | 857 | 2,587 | 0.8 |
| Fall on and from stairs and steps | 5,859 | 6,296 | 6,866 | 19,021 | 6.0 |
| Fall on and from ladder | 1,937 | 2,050 | 2,170 | 6,157 | 1.9 |
| Fall from, out of or through building or structure | 2,133 | 1,974 | 2,049 | 6,156 | 1.9 |
| Other fall from one level to another | 2,117 | 2,094 | 2,021 | 6,232 | 2.0 |
| Other fall on same level | 19,187 | 22,250 | 24,019 | 65,456 | 20.6 |
| Unspecified fall | 24,546 | 26,896 | 28,774 | 80,216 | 25.2 |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0 |

- The cause of the fall was not specified in 25.2 percent of hospital separations.
- The major causes of hospital separations in rank order were:
    - Slips, trips and stumbles on the same level (29.2%)
    - Other fall on same level (20.6%)
    - Fall involving bed (6.6%)
    - Fall on and from stairs and steps (6.0%)
    - Fall involving chair (3.9%)

### 9.9.5 Location of falls of hospital separations due to fall related events occurring in buildings

**Table 9.9.5.1 Frequency and percentage of fall related hospital separations ranked by specific location of fall occurrence, Australia, 2002/03-2004/05.**

| Place of fall occurrence | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other and unspecified place in home | 60,661 | 66,108 | 70,341 | 197,110 | 62.0 |
| Aged care facilities | 14,869 | 17,389 | 19,255 | 51,513 | 16.0 |
| Health Service area | 12,144 | 11,808 | 11,908 | 35,860 | 11.3 |
| School | 3,011 | 3,148 | 3,147 | 9,306 | 2.9 |
| Shop and store | 2,289 | 2,521 | 2,675 | 7,485 | 2.4 |
| Cafe, hotel and restaurant | 1,875 | 1,943 | 2,132 | 5,950 | 1.9 |
| Other specified institution and public administrative area | 1,112 | 894 | 942 | 2,948 | 0.9 |
| Other specified trade and service area | 768 | 699 | 773 | 2,240 | 0.7 |
| Sporting hall (indoor) | 538 | 601 | 610 | 1,749 | 0.6 |
| Other specified residential institution | 460 | 463 | 579 | 1,502 | 0.5 |
| Place not reported/not applicable | 635 | 156 | 93 | 884 | 0.3 |
| Prison | 76 | 75 | 90 | 241 | 0.1 |
| Commercial garage | 119 | 101 | 111 | 331 | 0.1 |
| Unspecified residential institution | 172 | 120 | 133 | 425 | 0.1 |
| Office building | 113 | 98 | 96 | 307 | 0.1 |
| Juvenile detention centre | 12 | 8 | 7 | 27 | 0.0 |
| Military camp | 8 | 6 | 13 | 27 | 0.0 |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0 |

- The place of occurrence (location) was in the home for 62 percent of separations (n=197,110).
- The next most common places of fall occurrence were aged care facilities (16%), health service areas (11%), schools (2.9%) and cafés, hotels and restaurants (2%).

### 9.9.6 Activity when fall occurred- fall related hospital separations occurring in buildings

**Table 9.9.6.1 Frequency and percentage of fall related hospital separations occurring in buildings by activity and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| While engaged in sports | 1,690 | 1,801 | 1,812 | 5,303 | 1.7 |
| While engaged in leisure | 1,410 | 1,366 | 1,088 | 3,864 | 1.2 |
| While working for income | 1,249 | 1,100 | 1,102 | 3,451 | 1.1 |
| While engaged in other types of work | 5,765 | 5,904 | 6,161 | 17,830 | 5.6 |
| While resting, sleeping, eating, etc. | 18,005 | 18,450 | 19,644 | 56,099 | 17.6 |
| Other specified activity | 17,982 | 18,924 | 18,432 | 55,338 | 17.4 |
| Unspecified activity | 51,991 | 58,235 | 64,472 | 174,698 | 55.0 |
| Activity not reported/not applicable | 716 | 358 | 194 | 1,268 | 0.4 |
| Total | 98,808 | 106,138 | 112,905 | 317,851 | 100.0 |

- Activity being undertaken at time of the fall was unspecified in 55 percent of hospital separations. The activity was coded as other or not reported in about 18 percent of separations.
- The most common activity noted being undertaken at the time of fall was while resting, sleeping and eating (17%), followed by while engaged in other types of work (5.6%), and engaged in sports (1.7%).

### 9.9.7 Body region and nature of injury - fall related hospital separations occurring in buildings

**Table 9.9.7.1 Frequency and percentage of fall related hospital separations occurring in buildings by major body region injured (principal diagnosis) and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other injuries not specified by body region & principal diagnosis not injury | 30,223 | 32,391 | 37,426 | 100,040 | 31.5% |
| Head | 13,268 | 13,978 | 15,237 | 42,483 | 13.4% |
| Trunk (neck, thorax, abdomen, lower back, lumber spine & pelvis | 10,545 | 11,604 | 12,155 | 34,304 | 10.8% |
| Shoulder and upper limb | 16,198 | 17,455 | 17,634 | 51,287 | 16.1% |
| Hip and lower limb | 28,628 | 30,710 | 30,453 | 89,791 | 28.2% |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0% |

- Over 31% of injuries did not specify a specific body region or injury was not the principal diagnosis. In over 69% of hospital separations the principal diagnosis was injury.

- The most common area injured was the hip and lower limb (28% of total hospital separations), followed by shoulder and upper limb (16%) and head (13%).

**Table 9.9.7.2 Frequency and percentage of falls related hospital separations occurring in buildings by principal diagnosis groups by year of separation, Australia, 2002/03-2004/05**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Principal diagnosis not poisoning or injury | 29,481 | 31,595 | 36,615 | 97,691 | 30.7% |
| Injuries to the head | 13,268 | 13,978 | 15,237 | 42,483 | 13.4% |
| Injuries to the neck | 759 | 965 | 998 | 2,722 | 0.9% |
| Injuries to the thorax | 3,492 | 3,869 | 3,926 | 11,287 | 3.6% |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 6,294 | 6,770 | 7,231 | 20,295 | 6.4% |
| Injuries to the shoulder & upper arm | 6,174 | 6,809 | 6,889 | 19,872 | 6.3% |
| Injuries to the elbow & forearm | 8,685 | 9,280 | 9,353 | 27,318 | 8.6% |
| Injuries to the wrist & hand | 1,339 | 1,366 | 1,392 | 4,097 | 1.3% |
| Injuries to the hip & thigh | 20,054 | 21,510 | 21,418 | 62,982 | 19.8% |
| Injuries to the knee & lower leg | 7,347 | 7,885 | 7,727 | 22,959 | 7.2% |
| Injuries to the ankle & foot | 1,227 | 1,315 | 1,308 | 3,850 | 1.2% |
| Injuries involving multiple body regions | 52 | 68 | 72 | 192 | 0.1% |
| Injuries to unspecified parts of trunk, limb or body region | 397 | 429 | 457 | 1,283 | 0.4% |
| Body type not relevant | 293 | 299 | 282 | 874 | 0.3% |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0% |

- Over 30% of hospital separations did not have a principal diagnosis of injury or poisoning.

- Of the 69% of hospitalisations with an injury related principal diagnosis:
    - injuries were most common to the hip and thigh (20%), followed by injuries to the elbow and forearm (9%), the knee and lower leg (7%), the abdomen, lower back, lumber spine and pelvis (6%) and to the shoulder and upper arm (6%).

**Table 9.9.7.3 Frequency and percentage of falls related hospital separations occurring in buildings by nature of injury (principle diagnosis = injury), by year of separation, Australia, 2002/03-2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 4,201 | 4,328 | 4,766 | 13,295 | 6.0% |
| Open wound (excluding eye) | 7,100 | 7,674 | 8,188 | 22,962 | 10.4% |
| Fracture (excluding tooth) | 43,998 | 47,402 | 47,567 | 138,967 | 63.1% |
| Dislocation | 1,582 | 1,745 | 1,723 | 5,050 | 2.3% |
| Sprain/strain | 955 | 1,017 | 974 | 2,946 | 1.3% |
| Nerve (including spinal cord; excluding brain) | 227 | 228 | 217 | 672 | 0.3% |
| Blood vessel | 93 | 78 | 118 | 289 | 0.1% |
| Muscle/tendon | 613 | 676 | 733 | 2,022 | 0.9% |
| Crush injury | * | * | 7 | 13 | 0.0% |
| Amputation (including partial) | 23 | 21 | 21 | 65 | 0.0% |
| Internal organ | 362 | 399 | 393 | 1,154 | 0.5% |
| Burn/corrosion (excluding eye) | 7 | 8 | 8 | 23 | 0.0% |
| Eye injury (excluding foreign body in external eye) | 176 | 175 | 156 | 507 | 0.2% |
| Foreign body: external eye | * | * | * | * | |
| Foreign body: aliment tract | * | * | * | * | |
| Intracranial(including concussion) | 3,154 | 3,314 | 3,758 | 10,226 | 4.6% |
| Dental (including fractured tooth) | 149 | 137 | 138 | 424 | 0.2% |
| Drowning, immersion | * | * | * | * | |
| Asphyxia/threat to breathing | * | * | * | * | |
| Electrical injury | * | * | * | * | |
| Poison/toxic effect (excluding bite) | 30 | 8 | 5 | 43 | 0.0% |
| Bite (including invenomation) | * | * | * | * | |
| Other specified nature of injury | 1,271 | 1,331 | 1,398 | 4,000 | 1.8% |
| Unspecified nature of injury | 5,388 | 5,939 | 6,065 | 17,392 | 7.9% |
| Injuries of more than one nature | 39 | 54 | 52 | 145 | 0.1% |
| Total | 69,376 | 74,538 | 76,289 | 220,203 | 100.0% |

* denotes small numbers.

NB: These separations are a subset (69%) of all fall related hospital separations occurring in buildings, and include all separations where the principal diagnosis was injury (n=220,203).

- The nature of the injuries was unspecified in 8% of cases.
- The most common injury was a fracture (63%), followed by open wound (10%), superficial injury (6%) and intracranial injury (5%).

### 9.9.8 Length of stay - fall related hospital separations occurring in buildings

**Table 9.9.8.1 Frequency and percentage of fall related hospital separations occurring in buildings by length of stay and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 32,853 | 34,767 | 36,455 | 104,075 | 32.7% |
| Length of stay is two to seven days | 27,664 | 29,821 | 30,721 | 88,206 | 27.7% |
| Length of stay is eight to thirty days | 31,320 | 33,826 | 37,459 | 102,605 | 32.3% |
| Length of stay is greater than thirty days | 7,025 | 7,724 | 8,270 | 23,019 | 7.2% |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0% |

- Only 7 percent of hospital separations for falls in buildings had a length of stay greater than 30 days. Thirty three percent of separations had a length of stay of less than two days, with 28% a length of stay between 2-7 days and 32 percent a length of stay of between 8 and 30 days.

### 9.9.9 Injury severity - falls related hospital separations occurring in buildings

The New Zealand research group (Cryer et al.) used a threat-to-life severity scale when defining a serious injury and only included hospitalisations with an International Classification of Diseases-based Injury Severity Score (ICISS) of less than or equal to 0.941 (i.e. a probability of death at admission of at least 5.9%).

Serious injury definition for this table is based on ICISS and Cryer's definition of serious injury.

**Table 9.9.9.1 Frequency and percentage of fall related hospital separations occurring in buildings by injury severity and year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 66,266 | 69,839 | 73,643 | 209,748 | 66.0% |
| Severe injury, ICISS <= 0.941 | 32,596 | 36,299 | 39,262 | 108,157 | 34.0% |
| Total | 98,862 | 106,138 | 112,905 | 317,905 | 100.0% |

- Sixty six percent of the hospital separations resulting from falls most likely occurring in buildings were coded using ICISS classification as not a severe injury, with 34 percent of hospital separations injuries coded as a severe injury (threat to life of 5.9%).

## 9.10 FALL RELATED HOSPITALISATIONS OCCURRING IN THE HOME

**Table 9.10.1 Age standardised rates per 100,000 population of fall related hospital separations occurring in the home by sex, Australia, 2002/03-2004/05**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| **Males** | 242.6733 | 255.4881 | 264.481 | 254.214 |
| **Females** | 340.7109 | 363.7784 | 377.2327 | 360.573 |
| **Persons** | 300.6487 | 319.271 | 330.3977 | 316.772 |

- From 2002/03-2004/05 the age standardised rate per 100,000 population of fall related hospital separations occurring the home has increased by 9.9% percent overall, from a rate of 300.6 separations per 100,000 persons in 2002/03 to 330.4 separations per 100,000 persons in 2004-05.
- The rate per 100,000 of population has increased by 10.7% among females over this time, from 340.7 per 100,000 females in 2002/03-2004/05 to 377.2 per 100,000 in 2004/05.
- Among males, the rate has increased 9.0% over the same time period from 242.7 per 1000,000 males in 2002/03- to 264.5 in 2004/05.
- The mean rate of home fall related hospital separations from 2002/03-2004/05 is 41.8% higher for females than for males (360.6 vs. 254.2).

### *9.4.* Sex*

**Table 9.10.2 Sex of fall related hospital separations occurring in the home by year of separation, Australia 2002-2005**

| Sex | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 21,121 | 22,874 | 24,297 | **68,292** | **34.6%** |
| Females | 39,540 | 43,234 | 46,042 | **128,816** | **65.4%** |
| **Persons** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

- Females accounted for over 65% (n = 128,816) of all admitted fall injuries in the home environment during the period 2002-03 to 2004-05.
- This proportion has remained stable, varying less than 1% over the three years covered in this analysis.
- The proportion of females suffering falls in the home is slightly higher than that recorded for all falls in buildings (65.4% vs. 64.7%).

### *9.4 * Age*

**Table 9.10.3 Frequency and percentage of fall related hospital separations occurring in the home by 5 year age groups, Australia 2002-2005.**

| Age groups | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| 0–4 | 3346 | 3531 | 3497 | **10374** | **5.3%** |
| 5–9 | 1530 | 1572 | 1473 | **4575** | **2.3%** |
| 10–14 | 655 | 696 | 663 | **2014** | **1.0%** |
| 15–19 | 473 | 492 | 494 | **1459** | **0.7%** |
| 20–24 | 616 | 620 | 614 | **1850** | **0.9%** |
| 25–29 | 667 | 705 | 760 | **2132** | **1.1%** |
| 30–34 | 860 | 868 | 932 | **2660** | **1.3%** |
| 35–39 | 966 | 1034 | 1055 | **3055** | **1.5%** |
| 40–44 | 1160 | 1266 | 1284 | **3710** | **1.9%** |
| 45–49 | 1357 | 1550 | 1658 | **4565** | **2.3%** |
| 50–54 | 1726 | 1844 | 1923 | **5493** | **2.8%** |
| 55–59 | 2097 | 2567 | 2495 | **7159** | **3.6%** |
| 60–64 | 2542 | 2637 | 2953 | **8132** | **4.1%** |
| 65–69 | 3106 | 3472 | 3847 | **10425** | **5.3%** |
| 70–74 | 5315 | 5587 | 5706 | **16608** | **8.4%** |
| 75–79 | 8617 | 9191 | 9813 | **27621** | **14.0%** |
| 80–84 | 10587 | 11996 | 13055 | **35638** | **18.1%** |
| 85+ | 15040 | 16480 | 18119 | **49639** | **25.2%** |
| **Total** | **60661** | **66108** | **70341** | **197110** | **100.0%** |

- Older persons, aged ≥65 years account for 71% (n = 139,931) of all slip, trip and fall injuries occurring in the home.
- While slip, trip and fall injuries in all buildings have increased by 14.2% between 2002-03 and 2004-05, and home based slip, trip and fall injuries have increased by 16% across all age groups during this period; injuries to those aged ≥65 have increased by 18.5% over the same time.
- Children ≤4 years of age account for 5.3% (n= 10,374 from 2002-03 to 2004-05) and have the highest proportion of home based slip, trip and fall injuries of any age group under 65 years.

### *9.4.*  All falls occurring in the home Australia 2002-05: year by age, by sex*

**Table 9.10.4**

| Males | 0-14 | 15-29 | 30-44 | 45-59 | 60-74 | 75+ | Total |
|---|---|---|---|---|---|---|---|
| 2002-03 | 3128 | 901 | 1537 | 2325 | 4076 | 9154 | 21121 |
| 2003-04 | 3247 | 942 | 1629 | 2716 | 4251 | 10089 | 22874 |
| 2004-05 | 3189 | 910 | 1620 | 2762 | 4643 | 11173 | 24297 |
| **Total** | **9564** | **2753** | **4786** | **7803** | **12970** | **30416** | **68292** |
| **Females** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** |
| 2002-03 | 2403 | 855 | 1449 | 2855 | 6887 | 25090 | 39540 |
| 2003-04 | 2552 | 875 | 1539 | 3245 | 7445 | 27578 | 43234 |
| 2004-05 | 2444 | 958 | 1651 | 3314 | 7862 | 29813 | 46042 |
| **Total** | **7399** | **2688** | **4639** | **9414** | **22194** | **82481** | **128816** |
| **Persons** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** |
| 2002-03 | 5531 | 1756 | 2986 | 5180 | 10963 | 34244 | 60661 |
| 2003-04 | 5799 | 1817 | 3168 | 5961 | 11696 | 37667 | 66108 |
| 2004-05 | 5633 | 1868 | 3271 | 6076 | 12506 | 40987 | 70341 |
| **Total** | **16963** | **5441** | **9425** | **17217** | **35165** | **112898** | **197110** |

- Until the age of 44, males narrowly exceed females in the frequency of hospital separations for falls occurring in the home. In 0-14 years broad age group, the male separations exceed females by 29.3% (n=2,165), in the 15-29 years broad age group this gap falls to 2.4% (n = 65) and remains relatively small in the 30-44 years broad age group at 3.2% (n=147).
- From the age of 45 years onwards, separations for falls at home among women exceed those of men. This peaks in the 75+ years broad age group, where there are 2.7 times more separations for females (n=82,481) than males (n=30,416).
- While the majority of broad age groups have shown minor increases in the frequency of separations for home based injuries over the three years covered above, injuries to those aged 45 years and over have increased substantially. In the 45-59 years broad age group, these injuries have increased by 15.1% (n=896), by 14.0% (n=1543) in the 60-74 years broad age group and by 19.7% (n=6793) in the 75+ years broad age group.

***Body region and nature of injury - falls related hospital separations occurring in the home***

**Table 9.10.5 Frequency and percentage of body region of principal diagnosis of fall related hospital separations occurring in the home by year of separation, Australia 2002-2005**

| Broad Body region | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other injuries not specified | 15,839 | 17,433 | 21,010 | **54,282** | **27.5%** |
| Head | 8,746 | 9,209 | 9,922 | **27,877** | **14.1%** |
| Trunk | 7,681 | 8,592 | 8,778 | **25,051** | **12.7%** |
| Shoulder and upper limb | 10,774 | 11,745 | 11,620 | **34,139** | **17.3%** |
| Hip and lower limb | 17,621 | 19,129 | 19,011 | **55,761** | **28.3%** |
| **Total** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

- Injuries to the hip and lower limb (28.3%, n = 55,761) and injuries not specified by body region (27.5%, n = 54282) are most prominent.
- The distributions for home based slip, trip and fall injury to the hip and lower limb are almost identical to that displayed for these injuries in all buildings (28.3% vs. 28.2%).
- The distributions for home based injuries to the head, trunk and shoulder and upper limb follow similar patterns to those for all building falls, although slightly higher percentages are displayed for these categories, with a resultant decrease in the number of injuries where the body region was unspecified.

**Table 9.10.6**

| Body region detailed | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not poisoning/injury | 15,284 | 16,833 | 20,387 | **52,504** | **26.6%** |
| Injuries to the head | 8,746 | 9,209 | 9,922 | **27,877** | **14.1%** |
| Injuries to the neck | 533 | 674 | 714 | **1,921** | **1.0%** |
| Injuries to the thorax | 2,717 | 3,096 | 3,057 | **8,870** | **4.5%** |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 4,431 | 4,822 | 5,007 | **14,260** | **7.2%** |
| Injuries to the shoulder & upper arm | 4,377 | 4,795 | 4,871 | **14,043** | **7.1%** |
| Injuries to the elbow & forearm | 5,517 | 6,060 | 5,880 | **17,457** | **8.9%** |
| Injuries to the wrist & hand | 880 | 890 | 869 | **2,639** | **1.3%** |
| Injuries to the hip & thigh | 11,372 | 12,336 | 12,242 | **35,950** | **18.2%** |
| Injuries to the knee & lower leg | 5,264 | 5,743 | 5,701 | **16,708** | **8.5%** |
| Injuries to the ankle & foot | 985 | 1,050 | 1,068 | **3,103** | **1.6%** |
| Injuries involving multiple body regions | 40 | 47 | 53 | **140** | **0.1%** |
| Injuries to unspec parts of trunk, limb or body region | 307 | 314 | 347 | **968** | **0.5%** |
| Body type not relevant | 208 | 239 | 223 | **670** | **0.3%** |
| **Total** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

*All falls occurring in the home, Australia 2002-05: broad body region by age, by sex*

**Table 9.10.7**

| **Males** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** |
|---|---|---|---|---|---|---|---|
| Other injuries not specified | 480 | 427 | 837 | 1611 | 3758 | 10972 | 18085 |
| Head | 4616 | 693 | 1086 | 1398 | 1863 | 3789 | 13445 |
| Trunk | 268 | 270 | 717 | 1397 | 2289 | 4611 | 9552 |
| Shoulder and upper limb | 3294 | 746 | 952 | 1398 | 1741 | 2898 | 11029 |
| Hip and lower limb | 906 | 617 | 1194 | 1999 | 3319 | 8146 | 16181 |
| Total | 9564 | 2753 | 4786 | 7803 | 12970 | 30416 | 68292 |
| **Females** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** |
| Other injuries not specified | 375 | 946 | 1077 | 1560 | 5298 | 26940 | 36196 |
| Head | 3557 | 502 | 742 | 1220 | 1856 | 6555 | 14432 |
| Trunk | 358 | 348 | 562 | 924 | 2368 | 10938 | 15499 |
| Shoulder and upper limb | 2492 | 381 | 919 | 2486 | 5163 | 11669 | 23110 |
| Hip and lower limb | 617 | 511 | 1339 | 3224 | 7509 | 26379 | 39579 |
| Total | 7399 | 2688 | 4639 | 9414 | 22194 | 82481 | 128816 |
| **Persons** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** |
| Other injuries not specified | 855 | 1373 | 1914 | 3171 | 9057 | 37912 | 54282 |
| Head | 8173 | 1195 | 1828 | 2618 | 3719 | 10344 | 27877 |
| Trunk | 626 | 618 | 1279 | 2321 | 4657 | 15549 | 25051 |
| Shoulder and upper limb | 5786 | 1127 | 1871 | 3884 | 6904 | 14567 | 34139 |
| Hip and lower limb | 1523 | 1128 | 2533 | 5223 | 10828 | 34526 | 55761 |
| **Total** | **16963** | **5441** | **9425** | **17217** | **35165** | **112898** | **197110** |

- Overall, injuries to the hip and lower limb account for 28.3% (n=55,761) of home fall related separations and those aged 60 years and over account for 81.3% (45,354) of hip and lower limb injuries across both genders.
- Women aged 60 years and over account for 85.6% of (n=33,888) of all hip and lower limb injuries to females, and women aged 60 years and over also account for 85.9% (n=13,306) of all trunk injuries to females.
- Head injuries predominate among children for falls in a home environment, with 48.2% (n=8,173) of injuries to children aged 14 years and under being head injuries.

***All falls occurring in the home, Australia 2002-05: nature of injury by principal diagnosis groups (detailed body region), by sex***

NB: 52,509 cases where the principal diagnosis group was listed as “not poisoning/injury” have been removed from the analysis of stair and step related injuries by detailed body region.

**Table 9.10.8**

| Males | head | neck | thorax | abdomen, lower back, lumbar spine & pelvis | shoulder & upper arm | elbow & forearm | wrist & hand | hip & thigh | knee & lower leg | ankle & foot | Other injuries not specified by body region | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficial | 1229 | 30 | 396 | 387 | 178 | 142 | 44 | 363 | 256 | 39 | 125 | 3189 |
| Open wound | 5057 | 18 | 67 | 113 | 125 | 514 | 303 | 64 | 531 | 90 | 71 | 6953 |
| Fracture | 1405 | 369 | 3026 | 2452 | 2908 | 4429 | 564 | 8285 | 3232 | 891 | 20 | 27581 |
| Dislocation | * | 50 | * | 19 | 605 | 103 | 125 | 274 | 99 | 45 | 0 | 1323 |
| Sprain/strain | 0 | 58 | 31 | 93 | 47 | 16 | 28 | 85 | 209 | 129 | 26 | 722 |
| Nerve | 6 | 138 | 34 | 23 | 11 | 28 | 66 | * | * | 5 | 16 | 331 |
| Blood vessel | 34 | * | * | 5 | 7 | 15 | 22 | * | 5 | * | * | 102 |
| Muscle/tendon | 5 | 16 | 17 | 29 | 186 | 61 | 117 | 163 | 126 | 28 | 35 | 783 |
| Crush injury | * | 0 | * | * | 0 | 0 | * | * | 0 | 0 | 0 | 6 |
| Amputation (including partial) | * | 0 | 0 | * | 0 | 0 | 22 | 0 | 0 | 10 | 0 | 35 |
| Internal organ | 0 | * | 398 | 189 | 0 | * | 0 | 0 | 0 | 0 | * | 588 |
| Burn/corrosion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 |
| Eye injury | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Foreign body: external eye | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Foreign body: aliment tract | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Intracranial(including concussion) | 3508 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3508 |
| Dental | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 183 |
| Drowning, immersion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Asphyxia/threat to breathing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Electrical injury | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Poison/toxic effect | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 9 |
| Bite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Other specified nature of injury | 118 | 53 | 105 | 144 | 47 | 16 | 9 | 149 | 42 | 29 | 325 | 1037 |
| Unspecified nature of injury | 1734 | 171 | 227 | 879 | 202 | 41 | 35 | 670 | 266 | 70 | 102 | 4397 |
| Injuries of more than one nature | * | 0 | * | 5 | 6 | * | * | 13 | * | * | 0 | 38 |
| Total | 13440 | 907 | 4306 | 4339 | 4322 | 5368 | 1339 | 10072 | 4770 | 1339 | 752 | 50954 |

| Females | head | neck | thorax | abdomen, lower back, lumbar spine & pelvis | shoulder & upper arm | elbow & forearm | wrist & hand | hip & thigh | knee & lower leg | ankle & foot | Other injuries not specified by body region | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficial | 2192 | 52 | 521 | 686 | 263 | 183 | 91 | 764 | 689 | 92 | 219 | 5752 |
| Open wound | 5199 | 26 | 20 | 229 | 122 | 553 | 225 | 54 | 1565 | 88 | 85 | 8166 |
| Fracture | 1331 | 481 | 3314 | 6616 | 7459 | 11045 | 669 | 22304 | 8267 | 883 | 35 | 62404 |
| Dislocation | 5 | 27 | 0 | 36 | 1122 | 177 | 85 | 515 | 148 | 55 | 0 | 2170 |
| Sprain/strain | * | 68 | 47 | 173 | 77 | * | 34 | 175 | 363 | 383 | 33 | 1363 |
| Nerve | 6 | 78 | 23 | 26 | * | 7 | 32 | * | * | * | 9 | 192 |
| Blood vessel | 47 | 0 | * | 6 | 6 | 5 | 9 | * | 14 | * | * | 96 |
| Muscle/tendon | 9 | 18 | 21 | 67 | 221 | 20 | 45 | 141 | 76 | 28 | 34 | 680 |
| Crush injury | 0 | 0 | 0 | * | 0 | 0 | * | 0 | * | 0 | * | 5 |
| Amputation (including partial) | * | 0 | * | 0 | * | 0 | 11 | 0 | * | 6 | 0 | 19 |
| Internal organ | 0 | 0 | 191 | 137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 328 |
| Burn/corrosion | 0 | 0 | 0 | * | 0 | 0 | * | 0 | 0 | 0 | 8 | 8 |
| Eye injury | 204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 204 |
| Foreign body: external eye | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Foreign body: aliment tract | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intracranial(including concussion) | 3200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3200 |
| Dental | 146 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 146 |
| Drowning, immersion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Asphyxia/threat to breathing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Electrical injury | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Poison/toxic effect | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 10 |
| Bite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other specified nature of injury | 154 | 61 | 126 | 278 | 88 | 22 | 17 | 382 | 129 | 52 | 426 | 1735 |
| Unspecified nature of injury | 1933 | 203 | 300 | 1653 | 349 | 67 | 81 | 1513 | 681 | 172 | 164 | 7116 |
| Injuries of more than one nature | * | 0 | 0 | 12 | 10 | * | 0 | 22 | * | * | 0 | 52 |
| Total | 14432 | 1014 | 4564 | 9921 | 9721 | 12089 | 1300 | 25877 | 11938 | 1764 | 1026 | 93646 |

| Persons | head | neck | thorax | abdomen, lower back, lumbar spine & pelvis | shoulder & upper arm | elbow & forearm | wrist & hand | hip & thigh | knee & lower leg | ankle & foot | Other injuries not specified by body region | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficial | 3421 | 82 | 917 | 1073 | 441 | 325 | 135 | 1127 | 945 | 131 | 344 | 8941 |
| Open wound | 10256 | 44 | 87 | 342 | 247 | 1067 | 528 | 118 | 2096 | 178 | 156 | 15119 |
| Fracture | 2736 | 850 | 6340 | 9068 | 10367 | 15474 | 1233 | 30590 | 11499 | 1774 | 55 | 89986 |
| Dislocation | 8 | 77 | 0 | 55 | 1727 | 280 | 210 | 789 | 247 | 100 | 0 | 3493 |
| Sprain/strain | * | 126 | 78 | 266 | 124 | 24 | * | 260 | 572 | 512 | 59 | 2085 |
| Nerve | 12 | 216 | 57 | 49 | 15 | 35 | 98 | * | * | 6 | 25 | 523 |
| Blood vessel | 81 | * | * | 11 | 13 | 20 | 31 | 6 | 19 | * | 5 | 198 |
| Muscle/tendon | 14 | 34 | 38 | 96 | 407 | 81 | 162 | 304 | 202 | 56 | 69 | 1463 |
| Crush injury | * | 0 | * | * | 0 | 0 | * | * | * | 0 | * | 11 |
| Amputation (including partial) | * | 0 | 0 | * | 0 | 0 | 33 | 0 | * | 16 | 0 | 54 |
| Internal organ | 0 | 0 | 589 | 326 | 0 | 0 | 0 | * | 0 | 0 | * | 916 |
| Burn/corrosion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 19 |
| Eye injury | 354 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 354 |
| Foreign body: external eye | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Foreign body: aliment tract | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Intracranial(including concussion) | 6708 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6708 |
| Dental | 329 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 329 |
| Drowning, immersion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Asphyxia/threat to breathing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Electrical injury | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Poison/toxic effect | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 19 |
| Bite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Other specified nature of injury | 272 | 114 | 231 | 422 | 135 | 38 | 26 | 531 | 171 | 81 | 751 | 2772 |
| Unspecified nature of injury | 3667 | 374 | 527 | 2532 | 551 | 108 | 116 | 2183 | 947 | 242 | 266 | 11513 |
| Injuries of more than one nature | 7 | * | * | 17 | 16 | 5 | * | 35 | * | * | 0 | 90 |
| **Total** | **27872** | **1921** | **8870** | **14260** | **14043** | **17457** | **2639** | **35950** | **16708** | **3103** | **1778** | **144601** |

- Fractures (62.2%, n=89,986), open wounds (10.5%, n=15,119) and intracranial injuries (4.6%, n=6708) dominate among separations where the nature of injury was specified.
- In total, fractures account for 66.6% (n=62,404) of home fall related injuries to women hip and thigh fractures account for 35.7% (n=22,304) of all fall related fractures suffered by women in the home. Among males, fractures account 54.1% (n=27,581) of home fall injuries and hip and thigh fractures account for 30.0% (n=8,285) of all fractures suffered by males in the home.

- For both males and females, the elbow and forearm were the next most prevalent fracture region, accounting for 17.7% (n=11,045) of fractures suffered by females and 16.1% (n=4,429) of fractures suffered by males in a home environment.
- The nature of injury was unspecified for a large proportion of cases, in a total of 11,513 (8.0%) separations; the nature of injury was not specified.

### *9.4.* Nature of injury*

**Table 9.10.9 Nature of fall related hospital separations occurring in the home by frequency and year of separation, Australia 2002-2005**

**NB – In 11 cases, the nature of injury was not included.**

| Nature of injury | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 2,830 | 2,950 | 3,161 | **8,941** | **4.5%** |
| Open wound (excluding eye) | 4,660 | 5,136 | 5,323 | **15,119** | **7.7%** |
| Fracture (excluding tooth) | 28,326 | 30,925 | 30,735 | **89,986** | **45.7%** |
| Dislocation | 1,117 | 1,225 | 1,151 | **3,493** | **1.8%** |
| Sprain/strain | 691 | 703 | 691 | **2,085** | **1.1%** |
| Nerve (including spinal cord; excluding brain) | 176 | 178 | 169 | **523** | **0.3%** |
| Blood vessel | 57 | 60 | 81 | **198** | **0.1%** |
| Muscle/tendon | 429 | 497 | 537 | **1,463** | **0.7%** |
| Crush injury | * | * | * | **11** | **0.0%** |
| Amputation (including partial) | 22 | 17 | 15 | **54** | **0.0%** |
| Internal organ | 287 | 319 | 310 | **916** | **0.5%** |
| Burn/corrosion (excluding eye) | * | * | * | **19** | **0.0%** |
| Eye injury (excluding foreign body in external eye) | 130 | 121 | 103 | **354** | **0.2%** |
| Foreign body: external eye | * | * | * | * | * |
| Foreign body: aliment tract | * | * | * | * | * |
| Intracranial(including concussion) | 2,076 | 2,149 | 2,483 | **6,708** | **3.4%** |
| Dental (including fractured tooth) | 111 | 116 | 102 | **329** | **0.2%** |
| Drowning, immersion | * | * | * | * | * |
| Asphyxia/threat to breathing | * | * | * | * | * |
| Electrical injury | * | * | * | * | * |
| Poison/toxic effect (excluding bite) | * | * | * | **19** | **0.0%** |
| Bite (including invenomation) | * | * | * | * | * |
| Other specified nature of injury | 850 | 916 | 1,006 | **2,772** | **1.4%** |
| Unspecified nature of injury | 3,568 | 3,910 | 4,035 | **11,513** | **5.8%** |
| Injuries of more than one nature | 24 | 34 | 32 | **90** | **0.0%** |
| Principal diagnosis not injury | 15,284 | 16,833 | 20,387 | **52,504** | **26.6%** |
| **Total** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

- Fractures accounted for the highest proportion of slip, trip and fall injuries in the home (45.7%, n= 89,986) between 2002-03 and 2004-05. While stable in 2002-03 (46.7%, n = 28,326) and 2003-04 (46.8%, n = 30,925) fractures fell slightly to 43.7% (n = 30,735) of slip, trip and fall related injuries in the home during 2004-05.
- The percentage of fractures for home slip, trip and fall injury is slightly higher than that reported for these injuries in all buildings (45.7% vs. 43.7%).
- As is also the case for slip, trip and fall injuries in all buildings, over the period covered by this analysis, the next most frequent injuries sustained in the home were open wounds (7.7%, n = 15,119), injuries of an unspecified nature (5.8%, n = 11,513) and superficial injuries (4.5%, n = 8,941).

***All fractures resulting from falls most occurring in the home, Australia 2002-05: nature of injury by broad body region, by age***

**Table 9.10.10**

| | **Other injuries not specified** | **Head** | **Trunk** | **Shoulder and upper limb** | **Hip and lower limb** | **Total** |
|---|---|---|---|---|---|---|
| **0-14** | * | 751 | * | 5408 | 1161 | 7355 |
| **15-29** | 0 | 184 | 171 | 691 | 812 | 1858 |
| **30-44** | 0 | 262 | 506 | 1369 | 1905 | 4042 |
| **45-59** | * | * | 1276 | 3197 | 4290 | 9115 |
| **60-74** | 9 | 395 | 3067 | 5559 | 8598 | 17628 |
| **75+** | 43 | 794 | 11203 | 10850 | 27097 | 49987 |
| **Total** | 55 | 2736 | 16258 | 27074 | 43863 | 89986 |

- Fractures of the hip and lower limb account for 48.7% (n=43,863) for fall separations occurring in the home, and 61.8% (n=27,097) of all fractures occurring in the home among those aged 75 years and over.
- Those aged 75 years and over account for 55.6% (n=49,987) of all fractures incurred in a home environment.
- Across all age groups, fractures of the shoulder and upper arm account for 30.1% (n=27,074) of all separations for home based fractures, and those aged 75 and over account for 40.1% (n=10,850) of all shoulder and upper arm fractures sustained in a home environment.

*Length of stay*

**Table 9.10.11 Length of stay - falls related hospital separations in the home, Australia 2002-2005 by Frequency and percentage**

| Length of stay | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 20,870 | 22,461 | 23,536 | **66,867** | **33.9%** |
| Length of stay is two to seven days | 17,339 | 18,796 | 19,366 | **55,501** | **28.2%** |
| Length of stay is eight to thirty days | 19,021 | 20,889 | 22,961 | **62,871** | **31.9%** |
| Length of stay is greater than thirty days | 3,431 | 3,962 | 4,478 | **11,871** | **6.0%** |
| **Total** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

- As shown in figure *, fall related injuries sustained in the home display a length of stay pattern very similar to that displayed for all falls most likely occurring in buildings.
- This trend is displayed across all length of stay categories: <two days (33.9% vs. 32.7% respectively), two to seven days (28.2% vs. 27.7%), eight to thirty days (31.9% vs. 32.3%) and over thirty days (6.0% vs. 7.2% respectively).
- Although a slightly smaller percentage of home fall injury patients fit into this longest length of stay category (in comparison to all building fall patients), the proportion of home fall admissions greater than thirty days has risen steadily over the three years covered in figure *, from 5.7% (n = 3,431) in 2002-03, to 6.4% (n = 4478) in 2004-05.

***Injury severity – Frequency and percentage of falls related hospital separations most likely occurring in the home***

**Table 9.10.12 Injury severity – Frequency and percentage of falls related hospital separations occurring in the home, Australia 2002-2005**

| Severity of injury | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 40,916 | 43,848 | 45,905 | **130,669** | **66.3%** |
| Severe injury, ICISS <= 0.941 | 19,745 | 22,260 | 24,436 | **66,441** | **33.7%** |
| **Total** | **60,661** | **66,108** | **70,341** | **197,110** | **100.0%** |

- As shown above in figure *, 33.7% (n = 66,441) of home based fall injuries were considered severe according to Cryer's definition and the ICISS (see section 9.3.8).
- This percentage has increased steadily from 32.5% (n = 19,745) in 2002-03 to 34.7% (n = 24,436) in 2004-05.
- Although less life threatening, the "not severe" injuries remain important because of their frequency, societal and economic cost and their impact on the health care system.

## 9.11 FALL RELATED HOSPITAL SEPARATIONS MOST LIKELY OCCURRING ON STAIRS AND STEPS

**Table 9.11.1 Age standardised rates per 100,000 population of fall related hospital separations occurring on stairs and steps by sex, Australia, 2002/03-2004/05**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| **Males** | 23.504 | 24.425 | 25.915 | 24.614 |
| **Females** | 33.84174 | 35.91592 | 38.21712 | 35.992 |
| **Persons** | 29.18808 | 30.67096 | 32.58245 | 30.814 |

- From 2002/03-2004/05 the age standardised rates per 100,000 population of fall related hospital separations occurring on stairs and steps as increased by 11.7% percent overall, from a rate of 29.2 separations per 100,000 persons in 2002/03 to 32.6 separations per 100,000 persons in 2004-05.
- The rate of stair and step injuries per 100,000 of population has increased by 12.9% among females over this time, from 33.8 per 100,000 females in 2002/03-2004/05 to 38.2 per 100,000 in 2004/05.
- Among males, the rate has increased 10.6% over the same time period from 23.5 per 1000,000 males in 2002/03 to 24.6 in 2004/05.
- The mean rate of stair and step fall related hospital separations from 2002/03-2004/05 is 25.2% higher for females than for males (30.8 vs. 24.6).

***Sex***

**Table 9.11.2 Sex of fall related hospital separations occurring on stairs and steps by year of separation, Australia 2002-2005 by Frequency and percentage**

| Sex | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 2,131 | 2,271 | 2,456 | **6,858** | **36.1%** |
| Females | 3,728 | 4,025 | 4,409 | **12,162** | **63.9%** |
| **Persons** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

- Figure * shows that females constituted nearly 64% (n = 12,162) of all hospital admissions involving stairs and steps from 2002-03 to 2004-05.
- This proportion has remained stable, varying less than 1% over the three years covered in this analysis.
- The gender distribution of stair and step injuries does not vary significantly from that of all falls in buildings.

*Age*

**Table 9.11.3 Frequency and percentage of fall related hospital separations occurring on stairs and steps by 5 year age groups, Australia 2002-2005**

| Age groups | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| | | | | | |
| 0–4 | 253 | 251 | 269 | **773** | **4.1%** |
| 5–9 | 116 | 110 | 104 | **330** | **1.7%** |
| 10–14 | 138 | 116 | 109 | **363** | **1.9%** |
| 15–19 | 101 | 110 | 84 | **295** | **1.6%** |
| 20–24 | 130 | 147 | 131 | **408** | **2.1%** |
| 25–29 | 141 | 159 | 132 | **432** | **2.3%** |
| 30–34 | 166 | 195 | 227 | **588** | **3.1%** |
| 35–39 | 174 | 195 | 208 | **577** | **3.0%** |
| 40–44 | 214 | 232 | 263 | **709** | **3.7%** |
| 45–49 | 271 | 298 | 292 | **861** | **4.5%** |
| 50–54 | 322 | 340 | 307 | **969** | **5.1%** |
| 55–59 | 316 | 378 | 408 | **1,102** | **5.8%** |
| 60–64 | 298 | 347 | 395 | **1,040** | **5.5%** |
| 65–69 | 324 | 386 | 478 | **1,188** | **6.2%** |
| 70–74 | 545 | 556 | 561 | **1,662** | **8.7%** |
| 75–79 | 710 | 746 | 815 | **2,271** | **11.9%** |
| 80–84 | 778 | 837 | 965 | **2,580** | **13.6%** |
| 85+ | 862 | 893 | 1,118 | **2,873** | **15.1%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

- Figure * shows that older persons are most at risk from stair and step related fall injury. Those aged ≥ 65 years of age accounted for 56% (n = 12,716) of these injuries.
- While stair and step injuries increased by 17.2% across all age groups during the period covered by this analysis, these injuries increased by 22.3% among those aged ≥ 65 years of age during the same period.
- Children ≤14 years of age account for a combined total of 7.7% of stair and step related injury, with the youngest age group (0-4 years) representing the majority of these injuries (4.1% of all stair and step injuries, n = 773) and the highest proportion of any age group under 45 years.

*Falls due to stairs and steps, Australia 2002-05: year by age, by sex*

**Table 9.11.4**

| Males | 0-14 | 15-29 | 30-44 | 45-59 | 60-74 | 75+ | Total | % |
|---|---|---|---|---|---|---|---|---|
| 2002-03 | 300 | 182 | 253 | 326 | 388 | 682 | 2131 | *11.2* |
| 2003-04 | 295 | 189 | 279 | 396 | 401 | 711 | 2271 | *11.9* |
| 2004-05 | 277 | 167 | 297 | 403 | 468 | 844 | 2456 | *12.9* |
| **Total** | **872** | **538** | **829** | **1125** | **1257** | **2237** | **6858** | ***36.1*** |
| ***Total %*** | ***59.5*** | ***47.4*** | ***44.2*** | ***38.4*** | ***32.3*** | ***29*** | ***36.1*** | ***36.1*** |
| | | | | | | | | |
| **Females** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** | **%** |
| 2002-03 | 207 | 190 | 301 | 583 | 779 | 1668 | 3728 | *19.6* |
| 2003-04 | 182 | 227 | 343 | 620 | 888 | 1765 | 4025 | *21.2* |
| 2004-05 | 205 | 180 | 401 | 604 | 965 | 2054 | 4409 | *23.2* |
| **Total** | **594** | **597** | **1045** | **1807** | **2632** | **5487** | **12162** | ***63.9*** |
| ***Total %*** | ***40.5*** | ***52.6*** | ***55.8*** | ***61.6*** | ***67.7*** | ***71*** | ***63.9*** | ***63.9*** |
| | | | | | | | | |
| **Persons** | **0-14** | **15-29** | **30-44** | **45-59** | **60-74** | **75+** | **Total** | **%** |
| 2002-03 | 507 | 372 | 554 | 909 | 1167 | 2350 | 5859 | *30.8* |
| 2003-04 | 477 | 416 | 622 | 1016 | 1289 | 2476 | 6296 | *33.1* |
| 2004-05 | 482 | 347 | 698 | 1007 | 1434 | 2898 | 6866 | *36.1* |
| **Total** | **1466** | **1135** | **1874** | **2932** | **3890** | **7724** | **19021** | ***100.0*** |
| ***Total %*** | ***100*** | ***100*** | ***100*** | ***100*** | ***100*** | ***100*** | ***100.0*** | ***100.0*** |

- Women aged ≥ 75 years account for over 45% (n = 5487) of all female stair and step injuries across all age groups, 71% of all injuries for this age group and 28.8% of all stair and step injuries in total.
- Injuries to both men and women aged ≥ 75 years have increased by over 23% (from n = 2350 in 2002-03 to n = 2989 in 2004-05) while stair and step related injuries across all age groups have increased by 17.2% over the three years covered by this analysis (from n = 5859 in 2002-03 to n = 6866 in 2004-05).
- Females outnumber males for hospital admission for falls due to stairs and steps across all broad age groups, except children aged 0-14 years, where males accounted for 59.5% ( n = 872) of stair and step related admissions and females accounted for 40.55 (n = 594) over the three years covered here.

*Falls due to stairs and steps, Australia 2002-05: place of occurrence by age*

**Table 9.11.5**

| | 0-14 | 15-29 | 30-44 | 45-59 | 60-74 | 75+ | Total |
|---|---|---|---|---|---|---|---|
| Other and unspecified place in home | 1034 | 674 | 1389 | 2207 | 3079 | 5948 | **14331** |
| Prison | * | 5 | 12 | * | 8 | * | **31** |
| Military camp | 0 | 0 | * | 0 | 0 | * | ***** |
| Aged care facilities | 0 | 0 | * | * | 43 | 305 | **358** |
| Other specified residential institution | * | * | 15 | 12 | 10 | 12 | **58** |
| Unspecified residential institution | 0 | 0 | 0 | * | * | * | **5** |
| School | 335 | 75 | 30 | 73 | 22 | 13 | **548** |
| Health Service area | 5 | 25 | 30 | 59 | 55 | 158 | **332** |
| Other specified institution and public admin area | 16 | 35 | 35 | 75 | 122 | 237 | **520** |
| Sporting hall (indoor) | * | 6 | 7 | 9 | 8 | * | **36** |
| Shop and store | 28 | 38 | 66 | 123 | 148 | 434 | **837** |
| Commercial garage | 0 | 0 | * | 11 | 8 | * | **27** |
| Office building | 0 | 14 | 20 | 22 | 13 | 16 | **85** |
| Cafe, hotel and restaurant | 20 | 193 | 182 | 222 | 265 | 388 | **1270** |
| Other specified trade and service area | 15 | 63 | 78 | 98 | 104 | 196 | **554** |
| Place not reported/not applicable | * | * | * | 9 | * | 7 | ***** |
| **Total** | **1466** | **1135** | **1874** | **2932** | **3890** | **7724** | **19021** |

- Injuries sustained in the home accounted for the vast majority of stair and step injury hospital separations, totalling 75.3% of separations (n = 14,331) across all age groups.
- The proportion of stair and step related injuries occurring in the home varied from a low of 59.4% among those aged 15-29 years, to a high of 79.2% among those aged ≥ 75 years.
- Those aged ≥ 60 years injured the home accounted for 47.5% (n = 6,255) of all stair and step injuries included in this analysis, and 63.0% of all stair and step injuries sustained in the home.
- Cafes, hotels and restaurants were the next most frequent injury location at 6.7% of all stair and step injury (n = 1,270) across all age groups, followed by injuries sustained in shops and stores, which accounted for 4.4% (n = 837) of all separations.
- Nearly 52% (n = 434) of stair and step injuries sustained in shops and stores were to people aged ≥ 75 years

*Body region and nature of injury - falls related hospital separations occurring on stairs and steps*

**Table 9.11.6 Frequency and percentage of body region of principal diagnosis of fall related hospital separations occurring on stairs and steps by year of separation, Australia 2002-2005**

| Broad body region | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| | | | | | |
| Other injuries not specified by body region | 976 | 1,044 | 1,418 | **3,438** | **18.1%** |
| Head | 1,177 | 1,168 | 1,393 | **3,738** | **19.7%** |
| Trunk (neck, thorax, abdomen, lwr back, lumb. spine & pelvis | 641 | 758 | 770 | **2,169** | **11.4%** |
| Shoulder and upper limb | 1,165 | 1,244 | 1,235 | **3,644** | **19.2%** |
| Hip and lower limb | 1,900 | 2,082 | 2,050 | **6,032** | **31.7%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |
| | | | | | |

- As figure * shows, injuries to the hip and lower limb account for nearly a third of all stair and step related fall injuries (31.7%, n = 6,032) and have increased by 7.8% over the three years covered here.
- 19.7% (n = 3,738) of stair and step related injuries are to the head, a figure that has increased 18.4% between 2002-3 and 2004-5.
- Injuries to the shoulder and upper limb make up 19.2% (n = 3,644) of these injuries, a proportion that has increased by 6.0% over this time period.
- 18.1% (n = 3,438) of stair and step related injuries are not specified by broad body region.

**Table 9.11.7**

| Body region detailed | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| Not poisoning/injury | 935 | 1,002 | 1,388 | **3,325** | **17.5%** |
| Injuries to the head | 1,177 | 1,168 | 1,393 | **3,738** | **19.7%** |
| Injuries to the neck | 69 | 128 | 112 | **309** | **1.6%** |
| Injuries to the thorax | 199 | 244 | 240 | **683** | **3.6%** |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 373 | 386 | 418 | **1,177** | **6.2%** |
| Injuries to the shoulder & upper arm | 426 | 500 | 467 | **1,393** | **7.3%** |
| Injuries to the elbow & forearm | 642 | 631 | 663 | **1,936** | **10.2%** |
| Injuries to the wrist & hand | 97 | 113 | 105 | **315** | **1.7%** |
| Injuries to the hip & thigh | 748 | 825 | 841 | **2,414** | **12.7%** |
| Injuries to the knee & lower leg | 976 | 1,097 | 1,015 | **3,088** | **16.2%** |
| Injuries to the ankle & foot | 176 | 160 | 194 | **530** | **2.8%** |
| Injuries to unspec parts of trunk, limb or body region | 27 | 27 | 20 | **74** | **0.4%** |
| Body type not relevant | 5 | 11 | 6 | **22** | **0.1%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

*Falls due to stairs and steps, Australia 2002-05: broad body region by age, by sex*

**Table 9.11.8**

| **Males** | **0-14** | **%** | **15-29** | **%** | **30-44** | **%** | **45-59** | **%** | **60-74** | **%** | **75+** | **%** | **Total** | **%** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Not specified | 33 | *9.3* | 50 | *9.3* | 91 | *11.0* | 179 | *15.9* | 267 | *21.2* | 549 | *24.5* | 1169 | *17.0* |
| Head | 447 | *51.3* | 183 | *34.0* | 253 | *30.5* | 341 | *30.3* | 308 | *24.5* | 442 | *19.8* | 1974 | *28.8* |
| Trunk | 26 | *3.0* | 45 | *8.4* | 99 | *11.9* | 164 | *14.6* | 184 | *14.6* | 359 | *16.0* | 877 | *12.8* |
| Shoulder and upper limb | 268 | *30.7* | 115 | *21.4* | 157 | *18.9* | 150 | *13.3* | 210 | *16.7* | 303 | *13.5* | 1203 | *17.5* |
| Hip and lower limb | 98 | *11.2* | 145 | *27.0* | 229 | *27.6* | 291 | *25.9* | 288 | *22.9* | 584 | *26.1* | 1635 | *23.8* |
| **Total males** | **872** | ***100.0*** | **538** | ***100.0*** | **829** | ***100.0*** | **1125** | ***100.0*** | **1257** | ***100.0*** | **2237** | ***100.0*** | **6858** | ***100.0*** |
| | | | | | | | | | | | | | | |
| **Females** | **0-14** | **%** | **15-29** | **%** | **30-44** | **%** | **45-59** | **%** | **60-74** | **%** | **75+** | **%** | **Total** | **%** |
| Not specified | 38 | *6.4* | 167 | *28.0* | 146 | *14.0* | 206 | *11.4* | 432 | *16.4* | 1279 | *23.3* | 2268 | *18.6* |
| Head | 307 | *51.7* | 101 | *16.9* | 155 | *14.8* | 252 | *13.9* | 299 | *11.4* | 650 | *11.8* | 1764 | *14.5* |
| Trunk | 23 | *3.9* | 84 | *14.1* | 141 | *13.5* | 155 | *8.6* | 236 | *9.0* | 653 | *11.9* | 1292 | *10.6* |
| Shoulder and upper limb | 169 | *28.5* | 70 | *11.7* | 159 | *15.2* | 374 | *20.7* | 642 | *24.4* | 1027 | *18.7* | 2441 | *20.1* |
| Hip and lower limb | 57 | *9.6* | 175 | *29.3* | 444 | *42.5* | 820 | *45.4* | 1023 | *38.9* | 1878 | *34.2* | 4397 | *36.2* |
| **Total** | **594** | ***100.0*** | **597** | ***100.0*** | **1045** | ***100.0*** | **1807** | ***100.0*** | **2632** | ***100.0*** | **5487** | ***100.0*** | **12162** | ***100.0*** |
| | | | | | | | | | | | | | | |
| **All Persons** | **0-14** | **%** | **15-29** | **%** | **30-44** | **%** | **45-59** | **%** | **60-74** | **%** | **75+** | **%** | **Total** | **%** |
| Not specified | 71 | *4.8* | 217 | *19.1* | 237 | *12.6* | 385 | *13.1* | 700 | *18.0* | 1828 | *23.7* | 3438 | *18.1* |
| Head | 754 | *51.4* | 284 | *25.0* | 408 | *21.8* | 593 | *20.2* | 607 | *15.6* | 1092 | *14.1* | 3738 | *19.7* |
| Trunk | 49 | *3.3* | 129 | *11.4* | 240 | *12.8* | 319 | *10.9* | 420 | *10.8* | 1012 | *13.1* | 2169 | *11.4* |
| Shoulder and upper limb | 437 | *29.8* | 185 | *16.3* | 316 | *16.9* | 524 | *17.9* | 852 | *21.9* | 1330 | *17.2* | 3644 | *19.2* |
| Hip and lower limb | 155 | *10.6* | 320 | *28.2* | 673 | *35.9* | 1111 | *37.9* | 1311 | *33.7* | 2462 | *31.9* | 6032 | *31.7* |
| **Total** | **1466** | ***100.0*** | **1135** | ***100.0*** | **1874** | ***100.0*** | **2932** | ***100.0*** | **3890** | ***100.0*** | **7724** | ***100.0*** | **19021** | ***100.0*** |

- Injuries to the hip and lower limb account for nearly a third (31.7%, n = 6032) of stair and step fall related injuries across all age groups. The proportion of injuries to this region is higher for females (36.2%, n = 4397) than for males (23.8%, n = 1635).

- Females account for 72.9% (n = 4397) of hip and lower limb injuries overall, increasing from 36.8% (n = 155) among those aged ≤ 14 years, to 76.3% (n = 1878) among those aged ≥ 75 years.
- For all age groups, hip and lower limb injuries are followed in frequency by injuries to the head (19.7%, n= 3738), shoulder and upper limb (19.2%, n = 3644), separations where the injury was not specified by body region (18.1%, n = 3438) and injuries to the trunk (11.4%, n = 2169).
- Injuries to the head account for the majority of separations for children aged 0 – 14 years (51.4%, n = 754). This figure is similar for both male and female children, as is the proportional distribution for all broad body regions.
- Stair and step fall related injuries to the head decrease steadily as age increases, comprising 14.1% (n = 1092) of these injuries to those aged ≥ 75 years and 19.7%
- (n = 3738) of stair and step fall related injuries for all persons across all age groups.
- Conversely, the proportion of injuries to the hip and lower limb increases with age, from 10.6% (n = 155) among those aged 0 – 14 years, and peaks with the 45-59 year age group at 37.9% (n = 1111).

***Falls due to stairs and steps, Australia 2002-05: nature of injury by detailed body region, by sex***

NB: 3,325 cases where the principal diagnosis group was listed as “not poisoning/injury” have been removed from the analysis of stair and step related injuries by detailed body region.

**Table 9.11.9**

| **Males** | **Head** | **Neck** | **Thorax** | **Abdomen, lower back, lumbar spine & pelvis** | **Shoulder & upper arm** | **Elbow & forearm** | **Wrist & hand** | **Hip & thigh** | **Knee & lower leg** | **Ankle & foot** | **Other injuries** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficial (excluding eye) | 200 | 6 | 27 | 46 | 26 | 15 | * | 26 | 23 | * | 8 | **385** |
| Open wound (excluding eye) | 610 | * | * | * | 7 | 44 | 24 | * | 50 | 6 | 5 | **754** |
| Fracture (excluding tooth) | 264 | * | 257 | 193 | 298 | 526 | 107 | 598 | 551 | 90 | * | **2941** |
| Dislocation | 0 | * | 0 | * | 54 | 16 | 16 | * | 20 | 12 | 0 | **128** |
| Sprain/strain | 0 | 12 | 6 | 8 | * | * | * | 6 | 31 | 23 | * | **92** |
| Nerve (including spinal cord; excluding brain) | 0 | 21 | * | * | 0 | * | * | 0 | * | 0 | * | **34** |
| Blood vessel | 5 | 0 | 0 | 0 | * | 0 | * | 0 | 0 | * | 0 | **8** |
| Muscle /tendon | 0 | * | * | 5 | 12 | * | 5 | 57 | 21 | * | 7 | **114** |
| Amputation (including partial) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Internal organ | 0 | 0 | 24 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **45** |
| Burn/corrosion (excluding eye) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | * |
| Eye injury (excluding foreign body in external eye) | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **17** |
| Intracranial (including concussion) | 615 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **615** |
| Dental (including fractured tooth) | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **16** |
| Other specified nature of injury | 22 | 7 | 8 | 12 | 7 | * | * | 12 | * | 6 | 13 | **92** |
| Unspecified nature of injury | 223 | 31 | 21 | 96 | 19 | * | * | 45 | 23 | 16 | 8 | **489** |
| Injuries of more than one nature | * | 0 | * | 0 | * | * | 0 | 0 | 0 | 0 | 0 | * |
| **Total Males** | **1974** | **139** | **348** | **390** | **427** | **613** | **163** | **751** | **724** | **160** | **47** | **5736** |

| **Females** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficial (excluding eye) | 250 | 9 | 47 | 77 | 16 | 9 | 8 | 50 | 57 | 15 | 14 | **552** |
| Open wound (excluding eye) | 518 | * | 0 | * | 7 | 59 | 24 | * | 279 | 12 | 8 | **916** |
| Fracture (excluding tooth) | 217 | * | 225 | 488 | 777 | 1219 | 90 | 1476 | 1888 | 199 | * | **6650** |
| Dislocation | 0 | 6 | 0 | 5 | 107 | 24 | 13 | 5 | 24 | 13 | 0 | **197** |
| Sprain/strain | 0 | 17 | * | 16 | 8 | 0 | 0 | 10 | 40 | 88 | * | **186** |
| Nerve (including spinal cord; excluding brain) | * | 11 | * | * | 0 | * | 0 | 0 | 0 | 0 | * | **22** |
| Blood vessel | 7 | 0 | 0 | * | 0 | 0 | * | 0 | * | 0 | 0 | **14** |
| Muscle/tendo n | 0 | * | * | 10 | 16 | * | 7 | 11 | 14 | 7 | * | **77** |
| Amputation (including partial) | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | * | 0 | ***** |
| Internal organ | 0 | 0 | 19 | 10 | 0 | 0 | 0 | 0 | 0 | * | * | **30** |
| Burn/corrosio n (excluding eye) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Eye injury (excluding foreign body in external eye) | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **15** |
| Intracranial(in cluding concussion) | 515 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **515** |
| Dental (including fractured tooth) | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **10** |
| Other specified nature of injury | 24 | 9 | 10 | 30 | 15 | * | * | 30 | 6 | 7 | 18 | **155** |
| Unspecified nature of injury | 207 | 43 | 26 | 139 | 18 | * | * | 76 | 54 | 28 | 16 | **614** |
| Injuries of more than one nature | * | 0 | 0 | * | * | 0 | 0 | * | * | 0 | 0 | ***** |
| **Total Females** | **1764** | **170** | **335** | **787** | **966** | **1323** | **152** | **1663** | **2364** | **370** | **66** | **9960** |
| **All persons** | **3738** | **309** | **683** | **1177** | **1393** | **1936** | **315** | **2414** | **3088** | **530** | **113** | **15696** |

- Fractures are by far the most common injury resulting from falls involving stairs and steps, accounting for 61.1% (n = 9,591) of principally diagnosed injuries. These are followed in frequency by open wounds (10.6%, n = 1670), intracranial injuries (7.2%, n = 1130), and injuries of an unspecified nature (7.1%, 1103).
- More than two thirds (66.8%, n = 6,650) of injuries of stair and step related fall injuries to females recorded between 2002/3 – 2004/5 are fractures, as are 51.3% (n = 2,941) of injuries to males.
- 53.6% (n = 3563) of fractures suffered by females are to the lower extremities, as are 42.1% (n = 1239) of fractures suffered by males.

- Open wounds constitute 10.6% (n = 1,670) of stair and step related principal diagnoses, 13.1% (n = 754) of injuries to males and 9.2% (n = 916) of injuries to females.
- Among males, wounds to the head accounted for 80.9% (n = 610) of open wound diagnoses, while wounds of this nature accounted for 56.6% (n = 518) of open wounds suffered by females. In contrast, 30.5% (n = 279) of open wounds suffered by females were to the knee and lower leg compared to 6.6% (n = 50) of open wounds suffered by males.
- Intracranial injury was also higher among males, accounting for 10.7% (n = 615) of principal diagnoses, compared to 5.2% (n = 515) among females.

**Table 9.11.10 Falls due to stairs and steps, Australia 2002-05: principal diagnosis groups (detailed body region) by place of occurrence, by sex**

| Males | Not poisoning /injury | Head | Neck | Thorax | Abdomen, lower back, lumbar spine & pelvis | Shoulder & upper arm | Elbow & forearm | Wrist & hand | Hip & thigh | Knee & lower leg | Ankle & foot | Other injuries | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other and unspecified place in home | 810 | 1328 | 106 | 289 | 300 | 320 | 401 | 117 | 586 | 513 | 116 | 34 | **4920** |
| Prison | * | 12 | 0 | 0 | * | * | * | 0 | * | * | 0 | 0 | **21** |
| Military camp | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | ***** |
| Aged care facilities | 19 | 26 | * | * | 5 | * | * | 0 | 24 | 6 | 0 | 0 | **90** |
| Other specified residential institution | * | 9 | * | 0 | * | * | 0 | 0 | * | * | 0 | * | **28** |
| Unspecified residential institution | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ***** |
| School | 6 | 76 | * | * | 10 | 20 | 100 | 13 | 8 | 31 | 10 | * | **278** |
| Health Service area | 60 | 23 | * | * | 5 | 5 | * | * | 9 | * | 7 | * | **125** |
| Other specified institution and public administrative area | 43 | 48 | * | * | 9 | 14 | 13 | 5 | 20 | 12 | * | * | **172** |
| Sporting hall (indoor) | * | 5 | 0 | 0 | 0 | 0 | * | 0 | * | * | 0 | 0 | **14** |

| Males | Not poisoning /injury | Head | Neck | Thorax | Abdomen, lower back, lumbar spine & pelvis | Shoulder & upper arm | Elbow & forearm | Wrist & hand | Hip & thigh | Knee & lower leg | Ankle & foot | Other injuries | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shop and store | 36 | 61 | 5 | 6 | 15 | 18 | 19 | 6 | 34 | 32 | * | * | **235** |
| Commercial garage | * | 0 | * | 0 | 0 | 0 | * | 0 | * | 0 | 0 | 0 | **10** |
| Office building | 8 | 9 | * | 0 | * | * | * | 0 | * | 8 | * | 0 | **35** |
| Cafe, hotel and restaurant | 97 | 281 | 16 | 30 | 30 | 30 | 42 | 17 | 41 | 68 | 18 | 6 | **676** |
| Other specified trade and service area | 31 | 95 | * | 10 | 7 | 13 | 19 | * | 17 | 40 | * | * | **244** |
| Place not reported/not applicable | * | * | 0 | 0 | * | * | * | 0 | * | 0 | 0 | 0 | **9** |
| **All Males** | **1122** | **1974** | **139** | **348** | **390** | **427** | **613** | **163** | **751** | **724** | **160** | **47** | **6858** |
| **Females** | | | | | | | | | | | | | |
| Other and unspecified place in home | 1726 | 1317 | 129 | 276 | 634 | 740 | 974 | 103 | 1323 | 1848 | 290 | 50 | **9410** |
| Prison | * | 0 | 0 | * | 0 | * | 0 | 0 | 0 | * | 0 | 0 | **10** |
| Military camp | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ***** |
| Aged care facilities | 56 | 46 | * | 9 | 17 | 20 | 25 | * | 61 | 27 | * | 0 | **268** |

| Males | Not poisoning /injury | Head | Neck | Thorax | Abdomen, lower back, lumbar spine & pelvis | Shoulder & upper arm | Elbow & forearm | Wrist & hand | Hip & thigh | Knee & lower leg | Ankle & foot | Other injuries | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other specified residential institution | 6 | 5 | * | 0 | * | * | * | 0 | * | 6 | * | 0 | **30** |
| Unspecified residential institution | * | 0 | 0 | 0 | 0 | * | 0 | 0 | * | * | 0 | 0 | ***** |
| School | 33 | 53 | 6 | * | 14 | 17 | 58 | 7 | 10 | 59 | 9 | * | **270** |
| Health Service area | 87 | 12 | * | * | 9 | 14 | 13 | * | 30 | 26 | 7 | 0 | **207** |
| Other specified institution and public administrative area | 50 | 58 | * | 7 | 20 | 24 | 54 | 8 | 54 | 62 | 10 | * | **348** |
| Sporting hall (indoor) | 0 | * | 0 | 0 | 0 | * | 10 | * | * | 7 | 0 | 0 | **22** |
| Shop and store | 107 | 84 | 14 | 9 | 33 | 56 | 66 | 11 | 72 | 131 | 16 | * | **602** |
| Commercial garage | * | * | * | 0 | * | * | * | 0 | * | * | 0 | 0 | **17** |
| Office building | 15 | 8 | * | 0 | 0 | * | * | * | * | 13 | * | 0 | **50** |
| Cafe, hotel and restaurant | 71 | 118 | 9 | 15 | 35 | 59 | 65 | 10 | 72 | 113 | 21 | 6 | **594** |

| Males | Not poisoning /injury | Head | Neck | Thorax | Abdomen, lower back, lumbar spine & pelvis | Shoulder & upper arm | Elbow & forearm | Wrist & hand | Hip & thigh | Knee & lower leg | Ankle & foot | Other injuries | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other specified trade and service area | 36 | 59 | * | 13 | 20 | 26 | 49 | 5 | 26 | 58 | 9 | * | **310** |
| Place not reported/not applicable | * | 0 | 0 | 0 | 0 | * | * | 0 | * | 10 | 0 | 0 | **18** |
| **All Females** | **2202** | **1764** | **170** | **335** | **787** | **966** | **1323** | **152** | **1663** | **2364** | **370** | **66** | **12162** |
| **Total** | **3325** | **3738** | **309** | **683** | **1177** | **1393** | **1936** | **315** | **2414** | **3088** | **530** | **113** | **19021** |

- Over three quarters (75.3%, n = 14,330) of hospital separations (including the principal diagnosis code of not poisoning/injury) occurred in a private home.
- The proportion of home based stair and step injury was slightly higher for females (77.4%, n = 9,410) than for males (71.7%, n = 4,920).
- While males recorded a much higher proportion of home based stair and step fall related injuries to the head (27.0%, n = 1328 vs. 14.0%, n = 1317), females showed a significantly higher proportion of injuries these injuries at home to the lower extremities (33.7%, n = 3,171 vs. 22.3%, n = 1,099).
- Stair and step fall related injuries sustained in cafes, hotels and restaurants accounted for 6.7% (n = 1270) of all separations. The proportion of males injured in this location was higher among males (9.9%, n = 676) than among females (4.9%, n = 594).
- Conversely, a higher proportion of females than males were injured by stairs and steps in shops and stores (4.9%, n = 602 vs. 3.4%, n = 235).

**Table 9.11.11 Fractures sustained from falls involving stairs and steps, Australia 2002-05, by broad body region and age group**

| | Other injuries | Head | Trunk | Shoulder and upper limb | Hip and lower limb | Total |
|---|---|---|---|---|---|---|
| 0-14 | 0 | 70 | 7 | 410 | 121 | **608** |
| 15-29 | 0 | 38 | 22 | 133 | 247 | **440** |
| 30-44 | 0 | 63 | 80 | 251 | 504 | **898** |
| 45-59 | * | * | 155 | 449 | 930 | **1645** |
| 60-74 | 0 | 71 | 258 | 711 | 1084 | **2124** |
| 75+ | * | * | 767 | 1063 | 1916 | **3876** |
| **All Fractures** | ***** | ***** | **1289** | **3017** | **4802** | **9591** |

- Nearly eighty percent (79.7%, n = 7,645) of stair and step fall related fractures are to those aged ≥ 45 years. Of these, 51.4% (n = 3,930) are hip and lower limb fractures.
- 62.5% (n = 3,000) of hip and lower limb fractures are to those aged ≥ 60 years.
- Over two thirds (67.4%, n = 410) of stair and step fall related fractures incurred by children aged ≥ 14 years are fractures of the shoulder and upper limb. Injuries to this body region account for 31.5% (n = 3017) of all fractures across all age groups.
- Nearly eighty percent (79.5%, n = 1,025) of stair and step fall related fractures to the trunk are to those aged ≥ 60 years, this age group accounts for 62.6% (n = 6,000) of fractures across all body regions.

*Nature of injury*

**Table 9.11.12 Nature of fall related hospital separations occurring on stairs and steps by year of separation, Australia 2002-2005**

| Nature of injury | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 271 | 277 | 389 | **937** | **4.9%** |
| Open wound (excluding eye) | 523 | 550 | 597 | **1,670** | **8.8%** |
| Fracture (excluding tooth) | 3,034 | 3,288 | 3,269 | **9,591** | **50.4%** |
| Dislocation | 104 | 123 | 98 | **325** | **1.7%** |
| Sprain/strain | 75 | 102 | 101 | **278** | **1.5%** |
| Nerve (including spinal cord; excluding brain) | 20 | 20 | 16 | **56** | **0.3%** |
| Blood vessel | 5 | 7 | 10 | **22** | **0.1%** |
| Muscle/tendon | 63 | 53 | 75 | **191** | **1.0%** |
| Amputation (including partial) | * | * | * | * | * |
| Internal organ | 24 | 26 | 25 | **75** | **0.4%** |
| Burn/corrosion (excluding eye) | * | * | * | * | * |
| Eye injury (excluding foreign body in external eye) | 11 | 12 | 9 | **32** | **0.2%** |
| Intracranial(including concussion) | 343 | 366 | 421 | **1,130** | **5.9%** |
| Dental (including fractured tooth) | 9 | 8 | 9 | **26** | **0.1%** |
| Other specified nature of injury | 81 | 77 | 89 | **247** | **1.3%** |
| Unspecified nature of injury | 358 | 378 | 367 | **1,103** | **5.8%** |
| Injuries of more than one nature | * | * | * | **10** | **0.1%** |
| Principal diagnosis not injury group | 935 | 1,002 | 1,388 | **3,325** | **17.5%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

- Over 50% (50.4%, n = 9,561) of hospital admitted stair and step fall injuries result in fractures, and 8.8% (n = 1,670) of these injuries were coded as open wounds.
- Intracranial injuries (including concussion) account for 5.9% (n = 1,130) of nature of injury codes, a proportion that increased by 22.7% from 2002-03 to 2004-05.
- The nature of injury was unspecified in 5.8% (n = 1,103) of cases.

*Length of stay*

**Table 9.11.13 Length of stay - falls related hospital separations occurring on stairs and steps 2002-2005 by frequency**

| Length of stay | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 2,458 | 2,589 | 2,857 | **7,904** | **41.6%** |
| Length of stay is two to seven days | 1,768 | 1,930 | 1,948 | **5,646** | **29.7%** |
| Length of stay is eight to thirty days | 1,422 | 1,521 | 1,748 | **4,691** | **24.7%** |
| Length of stay is greater than thirty days | 211 | 256 | 313 | **780** | **4.1%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

- The majority of stair and step injuries (58.4%, n = 11,117) resulted in a hospital stay of greater than two days, and 28.8% (n = 5,471) resulted in admission exceeding eight days.
- While stair and step related injuries increased by 17.2% overall during the period covered by this analysis, the proportion of patients whose hospital stay exceeded eight days increased by 26.2% over the same period.

***Injury severity - falls related hospital separations most likely occurring on stairs and steps***

**Table 9.11.14 Injury severity - falls related hospital separations occurring on stairs and steps 2002-2005 by Frequency and percentage**

| Injury Severity | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 4,235 | 4,448 | 4,750 | **13,433** | **70.6%** |
| Severe injury, ICISS <= 0.941 | 1,624 | 1,848 | 2,116 | **5,588** | **29.4%** |
| **Total** | **5,859** | **6,296** | **6,866** | **19,021** | **100.0%** |

- Overall, 29.4% (n = 5,588) of stair and step related fall injuries included in this analysis met Cryer's definition of a serious injury (see section 9.3.8).
- The percentage of severe stair and step related fall injury has increased from 27.7% (n = 1,624) in 2002-03 to 30.8% (n = 2,116) in 2004-05. This represents a greater proportional increase for severe injuries than is shown for all building fall injury, which has increased from 33.0% in 2002-03 to 34.8% in 2004-05.

## 9.12 FALL RELATED HOSPITAL SEPARATIONS OCCURRING IN RESIDENTIAL AGED CARE

NB:

Residential aged care facilities includes: a nursing home, old people's home and retirement villages.

Admitted patients transferred from another hospital make up 12% of all fall related hospital separations most likely occurring in buildings in residential aged care in Australia in 2002/03- 2004/05. This results in an over-estimation of actual cases of falls.

Cell counts <5 denoted by * have been suppressed for privacy reasons.

**Trend in the frequency and rate of hospital separations occurring in buildings in residential aged care**

***Frequency***

- The number of fall related hospital separations occurring in buildings in residential aged care for all persons increased by 41% from 14,869 in 2002/03 to 51,513 in 2004/05. Female hospital separations increased by 26 percent from 11, 605 to 14, 669 and male hospital separations by 40 percent from 3,264 to 4,585 for the same period.

***Rates***

**Table 9.12.1 Age standardised rates per 100,000 population of fall related hospital separations occurring in buildings in residential aged care by sex, and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| Males | 44.0 | 51.0 | 56.1 | 50.5 |
| Females | 88.1 | 99.1 | 104.6 | 97.4 |
| Persons | 72.5 | 82.0 | 87.1 | 80.7 |

- The age standardised rate of hospital separations occurring in buildings in residential aged care has increased in all persons by 20 percent from 72.5 hospital separations per 100,000 population per year in 2002/03 to 87.1 per 100,000 population in 2004/5.
- The age standardised rate for males has increased by 28 percent from 44 hospital separations per 100,000 population per year to 56.1 per 100,000 population in 2004/05, with the female age standardised rate increasing by 19 percent for this same period, from 88.1 to 104.6 hospital separations per 100,000 population per year.

## Age and sex fall related hospital separations that occurring in buildings in residential aged care

### *Frequency and percentage*

**Table 9.12.2 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by sex, and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 3,264 | 3,953 | 4,585 | **11,802** | **22.9%** |
| Females | 11,605 | 13,436 | 14,669 | **39,710** | **77.1%** |
| Persons | 14,869 | 17,389 | 19,255 | **51,513** | **100.0%** |

- Females accounted for a total of 39,710 (77 %) of all hospital separations occurring in residential aged care in Australia in 2002/03-2004/05, and males 11,802 (23%).

### Rates

Age standardised rates per 100,00 of population of fall related hospital separations occurring in buildings in residential aged care by sex, and year of separation in Australia in 2002/03 to 2004/05.

- The age standardised rates for hospital separations for females in residential aged care for 2002/03 to 2004/05 are almost double that of males in residential aged care, with 97.4 hospital separations per 100,000 population for females and 50.5 hospital separations per 100,000 population for males.

**Table 9.12.3 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by 5 year age groups to 85+, and year of separation, Australia, 2002/03-2004/05.**

| Age groups | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| | | | | | |
| 0–4 | * | * | * | * | |
| 5–9 | * | * | * | * | |
| 10–14 | * | * | * | * | |
| 15–19 | * | * | * | * | |
| 20–24 | * | * | * | 8 | 0.0% |
| 25–29 | * | * | * | 9 | 0.0% |
| 30–34 | * | * | * | 6 | 0.0% |
| 35–39 | * | * | * | 17 | 0.0% |
| 40–44 | 17 | 11 | 20 | 48 | 0.1% |
| 45–49 | 20 | 19 | 29 | 68 | 0.1% |
| 50–54 | 31 | 29 | 49 | 109 | 0.2% |
| 55–59 | 56 | 71 | 118 | 245 | 0.5% |
| 60–64 | 88 | 117 | 151 | 356 | 0.7% |
| 65–69 | 260 | 253 | 317 | 830 | 1.6% |
| 70–74 | 585 | 690 | 726 | 2,001 | 3.9% |
| 75–79 | 1,517 | 1,980 | 2,000 | 5,497 | 10.7% |
| 80–84 | 3,364 | 3,718 | 4,344 | 11,426 | 22.2% |
| 85+ | 8,917 | 10,490 | 11,479 | 30,886 | 60.0% |
| Total | 14,869 | 17,389 | 19,255 | 51,513 | 100.0% |

- Persons 85 years and accounted for 60 percent of the residential aged care hospital separations, with 30,866 hospital separations from 2002/03-2004/05. Persons 65 years and over accounted for 98 percent of hospital separations for this same time period.

**Causes of fall related hospital separations that occurring in buildings in residential aged care**

**Table 9.12.4 Frequency and percentage of fall related hospital separations by cause occurring in residential aged care facilities, by year of separation, Australia 2002/03- 2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Fall on same level from slipping, tripping and stumbling | 3,545 | 3,703 | 4,074 | 11,322 | 22.0% |
| *Slipping* | 1,147 | 1,218 | 1,360 | 3,725 | 7.2% |
| *Tripping* | 1,663 | 1,850 | 2,030 | 5,543 | 10.8% |
| *Stumbling* | 735 | 635 | 684 | 2,054 | 4.0% |
| Other fall on same level due to collision with, or pushing by, another person | 80 | 100 | 96 | 276 | 0.5% |
| Fall while being carried or supported by other persons | * | * | 5 | 21 | 0.0% |
| Fall involving wheelchair | 152 | 191 | 222 | 565 | 1.1% |
| Fall involving bed | 1,342 | 1,561 | 1,699 | 4,602 | 8.9% |
| Fall involving chair | 479 | 617 | 618 | 1,714 | 3.3% |
| Fall involving other furniture | 27 | 40 | 37 | 104 | 0.2% |
| Fall on and from stairs and steps | 105 | 116 | 137 | 358 | 0.7% |
| Fall on and from ladder | * | * | 8 | 21 | 0.0% |
| Fall from, out of or through building or structure | 13 | 15 | 24 | 52 | 0.1% |
| Other fall from one level to another | 41 | 48 | 69 | 158 | 0.3% |
| Other fall on same level | 3,215 | 4,106 | 4,587 | 11,908 | 23.1% |
| Unspecified fall | 5,855 | 6,878 | 7,679 | 20,412 | 39.6% |
| Total | 14,869 | 17,389 | 19,255 | 51,513 | 100.0% |

Almost 40 percent of these separations did not specify the type of fall.

The major causes in rank order were:

-other same level falls (23%)

-slips, trips and stumbles (22 %)

-fall involving a bed (9%)

-fall involving a chair (3%)

-fall involving a wheelchair (1%).

- Hospital separations from falls from beds in residential aged care occurred predominately in older residents with 93% of separations occurring in persons aged 75 years and over (n=4272) and 6% in persons aged between 60-74 years (n=274).

### Activity - fall related hospital separations occurring in buildings in residential aged care

The activity variable was unspecified or not reported on in 66 percent of separations in residential aged care. When this variable was reported on, the most common category of activity being undertaken at the time of the fall was ‘activities of daily living’.

### Body region and nature of injury - fall related hospital separations occurring in buildings in residential aged care

**Table 9.12.5 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by major body region injured (principal diagnosis) and year of separation, Australia, 2002/03-2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Other injuries not specified by body region & principal diagnosis not injury | 3022 | 3493 | 4346 | 10861 | 21.10% |
| Head | 1926 | 2338 | 2710 | 6974 | 13.50% |
| Trunk (neck, thorax, abdomen, lower back, lumbar. spine & pelvis) | 1661 | 1938 | 2266 | 5865 | 11.40% |
| Shoulder and upper limbs | 1537 | 1777 | 2053 | 5367 | 10.40% |
| Hip and lower limbs | 6723 | 7843 | 7880 | 22446 | 43.60% |
| Total | 14869 | 17389 | 19255 | 51513 | 100.00% |

- In over twenty one percent of hospital separations the body region of the injury was not specified or injury was not the principal diagnosis. In about 79% of hospital separations the principal diagnosis was injury.

- The body region most commonly injured by broad category was the: hip and lower limbs with 22,446 separations (44%), followed by the head with 6,974 separations (14%), the trunk with 5,865 separations (11%) and the shoulders and upper limbs with 5,367 separations (10%).

**Table 9.12.6 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by principal diagnosis and year of separation, Australia, 2002/03-2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Principal diagnosis not poisoning or injury | 2935 | 3383 | 4228 | 10546 | 20.5 |
| Injuries to the head | 1926 | 2338 | 2710 | 6974 | 13.5 |
| Injuries to the neck | 66 | 95 | 124 | 285 | 0.6 |
| Injuries to the thorax | 452 | 510 | 575 | 1537 | 3.0 |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 1143 | 1333 | 1567 | 4043 | 7.8 |
| Injuries to the shoulder & upper arm | 765 | 936 | 1020 | 2721 | 5.3 |
| Injuries to the elbow & forearm | 649 | 705 | 855 | 2209 | 4.3 |
| Injuries to the wrist & hand | 123 | 136 | 178 | 437 | 0.8 |
| Injuries to the hip & thigh | 6043 | 7017 | 7134 | 20194 | 39.2 |
| Injuries to the knee & lower leg | 611 | 735 | 671 | 2017 | 3.9 |
| Injuries to the ankle & foot | 69 | 91 | 75 | 235 | 0.5 |
| Injuries involving multiple body regions | 7 | 13 | 10 | 30 | 0.1 |
| Injuries to unspecified parts of trunk, limb or body region | 48 | 71 | 78 | 197 | 0.4 |
| Body type not relevant | 32 | 26 | 30 | 88 | 0.2 |
| Total | 14869 | 17389 | 19255 | 51513 | 100.0 |

- Over 20 percent of fall related hospital separations occurring in buildings in residential aged care did not have a principal diagnosis of injury or poisoning. Over 79% of hospital separations had a principal diagnosis of injury.

- The most common areas of injury were: hip and thigh (39%), head (14%), abdomen, lower back, lumber spine and pelvis (8%), shoulder and upper arm (5%), elbow and forearm (4%) and knee and lower leg (4%).

**Table 9.12.7 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by nature of injury by year of separation, Australia, 2002/03-2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 809 | 915 | 1,067 | 2,791 | 5.4% |
| Open wound (excluding eye) | 1,350 | 1,540 | 1,780 | 4,670 | 9.1% |
| Fracture (excluding tooth) | 7,944 | 9,217 | 9,741 | 26,902 | 52.2% |
| Dislocation | 137 | 186 | 192 | 515 | 1.0% |
| Sprain/strain | 90 | 121 | 106 | 317 | 0.6% |
| Nerve (including spinal cord; excluding brain) | 13 | 7 | 11 | 31 | 0.1% |
| Blood vessel | 14 | 12 | 19 | 45 | 0.1% |
| Muscle/tendon | 46 | 37 | 62 | 145 | 0.3% |
| Amputation (including partial) | * | * | * | * | * |
| Internal organ | 20 | 32 | 33 | 85 | 0.2% |
| Burn/corrosion (excluding eye) | * | * | * | * | * |
| Eye injury (excluding foreign body in external eye) | 26 | 39 | 38 | 103 | 0.2% |
| Intracranial(including concussion) | 288 | 393 | 461 | 1,142 | 2.2% |
| Dental (including fractured tooth) | * | * | * | * | * |
| Poison/toxic effect (excluding bite) | * | * | * | * | * |
| Other specified nature of injury | 238 | 253 | 233 | 724 | 1.4% |
| Unspecified nature of injury | 943 | 1,238 | 1,262 | 3,443 | 6.7% |
| Injuries of more than one nature | 11 | 13 | 19 | 43 | 0.1% |
| Primary diagnosis not injury | 2,935 | 3,383 | 4,228 | 10,546 | 20.5% |
| Total | 14,869 | 17,389 | 19,255 | 51,513 | 100.0% |

- Over 20% of primary diagnosis of fall related hospital separations most likely occurring in residential aged care did not have a principal diagnosis as injury and in over 6 percent of separations the nature of the injury was not specified.
- The most common injury was a fracture with 52 percent (26,902 hospital separations), followed by an open wound at 9 percent (4,670 hospital separations), superficial injury at 5 percent (2,791 hospital separations), and intracranial injury at 2 percent (1,142 hospital separations).
- Females accounted for 79% (n=21,305) of fractures and males 21% (n=5597).

**Table 9.12.8 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by nature of injury - fracture, by principal diagnosis group (detailed body region), Australia, 2002/03-2004/05.**

| | Freq | % |
|---|---|---|
| Injuries to the head | 413 | 1.54 |
| Injuries to the neck | 171 | 0.64 |
| Injuries to the thorax | 1113 | 4.14 |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 3062 | 11.38 |
| Injuries to the shoulder & upper arm | 1948 | 7.24 |
| Injuries to the elbow & forearm | 1658 | 6.16 |
| Injuries to the wrist & hand | 170 | 0.63 |
| Injuries to the hip & thigh | 17307 | 64.33 |
| Injuries to the knee & lower leg | 974 | 3.62 |
| Injuries to the ankle & foot | * | * |
| Other injuries not specified by body region | * | * |
| Total | 26902 | 99.68 |

This data is a subset of fall related hospital separations occurring in residential aged care. Of the 52.2 % of hospital separations occurring in aged care facilities coded by nature of injury as fracture:

- The most common region of fracture by principal diagnosis group was in the hip and thigh region (64%), followed by abdomen, lower back, lumbar spine and pelvis (11%) and elbow and forearm (6%).
- Females accounted for 77% (n= 13,389) of fractures to the hip and thigh region and males 23% (n=3,918).

On examining the subset of fall related hospital separations occurring in residential aged care coded by nature of injury as an open wound (n=4670), 77% were injuries to the head (excluding the eye), 9% to the knee and lower leg and 8% to the elbow and forearm.

## Length of stay- falls related hospital separations occurring in buildings in residential aged care

**Table 9.12.9 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by length of stay groups by year of separation, Australia, 2002/03- 2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 4,377 | 4,937 | 5,398 | 14,712 | 28.6% |
| Length of stay is two to seven days | 4,729 | 5,703 | 6,012 | 16,444 | 31.9% |
| Length of stay is eight to thirty days | 5,012 | 5,805 | 6,814 | 17,631 | 34.2% |
| Length of stay is greater than thirty days | 751 | 944 | 1,031 | 2,726 | 5.3% |
| Total | 14,869 | 17,389 | 19,255 | 51,513 | 100.0% |

- Almost 29% of hospital separations had lengths of stay less than two days, with 32% staying 2-7 days, 34% staying 8-30 days and 5% staying greater than thirty days.

**Injury severity- falls related hospital separations occurring in buildings in residential aged care**

**Table 9.12.10 Frequency and percentage of fall related hospital separations occurring in buildings in residential aged care by severity of injury groups by year of separation, Australia, 2002/03- 2004/05.**

| | 2002/03 | 2003/04 | 2004/05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 7,397 | 8,368 | 9,454 | 25,219 | 49.0% |
| Severe injury, ICISS <= 0.941 | 7,472 | 9,021 | 9,801 | 26,294 | 51.0% |
| Total | 14,869 | 17,389 | 19,255 | 51,513 | 100% |

- Hospital separations occurring as a result of a fall in a residential aged care facility were more likely to be classified as a serious injury, than separations associated with falls in acute health services or falls in other buildings. Of the hospital separations resulting from falls in residential aged care facilities, 49 % were coded using ICISS classification as not a severe injury, with about 51% of hospital separations injuries coded as a severe injury (see section 9.3.8).

## 9.13 FALL RELATED HOSPITAL SEPARATIONS OCCURRING IN HEALTH SERVICE AREAS

NB:

Health service area includes: day procedure centre, health centre, home for the sick, hospice, hospital and outpatient clinic.

Admitted patients transferred from another hospital make up 18.9% of all fall related hospital separations most likely occurring in buildings in acute health services in Australia in 2002/03-2004/05. This results in an over-estimation of actual cases of falls.

Unlike other categories of hospital admitted falls in buildings, those occurring in health service areas are not generally the primary reason for the hospital admission.

Cell counts <5 denoted by * have been suppressed for privacy reasons.

***Trend in the frequency and rate of fall related hospital separations occurring in buildings in health service areas***

***Frequency***

- The frequency of fall related hospital separations occurring in buildings in health service areas for all persons decreased by 2 percent from 12,144 in 2002/03 to 11,908 in 2004/05. Female hospital separations decreased by 10 percent from 7,041 in 2002/03 to 6,346 in 2004/05, and male separations increased by 9 percent from 5,102 in 2002/03 to 5,561 in 2003/04.

### *Rates*

**Table 9.13.1 Age standardised rates per 100,000 population of fall related hospital separations occurring in buildings in health service areas by sex, and year of separations, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| Males | 62.2 | 61.8 | 62.4 | 62.1 |
| Females | 58.5 | 53.4 | 51.1 | 54.2 |
| Persons | 59.8 | 56.5 | 55.3 | 57.1 |

- The age standardised rate of hospital separations occurring in buildings in health service areas has decreased in all persons by 8 percent from 59.8 hospital separations per 100,000 population per year in 2002/03 to 55.3 hospital separations per 100,000 population per year in 2004/05.
- The age standardised rate for males has remained relatively stable with an increase of 0.3 percent from 62.2 hospital separations per 100,000 population per year in 2002/03 to 62.4 per 100,000 population per year, with the female age standardised rate decreasing by 13 percent for this same period, from 58.5 to 51.1 separations per 100,000 population per year.

### *Age and sex fall related hospital separations occurring in buildings in health service areas*

### *Frequency and percentage*

**Table 9.13.2 Fall related hospital separations most likely occurring in buildings in health service areas by sex, and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 5,102 | 5,252 | 5,561 | 15,915 | 44.4% |
| Females | 7,041 | 6,555 | 6,347 | 19,943 | 55.6% |
| Persons | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- Females accounted for a total of 19,943 (56%) of all hospital separations occurring in health service areas in Australia in 2002/03 to 2004/05, and males 15,915 (44%).

### *Rates*

- The age standardised rates per 100,000 population for hospital separations for males in health service areas for 2002/03-2004/05 are 8 hospital separations per 100,000 population higher than those of females in health service areas, with 62.1 separations per 100,000 population for males and 54.2 separations for females per 100,000 population.

*Age*

**Table 9.13.3 Frequency and percentage of fall related hospital separations occurring in buildings in health service areas by 5 year age groups to 85+, and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| 0–4 | 105 | 90 | 124 | 319 | 0.9% |
| 5–9 | 15 | 29 | 27 | 71 | 0.2% |
| 10–14 | 30 | 20 | 19 | 69 | 0.2% |
| 15–19 | 50 | 48 | 47 | 145 | 0.4% |
| 20–24 | 49 | 70 | 59 | 178 | 0.5% |
| 25–29 | 117 | 81 | 88 | 286 | 0.8% |
| 30–34 | 102 | 113 | 125 | 340 | 0.9% |
| 35–39 | 126 | 138 | 129 | 393 | 1.1% |
| 40–44 | 169 | 162 | 180 | 511 | 1.4% |
| 45–49 | 189 | 204 | 206 | 599 | 1.7% |
| 50–54 | 218 | 237 | 244 | 699 | 1.9% |
| 55–59 | 307 | 343 | 396 | 1,046 | 2.9% |
| 60–64 | 392 | 394 | 459 | 1,245 | 3.5% |
| 65–69 | 617 | 577 | 734 | 1,928 | 5.4% |
| 70–74 | 1,086 | 1,150 | 1,070 | 3,306 | 9.2% |
| 75–79 | 2,015 | 1,898 | 2,034 | 5,947 | 16.6% |
| 80–84 | 2,672 | 2,655 | 2,670 | 7,997 | 22.3% |
| 85+ | 3,884 | 3,599 | 3,297 | 10,780 | 30.1% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- Persons aged 65 years and over accounted for 84 percent of the of the health service area hospital separations, with 29,958 separations occurring in the period 2002/03 to 2004/05, with persons 85 years and over accounting for 30 percent (10,780) of all hospital separations for this same time period.

*Causes of fall related hospital separations occurring in buildings in health service areas*

**Table 9.13.4 Frequency and percentage of fall related hospital separations occurring in health service areas, cause by year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Fall on same level from slipping, tripping and stumbling | 2,686 | 2,386 | 2,505 | 7,577 | 21.1% |
| *Slipping* | 1,329 | 1,228 | 1,284 | 3,841 | 10.7% |
| *Tripping* | 763 | 666 | 718 | 2,147 | 6.0% |
| *Stumbling* | 593 | 492 | 503 | 1,588 | 4.4% |
| Other fall on same level due to collision with, or pushing by, another person | 31 | 22 | 27 | 80 | 0.2% |
| Fall while being carried or supported by other persons | 15 | 13 | 6 | 34 | 0.1% |
| Fall involving wheelchair | 134 | 133 | 129 | 396 | 1.1% |
| Fall involving bed | 1,993 | 1,856 | 1,911 | 5,760 | 16.1% |
| Fall involving chair | 498 | 506 | 479 | 1,483 | 4.1% |
| Fall involving other furniture | 47 | 51 | 39 | 137 | 0.4% |
| Fall on and from stairs and steps | 116 | 110 | 106 | 332 | 0.9% |
| Fall on and from ladder | 16 | 21 | 7 | 44 | 0.1% |
| Fall from, out of or through building or structure | 39 | 26 | 38 | 103 | 0.3% |
| Other fall from one level to another | 72 | 76 | 56 | 204 | 0.6% |
| Other fall on same level | 2,859 | 2,971 | 3,060 | 8,890 | 24.8% |
| Unspecified fall | 3,638 | 3,637 | 3,545 | 10,820 | 30.2% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

The cause of the fall was not specified in over 30 percent of separations.

The major causes of falls in rank order were:

-fall on same level (25%)

-slips, trips and stumbles on the same level (21%)

-fall involving a bed (16%)

-fall involving a chair (4%)

-fall involving a wheel chair (1%).

*Activity when fell occurred- falls related hospital separations occurring in buildings in health service areas*

**Table 9.13.5 Frequency and percentage of fall related hospital separations occurring in health service area, by activity being undertaken and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| While engaged in sports | 34 | 25 | 10 | 69 | 0.2% |
| While engaged in leisure | 12 | 8 | 13 | 33 | 0.1% |
| While working for income | 163 | 134 | 136 | 433 | 1.2% |
| While engaged in other types of work | 33 | 41 | 34 | 108 | 0.3% |
| While resting, sleeping, eating, etc. | 4,039 | 3,733 | 3,965 | 11,737 | 32.7% |
| Other specified activity | 2,241 | 2,326 | 2,166 | 6,733 | 18.8% |
| Unspecified activity | 5,503 | 5,446 | 5,516 | 16,465 | 45.9% |
| Activity not reported/not applicable | 115 | 95 | 68 | 278 | 0.8% |
| Total | 12,140 | 11,808 | 11,908 | 35,856 | 100.0% |

- The activity variable is not well reported in the national data and was unspecified or not reported in over 46 percent of hospital separations, while a further 19 percent were coded to the category of ‘other specified activity’.
- The activity being undertaken at the time of fall was listed as resting, sleeping, eating etc. in 33 percent of hospital separations, while working for an income in 1 percent of hospital separations, and while engaged in other types of work for 0.3 percent of hospital separations. The last two activities suggest falls by persons who were not inpatients of health services, possibly staff members, volunteers, visitors or persons working in health service areas.

*Body region and nature of injury – Frequency and percentage of fall related hospital separations occurring in buildings in health service areas*

**Table 9.13.6 Frequency of fall related hospital separations occurring in buildings in health service areas by major body region injured (principal diagnosis) and year of separation, Australia, 2002/3-2004/5.**

| | 2002-03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other injuries not specified by body region & principal diagnosis not injury | 9,281 | 9,667 | 10,035 | 28,983 | 80.8% |
| Head | 489 | 387 | 339 | 1,215 | 3.4% |
| Trunk (neck, thorax, abdomen, lower back, lumbar spine & pelvis | 354 | 274 | 248 | 876 | 2.4% |
| Shoulder and upper limb | 379 | 337 | 283 | 999 | 2.8% |
| Hip and lower limb | 1,641 | 1,143 | 1,003 | 3,787 | 10.6% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- In over 80 percent of hospital separations the major body region injured was not specified or the principal diagnosis was not injury. Of the 19% of hospital separations with a principal diagnosis of injury:
- The body region most commonly injured by broad category was the: hip and lower limb (11%), head (3%), shoulder and upper limb (3%) and the trunk (2%).

**Table 9.13.7 Frequency and percentage of fall related hospital separations occurring in buildings in health service areas by principal diagnosis and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Principal diagnosis not poisoning or injury | 9,234 | 9,632 | 10,011 | 28,877 | 80.5% |
| Injuries to the head | 489 | 387 | 339 | 1,215 | 3.4% |
| Injuries to the neck | 20 | 31 | 27 | 78 | 0.2% |
| Injuries to the thorax | 93 | 69 | 76 | 238 | 0.7% |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 241 | 174 | 145 | 560 | 1.6% |
| Injuries to the shoulder & upper arm | 168 | 163 | 133 | 464 | 1.3% |
| Injuries to the elbow & forearm | 188 | 135 | 120 | 443 | 1.2% |
| Injuries to the wrist & hand | 23 | 39 | 30 | 92 | 0.3% |
| Injuries to the hip & thigh | 1,411 | 970 | 851 | 3,232 | 9.0% |
| Injuries to the knee & lower leg | 199 | 152 | 129 | 480 | 1.3% |
| Injuries to the ankle & foot | 31 | 21 | 23 | 75 | 0.2% |
| Injuries involving multiple body regions | * | * | * | 10 | 0.0% |
| Injuries to unspecified parts of trunk, limb or body region | * | * | * | 24 | 0.1% |
| Body region not relevant | 35 | 20 | 17 | 72 | 0.2% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- Over 80 percent of hospital separations occurring in health service areas did not have a principal diagnosis of injury of poisoning. Of the 19.5 % of hospital separations with an injury related principal diagnosis:
- The most common areas of injury coded were to the: hip and thigh (9%), head (3 %), abdomen, lower back, lumbar spine and pelvis (2%), shoulder and upper arm (1%), elbow and forearm (1%) and the knee and lower leg (1%).

**Table 9.13.8 Frequency and percentage of fall related hospital separations occurring in buildings in health service areas by nature of injury and year of separation (principle diagnosis = injury), Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 177 | 103 | 109 | 389 | 5.6% |
| Open wound (excluding eye) | 234 | 185 | 153 | 572 | 8.2% |
| Fracture (excluding tooth) | 1,969 | 1,458 | 1,260 | 4,687 | 67.1% |
| Dislocation | 50 | 62 | 48 | 160 | 2.3% |
| Sprain/strain | 24 | 23 | 21 | 68 | 1.0% |
| Nerve (including spinal cord; excluding brain) | * | * | 5 | 12 | 0.2% |
| Blood vessel | 5 | * | * | 10 | 0.1% |
| Muscle/tendon | 16 | 15 | 17 | 48 | 0.7% |
| Crush injury | * | * | * | * | |
| Internal organ | 11 | 8 | 7 | 26 | 0.4% |
| Burn/corrosion (excluding eye) | * | * | * | * | |
| Eye injury (excluding foreign body in external eye) | 6 | * | 5 | 13 | 0.2% |
| Intracranial(including concussion) | 135 | 129 | 111 | 375 | 5.4% |
| Dental (including fractured tooth) | * | * | * | 6 | 0.1% |
| Poison/toxic effect (excluding bite) | 16 | * | * | 19 | 0.3% |
| Other specified nature of injury | 52 | 41 | 43 | 136 | 1.9% |
| Unspecified nature of injury | 205 | 138 | 112 | 455 | 6.5% |
| Injuries of more than one nature | * | * | * | 5 | 0.1% |
| Total | 2,910 | 2,176 | 1,897 | 6,983 | 100.0% |

NB: This table refers to a sub-set of fall related hospital separations occurring in health service areas. Only 20 percent (n=6,983) of the total fall related hospital separations occurring in a health service area (n=35, 860) were coded with a principal diagnosis of injury. Of the 20% of separations:

- Over 6% (n= 455) of the fall related hospital separations (principle diagnosis = injury) occurring in a health service area did not specify the nature of the injury.
- The most common injury was a fracture (67%, n=4,687), followed by an open wound (8%, n=572), superficial injuries (6%, n=389), and intracranial injuries (5%, n=375).

**Table 9.13.9 Frequency of fall related hospital separations occurring in buildings in health service areas by ICD chapter (principal diagnosis groups =not injury), by year of separation, 2002/03-2004/05, Australia.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Certain infectious and parasitic diseases | 177 | 167 | 198 | 542 | 1.9 |
| Neoplasms | 961 | 1,066 | 1,100 | 3,127 | 10.8 |
| Diseases of the blood, blood-forming organs, etc | 70 | 80 | 75 | 225 | 0.8 |
| Endocrine, nutritional and metabolic diseases | 244 | 277 | 283 | 804 | 2.8 |
| Mental and behavioural disorders | 809 | 878 | 897 | 2,584 | 8.9 |
| Diseases of the nervous system | 452 | 471 | 462 | 1,385 | 4.8 |
| Diseases of the eye and adnexa | 19 | 28 | 22 | 69 | 0.2 |
| Diseases of the ear and mastoid process | 13 | 20 | 18 | 51 | 0.2 |
| Diseases of the circulatory system | 1,329 | 1,340 | 1,439 | 4,108 | 14.2 |
| Diseases of the respiratory system | 726 | 781 | 821 | 2,328 | 8.1 |
| Diseases of the digestive system | 455 | 463 | 517 | 1,435 | 5.0 |
| Diseases of the skin and subcutaneous tissue | 130 | 155 | 140 | 425 | 1.5 |
| Diseases of the musculoskeletal system and connective tissue | 544 | 525 | 489 | 1,558 | 5.4 |
| Diseases of the genitourinary system | 327 | 347 | 346 | 1,020 | 3.5 |
| Pregnancy, childbirth and the puerperium | 78 | 66 | 78 | 222 | 0.7 |
| Certain conditions originating in the perinatal period | 8 | 6 | 10 | 24 | 0.1 |
| Congenital malformations, deformations etc | 8 | 8 | 6 | 22 | 0.1 |
| Symptoms, signs, abnormalities not elsewhere classified | 566 | 598 | 626 | 1,790 | 6.2 |
| Factors influencing health status - Z | 2,318 | 2,356 | 2,484 | 7,158 | 24.8 |
| Total | 9,234 | 9,632 | 10,011 | 28,877 | 100.0 |

NB: As over 80% of fall related separations occurring in buildings in health service areas did not have a principal diagnosis of injury, it is important to examine the area of principle diagnosis of these hospital separations. The above table is a subset of all fall related hospital separations occurring in health service areas.

- The most common ICD chapter group was factors influencing health status (25%), followed by diseases of the circulatory system (14%), neoplasms (11%), mental and behaviour disorders (9%) and disease of the respiratory system (8%).

*Length of stay-falls related hospital separations occurring in buildings in health service areas*

**Table 9.13.10 Frequency and percentage of fall related hospital separations occurring in buildings in health service areas by length of stay groups by year of separation, Australia, 2002/03- 2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 1,218 | 1,067 | 1,028 | 3,313 | 9.2% |
| Length of stay is two to seven days | 2,817 | 2,637 | 2,578 | 8,032 | 22.4% |
| Length of stay is eight to thirty days | 5,615 | 5,531 | 5,822 | 16,968 | 47.3% |
| Length of stay is greater than thirty days | 2,494 | 2,573 | 2,480 | 7,547 | 21.0% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- Twenty one percent of hospital separations due to falls in health service areas had a length of stay greater than 30 days. This is a much larger proportion of separations in this category than for other building areas examined: residential aged care (5%), home (6%) and all building (7%) of separations.
- Nine percent of separations had a length of stay of less than 2 days, with 22 % of separations with a length of stay of 2 -7 days and 47 percent with a length of stay of 8-30 days.

*Injury severity- falls related hospital separations occurring in buildings in health service areas*

**Table 9.13.11 Frequency and percentage of fall related hospital separations occurring in buildings in health service areas by severity groups by year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 8,922 | 8,985 | 9,236 | 27,143 | 75.7% |
| Severe injury, ICISS <= 0.941 | 3,222 | 2,823 | 2,672 | 8,717 | 24.3% |
| Total | 12,144 | 11,808 | 11,908 | 35,860 | 100.0% |

- Three quarters of the hospital separations resulting from falls in health service areas were coded using ICISS classification as not a severe injury, with about a quarter of hospital separations injuries coded as a severe (see section 9.3.8).

## 9.14 FALLS FROM BEDS: HOSPITAL SEPARATIONS

NB:

Admitted patients transferred from another hospital make up 11.7% of all fall related hospital separations most likely occurring in buildings caused by falls from bed in Australia in 2002/03- 2004/05. This results in an over-estimation of actual cases of falls.

Cell counts <5 denoted by * have been suppressed for privacy reasons.

### Trends in the frequency and rate of hospital separations resulting from falls from beds occurring in buildings

***Frequency***

The frequency of fall related hospital separations occurring in buildings caused by falls from beds for all persons increased by 7 percent from 6,793 in 2002/03 to 7,291 in 2004/05. Female hospital separations increased by 7 percent from 4,095 to 4,394 and male hospital separations by 7 percent from 2, 697 to 2,897 for the same period.

***Rate***

**Table 9.14.1 Age standardised rates per 100,000 population of fall related hospital separations occurring in buildings from beds by sex, and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total |
|---|---|---|---|---|
| Males | 32.2 | 31.9 | 32.4 | 32.1 |
| Females | 34.1 | 34.5 | 34.8 | 34.5 |
| Persons | 33.6 | 33.6 | 34.2 | 33.8 |

- The age standardised rate of hospital separations for falls from beds has increased by 1.8 percent from 33.6 per 100,000 persons in 2002/03 to 34.2 per 100,000 persons in 2004/05.
- Age standardised rates for falls from beds increased by 0.6 percent from 32.2 per 100,000 population in 2002/03 to 32.4 per 100,000 population in 2004/05, with the female rate increasing 2 percent from 34.1 per 100,000 population in 2002/2003 to 34.8 per 100,000 population in 2004/05.

### *Age and sex of falls occurring in buildings separations from beds*

#### *Frequency*

**Table 9.14.2 Frequency and percentage of fall related hospital separations occurring in buildings from beds by sex, and year of separation, Australia, 2002/03- 2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Males | 2,697 | 2,751 | 2,897 | 8,345 | 39.6% |
| Females | 4,095 | 4,214 | 4,394 | 12,703 | 60.3% |
| Persons | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Females accounted for a total of 12,703 (60%) of all fall related hospital separations occurring in buildings from beds in 2002/03 to 2004/05, and males 8,345 (40%).

#### *Rates*

- The age standardised rate for hospital separations for females for 2002/03 to 2004/05 were 2.4 hospital separations per 100,000 population higher than the rate for males, with 34.5 hospital separations per 100,000 population for females and 32.1 hospital separations per 100,000 population for males.

**Table 9.14.3 Frequency and percentage of fall related hospital separations occurring in buildings from beds by 5 year age and year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| 0–4 | 648 | 674 | 657 | 1,979 | 9.4% |
| 5–9 | 326 | 346 | 283 | 955 | 4.5% |
| 10–14 | 96 | 79 | 78 | 253 | 1.2% |
| 15–19 | 31 | 19 | 39 | 89 | 0.4% |
| 20–24 | 25 | 28 | 36 | 89 | 0.4% |
| 25–29 | 31 | 24 | 34 | 89 | 0.4% |
| 30–34 | 37 | 46 | 32 | 115 | 0.5% |
| 35–39 | 39 | 53 | 34 | 126 | 0.6% |
| 40–44 | 49 | 44 | 48 | 141 | 0.7% |
| 45–49 | 64 | 69 | 78 | 211 | 1.0% |
| 50–54 | 91 | 81 | 97 | 269 | 1.3% |
| 55–59 | 131 | 152 | 129 | 412 | 2.0% |
| 60–64 | 140 | 129 | 182 | 451 | 2.1% |
| 65–69 | 251 | 244 | 239 | 734 | 3.5% |
| 70–74 | 445 | 431 | 501 | 1,377 | 6.5% |
| 75–79 | 795 | 875 | 926 | 2,596 | 12.3% |
| 80–84 | 1,234 | 1,315 | 1,383 | 3,932 | 18.7% |
| 85+ | 2,359 | 2,356 | 2,515 | 7,230 | 34.3% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Persons aged 65 years and over accounted for 75.3% (n=15,869) of all hospital separations due to falls from beds in buildings, with persons aged 85 years and over accounting for 34.3 % (n= 7,230) of all separations.
- Young children aged between 0 and 4 years (9.4%, n=1,979) were also over-represented compared with all age groups up to 75 years.

*Location of falls occurring in buildings hospital separations from beds*

**Table 9.14.4 Frequency and percentage of fall related hospital separations occurring in buildings from beds by place of occurrence by year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other and unspecified place in home | 3,298 | 3,460 | 3,586 | 10,344 | 49.1% |
| Prison | * | * | * | 15 | 0.1% |
| Juvenile detention centre | * | * | * | * | |
| Military camp | * | * | * | * | |
| Orphanage | * | * | * | * | |
| Aged care facilities | 1,342 | 1,561 | 1,699 | 4,602 | 21.9% |
| Other specified residential institution | 29 | 36 | 48 | 113 | 0.5% |
| Unspecified residential institution | * | * | * | 18 | 0.1% |
| School | * | * | * | 11 | 0.1% |
| Health Service area | 1,993 | 1,856 | 1,911 | 5,760 | 27.4% |
| Other specified institution and public administrative area | 46 | 21 | 16 | 83 | 0.4% |
| Sporting hall (indoor) | * | * | * | * | |
| Shop and store | * | * | * | * | |
| Cafe, hotel and restaurant | 9 | 9 | 13 | 31 | 0.1% |
| Other specified trade and service area | * | * | * | 8 | 0.0% |
| Place not reported/not applicable | 50 | * | * | 55 | 0.3% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Over 49 percent of hospital separations due to falls from beds occurred in the home.
  - Persons aged 75 years and over were 52% of hospital separations of falls from bed in the home and children aged 0-14 years were 29 %.

- Health service areas were nominated as the place of occurrence in over 27% (n=5,760) of hospital separations, followed by aged care facilities in 22% (n=4,602) of separations in 2002/03 to 2004/05. Both settings accounting for almost 50 percent of hospital separations due to falls from beds.
  - Persons aged 75 years and over were 69% of hospital separations of falls from bed in health service areas and persons aged 60-74 years 19%.
  - Persons aged 75 years and over were 93% of hospital separation of falls from bed in residential aged facilities and persons aged 60-74 were 6%.

*Activity of falls most likely occurring in buildings hospital separations from beds*

**Table 9.14.5 Frequency and percentage of fall related hospital separations occurring in buildings from beds by broad activity by year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| While engaged in sports | * | * | * | 6 | 0.0% |
| While engaged in leisure | 34 | 39 | 21 | 94 | 0.4% |
| While working for income | * | * | * | 13 | 0.1% |
| While engaged in other types of work | 16 | 30 | 30 | 76 | 0.4% |
| While resting, sleeping, eating, etc. | 3,738 | 3,620 | 3,818 | 11,176 | 53.1% |
| Other specified activity | 1,052 | 1,063 | 1,055 | 3,170 | 15.1% |
| Unspecified activity | 1,880 | 2,185 | 2,341 | 6,406 | 30.4% |
| Activity not reported/not applicable | 61 | 21 | 22 | 104 | 0.5% |
| Total | 6,789 | 6,965 | 7,291 | 21,045 | 100.0% |

- The activity was not specified or reported on in about 31 percent of hospital separations.
- The activity was coded as ‘while resting, sleeping, eating, etc.’ in over 53 percent of cases with 15% of separations coded as ‘other specified activity’.

*Body region and nature of injury – falls occurring in buildings hospital separations from beds*

**Table 9.14.6 Frequency and percentage of fall related hospital separations occurring in buildings from beds by major body region injured (principal diagnosis) by year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Other injuries not specified by body region & principal diagnosis not injury | 2,777 | 2,787 | 3,041 | 8,605 | 40.9% |
| Head | 1,013 | 975 | 1,076 | 3,064 | 14.6% |
| Trunk (neck, thorax, abdomen, lower back, lumbar spine & pelvis | 528 | 583 | 679 | 1,790 | 8.5% |
| Shoulder and upper limb | 935 | 949 | 884 | 2,768 | 13.2% |
| Hip and lower limb | 1,540 | 1,671 | 1,611 | 4,822 | 22.9% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Table* shows the frequency of fall related hospital separations occurring in buildings from beds by major body region injured (principal diagnosis) by year in Australia in 2002/03 to 2004/05. In over 40 percent of hospital separations the body region of the injury was not specified or injury was not the principal diagnosis. Over 59% of hospital separations had a principal diagnosis of injury.
- The body region most commonly injured by broad category was the: hip and lower limb (23%), head (15%), shoulder and upper limb (13%) and trunk (9%).

**Table 9.14.7 Frequency and percentage of fall related hospital separations occurring in buildings from beds by principal diagnosis groups by year, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Principal diagnosis not poisoning or injury | 2,726 | 2,724 | 2,985 | 8,435 | 40.1% |
| Injuries to the head | 1,013 | 975 | 1,076 | 3,064 | 14.6% |
| Injuries to the neck | 47 | 79 | 69 | 195 | 0.9% |
| Injuries to the thorax | 161 | 181 | 194 | 536 | 2.5% |
| Injuries to the abdomen, lower back, lumbar spine & pelvis | 320 | 323 | 416 | 1,059 | 5.0% |
| Injuries to the shoulder & upper arm | 398 | 398 | 408 | 1,204 | 5.7% |
| Injuries to the elbow & forearm | 492 | 513 | 417 | 1,422 | 6.8% |
| Injuries to the wrist & hand | 45 | 38 | 59 | 142 | 0.7% |
| Injuries to the hip & thigh | 1,274 | 1,385 | 1,313 | 3,972 | 18.9% |
| Injuries to the knee & lower leg | 234 | 236 | 267 | 737 | 3.5% |
| Injuries to the ankle & foot | 32 | 50 | 31 | 113 | 0.5% |
| Injuries to unspecified parts of trunk, limb or body region | 30 | 28 | 30 | 88 | 0.4% |
| Body region not relevant | 19 | 26 | 24 | 69 | 0.3% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Over 40% of hospital separations did not have a principal diagnosis of injury or poisoning.
- Over 59% of hospital separations had an injury related principal diagnosis.
- The most common areas of injury were: to the hip and thigh (19%), to the head (15%), to the elbow and forearm (7%), and to the shoulder and upper arm (6%).

**Table 9.14.8 Frequency and percentage of falls related hospital separations occurring in buildings from beds by nature of injury and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Superficial (excluding eye) | 288 | 321 | 333 | 942 | 7.5% |
| Open wound (excluding eye) | 513 | 484 | 594 | 1,591 | 12.6% |
| Fracture (excluding tooth) | 2,317 | 2,422 | 2,357 | 7,096 | 56.3% |
| Dislocation | 82 | 108 | 79 | 269 | 2.1% |
| Sprain/strain | 49 | 51 | 48 | 148 | 1.2% |
| Nerve (including spinal cord; excluding brain) | 11 | 14 | 13 | 38 | 0.3% |
| Blood vessel | * | * | 7 | 13 | 0.1% |
| Muscle/tendon | 18 | 27 | 29 | 74 | 0.6% |
| Amputation (including partial) | * | * | * | * | |
| Internal organ | 19 | 15 | 6 | 40 | 0.3% |
| Burn/corrosion (excluding eye) | * | * | * | * | |
| Eye injury (excluding foreign body in external eye) | 13 | 9 | 15 | 37 | 0.3% |
| Intracranial (including concussion) | 198 | 174 | 166 | 538 | 4.3% |
| Dental (including fractured tooth) | 13 | 13 | 6 | 32 | 0.3% |
| Poison/toxic effect (excluding bite) | 8 | * | * | 12 | 0.1% |
| Other specified nature of injury | 83 | 119 | 96 | 298 | 2.4% |
| Unspecified nature of injury | 445 | 475 | 546 | 1,466 | 11.6% |
| Injuries of more than one nature | 6 | * | * | 15 | 0.1% |
| Total | 4,067 | 4,241 | 4,306 | 12,614 | 100.0% |

NB: The separations are a subset (59% n= 12,614) of all fall related hospital separations occurring from beds, and include all separations where the principal diagnosis was injury.

- Over 11 percent of hospital separations did not specify the nature of the injury sustained.
- The most common injury was a fracture (56%), followed by an open wound (13%), superficial injuries (8%), and intracranial injuries (4%).

On analysis of the subset of fall related hospital separations occurring from beds coded as fractures (n=7096).

- The majority of fractures were injuries to: the hip and thigh region (46%, n=3229), elbow and forearm (17%, n=1238), shoulder and upper arm (13%, n=907) and abdomen, lower back, lumbar spine and pelvis (9%, n=631).
- Females accounted for 68% of all fracture separations and 73 % of fracture separation to the hip and thigh region.

- Females and male proportions of separations due to fractures to the head region (n=227) were equal with females Maki and Fernieng up 49% and males 51% of separations.
- Persons aged 75 years and over were 64% of all hospital separations due to fracture with persons aged 0-14 years 22% and persons aged 60-74 years 9% of hospital separations.

On analysis of the subset of fall related hospital separations occurring from beds coded as open wounds (n=1,591).

- The majority of open wound injuries were to the following regions: head (77%), knee and lower leg (9%) and elbow and lower arm (6%).

Intracranial injuries were analysed as a subset due to the serious nature of this injury type. On analysis of the subset of fall related hospital separations occurring from beds coded as intracranial injury (n=538):

- Equal proportions of males and females separations were found as a consequence of falls from beds resulting in intracranial injuries.
- Persons aged 0-14 were 45% of hospital separations due to intracranial injuries, persons aged 60-74 were 10% and persons aged 75 years and older were 36% of hospital separations.

***Length of stay falls occurring in buildings hospital separations from beds***

**Table 9.14.9 Frequency and percentage of falls related hospital separations occurring in buildings from beds by length of stay and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Length of stay is less than two days | 2,268 | 2,192 | 2,301 | 6,761 | 32.1% |
| Length of stay is two to seven days | 1,685 | 1,855 | 1,834 | 5,374 | 25.5% |
| Length of stay is eight to thirty days | 2,216 | 2,291 | 2,520 | 7,027 | 33.4% |
| Length of stay is greater than thirty days | 624 | 627 | 636 | 1,887 | 9.0% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- 9% of hospital separations due to falls from beds had a length of stay over 30 days, where as 32% stayed less than 2 days, with 36% with a length of stay of 2 -7 days and 33 percent with a length of stay of 8-30 days.

***Injury severity of falls occurring in buildings hospital separations from beds***

**Table 9.14.10 Falls related hospital separations occurring in buildings from beds by severity of injury and year of separation, Australia, 2002/03-2004/05.**

| | 2002–03 | 2003–04 | 2004–05 | Total | % |
|---|---|---|---|---|---|
| Not severe injury, ICISS > 0.941 | 4,849 | 4,909 | 5,253 | 15,011 | 71.3% |
| Severe injury, ICISS <= 0.941 | 1,944 | 2,056 | 2,038 | 6,038 | 28.7% |
| Total | 6,793 | 6,965 | 7,291 | 21,049 | 100.0% |

- Seventy one percent of the hospital separations resulting from falls from beds most likely occurring in a building were coded using ICISS classification as not a severe injury, with almost 29 percent of hospital separations injuries coded as a severe.

## 9.15 INTRINSIC CONDITION OF INJURED PERSON

### 9.15.1 Introduction

A difficult question to answer is in what proportion of falls did intrinsic condition of the person suffering the falls contribute to the fall or to the occurrence or severity of injury? Data from the final 3 years (July 2002-June 2005) were analysed to attempt to quantify how many persons had other conditions recorded on their hospital record. It is important to note that this analysis takes into account all other possible diagnosis codes and includes conditions that may not have contributed to the fall or its consequences, for example the ICD-10-AM (International Classification of Diseases Version 10: Australian Modification) coding system contains a chapter “Factors influencing health status and contact with health services” which includes codes such as ‘family history of malignant neoplasm’ or ‘personal history of allergy to drugs, medicaments or biological substances’.

### 9.15.2 Results

The following overview table gives some indication of commonly occurring co-morbid conditions in different settings (Table 9.10.1). The column totals do not add up to 100% as more than one condition could be reported for all cases. These in-depth analyses are limited to Victoria, as the available resources for this study did not permit wider analysis.

- Overall, almost 30% of cases across all building locations had no additional ICD-10 codes recorded. Obviously the location of a fall influences this proportion as evidenced by only 6% of falls occurring in health service areas and 22% in residential services having no other codes recorded.
- Some co-morbidities listed in Table 9.10.1 may actually have occurred as a consequence of the fall. This may be true for abnormal clinical findings not elsewhere classified (in total 43.6% of cases in Table 9.10.1)

**Table 9.15.1 Co-morbid conditions by location among all persons admitted to Victorian hospitals who were injured due to falls in buildings 2002/3-2004/5**

| | Home | | Residential institution | | Health service area | | All other locations | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Certain infectious and parasitic diseases | 4032 | 9.7 | 1822 | 13.5 | 2002 | 23.9 | 236 | 3.5 | 8092 | 11.5 |
| Neoplasms | 1519 | 3.7 | 309 | 2.3 | 2261 | 27.0 | 47 | 0.7 | 4136 | 5.9 |
| Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 3561 | 8.6 | 1732 | 12.8 | 1198 | 14.3 | 213 | 3.1 | 6704 | 9.5 |
| Endocrine, nutritional and metabolic diseases | 13175 | 31.7 | 4952 | 36.7 | 4994 | 59.6 | 853 | 12.5 | 23974 | 34.1 |
| Mental and behavioural disorders | 6283 | 15.1 | 5124 | 37.9 | 3650 | 43.6 | 803 | 11.8 | 15860 | 22.6 |
| Diseases of the nervous system | 3543 | 8.5 | 1654 | 12.2 | 2018 | 24.1 | 271 | 4.0 | 7486 | 10.6 |
| Diseases of the eye and adnexa | 1041 | 2.5 | 437 | 3.2 | 554 | 6.6 | 79 | 1.2 | 2111 | 3.0 |
| Diseases of the ear and mastoid process | 500 | 1.2 | 228 | 1.7 | 192 | 2.3 | 47 | 0.7 | 967 | 1.4 |
| Diseases of the circulatory system | 14935 | 35.9 | 5382 | 39.8 | 6483 | 77.4 | 977 | 14.3 | 27777 | 39.5 |
| Diseases of the respiratory system | 4696 | 11.3 | 1761 | 13.0 | 2343 | 28.0 | 254 | 3.7 | 9054 | 12.9 |
| Diseases of the digestive system | 3981 | 9.6 | 1280 | 9.5 | 2312 | 27.6 | 233 | 3.4 | 7806 | 11.1 |
| Diseases of the skin and subcutaneous tissue | 2600 | 6.2 | 982 | 7.3 | 1274 | 15.2 | 146 | 2.1 | 5002 | 7.1 |
| Diseases of the musculoskeletal system and connective tissue | 6466 | 15.5 | 1693 | 12.5 | 3766 | 45.0 | 384 | 5.6 | 12309 | 17.5 |
| Diseases of the genitourinary system | 6426 | 15.4 | 3172 | 23.5 | 2803 | 33.5 | 312 | 4.6 | 12713 | 18.1 |
| Pregnancy, childbirth and the puerperium | 214 | 0.5 | 2 | 0.0 | 173 | 2.1 | 12 | 0.2 | 401 | 0.6 |
| Certain conditions originating in the perinatal period | 2 | 0.0 | 0 | 0.0 | 37 | 0.4 | 0 | 0.0 | 39 | 0.1 |
| Congenital malformations, deformations and chromosomal abnormalities | 73 | 0.2 | 21 | 0.2 | 34 | 0.4 | 21 | 0.3 | 149 | 0.2 |
| Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | 14946 | 35.9 | 6329 | 46.9 | 8161 | 97.5 | 1219 | 17.9 | 30655 | 43.6 |
| Factors influencing health status and contact with health services | 17831 | 42.9 | 3838 | 28.4 | 6705 | 80.1 | 1546 | 22.7 | 29920 | 42.6 |
| **NO OTHER ICD-10 CODE ON MEDICAL RECORD** | **13090** | **31.5** | **3032** | **22.4** | **486** | **5.8** | **3886** | **57.0** | **20494** | **29.2** |
| **ALL CASES** | **41607** | **100** | **13506** | **100** | **8373** | **100** | **6819** | **100** | **70305** | **100** |

Age also has an influence as detailed in the following table (Table 9.10.2).

- Almost 90% of child fall cases across all building locations had no additional ICD-10 codes recorded compared with 39% of persons aged 15-64 years and just 21% of cases involving a person aged 65 years and older.
- Falls that actually occurred in hospitals and residential care settings virtually, by definition, almost all had a pre-existing medical condition or frailty (only 5.8% did not) – though this condition may have been unrelated to the fall injury.

**Table 9.15.2 Co-morbid conditions by broad age group and location among all persons admitted to Victorian public and private hospitals who were injured due to falls in buildings 2002/3-2004/5**

| | | Home | | Residential institution | | Health service area | | All other locations | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| 0-14 years | Certain infectious and parasitic diseases | 42 | 1.4 | 1 | 10.0 | 10 | 11.8 | 14 | 0.7 | 67 | 1.3 |
| | Neoplasms | 5 | 0.2 | 0 | 0.0 | 0 | 0.0 | 2 | 0.1 | 7 | 0.1 |
| | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 17 | 0.6 | 0 | 0.0 | 0 | 0.0 | 6 | 0.3 | 23 | 0.4 |
| | Endocrine, nutritional and metabolic diseases | 20 | 0.7 | 0 | 0.0 | 13 | 15.3 | 4 | 0.2 | 37 | 0.7 |
| | Mental and behavioural disorders | 12 | 0.4 | 1 | 10.0 | 4 | 4.7 | 11 | 0.5 | 28 | 0.5 |
| | Diseases of the nervous system | 36 | 1.2 | 0 | 0.0 | 6 | 7.1 | 14 | 0.7 | 56 | 1.1 |
| | Diseases of the eye and adnexa | 7 | 0.2 | 0 | 0.0 | 2 | 2.4 | 6 | 0.3 | 15 | 0.3 |
| | Diseases of the ear and mastoid process | 9 | 0.3 | 0 | 0.0 | 0 | 0.0 | 3 | 0.1 | 12 | 0.2 |
| | Diseases of the circulatory system | 5 | 0.2 | 0 | 0.0 | 0 | 0.0 | 5 | 0.2 | 10 | 0.2 |
| | Diseases of the respiratory system | 25 | 0.9 | 0 | 0.0 | 12 | 14.1 | 12 | 0.6 | 49 | 1.0 |
| | Diseases of the digestive system | 16 | 0.5 | 0 | 0.0 | 3 | 3.5 | 10 | 0.5 | 29 | 0.6 |
| | Diseases of the skin and subcutaneous tissue | 9 | 0.3 | 0 | 0.0 | 6 | 7.1 | 20 | 0.9 | 35 | 0.7 |
| | Diseases of the musculoskeletal system and connective tissue | 19 | 0.7 | 0 | 0.0 | 4 | 4.7 | 30 | 1.4 | 53 | 1.0 |
| | Diseases of the genitourinary system | 5 | 0.2 | 0 | 0.0 | 2 | 2.4 | 1 | 0.0 | 8 | 0.2 |
| | Certain conditions originating in the perinatal period | 2 | 0.1 | 0 | 0.0 | 37 | 43.5 | 0 | 0.0 | 39 | 0.8 |
| | Congenital malformations, deformations and chromosomal abnormalities | 21 | 0.7 | 0 | 0.0 | 5 | 5.9 | 12 | 0.6 | 38 | 0.7 |
| | Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | 153 | 5.2 | 2 | 20.0 | 23 | 27.1 | 114 | 5.4 | 292 | 5.7 |

| | | Home | | Residential institution | | Health service area | | All other locations | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| | Factors influencing health status and contact with health services | 82 | 2.8 | 1 | 10.0 | 51 | 60.0 | 25 | 1.2 | 159 | 3.1 |
| | **NO OTHER ICD-10 CODE ON MEDICAL RECORD** | **2581** | **88.3** | **7** | **70.0** | **16** | **18.8** | **1893** | **89.8** | **4497** | **87.7** |
| | **ALL CASES** | **2922** | **100** | **10** | **100** | **85** | **100** | **2109** | **100** | **5126** | **100** |
| 15-64 years | Certain infectious and parasitic diseases | 378 | 4.3 | 29 | 6.7 | 230 | 19.0 | 40 | 1.6 | 677 | 5.2 |
| | Neoplasms | 216 | 2.4 | 2 | 0.5 | 383 | 31.7 | 10 | 0.4 | 611 | 4.7 |
| | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 350 | 4.0 | 27 | 6.3 | 178 | 14.7 | 22 | 0.9 | 577 | 4.5 |
| | Endocrine, nutritional and metabolic diseases | 1564 | 17.7 | 114 | 26.5 | 681 | 56.4 | 194 | 7.9 | 2553 | 19.8 |
| | Mental and behavioural disorders | 1695 | 19.2 | 161 | 37.4 | 575 | 47.6 | 508 | 20.7 | 2939 | 22.7 |
| | Diseases of the nervous system | 782 | 8.9 | 111 | 25.8 | 335 | 27.7 | 123 | 5.0 | 1351 | 10.5 |
| | Diseases of the eye and adnexa | 98 | 1.1 | 16 | 3.7 | 60 | 5.0 | 22 | 0.9 | 196 | 1.5 |
| | Diseases of the ear and mastoid process | 48 | 0.5 | 2 | 0.5 | 15 | 1.2 | 14 | 0.6 | 79 | 0.6 |
| | Diseases of the circulatory system | 1138 | 12.9 | 66 | 15.3 | 573 | 47.4 | 137 | 5.6 | 1914 | 14.8 |
| | Diseases of the respiratory system | 533 | 6.0 | 30 | 7.0 | 213 | 17.6 | 69 | 2.8 | 845 | 6.5 |
| | Diseases of the digestive system | 499 | 5.7 | 33 | 7.7 | 423 | 35.0 | 48 | 2.0 | 1003 | 7.8 |
| | Diseases of the skin and subcutaneous tissue | 224 | 2.5 | 20 | 4.6 | 120 | 9.9 | 30 | 1.2 | 394 | 3.0 |
| | Diseases of the musculoskeletal system and connective tissue | 803 | 9.1 | 27 | 6.3 | 538 | 44.5 | 119 | 4.8 | 1487 | 11.5 |
| | Diseases of the genitourinary system | 342 | 3.9 | 44 | 10.2 | 204 | 16.9 | 29 | 1.2 | 619 | 4.8 |
| | Pregnancy, childbirth and the puerperium | 214 | 2.4 | 2 | 0.5 | 173 | 14.3 | 12 | 0.5 | 401 | 3.1 |
| | Congenital malformations, deformations and chromosomal abnormalities | 25 | 0.3 | 12 | 2.8 | 10 | 0.8 | 9 | 0.4 | 56 | 0.4 |

| | | Home | | Residential institution | | Health service area | | All other locations | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| | Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | 1885 | 21.4 | 120 | 27.8 | 1024 | 84.8 | 409 | 16.6 | 3438 | 26.6 |
| | Factors influencing health status and contact with health services | 3389 | 38.4 | 152 | 35.3 | 1022 | 84.6 | 643 | 26.2 | 5206 | 40.3 |
| | **NO OTHER ICD-10 CODE ON MEDICAL RECORD** | **3519** | **39.9** | **118** | **27.4** | **127** | **10.5** | **1224** | **49.8** | **4988** | **38.6** |
| | **ALL CASES** | **8825** | **100** | **431** | **100** | **1208** | **100** | **2458** | **100** | **12922** | **100** |
| 65+ years | Certain infectious and parasitic diseases | 3612 | 12.1 | 1792 | 13.7 | 1762 | 24.9 | 182 | 8.1 | 7348 | 14.1 |
| | Neoplasms | 1298 | 4.3 | 307 | 2.3 | 1878 | 26.5 | 35 | 1.6 | 3518 | 6.7 |
| | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 3194 | 10.7 | 1705 | 13.1 | 1020 | 14.4 | 185 | 8.2 | 6104 | 11.7 |
| | Endocrine, nutritional and metabolic diseases | 11591 | 38.8 | 4838 | 37.0 | 4300 | 60.7 | 655 | 29.1 | 21384 | 40.9 |
| | Mental and behavioural disorders | 4576 | 15.3 | 4962 | 38.0 | 3071 | 43.4 | 284 | 12.6 | 12893 | 24.7 |
| | Diseases of the nervous system | 2725 | 9.1 | 1543 | 11.8 | 1677 | 23.7 | 134 | 6.0 | 6079 | 11.6 |
| | Diseases of the eye and adnexa | 936 | 3.1 | 421 | 3.2 | 492 | 6.9 | 51 | 2.3 | 1900 | 3.6 |
| | Diseases of the ear and mastoid process | 443 | 1.5 | 226 | 1.7 | 177 | 2.5 | 30 | 1.3 | 876 | 1.7 |
| | Diseases of the circulatory system | 13792 | 46.2 | 5316 | 40.7 | 5910 | 83.5 | 835 | 37.1 | 25853 | 49.5 |
| | Diseases of the respiratory system | 4138 | 13.9 | 1731 | 13.2 | 2118 | 29.9 | 173 | 7.7 | 8160 | 15.6 |
| | Diseases of the digestive system | 3466 | 11.6 | 1247 | 9.5 | 1886 | 26.6 | 175 | 7.8 | 6774 | 13.0 |
| | Diseases of the skin and subcutaneous tissue | 2367 | 7.9 | 962 | 7.4 | 1148 | 16.2 | 96 | 4.3 | 4573 | 8.8 |
| | Diseases of the musculoskeletal system and connective tissue | 5644 | 18.9 | 1666 | 12.8 | 3224 | 45.5 | 235 | 10.4 | 10769 | 20.6 |
| | Diseases of the genitourinary system | 6079 | 20.4 | 3128 | 23.9 | 2597 | 36.7 | 282 | 12.5 | 12086 | 23.1 |

| | | Home | | Residential institution | | Health service area | | All other locations | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| | Congenital malformations, deformations and chromosomal abnormalities | 27 | 0.1 | 9 | 0.1 | 19 | 0.3 | 0 | 0.0 | 55 | 0.1 |
| | Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | 12908 | 43.2 | 6207 | 47.5 | 7114 | 100.5 | 696 | 30.9 | 26925 | 51.5 |
| | Factors influencing health status and contact with health services | 14360 | 48.1 | 3685 | 28.2 | 5632 | 79.5 | 878 | 39.0 | 24555 | 47.0 |
| | **NO OTHER ICD-10 CODE ON MEDICAL RECORD** | **6990** | **23.4** | **2907** | **22.3** | **343** | **4.8** | **769** | **34.1** | **11009** | **21.1** |
| | **ALL CASES** | **29860** | **100** | **13065** | **100** | **7080** | **100** | **2252** | **100** | **52257** | **100** |

- Another factor in interpreting these data is that the sequence of fall and co-morbidity cannot readily be determined from the available datasets. For some conditions, by their nature, it is reasonable to assume that the condition was pre-existing and may have contributed to the fall eg some diseases of the musculoskeletal system such as muscular dystrophy; endocrine conditions such as diabetes; and diseases of the nervous system such as Parkinson’s disease. Other conditions may have contributed to the severity of the fall outcome. For example, persons with diseases of the blood or blood forming organs, severely ill residents of aged care facilities or hospital patients, from any cause, may have suffered greater consequences of the fall because of these conditions.

### 9.15.3 Discussion

Clearly, co-morbidity, whether it occurred before or after a fall, is evident in many cases of injury related to falls in buildings. A specific major new research study would be necessary to attempt to identify the sequence of events and the actual contribution to the fall and its outcome of the co-morbidity versus the contribution of the building design and construction.

This finding could be interpreted to suggest that the co-morbidity may have contributed to the fall and its consequences, thereby exonerating the building. The counter-argument, and current federal government policy, is that many injurious falls in buildings are to vulnerable members of the community, particularly the aged and the young who should be protected from harm. Government policy on “ageing in place” and equity appear to particularly support the need for measures to protect the health and independence of vulnerable populations.

It could be argued that building design and construction need to be modified to avoid contributing to causing falls or the serious consequences of falls. No argument can be made for exclusion from the regulatory framework that governs safety in building design and construction of vulnerable populations (the old, the young, and the sick) who account for up to 80% of total fall injuries in buildings.

Other players, such as sectors responsible for aged care facilities and hospitals also have a part to play in modifying building design and construction to avoid factors contributing to the initiation of a fall, and, most particularly, to diminishing the energy exchange to less than fracture threshold when the person falls onto a surface within the building. The development or adoption of new technology impact absorbing surface materials in high risk zones would be a logical outcome in both industry developments and regulatory terms. Laboratory testing and controlled trials of the implementation of such materials in high risk areas and fall injury outcomes (compared with control settings) would likely be needed.

## 9.16 DATA ISSUES

### Data sources

- National Coroners Information System (NCIS)
- National Injury Surveillance Unit (NISU)
    - Data analysis of fall related hospitalisations most likely occurring in buildings in Australia 199/00-2004/05 conducted by Research Centre for Injury Studies on behalf of the Monash University Accident Research Centre
- Victorian Admitted Episodes Database (VAED)
- Victorian Emergency Minimum Dataset (VEMD)
- Australian Bureau of Statistics (ABS)

Population estimates of residents of aged care facilities were obtained from the AIHW report 'Residential aged care in Australia 2005-2006: a statistical overview' (Australian Institute of Health and Welfare 2007).

### Relevant ICD-10-AM terms

**Y92 Place of occurrence**

*****the following category is for use with categories V00-Y89m to identify the place where the injury or poisoning (external cause) occurred.

**Y92.14 Aged care facilities** include: nursing homes, old people's homes and retirement villages

**Y92.18 Other specified residential institution**

**Y92.19 Unspecified residential institution**

**Y92.22 Health service areas** includes: day procedure centres, health centres, homes for the sick, hospice, hospitals and outpatient clinics.

**W10 Fall on and from stairs and steps:** includes fall (on)(from): escalator, incline, involving ice or snow on stairs and steps and ramp.

## Key terms

**Admitted patient:** A patient who undergoes a hospital's formal admission process to receive treatment and/or care. This treatment and/or care is provided over a period of time and can occur in hospital and/or in the person's home (for hospital in the home patients)(Australian Institute of Health and Welfare 2006).

**Age standardisation:** A set of techniques used to remove as far as possible the effects of differences in age when comparing two or more populations(Australian Institute of Health and Welfare 2006).

**Emergency attendance (Victoria): ***add definition

**Emergency admission (Victoria): ***add definition

**Separation:** An episode of care for an admitted patient, which can be a total hospital stay (from admission to discharge, transfer or death), or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation). Separation also means the process by which an admitted patient completes an episode of care either by being discharged, dying, transferring to another hospital or changing type of care (Australian Institute of Health and Welfare 2006).

**Hospitalisation:** is an episode of care that starts with an admission in the hospital system (Karmel, Lloyd et al. 2007);(episodes of care resulting from transfer between hospitals are included in the data).

**Length of stay**: is derived for episodes of care. The length of stay of an overnight episode is calculated by subtracting the date the patient is admitted from the date of separation and deducting days the patient was on leave. A same-day episode is allocated a length of stay of 1 day (Karmel, Lloyd et al. 2007).

### Injury Severity Classification

All hospital separations were classified as either less than or greater than or equal to an International Classification of Diseases-based Injury Severity Score (ICISS) of 0.941. A score of 0.941 or less indicates that patients on admission have injuries that give the patient a survival probability of 94.1% or a probability of death of 5.9% (on admission).

It is important to remember that some injuries may be judged as not serious, as they are classified as having a low threat to life, but that these same injuries may result in a high (threat-of) disability. For example penetrating eye injuries and finger amputations (Cryer and Langley 2006).

## Calculations of rates

### Data on Australian hospital separations

All rates used in the report are crude rates except for rates used in trend analysis. Rates used in trend analysis are age standardised. The age standardising population used for calculating age standardised rates was the Australian estimated resident population at the 30$^{th}$ June 2001.

Population data used in rate and age standardised calculations for national hospital separations data was obtained from the Australian Bureau of Statistics via the Australian Institute of Health and Welfare.

**Small case count issues**

**Data on Australian hospital separations**

Where data cell counts were less than 5, data has been either collapsed or suppressed (denoted by *) to prevent patient identification. This has been made obvious when this had occurred.

**Errors, inconsistencies and uncertainties**

**Data on Australian hospital separations**

It is important to note that hospital separations do not equal fall incidents. The number of hospital separations presented in this report over estimates the number of actual fall events through multiple records being generated via inter-hospital transfers and re-admission.

Multiple counting due to re-admission cannot be avoided in the national data at present.

The proportion of modes of admissions known to be 'admitted patient transfers' is provided for each type of data category in a box at the beginning of the appropriate sections to give an indication of the proportion of presumed multiple records for patient transfers in the data set under discussion. No estimate of the number of readmissions has been made.

## 9.17 REFERENCES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# CHAPTER 10 HOSPITAL TREATMENT COSTS OF FALL INJURIES AND FATALITIES MOST LIKELY OCCURRING IN BUILDINGS, AUSTRALIA, 2002-2005

### 10.1.1 COST PER CASEMIX-ADJUSTED SEPARATION

The method used for calculating the cost of a hospital bed day in this report is based on the cost per casemix-adjusted separation as used in the Australian Institute of Health and Welfare publication *Australian Hospital Statistics*. This annual report has been published since 1996–97 (AIHW 1998), and is included within frameworks of indicators by the National Health Ministers' Benchmarking Working Group (NHMBWG 1999), the Steering Committee for the Review of Government Service Provision (SCRGSP 2006) and the NHPC (NHPC 2004). It is a measure of the average recurrent expenditure for each admitted patient, adjusted using ARDRG cost weights for the relative complexity of the patient's clinical condition and for the hospital services provided.

**Hospitals excluded from this analysis**

Small non-acute hospitals, Multi-purpose services, Hospices, Rehabilitation hospitals, Mothercraft hospitals, other non-acute hospitals, Psychiatric hospitals, and hospitals in the Unpeered and other hospitals peer group have been excluded from this calculation of costs. Also excluded are hospitals for which expenditure or separation data were incomplete, although most of these hospitals would have been excluded for other reasons (for example, they are small non-acute hospitals).

### 10.1.2 COST PER CASEMIX-ADJUSTED SEPARATION/COST PER DAY

**Definition & Calculation of costs**

The formula used to calculate the cost per casemix-adjusted separation is:

$$\frac{\text{Recurrent expenditure x IFRAC}}{\text{Total separations x Average cost weight}}$$

where:

- Recurrent expenditure is defined by the AIHW as "expenditure on goods and services which are used up during the year, for example, salaries and wages expenditure and non-salary expenditure such as payments to visiting medical officers." (AIHW 2006 p. 361)
- IFRAC (admitted patient cost proportion) is the estimated proportion of total hospital expenditure that relates to admitted patients.
- Total separations exclude patients with no qualified days and records that do not relate to admitted patients.
- Average cost weight is a single number representing the relative expected resource use for the separations.

### 10.1.3 AVERAGE COST PER ACUTE PUBLIC HOSPITAL BED PER DAY

According to the AIHW *Hospital Statistics 2005-2006*, the average length of stay for acute public hospital separations is 3.7 days, and the average cost per separation calculated according to the above formula is $3,698. This average cost per separation consists of an average of $1,921 for non-medical labour expenditure, $745 for medical labour expenditure and $1, 032 for other recurrent expenses such as domestic services, repairs and maintenance, administration, and medical, drug and food supplies.

Given that the average acute public hospital separation cost is $3,698 and the average acute public hospital length of stay is 3.7 days, it has been determined that for the purpose of this analysis $999.46 is the average cost of an acute public hospital bed per day.

**Table 10.1.1 All falls most likely occurring in buildings, Australia 2002-05: Age groups by length of stay (days)**

| | 0-14 | 15-29 | 30-44 | 45-59 | 60-74 | 75+ | Total |
|---|---|---|---|---|---|---|---|
| **1** | 22860 | 6692 | 7836 | 10374 | 14749 | 41562 | 104075 |
| **2** | 2201 | 968 | 1427 | 2390 | 3648 | 8967 | 19601 |
| **3** | 708 | 556 | 1045 | 1776 | 2817 | 8745 | 15647 |
| **4** | 331 | 351 | 716 | 1358 | 2557 | 9127 | 14441 |
| **5** | 195 | 227 | 481 | 1068 | 2328 | 9160 | 13459 |
| **6** | 119 | 163 | 350 | 825 | 2104 | 9047 | 12608 |
| **7-9** | 221 | 273 | 690 | 1762 | 5371 | 24473 | 32790 |
| **10-12** | 89 | 150 | 360 | 1059 | 3679 | 17774 | 23111 |
| **13-15** | 59 | 66 | 185 | 710 | 2790 | 14498 | 18308 |
| **16-18** | 36 | 36 | 164 | 463 | 1791 | 9985 | 12475 |
| **19-21** | 33 | 45 | 97 | 366 | 1448 | 8349 | 10338 |
| **22-24** | 20 | 34 | 84 | 258 | 1015 | 5825 | 7236 |
| **25-27** | 13 | 22 | 68 | 200 | 798 | 4764 | 5865 |
| **28-30** | 20 | 20 | 48 | 167 | 638 | 4039 | 4932 |
| **31-60** | 78 | 91 | 227 | 683 | 2551 | 14584 | 18214 |
| **61-90** | 5 | 28 | 42 | 166 | 511 | 2354 | 3106 |
| **91-120** | * | * | 16 | 66 | 190 | 599 | 880 |
| **121-150** | * | * | 10 | 27 | 64 | 226 | 328 |
| **151-180** | * | * | 6 | 18 | 19 | 90 | 137 |
| **181-364** | * | 5 | * | 25 | 33 | 149 | 227 |
| **365+** | 0 | * | * | 9 | 33 | 79 | 127 |
| **Total** | 26993 | 9743 | 13866 | 23770 | 49134 | 194396 | 317905 |

- The above table shows a total of 3,386,231 acute public hospital bed days resulting from fall most likely occurring in buildings for the years 2002-2005.

- Using the formula described above, and applying an average cost per bed day of \$999.46, the total acute public hospital expenditure on falls most likely occurring in buildings over this time period is \$3,384,402,435.20.

**Age**

- Those aged ≥65 years account for almost 92% (91.95%, n= 3,113,775) of acute public hospital costs per bed day. The total cost of bed days occupied by those in this age group due to falls most likely occurring in buildings is \$3,112,093,561.

**Table 10.1.2 All falls most likely occurring in buildings, Australia 2002-05: principal diagnosis groups (detailed body region) by length of stay (days)**

| | Not poisoning/ injury | head | neck | thorax | abdomen, lower back, lumbar spine & pelvis | shoulder & upper arm | elbow & forearm | wrist & hand | hip & thigh | knee & lower leg | ankle & foot | Other injuries not specified by body region | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 15643 | 29556 | 1253 | 3034 | 5116 | 8561 | 17315 | 2888 | 11470 | 6837 | 1607 | 795 | 104075 |
| **2** | 4216 | 2598 | 180 | 909 | 1073 | 1788 | 3581 | 341 | 2240 | 2127 | 391 | 157 | 19601 |
| **3** | 3815 | 1637 | 148 | 845 | 980 | 1180 | 1595 | 188 | 2755 | 2086 | 291 | 127 | 15647 |
| **4** | 3706 | 1261 | 111 | 810 | 1012 | 964 | 891 | 104 | 3486 | 1709 | 252 | 135 | 14441 |
| **5** | 3656 | 974 | 96 | 690 | 1036 | 840 | 616 | 82 | 3773 | 1358 | 227 | 111 | 13459 |
| **6** | 3566 | 859 | 97 | 621 | 983 | 714 | 409 | 64 | 3900 | 1141 | 159 | 95 | 12608 |
| **7-9** | 10408 | 1846 | 215 | 1442 | 2631 | 1682 | 922 | 145 | 10434 | 2451 | 326 | 288 | 32790 |
| **10-12** | 8161 | 1114 | 158 | 900 | 1936 | 1082 | 612 | 84 | 7222 | 1472 | 219 | 151 | 23111 |
| **13-15** | 8006 | 675 | 90 | 663 | 1373 | 793 | 397 | 68 | 4972 | 1008 | 126 | 137 | 18308 |
| **16-18** | 5653 | 468 | 86 | 338 | 1005 | 545 | 255 | 39 | 3283 | 652 | 68 | 83 | 12475 |
| **19-21** | 5359 | 356 | 54 | 315 | 777 | 366 | 189 | 23 | 2262 | 524 | 52 | 61 | 10338 |
| **22-24** | 3952 | 251 | 36 | 166 | 524 | 276 | 101 | 15 | 1505 | 330 | 31 | 49 | 7236 |
| **25-27** | 3394 | 202 | 37 | 125 | 392 | 211 | 92 | 11 | 1130 | 224 | 16 | 31 | 5865 |
| **28-30** | 2998 | 128 | 28 | 99 | 308 | 179 | 64 | 8 | 900 | 180 | 13 | 27 | 4932 |
| **31-60** | 11540 | 475 | 91 | 288 | 1032 | 600 | 250 | 35 | 3060 | 692 | 62 | 89 | 18214 |
| **61-90** | 2233 | 59 | 14 | 29 | 97 | 71 | 21 | * | 439 | 122 | * | 11 | 3106 |
| **91-120** | 683 | 10 | 13 | 9 | 15 | 8 | 7 | * | 99 | 34 | 0 | * | 880 |
| **121-150** | 264 | 8 | 5 | * | * | 7 | * | 0 | 33 | * | * | * | 328 |
| **151-180** | 117 | * | * | 0 | * | * | * | 0 | 7 | 6 | 0 | 0 | 137 |
| **181-364** | 206 | * | * | * | * | * | 0 | 0 | 6 | * | 0 | 0 | 227 |
| **365+** | 115 | * | * | 0 | * | * | 0 | 0 | 6 | 0 | 0 | 0 | 127 |
| **Total** | 97691 | 42483 | 2722 | 11287 | 20295 | 19872 | 27318 | 4097 | 62982 | 22959 | 3850 | 2349 | 317905 |

### 10.1.4 Most costly injuries

- Among separations where injury nature was specified, injuries to the hip and thigh were most prevalent, and generally lead to longer periods of hospitalisation. Across all age groups injuries to the hip and thigh were responsible for a total of 694,544 acute public hospital bed days over the time covered by this analysis at an estimated total cost of $694,168,946.20.
- Of all acute public hospital bed days resulting from injuries to the hip and thigh, almost 90% (89.7%, n= 622,899) of these are fractures. According to this analysis, the estimated total cost of fractures of the hip and thigh resulting from falls most likely occurring in buildings from 2002-2005 is $622,562,634.50

### 10.1.5 Most costly injury locations

- Fall injuries in the home resulted in a total of 197,110 (62.0% of separations for falls in buildings) hospital separations for the years 2002-2005. There was an estimated 1871722 accumulated bed days for home building fall injury during this time. The total estimated cost of home fall building related separations for 2002-2005 is $1,870,711,270.
- Although falls in health service areas constitute 11.2% (n=35,860) of building related fall injury, the accumulated acute public hospital bed days required claims a much greater portion of the total health care cost. Fall in health service areas cost an estimated total of $822,874,407.70 for 2002-2005, representing 24.3% of the total cost for building related fall injury separations.
- Falls in aged care facilities cost a total $493,905,147.10, representing 14.6% of the total building related fall injury expense for the period included in this analysis.

### 10.2.1 Economic cost of slip, trip and fall fatalities

Estimates of the value of life vary substantially between disciplines and across nations, an example of the wide range of values and methods for assigning value is shown in the table below, extracted from the Price Waterhouse Coopers report *Victorian Institute of Forensic Medicine: Economic Benefits of the National Coroners Information System* (2003).

**Table 10.2.1 Values of Life – Selected studies**

| Method Used | Source | Value ($AUD) | Comment |
|---|---|---|---|
| Various US studies | Valuations of Health Benefits and Identification of Beneficiary Impact | 636,840 | Based on automobile air bag purchase |
| Various US studies | Valuations of Health Benefits and Identification of Beneficiary Impact | 659,837 | Based on smoke detector purchase (1987) |
| Various US studies | Valuations of Health Benefits and Identification of Beneficiary Impact | 1,503,650 | Based on wage premiums for dangerous police work (1987) |
| Net National Product (NNP) per head of the country under study. NNP = GNP less Depreciation | Valuations of Health Benefits and Identification of Beneficiary Impact | 450,000 - 800,000 | NNP range over an average lifetime of 70 years (actual amount is largely dependant on the real rate of interest) |
| Human Capital Approach | "What do we mean by valuing life and health" article. Dr Peter Abelson | 827,000 | Not applicable for non-earners |
| Willing to pay | "Value of Life and Health" by Dr P Abelson, for Cost of Injury Symposium, Macquarie University. | 1,769,000 - 26,535,000 | Results for a wide range of US studies |
| Willing to pay | "Value of Life and Health" by Dr P Abelson, for Cost of Injury Symposium, Macquarie University. | 1,794,000 | US EPA (Guidelines for Preparing Economic Analyses) recommendation (in 1996 prices) |
| Value of a Life Year (VOLY or perfect QALY). Derived from VSL | "Value of Life and Health" by Dr P Abelson, for Cost of Injury Symposium, Macquarie University. | 106,140 | If VSL is US$1 million, with 40 years of life and a discount rate of 5.0%, VOLY is about US$60,000 |
| Valuing a person's lost productivity | Anatomy of a road fatality, Sydney Morning Herald. Estimates of transport economists | 859,030 | Comprised of $319,030 for quality and $540,000 in lost labour to the economy. |

The principal reasons for the wide ranging variations of the economic value of life outlined in this table are the differing methodologies used. The main methodologies used in determining these values are:

- Implied value in the reduction of the risk of death
- Net National Product (NNP) per head of the country;
- The Human Capital Approach
- Willingness to Pay Approach (i.e. the maximum amount of money that an individual is willing to spend in order to reduce the risk and be no worse off than before); and
- Valuing a person's lost productivity.

Through the use of revealed preference data contained in the table above (the Human Capital Approach, the NPP approach and the Individual Productivity Approach) rather than relying on elicited and hypothetical responses as collected in the willingness to pay studies, Price Waterhouse Coopers determined the median value of life for Australians (in March 2003) to be $650,000 AUD (Price Waterhouse Coopers, 2003).

Adjusted to account for Consumer Price Index increases between the March 2003 and September 2007 Quarters, this value is currently $729,727.90 AUD (ABS, 2007).

### 10.2.2 NCIS BUILDING RELATED FALL SLIP, TRIP AND FALL FATALITIES, 2001-2005

(Full years and closed cases only)

**Table 10.2.2 Year by State, 2001 – 2005**

Note: Cases for the years 2000 (n=108), 2006 (n=274) and 2007 (n = 69) have been removed from this analysis of the NCIS database due to incomplete data collection.

| | 2001 | 2002 | 2003 | 2004 | 2005 | Total | % |
|---|---|---|---|---|---|---|---|
| **VIC** | 69 | 76 | 127 | 159 | 158 | 589 | 34.4 |
| **NSW** | 130 | 119 | 86 | 78 | 83 | 496 | 29.0 |
| **QLD** | 53 | 44 | 32 | 79 | 89 | 297 | 17.3 |
| **WA** | 23 | 31 | 27 | 31 | 33 | 145 | 8.5 |
| **SA** | 19 | 20 | 33 | 16 | 6 | 94 | 5.5 |
| **TAS** | 10 | 11 | 9 | 17 | 11 | 58 | 3.4 |
| **ACT** | 3 | 6 | 3 | 6 | 1 | 19 | 1.1 |
| **NT** | 3 | 2 | 2 | 3 | 5 | 15 | 0.9 |
| **ALL** | 310 | 309 | 319 | 389 | 386 | 1713 | 100.0 |

- Based on the value assigned to life as outlined above, the total cost of fatalities included in the NCIS database of closed coroner's cases for falls related to buildings from 2001 – 2005 is $1,250,023,892.
- Over the five years covered here, building fall related fatalities referred to the coroner have increased 24.5% (n = 76). This represents a cost increase of $55,459,320.40.
- Victoria displays the greatest proportion of building fall deaths referred to the coroner over the five year period (34.4%, n=589, total cost $429,809,733.10), followed by New South Wales (29.0%, n=496, total cost $361,945,038.40) and Queensland (17.3%, n=297, total cost $216,729,186.30).

**Table 10.2.3 Gender**

| | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|
| **Male** | 186 | 176 | 194 | 217 | 214 | 987 |
| **Female** | 124 | 133 | 125 | 172 | 172 | 726 |
| **ALL** | 310 | 309 | 319 | 389 | 386 | 1713 |

- Males account for 57.6% (n=987) of building fall related fatalities included in the NCIS for the years 2001-2005. This constitutes a total cost of $720,241,437.30 over this time.
- Female deaths from building related falls (42.4%, n=726) account for a total cost of $529,782,455.40 over this time.

**Table 10.2.4 Object involved in fall in building fatality, 2001-2005**

| | ACT | NSW | NT | QLD | SA | TAS | VIC | WA | ALL | % |
|---|---|---|---|---|---|---|---|---|---|---|
| Infant's or Child's Product | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0.1 |
| Furnishing | 1 | 50 | 3 | 23 | 7 | 4 | 83 | 18 | 189 | 11.0 |
| Household Appliance | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 0.3 |
| Utensil or Container | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 6 | 0.4 |
| Special Purpose Vehicles Mobile Machinery | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0.2 |
| Sporting Equipment | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0.2 |
| Tool Machine Apparatus | 0 | 24 | 1 | 14 | 8 | 2 | 35 | 2 | 86 | 5.0 |
| Animal Plant Person | 1 | 4 | 0 | 3 | 4 | 0 | 3 | 1 | 16 | 0.9 |
| Ground Surface and Conformations | 7 | 64 | 1 | 42 | 19 | 11 | 47 | 44 | 235 | 13.7 |
| Personal Use Item | 1 | 4 | 1 | 3 | 2 | 1 | 20 | 4 | 36 | 2.1 |
| Drugs (inc Alcohol and Pharmaceuticals) | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 5 | 0.3 |
| Building Component or Fitting | 8 | 304 | 6 | 176 | 24 | 31 | 374 | 39 | 962 | 56.2 |
| Material | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 5 | 0.3 |
| Medical / Surgical Devices and Procedures | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.1 |
| Miscellaneous Object Substance | 0 | 15 | 1 | 9 | 3 | 2 | 15 | 3 | 48 | 2.8 |
| Missing | 0 | 23 | 0 | 23 | 25 | 5 | 6 | 29 | 111 | 6.5 |
| ALL | 19 | 496 | 15 | 297 | 94 | 58 | 589 | 145 | 1,713 | 100.0 |

## Table 10.2.5 Detailed objects contributing to deaths by location

| | Home | Hospital or other health service | Industrial or construction area | Recreation area (place mainly for informal recreational activity) | Residential /Correctional facility | School other institution or public administrative area | Sports or athletics area | Trade or service area | Unspecified place | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Floor** | 177 | 222 | 2 | 0 | 58 | 1 | 0 | 10 | 1 | 471 |
| **Stairs steps** | 173 | 12 | 0 | 3 | 6 | 5 | 2 | 28 | 1 | 230 |
| **Ground surface** | 73 | 44 | 0 | 1 | 19 | 0 | 0 | 11 | 1 | 149 |
| **Other specified ground surface& conformations** | 18 | 6 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 29 |
| **Ground surface other specified** | 9 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 14 |
| **Building** | 82 | 17 | 6 | 3 | 3 | 5 | 0 | 16 | 1 | 133 |
| **Other specified building component or fitting** | 40 | 8 | 1 | 0 | 3 | 0 | 0 | 3 | 0 | 55 |
| **Bed** | 29 | 74 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 116 |
| **Ladder/ movable step** | 68 | 2 | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 77 |
| **Chair stool** | 17 | 16 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 38 |
| **Toilet** | 7 | 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 15 |
| **Bitumen** | 5 | 4 | 1 | 0 | 1 | 0 | 0 | 3 | 1 | 15 |
| **Shower** | 8 | 4 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 14 |

| | Home | Hospital or other health service | Industrial or construction area | Recreation area (place mainly for informal recreational activity) | Residential /Correctional facility | School other institution or public administrative area | Sports or athletics area | Trade or service area | Unspecified place | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Bathtub - (including internal spa bath)** | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| **Table desk bench etc** | 7 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 11 |
| **Wheelchair** | 4 | 3 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 10 |
| **Window** | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| **Gutters drains kerbs** | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **Handrail railing banister** | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 5 |
| **Rug mat loose carpet** | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **Fence gate** | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **Alcohol** | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
| **Scaffolding** | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| **Brick concrete block** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Other and Unspecified** | 93 | 60 | 0 | 3 | 13 | 1 | 0 | 9 | 0 | 179 |
| **missing** | 52 | 41 | 0 | 0 | 16 | 0 | 0 | 1 | 1 | 111 |
| **ALL** | 898 | 530 | 12 | 10 | 146 | 16 | 2 | 93 | 6 | 1713 |

- Building fall related fatalities in the home (52.4%, n=898) and in hospitals or health service areas (30.9%, n=530) were the most costly. The combined cost of all home fall deaths in the period covered here is estimated at $655,295,654.20 and the total cost of all health service and hospital deaths (including nursing homes in this instance) is $386,755,787.00.
- 75.2% (n=173) of stair fall related fatalities occur in the home, the total cost of which is estimated at $126,242,926.70.
- 63.8% (n=74) of bed related fall deaths occur in hospitals and health service areas, which the NCIS codes to include nursing homes. These fatalities have an estimated cost over the five years covered in this analysis of $53,999,864.60.
- 88.3% (n=68) of ladder fall fatalities occur in a domestic environment. The estimated cost of these deaths from 2001 to 2005 is $49,621,497.20.

## 10.3 SUMMARY COST OF FALLS IN BUILDINGS

The following costs are conservative estimates based solely on medical and non-medical labour costs and medical and food supply costs and do not include ongoing costs such as patient rehabilitation, depreciation of hospital assets and loss of patients and carers productivity due to injury. The total costs shown here likely underestimate the total costs of injuries and fatalities from falls in buildings in Australia.

NB: Counting hospital costs by bed days rather than separations overcomes the problem of multiple counting of patient transfers as seen in the injury admission data.

**Total average annual cost of hospital admitted cases**

The total estimated annual mean cost of hospital bed days for admitted cases between 2002/03 and 2004/05 is $1,128,134,145.09 ($1.28 billion).

**Total average annual cost of fatalities**

The total estimated annual mean cost of fatalities from falls in buildings between 2001 and 2005 is $250,004,778.40 ($250 million).

Although it is not ascertainable precisely what contribution the design and construction of buildings makes to these injuries and deaths, even if the contribution of buildings were as little as 20% (a highly conservative estimate) the total estimated costs would be $250,627,784.70 ($250.6 million) annually, excluding indirect costs for non-fatal falls cases.

## 10.4 REFERENCES

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# CHAPTER 11 DISCUSSION OF EVIDENCE BASE FROM CURRENT DATA AND SCIENTIFIC LITERATURE

## 11.1 OVERVIEW

The major building structural and design components identified as being associated with fall injuries in this study were flooring surfaces, stairs, windows, balconies, verandahs and, indirectly, guttering and roofs in residential settings. Fall related hospital separations that most likely occurred in buildings account for 59.1% (n = 317,705) of all fall related hospital separations for the period 2002/03 – 2004/05. As shown by the epidemiological data in this study, many of the victims of fall injuries in buildings are from vulnerable populations, particularly the elderly, the sick and children. Adults over the age of 70 years, and in particular women, have higher mortality rates due to falls than younger people and the increasing incidence of fatality with advancing age is evidenced world wide. The major causes of building fall hospital separations in rank order were: Slips, trips and stumbles on the same level, other fall on same level and combined falls from heights including stairs and steps.

Overall, fall injuries in buildings increased by 14.2 percent over the three year period 2000/01-2004/05. Persons 65 years and over accounted for 73.3% of all hospital separations for falls occurring in buildings, with persons aged 75 years and over accounting for 61.2 % of all hospital separations for falls occurring in buildings. The most common place of occurrence for these injuries was the home, which accounted for 62.0% of hospital separations. While fall injuries in all buildings have increased by 14.2% overall between 2002-03 and 2004-05, and home based slip, trip and fall injuries have increased by 16% across all age groups during this period; fall injuries in the home sustained by those aged 65 years and over have increased by 18.5% over the same time.

## 11.2 DISCUSSION OF PROJECT OBJECTIVES

The broad objective of this study was to ascertain whether existing requirements of the Building Code of Australia (BCA) provide an acceptable minimum standard of safety relating to the incidence of slips, trips and falls in buildings for the community. Specifically, the aims were to:

**(a) Determine the actual risk contribution of several relevant factors to the incidence of "slips, trips and falls" in buildings, including:**

**i. building design;**

**ii. building construction;**

The contribution of building design and construction to the incidence of slip, trip and fall injury was determined primarily through a critical examination of the scientific literature and the frequencies and trends shown in the national and state injury and fatality data. A building design and construction risk factor rating system based on the HHSRS Operating Guidance (2004, see section 2.2) was developed, but it was decided in consultation with the ABCB not to quantify the risk contribution of various building design and construction related hazards and harms based on this system, and instead to use the injury and fatality data as a guide to determining the greatest hazards.

iii. **obstacles not forming part of the structure that create a trip hazard;**

iv. **the presence or absence of surface contaminants (water, oil or grease);**

Through the analysis of VEMD free text narratives we have identified several items external to building structures that constitute significant trip and fall hazards. The most prominent of these are beds, chairs, phone cords, loose carpet and other floor coverings such as runners and rugs. This study has also identified the impact of surface contaminants on the slip resistance of flooring surfaces, particularly in the aged care and health service environments, and has made recommendations regarding the provision of increased slip resistant flooring materials in these environments, along with recommendations for the installation of flooring with greater force attenuation and absorptive properties in areas of particularly high fall risk, such as around beds and possibly in bathrooms and toilets.

v. **the intrinsic condition of the person suffering the injury; and**

The intrinsic health status and existing co-morbidities contribute to the risk of falling, and have a significant impact on the likelihood of resultant injury and its potential severity, and this is evidenced by the predominance of those aged over sixty five years across all categories of fall related injury. Details are provided in section 9.15. However, this report takes the view that it is the responsibility of the ABCB and state governments to consider the safety requirements of all parts of the community which utilise the buildings they regulate, and that the BCA should be designed to consider the most vulnerable parts of the population including children and the rapidly increasing aged population.

It should be noted here that the initiating factors involved in a fall, and any intrinsic characteristics that may influence these, should also be considered along with the actual final cause of the injury, most often contact with a hard surface.

vi. **the number of persons exposed to each particular hazard.**

This study has determined the main populations affected by each particular hazard associated with the design and construction of buildings through an analysis of the frequency and rates of falls in buildings. The total age specific population groups have, for he most part, been considered as the exposed populations since many of the hazards are ubiquitous, such as the home and public buildings. Where relevant, such as aged care, the number of persons in care has been taken as the exposed population.

**(b) Ascertain the level of risk in building classes (relevant to the BCA) in order to establish whether the inherent level of risk is acceptable.**

Through a review of the scientific literature and analysis of state and national injury and fatality data, this study has shown that the inherent level of risk allowed by the provisions of the BCA 2007 is clearly not acceptable, particularly in regards to the existing requirements for stair and step going and riser dimensions, lack of requirements for hand rails for stairs in domestic residential buildings, allowable minimum stair and step handrail heights, the minimum height at which verandahs must have a railing or balustrade installed and the four metre above ground level height at which window guards must be installed. There is also concern about the hardness of landing surfaces, though further research is required on effective and acceptable design solutions.

**(c) Identify and prioritise the incidence, frequency or severity of slips, trips and falls in relation to the design and construction of buildings in Australia.**

The study has identified the incidence, frequency and severity of slips, trips and falls occurring in buildings in Australia, and has ascertained that these falls account for almost 60% of all fall admissions to Australian public hospitals. Furthermore, we have identified the most common mechanisms of falls in buildings as slips, trips and stumbles on the same level (29.2% of all admissions for falls in buildings), other falls on the same level (20.6%), fall involving beds (6.6%), falls on and from stairs and steps (6.0%), combined falls from heights in buildings (5.8%).

Further in depth analysis of falls in buildings using individual state injury databases could be conducted, as could an in depth national study of fatal falls in buildings.

The high level of unspecified coding in both Victorian and national injury and death data, particularly amongst activity, location, cause and mechanism codes means that it is still not possible to determine the exact frequency or circumstances of falls in buildings.

Increased specificity is sought in the application of codes as is the provision of more precise cause and mechanism codes. For example, the recent expansion of the generic ICD-10AM fall code to allow for the specific coding of verandah falls will provide new information regarding these falls and assist prevention efforts substantially. A review of hospital admission and presentation data after one year of collection is suggested and will provide a much more precise indication of the frequency and severity of verandah falls.

**(d) Identify the age group most at risk of incurring injury from slips, trips and falls in buildings in Australia.**

Those aged over sixty five years have been identified as the age group most at risk overall for sustaining injury resulting from falls in buildings and account for almost 75% of these injurious falls. Older persons are most notably over represented in falls on the same level, falls involving beds and in falls on and from stairs and steps (which increased 22.3% among those aged 65 years and over during the period 2002/3 – 2004/05). Children are the next most frequently injured age group from falls in buildings.

**(e) Provide information regarding the cost of slips, trips and falls, hat would directly support a cost/benefit analysis of any proposed amendments to the BCA resulting from the research.**

Although it is difficult to ascertain a single average cost per hospital admission or bed day, and many organisations use widely varying estimates for these cost calculations, we have been able to provide credible conservative information on estimated costs for non-fatal hospital admissions and the cost of death. The estimates used for hospital bed day costs in this study were based on the formula developed the Australian Institute of Health and Welfare and deliberately erred on the side of conservatism in the calculation of bed days costs and the assignment of bed days to particular fall injuries and the building features deemed to be (at least partially) responsible for the injury event. The cost estimates also only included the cost of medication and treatment, food and medical and non-medical labour during admission and did not include substantial ongoing costs such as continued required medical treatment and public health system burden, depreciation of hospital assets and lost productivity. Assigned economic value of life, reported from a study by Price Waterhouse Coopers, enabled estimates of costs of fall fatalities in buildings.

# CHAPTER 12 OUTCOMES FROM EXPERT PANEL

## 12.1 INTRODUCTION

An Expert Panel (see Appendix 4 for participant list) was convened to review the assembled information and to assign values to the contribution of building design and construction to hazards and harms based on all of the available evidence presented from the study findings. The specific purpose of the meeting was to guide MUARC in the recommendations to be formulated for preventive measures based on the scoping of controllable hazards relevant to the Building Code of Australia and to other sectors. Unfortunately, the Department of Health and Ageing representative on the Panel was a late withdrawal from the meeting.

During the meeting, held in Melbourne on November 22nd, 2007, members of the MUARC research team presented the study findings to date on the following topics:

1. An overview of falls in buildings and the principals of prevention,

2. Stair and step falls,

3. Surfaces: impact absorption and slip resistance,

4. Falls from heights: windows, balconies and verandahs

5. Residential building maintenance and access to heights.

Discussion about these specific aspects of building design and construction was followed by further discussion of the Building Code of Australia and suggestions from the panel on how possible shortcomings in the BCA could be identified and addressed in future editions of the code.

## 12.2 STAIR AND STEP FALLS

### Geometry

Although the deemed to satisfy provisions for BCA 2007 (Class 1 & 10 buildings) specify that stair construction must be consistent throughout one flight and must satisfy the quantity requirement 2 x Riser + Going, the panel noted that the BCA does not strictly conform to the internationally recognised standard of “7-11” (177.8mm riser x 279.4mm going) for stair geometry as the optimum riser/going measurement.

The BCA allows for risers of between 115mm and 190mm and goings of between 240mm and 355mm for non-spiral stairs. The panel agreed that a riser/going combination of approximately 178mm x 280mm was the optimum for ease of use and safety and suggested that the current minimum requirement of the BCA allows for stairs that are practically too steep in some instances. It was subsequently noted that as up to 80% of stairway falls have been shown in both the literature and MUARC’s data analysis to occur during descent, and that the narrow going width currently allowed by the BCA could potentially encourage falls during descent.

Members of the panel suggested that the flexibility within the BCA in regards to the geometry of stair riser/going combinations may be an area for review. It was also suggested that the wide range of acceptable measurements currently allowable in both Volume 1 (Class 1 & 10 Buildings) and Volume 2 (Class 2 to 9 Buildings) of the BCA can have a positive application, in that this flexibility allows for maximum usage and by all sectors of society.

### Handrails

MUARC commented that various international studies (as reported in the literature in chapter 4) have found a handrail height of between 910-920mm to provide the greatest ease of use for all users. Members of the panel commented that the current BCA deemed to satisfy provision of a minimum handrail height of 865mm is below the recommended height and may fail to take into account the increase in the average person's centre of gravity as average heights have increased. The panel suggested that as 910-920mm has been shown through previous studies to be the optimum height, then the ABCB should consider increasing the minimum handrail height requirements of the BCA.

It was noted that the BCA allows for a stair 2 metres wide without providing a handrail as long as a balustrade of any kind (including a solid wall) is present on either side. The panel emphasised the potential for injury that this allows, as while a wall might prevent a person from falling over a flight of stairs, the anchoring function provided by a handrail is absent. The potential for injury on stairs bound by solid walls is also increased by the possibility of colliding with those walls during a fall.

### Expert panel recommendations for preventing stair and step injury

The prevalence of many different kinds of hazards on different stairs was noted by the panel and it was suggested that improvements to many stairs can be made easily, particularly in the areas of maintaining adequate lighting, improving contrast between stairs, suitable carpeting and increasing slip resistance. The panel agreed that the only real option for repairing stairs that are constructed dangerously is to rebuild, which can be prohibitively costly.

## 12.3 SURFACES: IMPACT ABSORPTION, SLIP RESISTANCE

The panel noted that while the current BCA refers to the terms 'non-slip', non-skid' and 'slip resistant' to describe the requirements of various surface finishes, nowhere does it actually specify what constitutes a non-slip, non-skid or slip resistant surface finish. It was also noted that there is generally an over reliance on a surfaces' coefficient of friction measurement when ascertaining slip resistance.

It was noted that the recommendations from HB 197 are included in a new draft appendix to the informative requirements of AS 4586 and the panel enquired as to whether these informative requirements could be used to update the BCA. The panel were informed that any proposal for change to the BCA would have to be approved by the ABCB board.

The panel discussed how increasing flooring slip resistance would increase the cost of flooring and it was suggested that the provision of suitable slip resistance is, and should be, the responsibility of the manufacturer.

The panel also discussed the design trend towards floor water waste drains in many wet areas and it was suggested that the gradients of floors to drain water (particularly in apartment buildings) are too steep. It was also noted that the encouragement of water onto the bathroom floor waste drain creates a slip hazard.

## 12.4 EXPERT PANEL RECOMMENDATIONS FOR IMPROVING SLIP RESISTANCE AND IMPACT ABSORPTION OF FLOORING

The panel suggested that the provision of impact absorptive flooring in wet areas was not feasible due to the requirement that floors in wet areas must be impervious to water.

The panel suggested that a greater focus on factors other than the coefficient of friction could improve the general slip resistance of flooring. It was noted that flooring slip resistance was particularly important in aged care environments due to the greater likelihood of the elderly falling and the increased injury consequences of such falls.

The panel suggested that many design changes which could potentially reduce slips and trips could be implemented quite easily during the construction phase. These include measures such as recessing (or rebating) aluminium sliding door frames into a building's concrete slab to minimise the trip hazard of the protruding door frame, and limiting slip and trip hazards in wet areas, such as steps and ledges surrounding showers and baths.

## 12.5 FALLS FROM HEIGHTS: WINDOWS, BALCONIES, VERANDAHS

Members of the panel stated that the BCA requires that a 125mm sphere cannot pass through balcony railings. MUARC emphasised to the panel that the anthropometric data on the centre of gravity on which this regulation is based is very old and measurements taken from it may no longer be applicable, particularly in relation to the required height of verandah balustrades and the acceptable minimum space between horizontal and vertical balcony railings. Climbability of balcony and verandah railings was also considered to be unacceptable from a safety perspective and New Zealand leads Australia on this issue.

The panel noted that the requirement that verandahs could be up to 1000mm from ground level before verandah railings are required by the BCA was quite high, and that severe injury was still possible from a fall of less than one metre. Members of the panel stated that railings were required at 600mm from ground level in previous versions of the BCA and that it seemed odd that this requirement has now been relaxed.

## 12.6 EXPERT PANEL RECOMMENDATIONS ON FALLS FROM HEIGHTS: WINDOWS, BALCONIES, VERANDAHS

Members of the panel noted that there are regulations in place for window openings (locks, heights) around pools, but these or similar regulations have not as yet been applied to window fall hazards, which are more prevalent and have greater immediate injury consequences.

The panel recommended that the current maximum tolerance of 1000mm be reviewed by the ABCB for future building codes with a view to reducing the minimum height at which verandahs must have a balustrade installed.

MUARC suggested that the balustrade requirements for window and balcony heights above 4 metres be reviewed, and that the BCA's current deemed to satisfy provision that "horizontal/near horizontal [balustrade] members between 150mm and 760mm above floors that are more than 4 metres above the surface beneath must not facilitate climbing" for buildings of all classes was insufficient and would not be tolerated in the workplace. This height tolerance should be greatly reduced.

A panel member stated that this has been recognised with regard to windows and that there is a proposal to regulate for the introduction of window guards for openings above 4 metres in the BCA 2008. It was also noted that that this issue will become more important with the current tendency towards construction of a greater number of multi storey dwellings.

## 12.7 RESIDENTIAL BUILDING MAINTENANCE AND ACCESS TO HEIGHTS

The panel suggested that in addition to gutter cleaning and maintenance, there is anecdotal evidence of an increasing frequency of domestic roof installations that require ongoing user maintenance: these include air conditioning units, heaters, solar panels, and aerials. The panel concluded that it is impossible to regulate domestic maintenance activity and that elimination of hazards is the then only practical prevention strategy for hazards associated with domestic building maintenance and the accompanying need to access heights and this issue should be addressed.

## 12.8 EXPERT PANEL RECOMMENDATIONS FOR RESIDENTIAL BUILDING MAINTENANCE AND ACCESS TO HEIGHTS

Provisions regarding gutters in the BCA are principally to address potential fire hazards, and the panel recognised that the ABCB needs to expand its focus to include an emphasis on preventing the need to access heights domestically. The panel discussed whether it was possible to regulate for preventative materials such as gutter guards, hinged gutters and ladder hooks through the BCA.

It was suggested that recommendations could be made through the accompanying guidance materials, although it was noted that since guidance materials do not require legal adherence, this would open designers up to potential litigation and potentially create confusion among designers and builders.

## 12.9 CONCLUSION AND SUMMARY

The principal recommendations of the ABCB/MUARC expert panel are outlined below:

### Slip resistance

- The panel concluded that the BCA needs to be improved in regards to its definition and measurement of slip resistance, and that other factors affecting slip resistance beyond the coefficient of friction need to be taken into account.
- It was stated that slip resistance is a complex area with large cost implications, and that the guidelines in HB 197 and AS 4586 could be inserted into the performance requirements of the BCA. The panel recommended that industry groups and business could be consulted for cost implications of this.

## Trip hazards

- The panel concluded that the BCA also needs to define structural trip hazards around the house and methodically address them.
- It was suggested that adequate mechanisms to deal with falls need to be found, that we must identify the parts of the BCA that deal with falls (handrails, balustrades etc), review these against the data and literature and suggest positive changes.

## The Building Code of Australia

- The members of the expert panel collectively agreed that given the evidence presented in the scientific literature and national injury and death data, that there was a sufficient case presented for action on low or moderate cost changes where the evidence is already strong and further research to be conducted with a view to informing changes to the BCA.
- The panel discussed possible methods of diverting additional manufacturing and construction costs that would be incurred as a result of implementing the discussed changes to the BCA.
- It was noted that it is more expensive to install safety features after construction than it is to build preventative measures originally, so the later is preferable both economically and in terms of improved safety.
- The panel discussed the possibility of encouraging State or Federal Government subsidies for preventative measures such as the installation of handrails, slip resistant and impact attenuating flooring and the recessing of removal of building features that can present a trip hazard.
- It was suggested that health care costs saved by implementing positive and preventative changes to the BCA could potentially be redirected towards possible subsidies for safer construction, and that these could be primarily directed towards businesses for the cost of retooling, or as a consumer rebate to offset increased prices (as is the case with the installation of water tanks in existing homes).
- The panel agreed that, in their collective opinion, the building industry would likely be receptive to implementing some preventative changes to construction practice or BCA regulations providing a clear public benefit could be shown and the cost of doing so was not prohibitive.

## Residential Aged Care

- The panel agreed that impact absorbing flooring designs should be further investigated where the material properties would be capable of averting serious fractures resulting from falls, whilst maintaining adequate stiffness for a firm surface.
- Assuming no other unwanted properties in these materials (i.e. suitably fire and contamination resistant), they should be trialled as replacement flooring (or underlay) in high risk areas such as residential aged care, most particularly in the area surrounding residents beds.

# CHAPTER 13 RECOMMENDATIONS FOR THE PREVENTION OF SLIPS, TRIPS AND FALLS IN BUILDINGS AND FUTURE RESEARCH

## 13.1 INTRODUCTION

**This chapter brings together recommendations based on the literature review, data analyses and cost estimates, and expert panel discussion, from the various chapters of this report. The recommendations are grouped according to the sectors that would need to take action for their implementation or further action.**

## 13.2 RECOMMENDATIONS TO THE ABCB AND BUILDING INDUSTRY

### 13.2.1 Recommendations for stair and step geometry

- It is recommended that the ABCB consider narrowing the wide range of geometrical going and riser combinations currently allowed by *BCA 2007* for non-spiral stairways from 115 to 190mm for risers and 240mm to 355mm for goings, to a riser/going combination of approximately 178mm x 280mm.
- Particular attention should be paid to narrowing the acceptable lower range of measurements for stair goings, as up to 80% of stair and step injuries have been shown in the international literature and national data to occur during descent and insufficiently narrow goings are a major cause of mis-steps during descent.
- These recommendations are made with particular relevance to Class 1 and 10 residential buildings as the majority of stair fall injuries and fatalities occur in the home.

### 13.2.2 Recommendations for the provision, design and optimal height of handrails and balustrades

- It is recommended that the ABCB consider raising the minimum stairway handrail height from 865mm as it currently stands in *BCA 2007*, to a height over 900mm (preferably 910-920mm) as has been shown to be the optimum height for the widest user demographic.
- This recommendation is of particular importance considering the rapidly increasing centre of gravity of the Australian population, and the substantial injury and fall prevention benefits shown by previous studies to be provided by correctly positioned handrails.
- The adequacy of current standards, codes and regulations that govern the design and installation of verandah balustrades are particularly deserving of attention in future reviews of the BCA.
- Of primary concern is the current BCA regulation that verandahs of less than 1000mm in height do not require a railing or balustrade. As shown in this study, falls from a height of less than one metre (as are the majority of verandah falls in Australia) can have severe injury consequences and are easily preventable through the provision of non-climbable barriers of a sufficient height.

### 13.2.3 Recommendations for slip resistance of flooring surfaces

- It is recommended that the ABCB include a thorough definition of slip resistance in future editions of the BCA, rather than referring to the definition included in Standards Australia Handbook HB 197:2005. This definition should also include factors other than the dry coefficient of friction measurement deemed appropriate by the above Standard and should include other environmental factors that may increase a surface's slipperiness.
- It is recommended that manufacturers and retailers provide comparative information on slip resistance, and the slip resistive properties of different flooring surfaces, to consumers for consideration before purchase.
- Alteration of the BCA should be considered to require the installation of slip-resistant surfaces in the internal wet areas and external pedestrian areas of all new homes and renovated homes, and that the Local Government and Shires Associations of NSW initiative, whereby certificates of occupancy are only issued to buildings where all flooring surfaces meet the recommendations on slip resistance of pedestrian surfaces as outlined in the revised Standards Australia Handbook HB 197:2005 is adopted and regulated nationally (Gunatilaka 2005).

### 13.2.4 Trip hazards

- It is recommended that a provision to recess or "rebate" structural trip hazards such as door frames, shower door frames and other structural trip hazards in new or renovated domestic dwellings be considered for future editions of the BCA.

### 13.2.5 Falls from heights

- It is recommended that the ABCB, the building industry, local councils and other stake holders investigate the possibility of limiting or removing the need to attain heights for domestic maintenance purposes. This could potentially be achieved through the provision of features such as hinged gutters and gutter guards, or through the subsidisation of skilled trades' people for those vulnerable to fall from height injury.
- The BCA should consider a provision for the required installation of window guards at second storey height in all domestic dwellings, irrespective of whether they exceed four metres in height. We also note that the current BCA requirement of window guards for heights over four metres offers substantial potential for injury, particularly in comparison with the stringent guard requirements in place for windows of any height opening to provide access to domestic swimming pool areas.
- It is recommended that the BCA be amended to require handrails for stairs in all domestic dwellings.
- All balcony, stair and verandah balustrades, irrespective of height above ground level, should be of non-climbable design and adequate height to prevent toppling-over.

## 13.3 AGED CARE FACILITIES AND HEALTH SERVICE AREAS

- Given the high proportion of falls suffered by older persons, and the high proportion of these that occur in aged care facilities, particularly around beds and in bathrooms, the installation of force attenuating surfaces in the immediate vicinity of beds in aged care facilities is recommended.

- It is recommended that the Department of Health and Ageing conduct a cost/benefit analysis based on the immediate and ongoing public health burden resulting from bed and bathroom falls in aged care facilities to determine the economic benefit of this suggested installation.
- It is recommended that new or renovated aged care facilities feature recessed or "rebated" door frames, shower door frames and other structural trip hazards now present in many facilities.

## 13.4 DATA RECOMMENDATIONS

- Attention is required to case capture for fall related fatalities in both the ABS and NCIS data sets.
- It is also recommended that greater consistency be developed between the NCIS and ABS fatality data sets, with particular reference to the very large number of unspecified cause/mechanism and location values found in both datasets.
- Measures should be taken by all state and territory Health Departments to improve the quality of hospital admissions data with regard to mechanism, activity and place of occurrence for all fall injuries.
- It is recommended that states which collect emergency department injury surveillance data pay greater attention to the collection of accurate narrative data as this would allow easier identification of hazards and faster implementation of targeted prevention strategies.

## 13.5 RECOMMENDATIONS FOR CONTINUING AND FUTURE RESEARCH

- It is recommended that the ABCB undertake an in depth study of the building related fall fatality data available through the National Coroners Information System, including both level one and two analyses of all recent (within 5 years) fatal falls in buildings in Australia, and a thorough analysis of the available narrative data and related information for each case.
- An in depth follow up study on balcony falls in Australia is suggested to fully explore the mechanism of these falls – including climbing, height and gaps in balustrades and railings.
- Research is required to investigate the capacity of new technology flooring (or underlay material) to attenuate the level of energy generated in falls to a level below the fracture threshold for hip fractures. This research would need to select only materials with the capacity to meet other aspects of the BCA with regard to fire, hygiene and other relevant standards.
- It is recommended that cost/benefit modelling be done on a range of potential interventions for a range of possible effects.

## 13.6 RECOMMENDATIONS FOR DISSEMINATION

- It is recommended that an Australasian workshop be held in early 2008 to present the findings of this research to stakeholders and to discuss the implementation of the research recommendations.

- That the study report be provided to Standards Australia and its "Safety in House Design" to inform the preparation of their revised guide.
- The research should be published in the scientific literature.
- Media releases should be prepared at the time of the workshop or the publication of the results in the scientific literature.

### 13.7 CONCLUSION

Slips, trips and falls in buildings constitute a large and costly public health problem, which is expected to grow in coming years due to the ageing of the Australian population and the increase in housing density, with associated trends to multi-storey dwellings. Although falls and injuries in buildings may be caused by a combination of factors including the design and construction of buildings, many potential solutions lie with the building industry and its regulators. Others with responsibility include the residential and community aged care sectors, the health sector, Standards makers and those responsible for death and injury data systems and research funding.

Given the enormous cost of the problem, investment in effective preventative solutions is imperative.

# APPENDIX 1

# RAW ET AL. – "A RISK ASSESSMENT PROCEDURE FOR HEALTH AND SAFETY IN BUILDINGS"

**List of harms and mean ratings in ascending order (revised by MUARC)**

| | HARM | MEAN | VAR | RANGE |
|---|---|---|---|---|
| 109 | Slight graze to hand | 1.06 | 0.06 | 1.00 |
| 108 | Slight graze to arm/leg | 1.22 | 0.24 | 2.00 |
| 36 | Occasional insect bites | 1.78 | 0.56 | 3.00 |
| 200 | Minor puncture/cuts to hands | 2.16 | 1.10 | 5.00 |
| 202 | Minor puncture/cuts to leg | 2.25 | 0.65 | 4.00 |
| 67 | Minor dislocated finger | 2.28 | 1.37 | 3.00 |
| 110 | Bad graze to face | 2.37 | 1.02 | 4.00 |
| 41 | Superficial blisters other than on face | 2.38 | 0.50 | 3.00 |
| 46 | Moderate bruising to legs | 2.44 | 1.03 | 4.00 |
| 18 | Temporary slight backache | 2.47 | 0.58 | 3.00 |
| 66 | Minor dislocated toe | 2.53 | 1.16 | 4.00 |
| 154 | Temporary/occasional slight irritation of eyes | 2.66 | 1.65 | 5.00 |
| 230 | Slight ligament injury in ankle | 2.66 | 0.49 | 3.00 |
| 85 | Slight electric shock | 2.75 | 1.94 | 5.00 |
| 198 | Moderate puncture/cuts to ankles/feet | 2.81 | 0.80 | 3.00 |
| 240 | Strained muscle/tendon in foot/leg | 2.81 | 1.00 | 3.00 |
| 45 | Moderate bruising to face | 2.88 | 1.53 | 4.00 |
| 182 | Temporary/occasional slight muscle weakness | 2.88 | 1.53 | 4.00 |
| 50 | Minor burns/scalds to legs/ankles | 2.94 | 1.09 | 5.00 |
| 123 | Hairline fracture of nose | 3.00 | 2.13 | 5.00 |
| 122 | Hairline fracture of toes | 3.12 | 1.02 | 3.00 |
| 241 | Strained abdominal muscle | 3.25 | 0.97 | 3.00 |

| | | | | |
|---|---|---|---|---|
| 266 | Slight ligament injury in wrist | 3.33 | 0.24 | 1.00 |
| 68 | Minor dislocated shoulder | 3.44 | 0.90 | 3.00 |
| 232 | Moderate ligament injury in elbow | 3.44 | 0.77 | 3.00 |
| 121 | Simple fracture of fingers | 3.63 | 1.53 | 4.00 |
| 201 | Moderate puncture/cuts to head/face | 3.66 | 0.75 | 4.00 |
| 204 | Moderate puncture/cuts to torso | 3.69 | 1.00 | 5.00 |
| 24 | Loss of finger/thumb/toe nail by surgical removal | 3.72 | 1.89 | 5.00 |
| 149 | Minor hernia | 3.72 | 0.66 | 3.00 |
| 228 | Slight slipped disc | 3.78 | 1.34 | 5.00 |
| 56 | Slight concussion | 3.88 | 0.89 | 3.00 |
| 231 | Moderate ligament injury in hip | 3.91 | 0.54 | 3.00 |
| 48 | Severe bruising to torso | 4.00 | 1.55 | 4.00 |
| 124 | Simple fracture of jaw | 4.06 | 1.61 | 4.00 |
| 54 | 10% burns/scalds | 4.13 | 1.85 | 4.00 |
| 113 | Simple fracture of ankles/feet | 4.13 | 1.02 | 4.00 |
| 51 | Moderate burns/scalds to feet | 4.16 | 1.10 | 4.00 |
| 37 | Immediate temporary impaired vision in one eye | 4.25 | 0.71 | 3.00 |
| 90 | Brief loss of consciousness | 4.25 | 1.61 | 5.00 |
| 42 | Serious blisters on face or hands | 4.28 | 0.85 | 3.00 |
| 131 | Mild hyperthermia | 4.28 | 1.37 | 4.00 |
| 118 | Hairline fracture of pelvis | 4.34 | 0.81 | 3.00 |
| 185 | Temporary paralysis of foot/feet | 4.41 | 0.96 | 4.00 |
| 199 | Serious puncture/cuts to arm/wrist | 4.50 | 0.97 | 4.00 |
| 53 | Moderate burns/scalds to torso | 4.53 | 0.97 | 3.00 |
| 116 | Compound, complicated or comminuted fracture of wrist/hands | 4.62 | 0.89 | 3.00 |
| 203 | Serious puncture/cuts to neck | 4.63 | 1.21 | 3.00 |
| 211 | Slight retinol haemorrhage | 4.66 | 1.39 | 5.00 |
| 49 | Severe multiple bruising | 4.72 | 1.24 | 4.00 |

| | | | | |
|---|---|---|---|---|
| 183 | Chronic/regular moderate muscular weakness | 4.72 | 1.05 | 3.00 |
| 85 | Serious dislocated jaw | 4.75 | 0.20 | 1.00 |
| 23 | Loss of finger | 4.78 | 2.69 | 6.00 |
| 47 | Severe bruising to head/neck | 4.78 | 1.27 | 4.00 |
| 233 | Serious ligament injury in knee | 4.78 | 0.50 | 3.00 |
| 205 | Multiple serious puncture/cuts | 4.84 | 2.33 | 4.00 |
| 27 | Permanent loss of hair because of burns | 4.88 | 1.60 | 4.00 |
| 69 | Serious dislocated knee | 4.88 | 1.08 | 3.00 |
| 133 | Moderate hypothermia | 4.94 | 1.03 | 3.00 |
| 150 | Major hernia | 5.00 | 0.26 | 2.00 |
| 15 | Asphyxiation with full recovery | 5.03 | 1.19 | 4.00 |
| 38 | Gradual permanent impaired vision in one eye | 5.09 | 0.67 | 3.00 |
| 52 | Severe burns/scalds to hands | 5.16 | 1.10 | 3.00 |
| 120 | Simple fracture of skull | 5.34 | 0.81 | 3.00 |
| 169 | Moderate internal abdominal damage | 5.38 | 0.37 | 3.00 |
| 186 | Temporary paralysis of arms | 5.39 | 1.18 | 4.00 |
| 114 | Compound, complicated or comminuted fracture of arms/shoulder | 5.41 | 0.70 | 4.00 |
| 184 | Chronic/regular severe muscle weakness | 5.41 | 0.77 | 4.00 |
| 229 | Serious slipped disc | 5.41 | 0.38 | 3.00 |
| 57 | Severe concussion | 5.44 | 0.90 | 3.00 |
| 270 | Serious ligament injury in neck | 5.58 | 0.27 | 1.00 |
| 117 | Simple fracture of legs | 5.63 | 1.92 | 4.00 |
| 119 | Compound, complicated or comminuted fracture of ribs | 5.66 | 0.56 | 3.00 |
| 115 | Simple fracture of back without damage to spinal cord | 5.75 | 0.71 | 3.00 |
| 242 | Attempted suicide with full recovery | 5.78 | 0.37 | 3.00 |
| 91 | Loss of consciousness for hours/days | 5.81 | 0.74 | 3.00 |
| 125 | Multiple compound, complicated or comminuted fractures | 5.81 | 0.35 | 3.00 |
| 187 | Permanent paralysis of leg | 5.91 | 0.67 | 2.00 |

| | | | | |
|---|---|---|---|---|
| 25 | Loss of foot | 6.00 | 0.58 | 2.00 |
| 134 | Severe hypothermia | 6.00 | 0.77 | 4.00 |
| 22 | Loss of dominant hand | 6.03 | 0.61 | 2.00 |
| 137 | Immediate permanent deafness in both ears | 6.12 | 0.89 | 5.00 |
| 245 | Severe retinol haemorrhage | 6.25 | 0.20 | 1.00 |
| 55 | Minor immediate brain damage | 6.33 | 0.24 | 1.00 |
| 84 | Serious dislocated spine | 6.42 | 0.27 | 1.00 |
| 105 | Severe electric shock | 6.42 | 0.27 | 1.00 |
| 20 | Loss of arms | 6.44 | 0.25 | 1.00 |
| 55 | 80% burns/scalds | 6.50 | 0.77 | 3.00 |
| 39 | Immediate permanent blindness in both eyes | 6.72 | 0.21 | 1.00 |
| 64 | Severe burns/scalds to face | 6.75 | 0.20 | 1.00 |
| 141 | Fracture of neck with damage to spinal cord | 6.83 | 0.15 | 1.00 |
| 21 | Loss of arms and legs | 6.84 | 0.14 | 1.00 |
| 188 | Permanent paralysis below neck | 6.91 | 0.09 | 1.00 |
| 16 | Asphyxiation resulting in major brain damage/death | 7.00 | 0.00 | 0.00 |
| 44 | Fatal immediate brain damage | 7.00 | 0.00 | 0.00 |
| 86 | Fatal electric shock | 7.00 | 0.00 | 0.00 |
| 92 | Permanent loss of consciousness | 7.00 | 0.00 | 0.00 |
| 132 | Fatal hypothermia | 7.00 | 0.00 | 0.00 |
| 170 | Fatal abdominal damage | 7.00 | 0.00 | 0.00 |
| 227 | Fatal stroke/heart attack | 7.00 | 0.00 | 0.00 |
| 243 | Suicide | 7.00 | 0.00 | 0.00 |

# APPENDIX 2

# RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

## Falls associated with baths etc.

**Matters relevant to the likelihood of an occurrence include:**

a) Poor friction – of the internal surface of a bath or shower.

b) Siting of taps, wastes, light switches and other controls– inappropriate sitings increasing the risk of falls.

c) Handles and grab rails – lack of, or insecurely fitted.

d) Unstable appliance – unstable fitting of bath, shower, WC basin, or wash hand basin.

e) Inadequate space – for the functional area immediately adjacent to the appliance.

f) Inadequate lighting – lack of adequate natural or artificial lighting.

g) Glare – from natural or artificial lighting.

h) Space heating – inadequate means of heating the bathroom.

**Matters relevant to the severity of the outcomes include:**

a) Projections – the presence of sharp edges, heating installations, or glass.

b) Inadequate space – functional space and space between appliances.

c) Space heating – inadequate means of heating the bathroom.

## Falls on level surfaces etc.

**Matters relevant to the likelihood of an occurrence include:**

a) Lack of floor surface – no properly constructed floor, path, or yard where needed.

b) Excessive slope – to the floor, path or yard.

c) Uneven surface – to the floor, path, or yard.

d) Trip steps/threshold – the presence of such steps or projecting thresholds.

e) Disrepair – to the structure and surface of the floor, path or yard.

f) Poor slip resistance – to the surface of the floor, path or yard.

g) Inadequate drainage – of surface water from the path or yard.

h) Inadequate space – for the carrying out of appropriate tasks and manoeuvres.

i) Poor lighting or glare – both artificial and natural.

j) Thermal efficiency – inadequate heating and insulation at the dwelling.

**Matters relevant to the severity of the outcome include**:

a) Hard surfaces – unforgiving or abrasive surface to the floor, path or yard.

b) Projections etc – the presence of sharp edges, heat producing appliances, or glass, in the area where a fall might occur.

c) Nature of area – and of the activities which will be undertaken in the area where a fall might occur.

d) Thermal efficiency – inadequate heating and insulation at for the dwelling.

## Falls on stairs etc.

**Matters relevant to the likelihood of an occurrence include:**

a) Tread lengths – of less than 280mm or greater than 360mm.

b) Riser heights – of less than 100mm or greater than 180mm.

c) Variation in tread or riser – dimensional variation producing an uneven pitch.

d) Nosing length – projecting more than 18mm beyond any riser.

e) Poor friction quality – of treads and nosings.

f) Openings – in stairs or guarding through which a 100mm diameter sphere can pass.

g) Alternating treads – stairs so constructed, particularly those not conforming to current regulations.

h) Lack of handrails – the absence to both sides of the staircase.

i) Height of handrails – set below 900mm or above 1,000mm.

j) Lack of guarding – the absence where there is no wall to both sides of the staircase.

k) Height of guarding – not extending to at least 900mm above the treads.

l) Easily climbed guarding – constructed so as to facilitate climbing.

m) Stair width – less than 1,000mm.

n) Length of flight – long flights may increase the likelihood of a fall.

o) Inadequate lighting – natural and/or artificial, particularly to the top and foot of a flight.

p) Lighting controls – inadequate or inconvenient means of controlling the artificial lighting.

q) Glare from lighting – whether natural or artificial.

r) Door(s) onto stairs – doors opening directly onto the stairs.

s) Inadequate landing – inadequate floor space leading to the stairs.

t) Construction/disrepair – inadequate construction or disrepair to any element of the stairs.

u) Thermal efficiency – inadequate heating and insulation of the dwelling.

**Matters relevant to the severity of the outcome include:**

a) Length of flight – long flights increase the severity of the outcome.

b) Pitch of stairs – stairs which are of above average steepness or shallowness.

c) Projections etc – the presence of sharp edges, heating installations, or glass, to the stairs or at the foot of the flight.

d) Hard surfaces – unforgiving surfaces at the foot of the flight.

e) Construction/disrepair – inadequate construction of, or disrepair to, any element of the stairs.

f) Thermal efficiency –inadequate heating and insulation of the dwelling.

## Falling between levels

**For windows, matters relevant to the likelihood of an occurrence include:**

a) Ease of window operation – degree of difficulty to use window catches and opening lights.

b) Safety catches – lack of such catches or features to catches.

c) Opening limiters – no restriction preventing windows being opened more than 100mm.

d) Sill heights – less than 1,100mm above floor level and/or lack of safety glass or guarding.

e) Disrepair of window – to frame, catches, hinges, sashes, safety devices and opening lights.

f) Ease of cleaning – outer surfaces that are difficult to clean.

**For balconies, landings, roof parapets, basement wells, etc, matters relevant to the likelihood of an occurrence include:**

a) Height of guarding – extending less than 1,100mm above the balcony, roof surface or floor.

b) Easily climbed guarding – constructed so as to facilitate climbing by young children.

c) Openings in guarding –openings greater than 100mm.

d) Construction/repair of guarding – insufficient strength and fixing.

**For windows, balconies, landings, roof parapets, basement wells, etc, matters relevant to the severity of the outcome include:**

a) Height above ground – the distance of a fall to the ground or next level.

b) Nature of ground – the nature of the surface and any features which may be collided with.

c) Non-safety glass – the lack of safety glass where appropriate in the window or guarding.

# APPENDIX 3

# COMPARISON OF NCIS AND ABS BUILDING FALL FATALITY DATABASES, AUSTRALIA, 2005-2005.

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **NCIS** | **ABS** | **NCIS** | **ABS** | **NCIS** | **ABS** | **NCIS** | **ABS** | **NCIS** | **ABS** | **NCIS** | **ABS** |
| State or territory | | | | | | | | | | | | |
| Victoria | 69 | 46 | 76 | 43 | 127 | 78 | 159 | 220 | 158 | 313 | **589** | **700** |
| New South Wales | 130 | 157 | 119 | 108 | 86 | 62 | 78 | 106 | 83 | 111 | **496** | **544** |
| Queensland | 53 | 62 | 44 | 55 | 32 | 25 | 79 | 41 | 89 | 58 | **297** | **241** |
| Western Australia | 23 | 15 | 31 | 15 | 27 | 19 | 31 | 24 | 33 | 46 | **145** | **119** |
| South Australia | 19 | 12 | 20 | 11 | 33 | 12 | 16 | 18 | 6 | 34 | **94** | **87** |
| Tasmania | 10 | 27 | 11 | 25 | 9 | 10 | 17 | 24 | 11 | 13 | **58** | **99** |
| Australian Capital Territory | * | 9 | 6 | * | * | * | 6 | * | * | * | **19** | **23** |
| Northern Territory | * | 6 | 2 | * | * | * | * | * | 5 | 7 | **15** | **19** |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |
| | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age group** | | | | | | | | | | | | |
| 0-14 | 6 | * | 5 | 5 | * | * | * | * | 5 | 7 | **23** | **20** |
| 15-29 | 16 | 15 | 14 | 16 | 9 | 8 | 9 | 5 | 8 | 9 | **56** | **53** |
| 30-44 | 28 | 25 | 25 | 21 | 25 | 20 | 16 | 15 | 15 | 12 | **111** | **93** |
| 45-59 | 46 | 43 | 39 | 32 | 45 | 28 | 36 | 29 | 32 | 35 | **198** | **167** |
| 60-74 | 127 | 65 | 71 | 58 | 56 | 41 | 73 | 58 | 67 | 67 | **334** | **289** |
| 75+ | 147 | 183 | 154 | 133 | 180 | 111 | 249 | 327 | 259 | 455 | **989** | **1209** |
| missing | * | * | * | * | * | * | * | * | * | * | * | * |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |
| | | | | | | | | | | | | |
| **Gender** | | | | | | | | | | | | |
| Male | 124 | 179 | 133 | 147 | 125 | 118 | 172 | 205 | 172 | 275 | **726** | **924** |
| Female | 186 | 155 | 176 | 118 | 194 | 94 | 217 | 231 | 217 | 310 | **987** | **908** |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |
| | | | | | | | | | | | | |

| **Cause (ABS)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| same level from slipping, tripping, stumbling | N/A | 49 | N/A | 53 | N/A | 32 | N/A | 93 | N/A | 56 | **N/A** | **283** |
| on and from stairs and steps | 56 | 50 | 47 | 32 | 37 | 30 | 49 | 44 | 41 | 36 | **230** | **192** |
| other fall on same level | N/A | 17 | N/A | 12 | N/A | 14 | N/A | 111 | N/A | 26 | **N/A** | **180** |
| from, out of or through building or structure | N/A | 38 | N/A | 29 | N/A | 24 | N/A | 13 | N/A | 19 | **N/A** | **123** |
| involving bed | 22 | 19 | 23 | 12 | 17 | 14 | 27 | 33 | 27 | 31 | **116** | **109** |
| on and from ladder | 16 | 10 | 14 | 18 | 20 | 14 | 9 | 7 | 18 | 14 | **77** | **63** |
| involving chair | * | * | 6 | 6 | 8 | * | 15 | 21 | 8 | 14 | **38** | **48** |
| other fall from one level to another | N/A | * | N/A | * | N/A | * | N/A | 10 | N/A | 9 | **N/A** | **35** |
| involving other furniture | N/A | * | N/A | * | N/A | * | N/A | 6 | N/A | 4 | **N/A** | **19** |
| involving wheelchair | N/A | * | N/A | * | N/A | * | N/A | 6 | N/A | 8 | **N/A** | **18** |
| on same level -collision with pushing by another person | N/A | * | N/A | * | N/A | * | N/A | 0 | N/A | * | **N/A** | * |
| while being carried or supported by other persons | N/A | 0 | N/A | * | N/A | 0 | N/A | * | N/A | * | **N/A** | * |
| unspecified fall | N/A | 131 | N/A | 83 | N/A | 64 | N/A | 91 | N/A | 347 | **N/A** | **716** |
| fracture unspecified, reclassified from X59 | N/A | 7 | N/A | 6 | N/A | 8 | N/A | 0 | N/A | 19 | **N/A** | **40** |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |
| | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cause (NCIS)** | | | | | | | | | | | | |
| Falling/jumping/pushed from a height: < 1m | 60 | N/A | 65 | N/A | 47 | N/A | 67 | N/A | 40 | N/A | **279** | **N/A** |
| Falling/jumping/pushed from a height: < 1m | 113 | N/A | 90 | N/A | 92 | N/A | 81 | N/A | 89 | N/A | **465** | **N/A** |
| Falling/stumbling by slipping on same level | 21 | N/A | 18 | N/A | 14 | N/A | 33 | N/A | 25 | N/A | **111** | **N/A** |
| Falling/stumbling by tripping on same level | 38 | N/A | 42 | N/A | 38 | N/A | 36 | N/A | 36 | N/A | **190** | **N/A** |
| Other falling/stumbling on the same level | 43 | N/A | 54 | N/A | 41 | N/A | 36 | N/A | 25 | N/A | **199** | **N/A** |
| Other specified falling/stumbling | 5 | N/A | 10 | N/A | 15 | N/A | 10 | N/A | 19 | N/A | **59** | **N/A** |
| Unspecified falling/stumbling | 30 | N/A | 30 | N/A | 72 | N/A | 126 | N/A | 152 | N/A | **410** | **N/A** |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |
| | | | | | | | | | | | | |
| **Location** | | | | | | | | | | | | |
| Home | 180 | 210 | 158 | 169 | 177 | 137 | 189 | 209 | 194 | 305 | **898** | **1030** |
| School other institution or public administrative area (includes hospital) | 74 | 37 | 93 | 26 | 100 | 23 | 133 | 57 | 147 | 58 | **546** | **201** |
| Residential/Correctional facility | 21 | 69 | 30 | 48 | 26 | 44 | 40 | 154 | 29 | 204 | **146** | **519** |
| Trade or service area | 25 | 18 | 24 | 22 | 11 | 8 | 21 | 16 | 12 | 18 | **93** | **82** |
| Other specified place | 10 | 0 | * | 0 | * | 0 | 5 | 0 | * | 0 | **24** | **0** |
| Unspecified place | 0 | 0 | * | 0 | * | 0 | * | 0 | * | 0 | **6** | **0** |
| All | 310 | 334 | 309 | 265 | 319 | 212 | 389 | 436 | 386 | 585 | **1713** | **1832** |

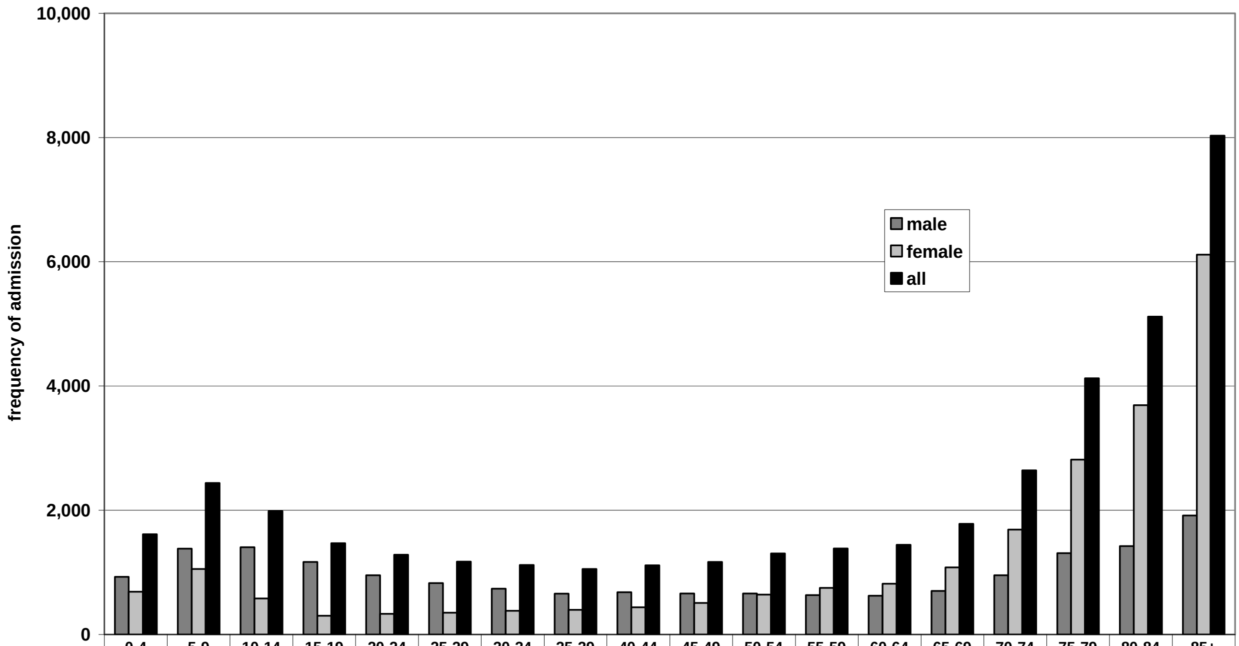
Note: coding differences make comparisons based on cause and location difficult. Data provided as a guide only.

# APPENDIX 4

# OVERVIEW OF HOSPITAL ADMITTED FALLS, VICTORIA 1998/9-2004/5

## Age and gender (frequency)

Average annual frequency of hospital admitted falls by age group and gender, Victoria 1998/9-2004/5

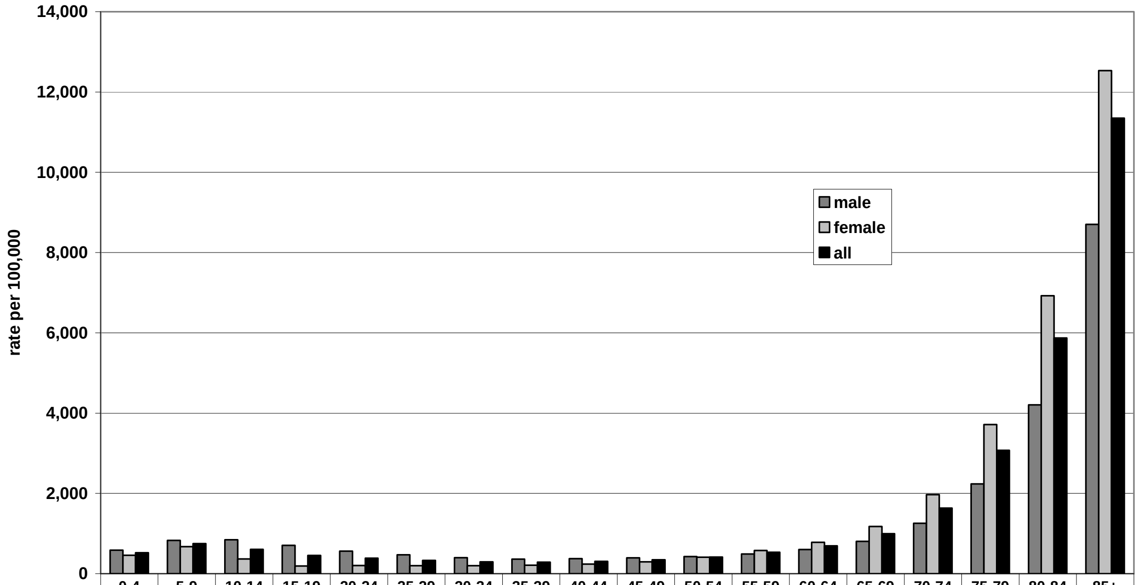



| | 0-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| male | 927 | 1380 | 1405 | 1166 | 954 | 826 | 737 | 657 | 679 | 660 | 661 | 635 | 626 | 702 | 955 | 1308 | 1425 | 1915 |
| female | 689 | 1056 | 581 | 303 | 332 | 349 | 380 | 397 | 436 | 507 | 643 | 751 | 817 | 1081 | 1688 | 2817 | 3692 | 6115 |
| all | 1616 | 2437 | 1986 | 1469 | 1286 | 1175 | 1117 | 1054 | 1116 | 1167 | 1305 | 1386 | 1443 | 1783 | 2642 | 4125 | 5117 | 8031 |

age group

## Age and gender (rates)

Average annual rate of hospital admitted falls by age group and gender, Victoria 1998/9-2004/5

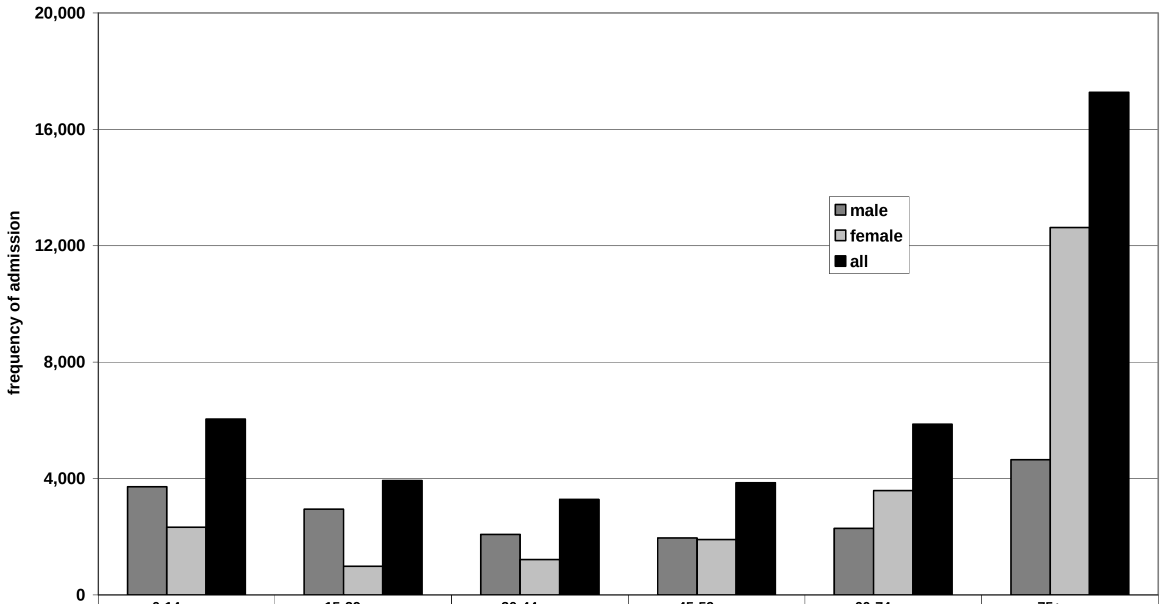



| | 0-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| male | 588.4 | 830.8 | 842.4 | 705.8 | 564.4 | 470.6 | 399.0 | 358.5 | 374.8 | 395.2 | 426.8 | 487.2 | 603.1 | 807.0 | 1254.3 | 2234.7 | 4205.4 | 8702.3 |
| female | 459.6 | 670.1 | 363.4 | 190.4 | 201.4 | 196.8 | 199.2 | 211.5 | 235.8 | 296.5 | 407.6 | 578.6 | 780.4 | 1176.9 | 1969.0 | 3712.2 | 6921.1 | 12533.6 |
| all | 525.6 | 752.6 | 608.0 | 452.9 | 385.2 | 333.0 | 297.5 | 284.1 | 304.6 | 345.3 | 417.1 | 532.8 | 692.0 | 997.0 | 1633.0 | 3069.6 | 5870.2 | 11346.0 |

age group

## Age and gender (frequency)

Average annual frequency of hospital admitted falls by broad age group and gender, Victoria 1998/9-2004/5

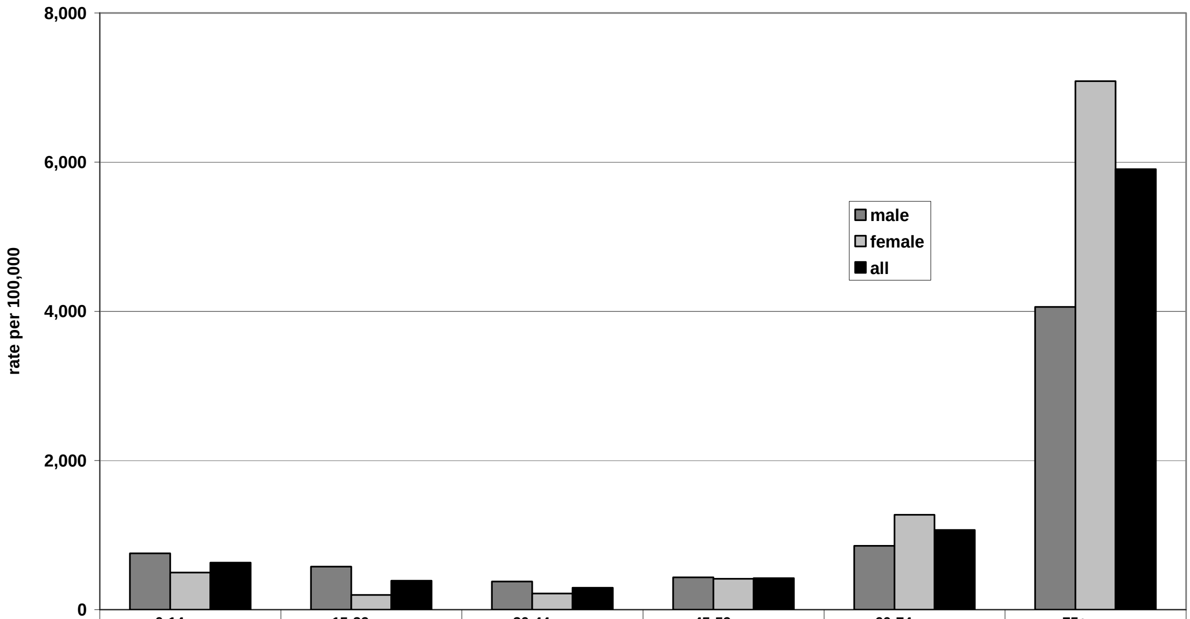



| | 0-14 years | 15-29 years | 30-44 years | 45-59 years | 60-74 years | 75+ years |
|---|---|---|---|---|---|---|
| male | 3712 | 2946 | 2073 | 1956 | 2283 | 4648 |
| female | 2326 | 984 | 1213 | 1901 | 3585 | 12625 |
| all | 6038 | 3930 | 3286 | 3857 | 5868 | 17273 |

age group

## Age and gender (rates)

Average annual rate of hospital admitted falls by broad age group and gender, Victoria 1998/9-2004/5

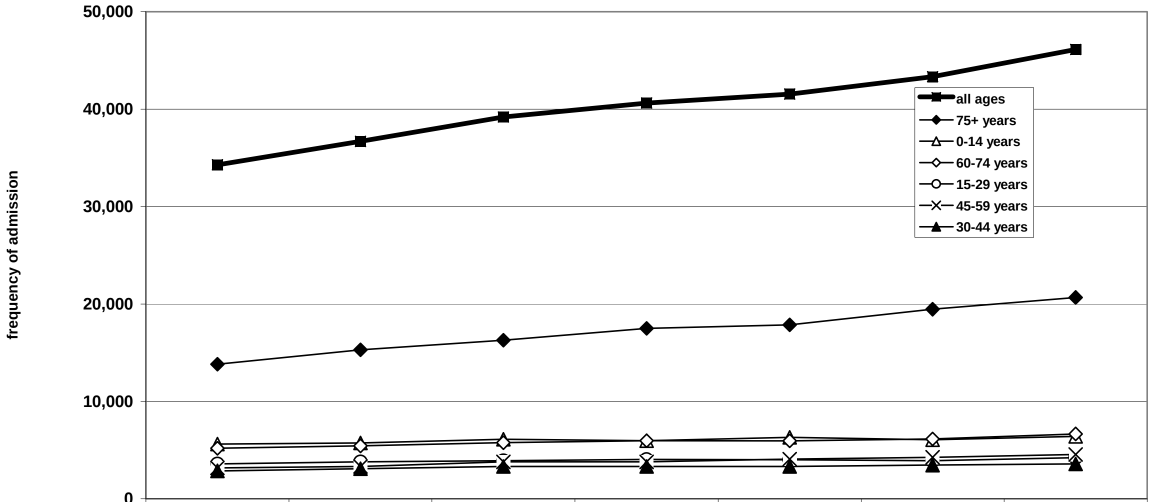



| | 0-14 years | 15-29 years | 30-44 years | 45-59 years | 60-74 years | 75+ years |
|---|---|---|---|---|---|---|
| male | 756.9 | 577.9 | 377.5 | 432.5 | 855.2 | 4058.7 |
| female | 497.7 | 196.3 | 215.4 | 414.5 | 1271.5 | 7086.5 |
| all | 630.4 | 388.7 | 295.4 | 423.4 | 1069.2 | 5904.2 |

age group

## Trend (frequency)

Trend in the frequency of hospital admitted falls by broad age group, Victoria 1998/9-2004/5

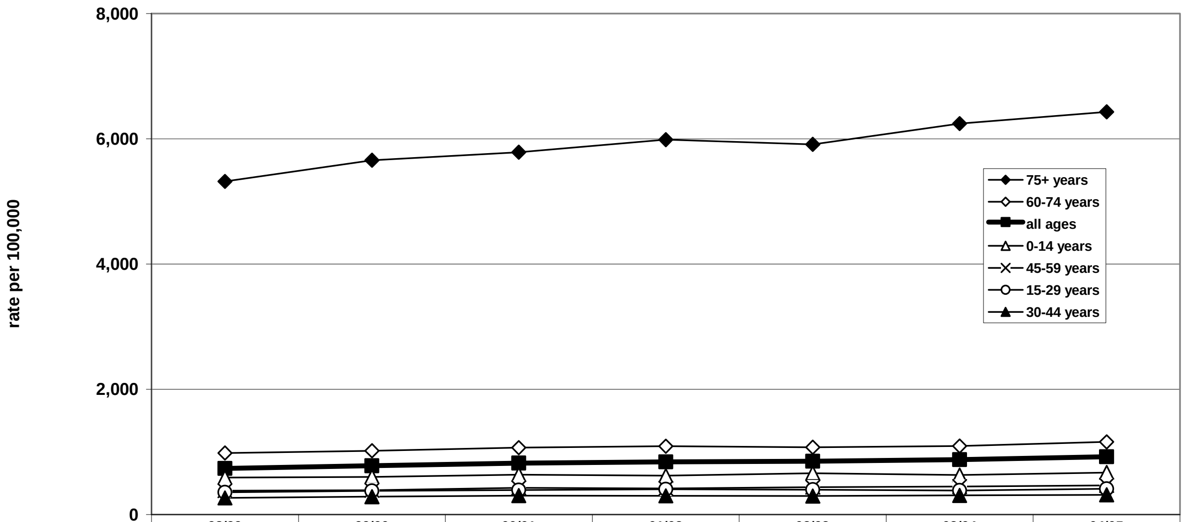



| | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 |
|---|---|---|---|---|---|---|---|
| all ages | 34286 | 36692 | 39187 | 40618 | 41545 | 43325 | 46119 |
| 75+ years | 13823 | 15298 | 16288 | 17502 | 17863 | 19461 | 20674 |
| 0-14 years | 5626 | 5741 | 6119 | 5978 | 6324 | 6066 | 6414 |
| 60-74 years | 5184 | 5426 | 5763 | 5958 | 5942 | 6144 | 6660 |
| 15-29 years | 3587 | 3793 | 3915 | 4049 | 4024 | 3918 | 4225 |
| 45-59 years | 3186 | 3327 | 3784 | 3803 | 4074 | 4273 | 4555 |
| 30-44 years | 2880 | 3107 | 3318 | 3328 | 3318 | 3463 | 3591 |

year of admission

## Trend (rates)

Trend in the rate of hospital admitted falls by broad age group, Victoria 1998/9-2004/5




| | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 |
|---|---|---|---|---|---|---|---|
| 75+ years | 5319 | 5658 | 5785 | 5985 | 5911 | 6243 | 6429 |
| 60-74 years | 982 | 1017 | 1068 | 1091 | 1074 | 1093 | 1160 |
| all ages | 735 | 778 | 821 | 841 | 851 | 878 | 924 |
| 0-14 years | 591 | 601 | 638 | 622 | 659 | 632 | 669 |
| 45-59 years | 380 | 386 | 428 | 419 | 437 | 448 | 467 |
| 15-29 years | 356 | 378 | 390 | 403 | 398 | 385 | 411 |
| 30-44 years | 267 | 285 | 301 | 298 | 294 | 306 | 317 |

year of admission

## Cause

Hospital admitted falls by mechanism, Victoria 1998/9-2004/5

| | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|---|---|---|---|
| same level from slipping, tripping, stumbling | 8,108 | 8,543 | 9,146 | 9,863 | 9,130 | 9,775 | 10,464 | **65,029** | ***23.1*** |
| *slip* | *N/A* | *N/A* | *N/A* | *N/A* | *2,882* | *2,956* | *3,235* | | |
| *trip* | *N/A* | *N/A* | *N/A* | *N/A* | *5,183* | *5,888* | *6,127* | | |
| *stumble* | *N/A* | *N/A* | *N/A* | *N/A* | *1,065* | *931* | *1,102* | | |
| other fall on same level | 3,637 | 3,550 | 3,722 | 4,752 | 5,651 | 6,171 | 6,590 | **34,073** | ***12.1*** |
| on and from stairs and steps | 1,491 | 1,603 | 1,739 | 1,903 | 2,053 | 2,066 | 2,291 | **13,146** | ***4.7*** |
| involving playground equipment | 1,454 | 1,456 | 1,467 | 1,543 | 1,632 | 1,547 | 1,658 | **10,757** | ***3.8*** |
| involving bed | 1,283 | 1,385 | 1,488 | 1,546 | 1,609 | 1,706 | 1,678 | **10,695** | ***3.8*** |
| other fall from one level to another | 1,382 | 1,301 | 1,239 | 1,188 | 1,177 | 1,138 | 1,293 | **8,718** | ***3.1*** |
| involving chair | 876 | 945 | 1,005 | 1,103 | 1,118 | 1,179 | 1,234 | **7,460** | ***2.6*** |
| on and from ladder | 916 | 931 | 1,017 | 1,064 | 1,078 | 1,153 | 1,263 | **7,422** | ***2.6*** |
| from, out of or through building or structure | 680 | 689 | 755 | 767 | 837 | 818 | 807 | **5,353** | ***1.9*** |
| same level, collision with or pushing by other person | 956 | 711 | 644 | 699 | 776 | 751 | 733 | **5,270** | ***1.9*** |
| involving ice skates, skis, roller-skates or skateboard | 588 | 723 | 853 | 753 | 736 | 749 | 739 | **5,141** | ***1.8*** |
| from tree | 303 | 293 | 295 | 268 | 266 | 236 | 247 | **1,908** | ***0.7*** |
| involving other furniture | 197 | 265 | 243 | 241 | 258 | 299 | 283 | **1,786** | ***0.6*** |
| involving wheelchair | 129 | 157 | 166 | 173 | 184 | 188 | 208 | **1,205** | ***0.4*** |
| while being carried or supported by other persons | 75 | 79 | 90 | 92 | 108 | 110 | 102 | **656** | ***0.2*** |
| diving or jumping into water | 66 | 60 | 91 | 58 | 67 | 73 | 65 | **480** | ***0.2*** |
| on and from scaffolding | 62 | 79 | 61 | 39 | 75 | 63 | 50 | **429** | ***0.2*** |
| from cliff | 34 | 27 | 33 | 26 | 74 | 55 | 61 | **310** | ***0.1*** |
| same level involving ice and snow | 23 | 40 | 23 | 20 | 47 | 29 | 20 | **202** | ***0.1*** |
| fracture unspecified, reclassified from X59 | 3,560 | 3,804 | 4,324 | 4,226 | 4,396 | 4,075 | 4,252 | **28,637** | ***10.2*** |
| unspecified fall | 8,466 | 10,051 | 10,786 | 10,294 | 10,273 | 11,144 | 12,081 | **73,095** | ***25.9*** |
| **ALL** | **34,286** | **36,692** | **39,187** | **40,618** | **41,545** | **43,325** | **46,119** | **281,772** | ***100*** |

** note X59*

## Location (broad)

Hospital admitted falls by location of injury occurrence, Victoria 1998/9-2004/5

| | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|---|---|---|---|
| Home | 11,790 | 11,947 | 12,098 | 13,402 | 13,288 | 14,367 | 15,166 | **92,058** | **32.7** |
| School, public buildings | 2,212 | 2,856 | 4,860 | 5,102 | 4,284 | 4,307 | 4,112 | **27,733** | **9.8** |
| Residential Institution | 2,757 | 2,920 | 2,335 | 2,347 | 3,868 | 4,704 | 4,942 | **23,873** | **8.5** |
| Sports & athletic areas | 1,852 | 1,853 | 1,690 | 1,689 | 1,737 | 1,620 | 1,876 | **12,317** | **4.4** |
| Road, street & highway | 1,212 | 1,316 | 1,410 | 1,602 | 1,592 | 1,536 | 1,617 | **10,285** | **3.7** |
| Trade & service area | 891 | 982 | 1,113 | 1,162 | 1,163 | 1,189 | 1,323 | **7,823** | **2.8** |
| Industrial & construction area | 379 | 359 | 344 | 252 | 273 | 285 | 252 | **2,144** | **0.8** |
| Farm | 75 | 89 | 94 | 87 | 100 | 91 | 101 | **637** | **0.2** |
| Other specified places | 1,240 | 1,231 | 1,365 | 1,248 | 1,107 | 1,138 | 1,130 | **8,459** | **3.0** |
| Unspecified places | 11,878 | 13,139 | 13,878 | 13,727 | 14,133 | 14,088 | 15,600 | **96,443** | **34.2** |
| **ALL** | **34,286** | **36,692** | **39,187** | **40,618** | **41,545** | **43,325** | **46,119** | **281,772** | **100.0** |

## Location final three years (more specific)

Hospital admitted falls by specific location of injury occurrence, Victoria 2002/3-2004/5

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| Driveway to home | 194 | 186 | 199 | 579 | **0.4** |
| Other and unspecified place in home | 13,094 | 14,181 | 14,967 | 42,242 | **32.2** |
| Residential institution prison | 15 | 15 | 18 | 48 | **0.0** |
| Residential institution juvenile detention centre | 0 | * | * | * | * |
| Residential institution, military camp | * | 0 | * | * | * |
| Residential institution, orphanage | 0 | * | * | * | * |
| Residential inst aged care facilities | 3,675 | 4,502 | 4,716 | 12,893 | **9.8** |
| Other specified residential institution | 154 | 144 | 159 | 457 | **0.3** |
| Unspecified residential institution | 23 | 41 | 43 | 107 | **0.1** |
| School | 1,213 | 1,165 | 1,297 | 3,675 | **2.8** |
| Health service area | 2,814 | 2,960 | 2,611 | 8,385 | **6.4** |
| Other specified institution & public admin area | 262 | 182 | 204 | 648 | **0.5** |
| Sporting grounds-outdoor | 1,050 | 954 | 1,126 | 3,130 | **2.4** |
| Sporting hall-indoor | 194 | 218 | 202 | 614 | **0.5** |
| Swimming centre | 27 | 35 | 35 | 97 | **0.1** |
| Racetrack and racecourse | 21 | 19 | 23 | 63 | **0.0** |
| Equestrian facility | * | * | * | * | * |
| Sports and athletics area, skating rink | 76 | 70 | 75 | 221 | **0.2** |
| Sports and athletics area, skiing | 171 | 155 | 204 | 530 | **0.4** |
| Other spec sports & athletics area | 83 | 79 | 90 | 252 | **0.2** |
| Sports and athletics area, unspecified | 113 | 89 | 120 | 322 | **0.2** |
| Street & highway roadway | 312 | 356 | 390 | 1,058 | **0.8** |
| Street & highway, sidewalk | 1,139 | 1,087 | 1,122 | 3,348 | **2.6** |
| Street & highway cycleway | * | * | * | 7 | **0.0** |
| Other specified public highway, street, road | 56 | 40 | 58 | 154 | **0.1** |
| Unspecified public highway street road | 82 | 52 | 44 | 178 | **0.1** |
| Trade and service area, shop and store | 546 | 559 | 603 | 1,708 | **1.3** |
| Trade service area commercial garage | 18 | 16 | 25 | 59 | **0.0** |
| Trade and service area, office building | 10 | 18 | 22 | 50 | **0.0** |
| Trade service area café hotel restaurant | 401 | 391 | 433 | 1,225 | **0.9** |
| Other specified trade and service area | 162 | 166 | 212 | 540 | **0.4** |
| Unspecified trade and service area | 26 | 39 | 28 | 93 | **0.1** |
| Construct area | 127 | 132 | 104 | 363 | **0.3** |
| Industrial & construction area demolition site | * | * | * | 5 | **0.0** |
| Industrial & construction area factory & plant | 71 | 70 | 80 | 221 | **0.2** |
| Industrial & construction area mine & quarry | * | 5 | * | 10 | **0.0** |
| Industrial & construction area oil gas extraction | * | 0 | * | * | * |
| Industrial & construction area shipyard | 8 | * | * | 12 | **0.0** |
| Industrial & construction area power station | * | 0 | 0 | * | * |
| Other specified industrial & construction area | 20 | 23 | 15 | 58 | **0.0** |
| Unspecified industrial & construction area | 39 | 52 | 42 | 133 | **0.1** |
| Farm | 100 | 91 | 101 | 292 | **0.2** |
| Area of still water | 24 | 19 | 23 | 66 | **0.1** |
| Stream of water | 41 | 53 | 49 | 143 | **0.1** |
| Large area of water | 36 | 50 | 52 | 138 | **0.1** |
| Beach | 90 | 82 | 97 | 269 | **0.2** |
| Forest | 33 | 29 | 25 | 87 | **0.1** |
| Desert | 0 | 0 | * | * | * |
| Other specified countryside | 122 | 150 | 112 | 384 | **0.3** |
| Parking lot | 84 | 63 | 71 | 218 | **0.2** |
| Other specified place of occurrence | 677 | 692 | 700 | 2,069 | **1.6** |
| Unspecified place of occurrence | 14,128 | 14,088 | 15,600 | 43,836 | **33.5** |
| | **41,545** | **43,325** | **46,119** | **130,989** | **100.0** |

## Overview of hospital admitted falls occurring in buildings, Victoria 2002/3-2004/5

Following data have been selected according to instructions from ABCB. Instructions were to exclude the following locations: driveway to home, sporting grounds-outdoor, swimming centre, racetrack and racecourse, equestrian facility, sports and athletics area skating rink, sports and athletics area skiing, other specified sports & athletics area, sports and athletics area unspecified, street & highway roadway, street & highway sidewalk, street & highway cycleway, other specified public highway, street, road, unspecified public highway street road, unspecified trade and service area, construct area, industrial & construction area demolition site, industrial & construction area mine & quarry, industrial & construction area oil gas extraction, industrial & construction area shipyard, industrial & construction area power station, industrial & construction area factory and plant, other specified industrial & construction area, unspecified industrial & construction area, farm, area of still water, stream of water, large area of water, beach, forest, desert, other specified countryside, parking lot, other specified place of occurrence, unspecified place of occurrence.

Falls from cliffs, playground equipment, trees, ice/skates/skis/roller-skates/skateboards, on and from scaffolding, diving or jumping into water and same level ice and snow have also been excluded.

### Location

Hospital admitted falls by specific location of injury occurrence, Victoria 2002/3-2004/5

| | **02/03** | **03/04** | **04/05** | **ALL** | **%** |
|---|---|---|---|---|---|
| Other and unspecified place in home | 12885 | 13954 | 14768 | 41607 | **59.2** |
| Residential institution prison | 15 | 15 | 18 | 48 | **0.1** |
| Residential institution, juvenile detention centre | 0 | * | * | * | ***** |
| Residential institution, military camp | * | 0 | * | * | ***** |
| Residential institution, orphanage | 0 | * | * | * | ***** |
| Residential institution, aged care facilities | 3675 | 4500 | 4713 | 12888 | **18.3** |
| Other specified residential institution | 153 | 142 | 159 | 454 | **0.6** |
| Unspecified residential institution | 23 | 41 | 43 | 107 | **0.2** |
| School | 670 | 676 | 726 | 2072 | **2.9** |
| Health service area | 2812 | 2956 | 2605 | 8373 | **11.9** |
| Other specified institution & public administration area | 253 | 173 | 200 | 626 | **0.9** |
| Sporting hall-indoor | 188 | 205 | 198 | 591 | **0.8** |
| Trade and service area, shop and store | 543 | 555 | 597 | 1695 | **2.4** |
| Trade service area commercial garage | 18 | 16 | 25 | 59 | **0.1** |
| Trade and service area, office building | 10 | 18 | 22 | 50 | **0.1** |
| Trade service area café hotel restaurant | 381 | 383 | 426 | 1190 | **1.7** |
| Other specified trade and service area | 161 | 164 | 211 | 536 | **0.8** |
| | **21788** | **23800** | **24717** | **70305** | **100.0** |

## Cause

### Hospital admitted falls by specific cause, Victoria 2002/3-2004/5

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| same level from slipping, tripping, stumbling | | | | | ***27.6*** |
| *slip* | 2018 | 2073 | 2241 | 6332 | *9.0* |
| *trip* | 3161 | 3744 | 3891 | 10796 | *15.4* |
| *stumble* | 793 | 698 | 818 | 2309 | *3.3* |
| other fall on same level | 4027 | 4494 | 4669 | 13190 | **18.8** |
| involving bed | 1527 | 1614 | 1582 | 4723 | **6.7** |
| on and from stairs and steps | 1224 | 1224 | 1338 | 3786 | **5.4** |
| involving chair | 845 | 922 | 922 | 2689 | **3.8** |
| on and from ladder | 492 | 543 | 562 | 1597 | **2.3** |
| other fall from one level to another | 365 | 372 | 414 | 1151 | **1.6** |
| from, out of or through building or structure | 383 | 371 | 375 | 1129 | **1.6** |
| on same level -collision with or pushing by other person | 202 | 229 | 203 | 634 | **0.9** |
| involving other furniture | 181 | 209 | 197 | 587 | **0.8** |
| involving wheelchair | 127 | 128 | 153 | 408 | **0.6** |
| while being carried or supported by other persons | 56 | 53 | 48 | 157 | **0.2** |
| fracture unspecified, reclassified from X59 | 6034 | 6795 | 7073 | 19902 | **28.3** |
| unspecified fall | 353 | 331 | 231 | 915 | **1.3** |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |

**Note:** Admissions originally classified to X59 (exposure to unspecified factor) are classified as 'falls' rather than 'other unintentional' if they have at least one injury diagnosis coded as a 'fracture'.

## Detailed analysis of final set

Trend

Age groups

Co-morbidity

The New Zealand research group (Cryer et al.) used a threat-to-life severity scale when defining a serious injury and only included hospitalisations with an International Classification of Diseases-based Injury Severity Score (ICISS) of less than or equal to 0.941 (i.e. a probability of death at admission of at least 5.9%).

Serious injury definition for this table is based on ICISS score and Cryer's definition of what a serious injury is.

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| | | | | | |
| **Gender** | | | | | |
| male | 7560 | 8207 | 8665 | 24432 | 34.8 |
| female | 14228 | 15593 | 16052 | 45873 | 65.2 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Age group** | | | | | |
| 0-4yrs | 684 | 688 | 757 | 2129 | 3.0 |
| 5-9yrs | 542 | 527 | 564 | 1633 | 2.3 |
| 10-14yrs | 442 | 453 | 469 | 1364 | 1.9 |
| 15-19yrs | 210 | 263 | 238 | 711 | 1.0 |
| 20-24yrs | 214 | 239 | 224 | 677 | 1.0 |
| 25-29yrs | 241 | 232 | 256 | 729 | 1.0 |
| 30-34yrs | 274 | 306 | 344 | 924 | 1.3 |
| 35-39yrs | 304 | 345 | 339 | 988 | 1.4 |
| 40-44yrs | 361 | 408 | 408 | 1177 | 1.7 |
| 45-49yrs | 451 | 466 | 516 | 1433 | 2.0 |
| 50-54yrs | 538 | 590 | 559 | 1687 | 2.4 |
| 55-59yrs | 651 | 744 | 764 | 2159 | 3.1 |
| 60-64yrs | 758 | 804 | 875 | 2437 | 3.5 |
| 65-69yrs | 1037 | 1076 | 1164 | 3277 | 4.7 |
| 70-74yrs | 1608 | 1755 | 1763 | 5126 | 7.3 |
| 75-79yrs | 2900 | 3096 | 3243 | 9239 | 13.1 |
| 80-84yrs | 3819 | 4366 | 4647 | 12832 | 18.3 |
| 85+ yrs | 6754 | 7442 | 7587 | 21783 | 31.0 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Broad body region** | | | | | |
| head/face/neck | 4980 | 5345 | 5698 | 16023 | 22.8 |
| trunk | 3145 | 3428 | 3679 | 10252 | 14.6 |
| upper extremity | 4719 | 5112 | 5261 | 15092 | 21.5 |
| lower extremity | 8318 | 9157 | 9376 | 26851 | 38.2 |
| multiple body regions | 18 | 21 | 13 | 52 | 0.1 |
| body region not relevant | 95 | 125 | 109 | 329 | 0.5 |
| unspecified body region | 150 | 181 | 145 | 476 | 0.7 |
| missing body region | 363 | 431 | 436 | 1230 | 1.7 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Detailed body region** | | | | | |
| head | 4731 | 4996 | 5319 | 15046 | 21.4 |
| neck | 248 | 349 | 377 | 974 | 1.4 |
| thorax | 1084 | 1262 | 1331 | 3677 | 5.2 |
| abdomen, lowerback, lumbar spine & pelvis | 2061 | 2165 | 2348 | 6574 | 9.4 |
| shoulder & upper arm | 1972 | 2157 | 2130 | 6259 | 8.9 |
| elbow & forearm | 2281 | 2416 | 2565 | 7262 | 10.3 |
| wrist & hand | 465 | 539 | 563 | 1567 | 2.2 |
| hip & thigh | 5676 | 6236 | 6433 | 18345 | 26.1 |
| knee & lower leg | 2251 | 2449 | 2469 | 7169 | 10.2 |
| ankle & foot | 391 | 471 | 473 | 1335 | 1.9 |
| multiple body regions | 18 | 21 | 13 | 52 | 0.1 |

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| unspecified body region | 150 | 181 | 145 | 476 | 0.7 |
| body region not relevant | 95 | 125 | 109 | 329 | 0.5 |
| missing injury code | 365 | 433 | 442 | 1240 | 1.7 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Injury type** | | | | | |
| superficial injury | 2007 | 2068 | 2132 | 6207 | 8.8 |
| open wound | 3021 | 3299 | 3495 | 9815 | 14.0 |
| eye injury- excl foreign body | 69 | 71 | 71 | 211 | 0.3 |
| intracranial injury | 865 | 924 | 992 | 2781 | 4.0 |
| injury to internal organs | 81 | 111 | 101 | 293 | 0.4 |
| burns | * | * | 6 | 10 | 0.0 |
| poisoning- drugs, medicaments & bio subs | * | * | 0 | * | * |
| toxic effects- subs nonmedicinal | * | 0 | 0 | * | * |
| other & unspec effects of ext causes | 7 | 12 | 10 | 29 | 0.0 |
| early and other complications of trauma | 57 | 69 | 81 | 207 | 0.3 |
| fracture | 11713 | 12819 | 13340 | 37872 | 53.9 |
| sequelae of injuries, poisoning & ext cause | * | 8 | * | 12 | 0.0 |
| dislocation, sprain & strain | 688 | 782 | 769 | 2239 | 3.2 |
| injury to nerves & spinal cord | 68 | 72 | 62 | 202 | 0.3 |
| injury to blood vessels | 5 | 11 | 22 | 38 | 0.1 |
| injury to muscle & tendon | 148 | 185 | 195 | 528 | 0.8 |
| crushing injury | 0 | * | * | 5 | 0.0 |
| traumatic amputation | 5 | * | 5 | 14 | 0.0 |
| other & unspecified injury | 2658 | 2895 | 2978 | 8531 | 12.1 |
| missing injury code | 363 | 431 | 436 | 1230 | 1.7 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Location** | | | | | |
| Home | 12885 | 13954 | 14768 | 41607 | 59.2 |
| Residential Institution | 3867 | 4700 | 4939 | 13506 | 19.2 |
| School, public buildings | 3730 | 3805 | 3531 | 11066 | 15.7 |
| Sports & athletic areas | 188 | 205 | 198 | 591 | 0.8 |
| Trade & service area | 1113 | 1136 | 1281 | 3530 | 5.0 |
| Legal intervention & medical cause codes | 5 | 0 | 0 | 5 | 0.0 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Detailed location** | | | | | |
| Other and unspecified place in home | 12885 | 13954 | 14768 | 41607 | 59.2 |
| Residential institution prison | 15 | 15 | 18 | 48 | 0.1 |
| Residential inst juvnle detention centre | 0 | * | * | * | * |
| Residential institution, military camp | * | 0 | * | * | * |
| Residential institution, orphanage | 0 | * | * | * | * |
| Residential inst aged care facilities | 3675 | 4500 | 4713 | 12888 | 18.3 |
| Other specified residential institution | 153 | 142 | 159 | 454 | 0.6 |
| Unspecified residential institution | 23 | 41 | 43 | 107 | 0.2 |
| School | 670 | 676 | 726 | 2072 | 2.9 |
| Health service area | 2812 | 2956 | 2605 | 8373 | 11.9 |
| Oth spec institution & public admin area | 253 | 173 | 200 | 626 | 0.9 |
| Sporting hall-indoor | 188 | 205 | 198 | 591 | 0.8 |
| Trade and service area, shop and store | 543 | 555 | 597 | 1695 | 2.4 |
| Trade service area commercial garage | 18 | 16 | 25 | 59 | 0.1 |
| Trade and service area, office building | 10 | 18 | 22 | 50 | 0.1 |
| Trade service area café hotel restaurant | 381 | 383 | 426 | 1190 | 1.7 |
| Other specified trade and service area | 161 | 164 | 211 | 536 | 0.8 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Length of stay** | | | | | |
| < 2 days | 8200 | 8276 | 8701 | 25177 | 35.8 |
| 2-7 days | 5954 | 6449 | 6582 | 18985 | 27.0 |
| 8-30 days | 6453 | 7308 | 7873 | 21634 | 30.8 |
| 31+ days | 1181 | 1767 | 1561 | 4509 | 6.4 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |
| **Severity of injury** | | | | | |
| serious injury | 6712 | 7555 | 7907 | 22174 | 31.5 |
| non-serious injury | 15076 | 16245 | 16810 | 48131 | 68.5 |
| | 21788 | 23800 | 24717 | 70305 | 100.0 |
| | | | | | |

## STAIRS AND STEPS

Trend

Age group rates

Co-morbidity

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| | | | | | |
| **Gender** | | | | | |
| male | 428 | 407 | 470 | 1305 | **34.5** |
| female | 796 | 817 | 868 | 2481 | **65.5** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Age group** | | | | | |
| 0-4yrs | 47 | 24 | 35 | 106 | **2.8** |
| 5-9yrs | 21 | 21 | 18 | 60 | **1.6** |
| 10-14yrs | 20 | 19 | 8 | 47 | **1.2** |
| 15-19yrs | 17 | 26 | 11 | 54 | **1.4** |
| 20-24yrs | 27 | 27 | 27 | 81 | **2.1** |
| 25-29yrs | 22 | 38 | 28 | 88 | **2.3** |
| 30-34yrs | 30 | 29 | 46 | 105 | **2.8** |
| 35-39yrs | 33 | 31 | 42 | 106 | **2.8** |
| 40-44yrs | 48 | 52 | 62 | 162 | **4.3** |
| 45-49yrs | 55 | 55 | 64 | 174 | **4.6** |
| 50-54yrs | 52 | 71 | 48 | 171 | **4.5** |
| 55-59yrs | 73 | 73 | 98 | 244 | **6.4** |
| 60-64yrs | 72 | 67 | 66 | 205 | **5.4** |
| 65-69yrs | 68 | 85 | 97 | 250 | **6.6** |
| 70-74yrs | 105 | 110 | 114 | 329 | **8.7** |
| 75-79yrs | 166 | 151 | 165 | 482 | **12.7** |
| 80-84yrs | 176 | 158 | 189 | 523 | **13.8** |
| 85+ yrs | 192 | 187 | 220 | 599 | **15.8** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Broad body region** | | | | | |
| head/face/neck | 280 | 261 | 339 | 880 | **23.2** |
| trunk | 156 | 161 | 146 | 463 | **12.2** |
| upper extremity | 260 | 250 | 294 | 804 | **21.2** |
| lower extremity | 510 | 530 | 542 | 1582 | **41.8** |
| multiple body regions | * | * | * | * | ***** |
| body region not relevant | * | * | * | 5 | **0.1** |
| unspecified body region | * | * | * | 8 | **0.2** |
| missing body region | 14 | 15 | 12 | 41 | **1.1** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Detailed body region** | | | | | |
| head | 264 | 228 | 308 | 800 | **21.1** |
| neck | 16 | 33 | 31 | 80 | **2.1** |
| thorax | 44 | 48 | 53 | 145 | **3.8** |
| abdomen, lowerback, lumbar spine & pelvis | 112 | 113 | 93 | 318 | **8.4** |
| shoulder & upper arm | 118 | 107 | 112 | 337 | **8.9** |
| elbow & forearm | 125 | 117 | 149 | 391 | **10.3** |
| wrist & hand | 17 | 26 | 33 | 76 | **2.0** |
| hip & thigh | 215 | 210 | 237 | 662 | **17.5** |
| knee & lower leg | 253 | 281 | 243 | 777 | **20.5** |
| ankle & foot | 42 | 39 | 62 | 143 | **3.8** |
| multiple body regions | * | * | * | * | ***** |
| unspecified body region | * | * | * | 8 | **0.2** |
| body region not relevant | * | * | * | 5 | **0.1** |
| missing injury code | 14 | 15 | 12 | 41 | **1.1** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Injury type** | | | | | |
| superficial injury | 76 | 69 | 81 | 226 | **6.0** |
| open wound | 130 | 136 | 156 | 422 | **11.1** |
| eye injury- excl foreign body | * | * | * | * | ***** |
| intracranial injury | 86 | 83 | 105 | 274 | **7.2** |
| injury to internal organs | * | 8 | 7 | 18 | **0.5** |

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| early and other complications of trauma | * | * | * | * | ***** |
| fracture | 702 | 723 | 766 | 2191 | **57.9** |
| sequelae of injuries, poisoning & ext cause | 0 | * | 0 | * | ***** |
| dislocation, sprain & strain | 51 | 51 | 50 | 152 | **4.0** |
| injury to nerves & spinal cord | * | * | 5 | 9 | **0.2** |
| injury to blood vessels | 0 | 0 | * | * | ***** |
| injury to muscle & tendon | 13 | 13 | 17 | 43 | **1.1** |
| traumatic amputation | * | 0 | 0 | * | ***** |
| other & unspecified injury | 142 | 121 | 135 | 398 | **10.5** |
| missing injury code | 14 | 15 | 12 | 41 | **1.1** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Location** | | | | | |
| Home | 899 | 928 | 990 | 2817 | **74.4** |
| Residential Institution | 24 | 28 | 30 | 82 | **2.2** |
| School, public buildings | 123 | 73 | 100 | 296 | **7.8** |
| Sports & athletic areas | 0 | 5 | * | 8 | **0.2** |
| Trade & service area | 177 | 190 | 215 | 582 | **15.4** |
| Legal intervention & medical cause codes | * | 0 | 0 | * | |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Detailed location** | | | | | |
| Other and unspecified place in home | 899 | 928 | 990 | 2817 | **74.4** |
| Residential institution prison | * | 0 | * | * | ***** |
| Residential inst aged care facilities | 19 | 22 | 23 | 64 | **1.7** |
| Other specified residential institution | * | * | 5 | 12 | **0.3** |
| Unspecified residential institution | 0 | * | 0 | * | ***** |
| School | 48 | 35 | 29 | 112 | **3.0** |
| Health service area | 31 | 15 | 23 | 69 | **1.8** |
| Oth spec institution & public admin area | 45 | 23 | 48 | 116 | **3.1** |
| Sporting hall-indoor | 0 | 5 | * | 8 | **0.2** |
| Trade and service area, shop and store | 50 | 59 | 61 | 170 | **4.5** |
| Trade service area commercial garage | * | * | * | * | ***** |
| Trade and service area, office building | * | * | 7 | 12 | **0.3** |
| Trade service area café hotel restaurant | 82 | 92 | 95 | 269 | **7.1** |
| Other specified trade and service area | 41 | 36 | 50 | 127 | **3.4** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Length of stay** | | | | | |
| < 2 days | 568 | 527 | 576 | 1671 | **44.1** |
| 2-7 days | 362 | 384 | 392 | 1138 | **30.1** |
| 8-30 days | 267 | 274 | 327 | 868 | **22.9** |
| 31+ days | 27 | 39 | 43 | 109 | **2.9** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |
| **Severity of injury** | | | | | |
| serious injury | 321 | 329 | 373 | 1023.0 | **27.0** |
| non-serious injury | 903 | 895 | 965 | 2763.0 | **73.0** |
| | 1224 | 1224 | 1338 | 3786 | **100.0** |
| | | | | | |

**HOME**

Trend

Age group rates

Severity

Co-morbidity

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| | | | | | |
| **Gender** | | | | | |
| male | 4390 | 4714 | 5050 | 14154 | 34.0 |
| female | 8495 | 9240 | 9718 | 27453 | 66.0 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Age group** | | | | | |
| 0-4yrs | 566 | 590 | 630 | 1786 | 4.3 |
| 5-9yrs | 266 | 270 | 266 | 802 | 1.9 |
| 10-14yrs | 94 | 125 | 115 | 334 | 0.8 |
| 15-19yrs | 77 | 100 | 97 | 274 | 0.7 |
| 20-24yrs | 116 | 126 | 114 | 356 | 0.9 |
| 25-29yrs | 149 | 153 | 151 | 453 | 1.1 |
| 30-34yrs | 181 | 195 | 224 | 600 | 1.4 |
| 35-39yrs | 205 | 252 | 229 | 686 | 1.6 |
| 40-44yrs | 246 | 290 | 278 | 814 | 2.0 |
| 45-49yrs | 304 | 346 | 373 | 1023 | 2.5 |
| 50-54yrs | 391 | 419 | 405 | 1215 | 2.9 |
| 55-59yrs | 495 | 565 | 557 | 1617 | 3.9 |
| 60-64yrs | 570 | 590 | 627 | 1787 | 4.3 |
| 65-69yrs | 716 | 758 | 849 | 2323 | 5.6 |
| 70-74yrs | 1092 | 1190 | 1201 | 3483 | 8.4 |
| 75-79yrs | 1849 | 1928 | 2127 | 5904 | 14.2 |
| 80-84yrs | 2236 | 2565 | 2777 | 7578 | 18.2 |
| 85+ yrs | 3332 | 3492 | 3748 | 10572 | 25.4 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Broad body region** | | | | | |
| head/face/neck | 2701 | 2754 | 3067 | 8522 | 20.5 |
| trunk | 2155 | 2332 | 2500 | 6987 | 16.8 |
| upper extremity | 2829 | 3084 | 3113 | 9026 | 21.7 |
| lower extremity | 4859 | 5388 | 5675 | 15922 | 38.3 |
| multiple body regions | 11 | 10 | 5 | 26 | 0.1 |
| body region not relevant | 68 | 85 | 91 | 244 | 0.6 |
| unspecified body region | 73 | 86 | 82 | 241 | 0.6 |
| missing body region | 189 | 215 | 235 | 639 | 1.5 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Detailed body region** | | | | | |
| head | 2550 | 2525 | 2798 | 7873 | 18.9 |
| neck | 151 | 229 | 268 | 648 | 1.6 |
| thorax | 778 | 933 | 976 | 2687 | 6.5 |
| abdomen, lowerback, lumbar spine & pelvis | 1377 | 1398 | 1524 | 4299 | 10.3 |
| shoulder & upper arm | 1267 | 1373 | 1376 | 4016 | 9.7 |
| elbow & forearm | 1301 | 1434 | 1452 | 4187 | 10.1 |
| wrist & hand | 260 | 277 | 283 | 820 | 2.0 |
| hip & thigh | 3129 | 3397 | 3635 | 10161 | 24.4 |
| knee & lower leg | 1460 | 1658 | 1707 | 4825 | 11.6 |
| ankle & foot | 270 | 332 | 332 | 934 | 2.2 |
| multiple body regions | 11 | 10 | 5 | 26 | 0.1 |
| unspecified body region | 73 | 86 | 82 | 241 | 0.6 |
| body region not relevant | 68 | 85 | 91 | 244 | 0.6 |
| missing injury code | 190 | 217 | 239 | 646 | 1.6 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Injury type** | | | | | |
| superficial injury | 982 | 951 | 993 | 2926 | 7.0 |
| open wound | 1531 | 1633 | 1822 | 4986 | 12.0 |
| eye injury- excl foreign body | 48 | 37 | 32 | 117 | 0.3 |

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| intracranial injury | 535 | 542 | 605 | 1682 | 4.0 |
| injury to internal organs | 67 | 85 | 82 | 234 | 0.6 |
| burns | * | * | * | 7 | 0.0 |
| poisoning- drugs, medicaments & bio subs | * | * | 0 | * | * |
| toxic effects- subs nonmedicinal | * | 0 | 0 | * | * |
| other & unspec effects of ext causes | 7 | 10 | 9 | 26 | 0.1 |
| early and other complications of trauma | 48 | 59 | 72 | 179 | 0.4 |
| fracture | 7336 | 8032 | 8504 | 23872 | 57.4 |
| complications of surgical & med care NEC | 9 | 10 | 9 | 28 | 0.1 |
| sequelae of injuries, poisoning & ext cause | * | * | * | 7 | 0.0 |
| dislocation, sprain & strain | 458 | 508 | 494 | 1460 | 3.5 |
| injury to nerves & spinal cord | 55 | 60 | 49 | 164 | 0.4 |
| injury to blood vessels | 4 | 11 | 14 | 29 | 0.1 |
| injury to muscle & tendon | 94 | 132 | 128 | 354 | 0.9 |
| crushing injury | 0 | * | * | * | * |
| traumatic amputation | 5 | * | * | 11 | 0.0 |
| other & unspecified injury | 1512 | 1658 | 1708 | 4878 | 11.7 |
| missing injury code | 189 | 215 | 235 | 639 | 1.5 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Length of stay** | | | | | |
| < 2 days | 4899 | 5010 | 5183 | 15092 | 36.3 |
| 2-7 days | 3705 | 3981 | 4160 | 11846 | 28.5 |
| 8-30 days | 3815 | 4201 | 4659 | 12675 | 30.5 |
| 31+ days | 466 | 762 | 766 | 1994 | 4.8 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |
| **Severity of injury** | | | | | |
| serious injury | 4007 | 4327 | 4770 | 13104 | 31.5 |
| non-serious injury | 8878 | 9627 | 9998 | 28503 | 68.5 |
| | 12885 | 13954 | 14768 | 41607 | 100.0 |
| | | | | | |

## AGED CARE

Trend

Age group rates

Severity

Co-morbidity

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| | | | | | |
| **Gender** | | | | | |
| male | 817 | 1033 | 1145 | 2995 | **23.2** |
| female | 2858 | 3467 | 3568 | 9893 | **76.8** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Age group** | | | | | |
| 5-9yrs | 0 | * | 0 | * | * |
| 10-14yrs | 0 | 0 | * | * | * |
| 20-24yrs | 0 | 0 | * | * | * |
| 25-29yrs | 0 | 0 | * | * | * |
| 30-34yrs | * | * | 0 | * | * |
| 35-39yrs | * | * | * | 7 | **0.1** |
| 40-44yrs | * | * | * | 9 | **0.1** |
| 45-49yrs | 7 | 7 | 9 | 23 | **0.2** |
| 50-54yrs | 9 | 9 | 9 | 27 | **0.2** |
| 55-59yrs | 17 | 16 | 17 | 50 | **0.4** |
| 60-64yrs | 21 | 36 | 37 | 94 | **0.7** |
| 65-69yrs | 67 | 70 | 66 | 203 | **1.6** |
| 70-74yrs | 138 | 166 | 191 | 495 | **3.8** |
| 75-79yrs | 345 | 477 | 497 | 1319 | **10.2** |
| 80-84yrs | 802 | 952 | 1032 | 2786 | **21.6** |
| 85+ yrs | 2264 | 2759 | 2842 | 7865 | **61.0** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Broad body region** | | | | | |
| head/face/neck | 736 | 881 | 984 | 2601 | **20.2** |
| trunk | 494 | 591 | 690 | 1775 | **13.8** |
| upper extremity | 506 | 628 | 688 | 1822 | **14.1** |
| lower extremity | 1863 | 2293 | 2267 | 6423 | **49.8** |
| multiple body regions | * | * | * | 6 | **0.0** |
| body region not relevant | 6 | 11 | 7 | 24 | **0.2** |
| unspecified body region | 18 | 24 | 20 | 62 | **0.5** |
| missing body region | 51 | 68 | 56 | 175 | **1.4** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Detailed body region** | | | | | |
| head | 707 | 847 | 941 | 2495 | **19.4** |
| neck | 28 | 34 | 42 | 104 | **0.8** |
| thorax | 135 | 160 | 191 | 486 | **3.8** |
| abdomen, lowerback, lumbar spine & pelvis | 359 | 431 | 499 | 1289 | **10.0** |
| shoulder & upper arm | 256 | 359 | 346 | 961 | **7.5** |
| elbow & forearm | 209 | 220 | 273 | 702 | **5.4** |
| wrist & hand | 41 | 49 | 69 | 159 | **1.2** |
| hip & thigh | 1601 | 1990 | 1977 | 5568 | **43.2** |
| knee & lower leg | 231 | 266 | 257 | 754 | **5.9** |
| ankle & foot | 31 | 37 | 33 | 101 | **0.8** |
| multiple body regions | * | * | * | 6 | **0.0** |
| unspecified body region | 18 | 24 | 20 | 62 | **0.5** |
| body region not relevant | 6 | 11 | 7 | 24 | **0.2** |
| missing injury code | 52 | 68 | 47 | 177 | **1.4** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Injury type** | | | | | |
| superficial injury | 328 | 382 | 401 | 1111 | **8.6** |
| open wound | 541 | 586 | 658 | 1785 | **13.9** |
| eye injury- excl foreign body | 10 | 17 | 18 | 45 | **0.3** |
| intracranial injury | 77 | 103 | 120 | 300 | **2.3** |
| burns | * | 0 | * | * | * |

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| early and other complications of trauma | 5 | 5 | 5 | 15 | **0.1** |
| fracture | 2088 | 2579 | 2670 | 7337 | **56.9** |
| complications of surgical & med care NEC | * | 6 | * | 9 | **0.1** |
| dislocation, sprain & strain | 53 | 94 | 80 | 227 | **1.8** |
| injury to nerves & spinal cord | * | * | * | 11 | **0.1** |
| injury to blood vessels | * | 0 | * | * | ***** |
| injury to muscle & tendon | 14 | 7 | 21 | 42 | **0.3** |
| traumatic amputation | 0 | * | 0 | * | ***** |
| other & unspecified injury | 495 | 639 | 671 | 1805 | **14.0** |
| missing injury code | 51 | 68 | 56 | 175 | **1.4** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Length of stay** | | | | | |
| < 2 days | 1423 | 1557 | 1678 | 4658 | **36.1** |
| 2-7 days | 1021 | 1291 | 1294 | 3606 | **28.0** |
| 8-30 days | 1083 | 1377 | 1529 | 3989 | **31.0** |
| 31+ days | 148 | 275 | 212 | 635 | **4.9** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |
| | | | | | |
| **Severity of injury** | | | | | |
| serious injury | 1600 | 2080 | 2123 | 5803 | **45.0** |
| non-serious injury | 2075 | 2420 | 2590 | 7085 | **55.0** |
| | 3675 | 4500 | 4713 | 12888 | **100.0** |

**BEDS**

Trend

Age group rates

Severity

Co-morbidity

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| | | | | | |
| **Gender** | | | | | |
| male | 599 | 624 | 603 | 1826 | 38.7 |
| female | 928 | 990 | 979 | 2897 | 61.3 |
| | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| **Age group** | | | | | |
| 0-4yrs | 116 | 115 | 106 | 337 | 7.1 |
| 5-9yrs | 58 | 61 | 50 | 169 | 3.6 |
| 10-14yrs | 14 | 16 | 15 | 45 | 1.0 |
| 15-19yrs | 6 | * | 6 | 14 | 0.3 |
| 20-24yrs | 5 | 7 | 10 | 22 | 0.5 |
| 25-29yrs | 5 | 5 | 12 | 22 | 0.5 |
| 30-34yrs | 7 | 13 | 8 | 28 | 0.6 |
| 35-39yrs | 12 | 9 | 8 | 29 | 0.6 |
| 40-44yrs | 11 | 11 | 11 | 33 | 0.7 |
| 45-49yrs | 15 | 10 | 16 | 41 | 0.9 |
| 50-54yrs | 25 | 20 | 20 | 65 | 1.4 |
| 55-59yrs | 27 | 32 | 30 | 89 | 1.9 |
| 60-64yrs | 31 | 38 | 40 | 109 | 2.3 |
| 65-69yrs | 53 | 58 | 45 | 156 | 3.3 |
| 70-74yrs | 86 | 98 | 112 | 296 | 6.3 |
| 75-79yrs | 169 | 214 | 194 | 577 | 12.2 |
| 80-84yrs | 300 | 309 | 300 | 909 | 19.2 |
| 85+ yrs | 587 | 596 | 599 | 1782 | 37.7 |
| | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| **Broad body region** | | | | | |
| head/face/neck | 457 | 441 | 427 | 1325 | 28.1 |
| trunk | 181 | 184 | 242 | 607 | 12.9 |
| upper extremity | 331 | 331 | 304 | 966 | 20.5 |
| lower extremity | 496 | 570 | 540 | 1606 | 34.0 |
| multiple body regions | * | * | * | 7 | 0.1 |
| body region not relevant | * | 14 | 8 | 24 | 0.5 |
| unspecified body region | 22 | 22 | 10 | 54 | 1.1 |
| missing body region | 35 | 49 | 50 | 134 | 2.8 |
| | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| **Detailed body region** | | | | | |
| head | 435 | 406 | 393 | 1234 | 26.1 |
| neck | 22 | 35 | 34 | 91 | 1.9 |
| thorax | 70 | 62 | 73 | 205 | 4.3 |
| abdomen, lowerback, lumbar spine & pelvis | 111 | 122 | 169 | 402 | 8.5 |
| shoulder & upper arm | 142 | 142 | 116 | 400 | 8.5 |
| elbow & forearm | 163 | 157 | 155 | 475 | 10.1 |
| wrist & hand | 26 | 32 | 33 | 91 | 1.9 |
| hip & thigh | 365 | 442 | 391 | 1198 | 25.4 |
| knee & lower leg | 109 | 109 | 123 | 341 | 7.2 |
| ankle & foot | 22 | 19 | 25 | 66 | 1.4 |
| multiple body regions | * | * | * | 7 | 0.1 |
| unspecified body region | 22 | 22 | 10 | 54 | 1.1 |
| body region not relevant | * | 14 | 9 | 25 | 0.5 |
| missing injury code | 35 | 49 | 50 | 134 | 2.8 |
| | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| **Injury type** | | | | | |
| superficial injury | 209 | 210 | 193 | 612 | 13.0 |
| open wound | 291 | 300 | 303 | 894 | 18.9 |
| eye injury- excl foreign body | * | 5 | 6 | 13 | 0.3 |

| | 02/03 | 03/04 | 04/05 | ALL | % |
|---|---|---|---|---|---|
| intracranial injury | 55 | 45 | 33 | 133 | 2.8 |
| injury to internal organs | 5 | * | * | 9 | 0.2 |
| burns | 0 | 0 | * | * | * |
| other & unspec effects of ext causes | 0 | * | 0 | * | * |
| early and other complications of trauma | * | 8 | 7 | 16 | 0.3 |
| fracture | 645 | 682 | 650 | 1977 | 41.9 |
| complications of surgical & med care NEC | * | * | * | * | * |
| sequelae of injuries, poisoning & ext cause | 0 | * | 0 | * | * |
| dislocation, sprain & strain | 36 | 41 | 42 | 119 | 2.5 |
| injury to nerves & spinal cord | * | 5 | 5 | 13 | 0.3 |
| injury to blood vessels | 0 | 0 | * | * | * |
| injury to muscle & tendon | 7 | 11 | 7 | 25 | 0.5 |
| other & unspecified injury | 237 | 250 | 281 | 768 | 16.3 |
| missing injury code | 35 | 49 | 50 | 134 | 2.8 |
| | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| **Location** | 659 | 699 | 697 | 2055 | 43.5 |
| Home | 389 | 457 | 479 | 1325 | 28.1 |
| Residential Institution | 475 | 454 | 406 | 1335 | 28.3 |
| School, public buildings | 0 | * | 0 | * | * |
| Sports & athletic areas | * | * | 0 | 7 | 0.1 |
| Trade & service area | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| | | | | | |
| **Detailed location** | 659 | 699 | 697 | 2055 | 43.5 |
| Other and unspecified place in home | * | * | * | 5 | 0.1 |
| Residential institution prison | 0 | 0 | * | * | * |
| Residential inst juvnle detention centre | * | 0 | 0 | * | * |
| Residential institution, military camp | 375 | 446 | 461 | 1282 | 27.1 |
| Residential inst aged care facilities | 11 | 6 | 16 | 33 | 0.7 |
| Other specified residential institution | 0 | * | 0 | * | * |
| Unspecified residential institution | * | * | 0 | * | * |
| School | 459 | 449 | 404 | 1312 | 27.8 |
| Health service area | 14 | * | * | 19 | 0.4 |
| Oth spec institution & public admin area | 0 | * | 0 | * | * |
| Sporting hall-indoor | * | 0 | 0 | * | * |
| Trade and service area, shop and store | * | * | 0 | * | * |
| Trade service area café hotel restaurant | * | * | 0 | * | * |
| Other specified trade and service area | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| | | | | | |
| **Length of stay** | 572 | 525 | 546 | 1643 | 34.8 |
| < 2 days | 362 | 396 | 383 | 1141 | 24.2 |
| 2-7 days | 465 | 535 | 541 | 1541 | 32.6 |
| 8-30 days | 128 | 158 | 112 | 398 | 8.4 |
| 31+ days | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |
| | | | | | |
| **Severity of injury** | 405 | 459 | 407 | 1271 | 26.9 |
| serious injury | 1122 | 1155 | 1175 | 3452 | 73.1 |
| non-serious injury | 1527 | 1614 | 1582 | 4723 | 100.0 |
| | | | | | |

# APPENDIX 5 EXPERT PANEL

Brian Ashe (Manager, Major Projects and Research, ABCB - Chair)

Ivan Donaldson (General Manager, ABCB)

Megumi Hata (Project Officer, ABCB)

Neil Evans (National Director, Technical and Regulatory Policy, Master Builders Australia)

David Hallett (General Manager, Business Development & Delivery
Archicentre)

Tom Fisher (Federal Safety Commissioner, Office of the Federal Safety Commissioner)

Andrea Novak (Office of the Federal Safety Commissioner)

Rod Johnson (Association of Consulting Engineers/Electronic Blueprint)

Ken Gordon (Building Designers Association of Australia)

Stephen Greenwood (Assistant Director Technical Services, Housing Industry Association)

Joan Ozanne-Smith (Principal Research Fellow, MUARC)

Jonathon Guy (Research Assistant, MUARC)

Mary Kelly (Public Health Trainee, MUARC