Australian Government
Australian Institute of Health and Welfare

Hospitalisations due to falls by older people, Australia 2006–07

Flinders UNIVERSITY

INJURY RESEARCH AND STATISTICS SERIES NUMBER 57

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Authoritative information and statistics to promote better health and wellbeing

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Hospitalisations due to falls by older people, Australia

2006–07

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AR-DRG	Australian Refined Diagnosis Related Group
ASGC	Australian Standard Geographical Classification
DoHA	Australian Government Department of Health and Ageing
ICISS	ICD-based injury severity score
MDC	Major Diagnostic Category
NHCDC	National Hospital Cost Data Collection
NHMD	National Hospital Morbidity Database
NISU	National Injury Surveillance Unit

Symbols

n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data
CI	confidence interval
SD	standard deviation
SE	standard error

Summary

This report is the third in a series of reports on hospitalisations due to falls by older people in Australia. The report focuses on hospitalised falls that occurred in the financial year 2006–07 and examines trends in fall-related hospitalisations over the period 1999–2007.

Hospitalised falls 2006–07

- The estimated number of hospitalised injury cases due to falls in people aged 65 and over was 71,750, nearly 5,000 more cases than identified in 2005–06.
- The age-standardised rate of fall injury cases for older people (2,503 per 100,000 population) also rose compared with that for 2005–06 (2,415 per 100,000).
- As in previous reports, females accounted for most of the hospitalised fall injury cases and a third of all cases had injuries to the hip and thigh.
- A fall on the same level, due to slipping, tripping and stumbling, was the most common cause of a hospitalised fall.
- The home was the most common place of occurrence for serious falls, followed by aged care facilities. Together, these places accounted for 70% of hospitalised falls. Older people who lived in aged care facilities had a rate of falls five times as high as that for people of the same age who lived in the community and fell in their home.
- Episodes of hospital care that were directly attributable to injuries due to falls accounted for nearly 1.2 million patient days in 2006–07. The average total length of stay per fall injury case was estimated to be 16.3 days.
- Acute episodes of hospital care attributable to fall injuries in 2006–07 were estimated to have cost more than $600 million.

Trends in hospitalised fall-related injury 1999–2007

- This analysis confirms the work presented in the previous edition of this series; age-standardised rates of hospitalised fall-related injury separations increased over the eight year study period to June 2007, despite a decrease in the rate for hip fractures due to falls.
- Although lower overall, rates of falls involving males increased faster than those for females. Rates of hip fracture also increased for male residents of aged care facilities.
- Falls resulting in head injuries increased substantially, as did falls described as 'other falls on the same level'. These observations may be pertinent to the future development of prevention interventions.

As discussed in the previous edition of this series, this report again demonstrates the weakness of commonly used methods for measuring the incidence of serious falls and associated hospital care from current administrative data. Better measurement, especially of trends, requires a method that takes account of all episodes of hospital care for a person who has suffered injuries due to a fall.

1 Introduction

This report is the third in a series on hospitalisations due to falls by people aged 65 and older in Australia. The two earlier reports analysed hospitalised falls in the financial years 2003–04 (Bradley & Harrison 2007) and 2005–06 (Bradley & Pointer 2008). The present report uses hospital separations data from the National Hospital Morbidity Database (NHMD) to describe fall-related hospitalisations in the financial year 2006–07 and to present results of trends analyses for the period 1999–2007.

Falls are common among older people and often result in fractures or other serious injuries (Gillespie et al. 2009; Lord et al. 2001; Tinetti et al. 1988). They may have substantial impacts on the older person's health and well-being and may result in loss of independence and admission to residential care (for example; Chang et al. 2004; Clemson et al. 2008; Rubenstein 2006). The Australian Institute of Health and Welfare (AIHW) has estimated that between 21% and 23% of Australians aged 65 and older who separated from hospital due to an injurious fall in 2001–02 (and left hospital alive) went to residential aged care immediately on leaving hospital. Of these, about 20% were new admissions into permanent care and about 10% were admissions into respite (that is, short-term) residential care (Karmel et al. 2008).

In Australia, an estimated one in three older people living at home experiences a fall annually (for example; Dolinis et al. 1997; Lord et al. 1993; Morris et al. 2004) and about three-quarters of all hospitalised injuries involving older Australians are due to falls (for example; Bradley & Harrison 2008). Rates of falls increase with age (see Sattin 1992) and additional risk factors for falls and fall-related injury include gender, medication use and predisposing medical conditions including Parkinson's disease, osteoporosis and vision problems (for example; Cumming 1998; Lord 2006; Lord et al. 2001; Wood et al. 2002). Social, and socio-economic, factors can also affect the risk of falls for older people (Dolinis et al. 1997; Gill et al. 2005; West et al. 2004). Importantly, having had one fall is a risk factor for future falls (for example; Pluijm et al. 2006) and the development of a fear of falling, which may result in a reduction in activity levels, can also increase falls risk (Rubenstein 2006).

A substantial proportion of injurious falls involving older people result in hospitalisation (for example; Lord et al. 1993; Sattin et al. 1990; Tinetti et al. 1988) and the cost to the health system of serious fall-related injuries is considerable (Hall & Hendrie 2003; Mathers & Penm 1999). Our 2003–04 falls report estimated the total cost of fall-related acute episodes of hospital care for older people at $566.0 million (Bradley & Harrison 2007). Further, estimates of the costs associated with injurious falls which include 'lifetime' costs (that is, indirect costs such as lost production due to incapacitation or premature death or costs borne by the family or community) exceed $1 billion per year (Moller 1998; see also Potter-Forbes & Aisbett 2003).

This report

This report examines all NHMD records for people aged 65 and older that included both an injury diagnosis (S00–T75 or T79) and an external cause code signifying an unintentional fall (W00–W19) for the financial year 2006–07. These codes could appear anywhere within the record (that is, analysis was not restricted to records which had a principal diagnosis indicating that the injury was the primary reason for the episode of hospital care).

Two major aspects of hospitalised fall-related injury are discussed:

1. the annual incidence of new cases and
2. the burden to the hospital system (that is, the patient days attributed to fall-related episodes of care and the estimated cost of this care).

Chapter Two presents the estimated annual incidence of fall events resulting in injury and hospitalisation in 2006–07 for people aged 65 and older while Chapter Three describes the characteristics of these cases, including the mechanism and circumstances of the event.

Chapter Four discusses the burden to the hospital system due to fall-related episodes of admitted patient care. The section provides a brief description of a set of separations omitted from Chapters Two and Three; the hospital records that meet our definition of an incident case, but have been generated through an admitted patient's being transferred from one hospital to another ('inward transfers'). Including these separations in incidence estimates would result in the multiple counting of some injurious fall events. Chapter Four also presents estimates of additional hospital episodes involving fall-related injuries for people aged 65 and older in 2006–07, primarily care that can be characterised as 'fall-related follow-up care'.

Continuing our assessment of the burden to the hospital system due to injurious falls by older Australians, Chapter Five presents a short analysis of the length of stay for fall-related episodes of care while Chapter Six provides an estimate of the cost to the hospital system for fall-related care. This cost estimate is akin to that presented in the 2003–04 report (Bradley & Harrison 2007); however, availability of cost weight data correct for the sector in which the care was provided (that is, public versus private) for 2006–07 now allows a more accurate assessment of cost.

For the first time in the series, the present report also includes analysis of another type of fall-related hospital record: those separations coded with the diagnosis R29.6 (tendency to fall, not elsewhere classified; Chapter Seven). As the nature of these separations, and their relationship to injurious falls, is not fully understood, these 'tendency to fall' records have not been included in the analyses of the burden on the hospital system due to falls but are analysed separately.

Chapter Eight presents a more detailed analysis of rates of fall-related hospitalisations over time than that included in our previous report in the series (Bradley & Pointer 2008). Trends in fall-related hospitalisations for the eight-year period 1999–2007 are assessed, including analyses by injury type and external cause.

Unlike previous reports in the series, this report does not analyse interventions or procedures undertaken during the fall-related hospitalisations.

Confidence intervals around single estimates are provided in some figures to show non-sampling variation. Confidence intervals are also provided for estimated trends in rates, which are also subject to non-sampling variation. In both instances, variation can be large when case numbers are small. Further information is provided in Data Issues.

2 Fall injury incidence

This chapter presents the estimated annual incidence of fall events resulting in injury and hospitalisation in 2006–07 for people aged 65 and older.

During 2006–07, over 2.7 million hospital separations in Australia were generated by people who were aged 65 and older (AIHW 2008a). Of these, 104,196 (3.8%) had a principal diagnosis in the range S00–T75 or T79, denoting community injury (that is, excluding injuries sustained in the context of surgical and medical care, such as complications or sequelae). More than three-quarters of these injury separations (77.1%, *n* = 80,364) also had a first external cause code in the range W00–W19, denoting an unintentional fall (Table 1).

The number of new cases of fall-related injury resulting in hospitalisation is difficult to estimate, due to certain limitations of data available at a national level. The incidence of injury events resulting in hospitalisation can be estimated from the NHMD by excluding any separation meeting the specified selection criteria that also has a mode of admission denoting 'transfer from another acute hospital' (see Data issues chapter). This method accounts for transfers between hospitals but not readmissions, if these are also recorded as injury cases due to a fall.

Calculated in this way, the estimated number of hospitalised injury cases due to falls in people aged 65 and over in 2006–07 was 71,746—a rise of 4,962 (7.4%) since the previous year (see Bradley & Pointer 2008). These 71,746 fall injury cases represent 2.6% of all hospital separations for the population aged 65 and older in 2006–07 (Table 2.1).

Table 2.1: Key indicators for hospital separations of people aged 65+, Australia 2006–07

Key indicators	Males	Females	Persons[(b)]
All hospital separations 2006–07, aged 65 + years[(a)]	1,404,525	1,324,576	2,729,145
Principal diagnosis S00–T75 or T79	35,300	68,893	104,196
Principal diagnosis S00–T75 or T79 and external cause W00–W19	23,965	56,396	80,364
Estimated fall injury cases	21,348	50,396	71,746
As percentage of all hospital separations aged 65+	1.5%	3.8%	2.6%
As percentage of all S00–T75 or T79 separations aged 65+	60.5%	73.2%	68.9%
Mean length of stay for fall injury cases: days (SD)	7.4 (9.9)	7.6 (10.2)	7.5 (10.2)
Total patient days, fall injury cases	156,952	382,999	539,973
As percentage of all hospital patient days aged 65+	2.8%	6.0%	4.5%

(a) Data source: Australian hospital statistics 2006–07 (AIHW 2008a).

(b) Persons totals include separations for which sex was not reported.

The age-standardised rate of fall injury cases for people aged 65 and older in 2006–07 was 2,503 per 100,000 population. Again, this is a higher figure than that estimated for 2005–06 (Bradley & Pointer 2008). The increasing rate of hospitalised fall injuries since 1999–00 is discussed further in Chapter Six.

Age and sex

Females aged 65 and older sustained a greater number of hospitalised fall injuries than males, constituting 70.2% of the cases in 2006–07 (n = 50,396). The age-standardised rate of hospitalised falls for females aged 65 and older was higher than the equivalent rate for males in the same age range: 2,947 per 100,000 population compared with 1,882 per 100,000. This represents a male:female (M:F) rate ratio of 0.6 hospitalised falls for males for every 1.0 female case.

Further, the females aged 65 and older hospitalised due to an injurious fall were significantly older than the males who were similarly hospitalised (Mann Whitney U test, $p < 0.001$). The mean age of females hospitalised due to an injurious fall was 82.3 years (± 7.9 SD) while the mean age of males was 80.4 years (± 7.9 SD. All persons: 81.8 years ± 7.9 SD).

Age-specific rates of fall injury cases increase markedly with age. In 2006–07 the highest rate observed for hospitalised cases was for the 95 and older age group; 12,824 cases per 100,000 population. Figure 2.1 describes the age-specific rates of fall injury cases for males and females aged 65 and older; the rate for females was greater than that for males in all age groups. This difference was greatest for people aged 75–79, for whom the M:F rate ratio was 0.56 to 1.00 (that is, only about half the rate of falls involving males than those involving females). For people aged 95 and older, however, this difference was the least, with a M:F ratio of 0.85 to 1.00 (that is, almost equal rates of falls for both males and females).

Figure 2.1 demonstrates that the rate of serious falls was substantially higher above the age of 75 for both sexes. While convention maintains that fall injury indicators include all people aged 65 and older, following Pointer et al. (2003) we also present age-standardised rates of fall injury cases specifically for the population 75 and older; in this older aged population, the rate was almost double that for the population aged 65 and older (4,283 per 100,000 persons).

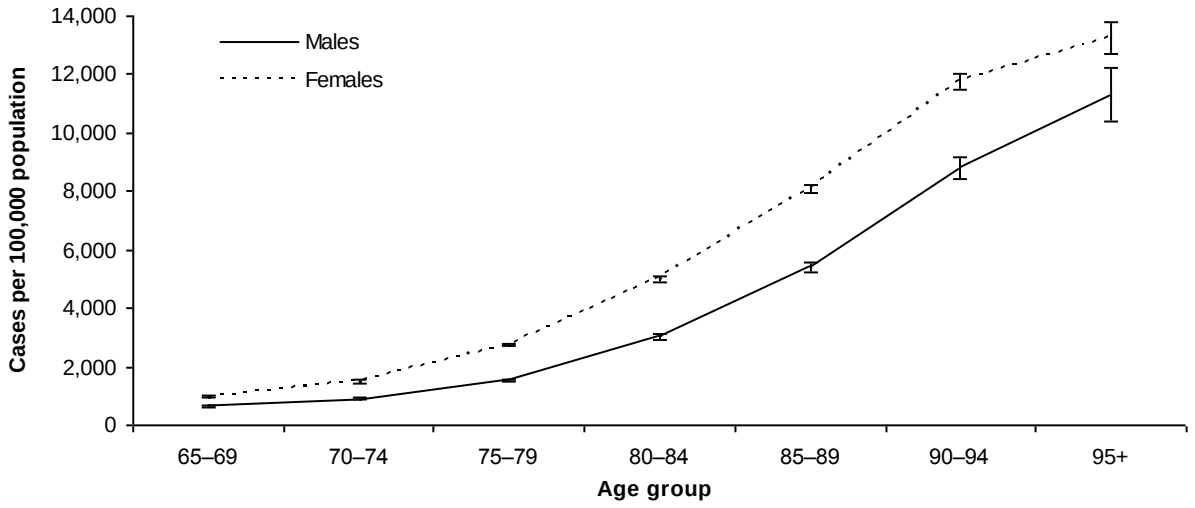


Figure 2.1: Age-specific rates of fall injury cases (± 95% CI); males and females aged 65+, Australia 2006–07

Injury type

As in previous years, the largest proportion of fall injury cases for both males and females resulted in injuries to the hip and thigh (Table 2.2). Fractures of the neck of the femur (also called 'hip fractures'; cases with a principal diagnosis of S72.0–S72.2) accounted for most injuries to the hip and thigh. A higher proportion of cases involving females resulted in injuries to the hip and thigh, and fractures of the neck of the femur, than for males. The proportion of persons with a principal diagnosis of an injury to the hip and thigh in 2006–07 was slightly lower than that in previous years (30.3%, compared with 31.1% in 2005–06 and 33.5% in 2003–04).

Injuries to the head were the second most common principal diagnosis for both males and females, constituting 18.0% of all fall cases—a slight rise in proportion compared with previous years. As observed previously, however, the proportion of males who suffered head injuries was much higher (24.3%) than for females (15.4%).

Table 2.2: Principal diagnosis injury types for fall injury cases; males, females and persons aged 65+, Australia 2006–07

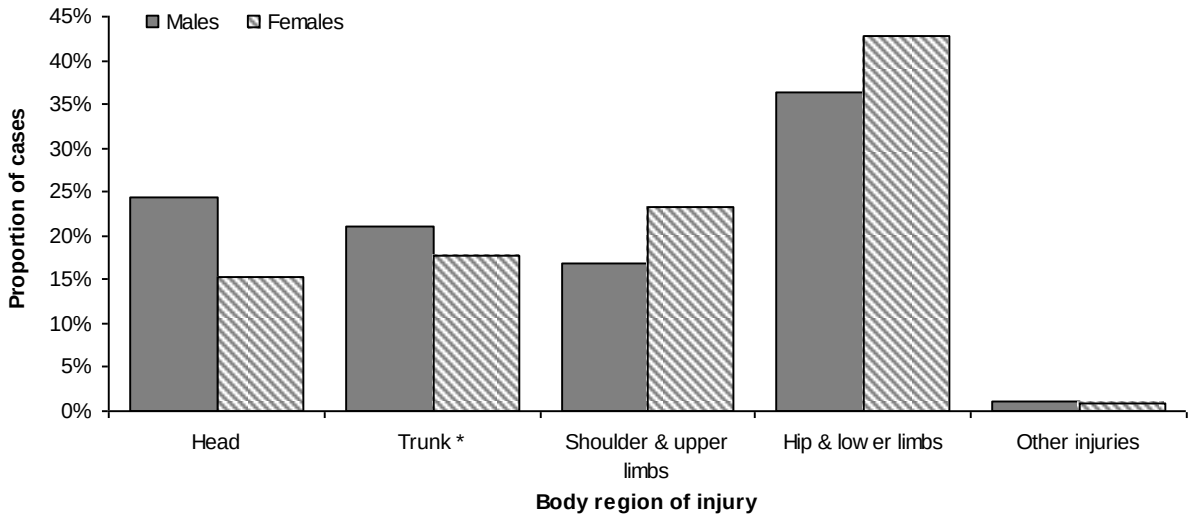
Principal diagnosis	Males	Females	Persons*
Injuries to the head	5,192 (24.3%)	7,745 (15.4%)	12,937 (18.0%)
Injuries to the neck	389 (1.8%)	489 (1.0%)	878 (1.2%)
Injuries to the thorax	1,987 (9.3%)	2,575 (5.1%)	4,562 (6.4%)
Injuries to the abdomen, lower back, lumbar spine and pelvis	2,129 (10.0%)	5,831 (11.6%)	7,960 (11.1%)
Injuries to the shoulder and upper arm	1,788 (8.4%)	5,101 (10.1%)	6,891 (9.6%)
Injuries to the elbow and forearm	1,265 (5.9%)	5,802 (11.5%)	7,067 (9.9%)
Injuries to the wrist and hand	564 (2.6%)	839 (1.7%)	1,403 (2.0%)
Fractured neck of femur	4,461 (20.9%)	12,027 (23.9%)	16,488 (23.0%)
Other hip and thigh injuries	1,439 (6.7%)	3,814 (7.6%)	5,253 (7.3%)
Total injuries to the hip and thigh	*5,900 (27.6%)*	*15,841 (31.4%)*	*21,741 (30.3%)*
Injuries to the knee and lower leg	1,616 (7.6%)	5,031 (10.0%)	6,647 (9.3%)
Injuries to the ankle and foot	261 (1.2%)	688 (1.4%)	949 (1.3%)
Injuries involving multiple body regions	27 (0.1%)	36 (0.1%)	63 (0.1%)
Injuries to unspecified parts of trunk, limb or body region	156 (0.7%)	307 (0.6%)	463 (0.6%)
Burns	n.p. (0.0%)	n.p. (0.0%)	n.p. (0.0%)
Poisoning by drugs, medicaments and biological substances	n.p. (0.0%)	n.p. (0.0%)	n.p. (0.0%)
Other and unspecified effects of external causes	7 (0.0%)	13 (0.0%)	20 (0.0%)
Certain early complications of trauma	65 (0.3%)	95 (0.2%)	160 (0.2%)
Total	**21,348 (100%)**	**50,396 (100%)**	**71,746 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Persons includes two cases for which sex was not reported.

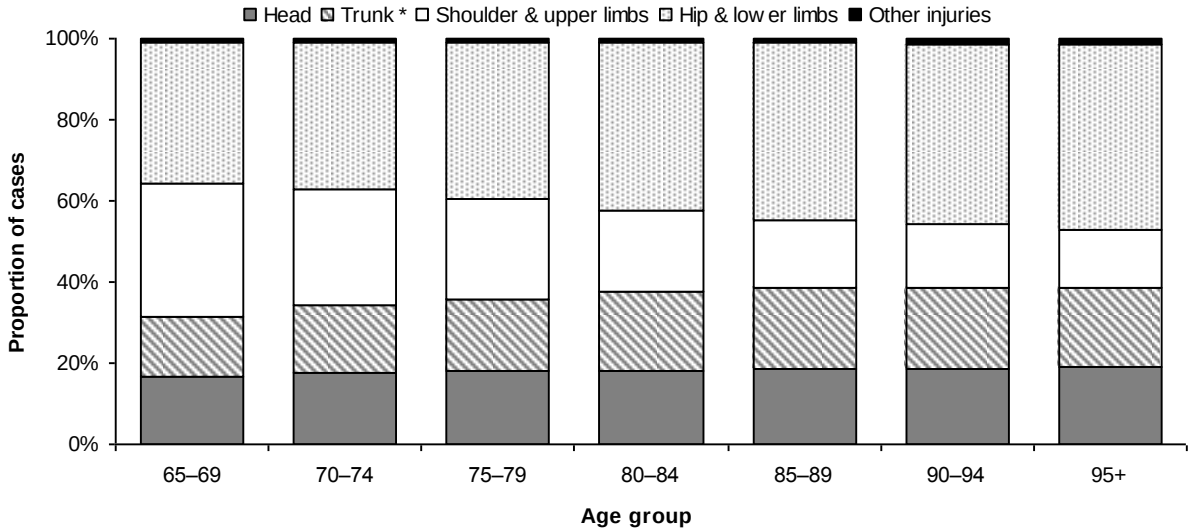
Figure 2.2 highlights the differences in the types of injury sustained by males and females aged 65 and older in 2006–07; males sustained proportionately more injuries to the head and trunk regions while females sustained proportionately more injuries to the shoulder and upper limbs and the hip and lower limbs. Figure 2.3 describes the body region injured for falls injury cases according to age. Of most interest, the proportion of injuries to the shoulder

and upper limbs declined with increasing age while the proportion of injuries to the hip and lower limbs increased.



*Trunk includes neck, thorax, abdomen, lower back, lumbar spine & pelvis.

Figure 2.2: Major body region injured according to the principal diagnosis for fall injury cases; males and females aged 65+, Australia 2006–07



*Trunk includes neck, thorax, abdomen, lower back, lumbar spine and pelvis.

Figure 2.3: Major body region injured according to the principal diagnosis by age; fall injury cases involving people aged 65+, Australia 2006–07

Fractures

Two thirds (62.7%, *n* = 44,955) of people aged 65 and older hospitalised due to an injurious fall in 2006–07 sustained at least one fracture, a slight decrease from the proportion observed in previous years (Bradley & Harrison 2007; Bradley & Pointer 2008). The number of fractures present in the multiple diagnosis fields of the case separations in 2006–07 ranged from 0 (37.3%, *n* = 26,791) to 17 (*n* = 1). Most people hospitalised due to a fall injury sustained a single fracture (55.0%, *n* = 39,464) and a higher proportion of females sustained fractures compared with males (66.2% versus 54.4%, respectively).

While the rate of hospitalised fall injury cases involving fractures increased with age (Figure 2.4, a similar pattern to that for fall injury itself), fracture cases represented a decreasing proportion of all fall injury cases as age increased. This age-related decrease was largely driven by decreases in the proportion of fracture-related falls injuries involving females, as the proportion of cases involving fractures remained fairly consistent for males (Figure 2.5).

Fall cases with a principal diagnosis denoting injuries to the elbow and forearm and injuries to the hip and thigh had the largest proportion of fractures present among the diagnoses; 83.9% (*n* = 5,927) and 82.9% (*n* = 18,024), respectively, see Table 2.3. Injuries to the hip and thigh accounted for the greatest proportion of all fracture-related fall injury cases, about two in every five such injuries (40.1%). The vast majority of these hip and thigh cases (91.5%) had a principal diagnosis of fractured neck of femur.

Fracture-related fall injury cases which had a principal diagnosis of fractured neck of femur (*n* = 16,488, see Table 2.3 above) occurred at an age-standardised rate of 567 per 100,000 in 2006–07. Females had a higher rate of fall-related fractured neck of femur (677 cases per 100,000) than males (405 per 100,000). Age-specific rates of fall-related fractured neck of femur injuries were highest for people aged 95 and older; 3,814 per 100,000 population, compared with 92 per 100,000 for people aged 65–74.

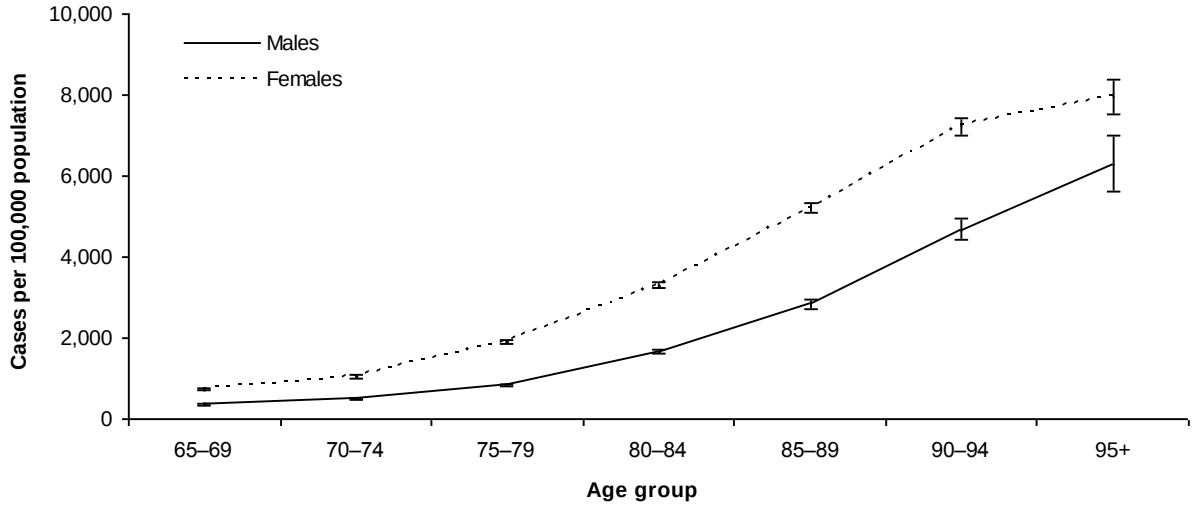


Figure 2.4: Age-specific rates of fall injury cases having one or more fracture diagnosis (± 95% CI); males and females aged 65+, Australia 2006–07

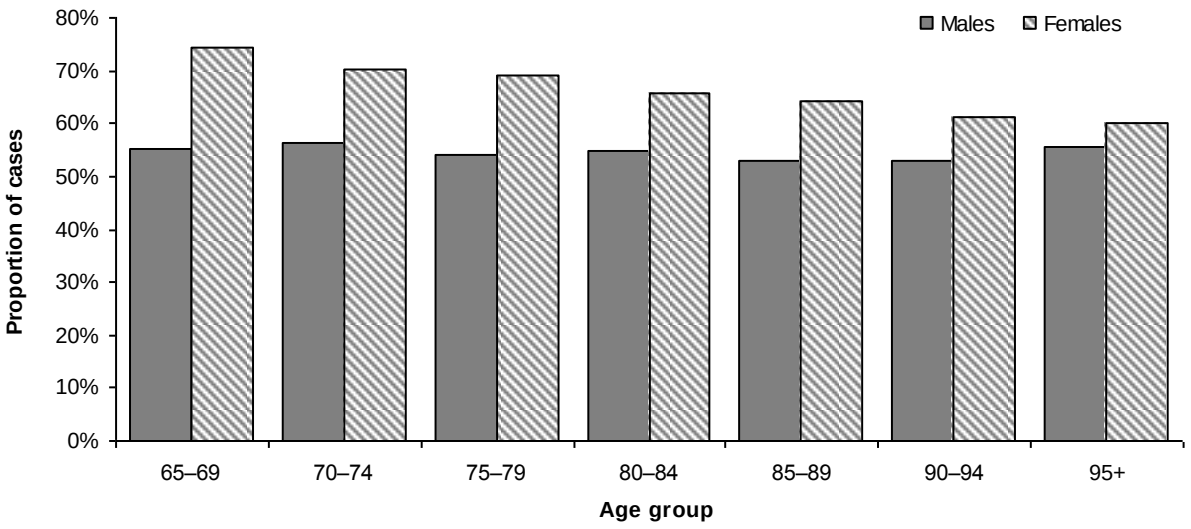


Figure 2.5: Fall injury cases having one or more fracture diagnosis as a proportion of the total number of hospitalised cases; males and females aged 65+, Australia 2006–07

Table 2.3: Principal diagnosis injury type for fall injury cases involving fractures; males, females and persons aged 65+, Australia 2006–07

Principal diagnosis	Males	Females	Persons*	Per cent of case type
Injuries to the head	791 (6.8%)	1,117 (3.3%)	1,908 (4.2%)	14.7%
Injuries to the neck	221 (1.9%)	285 (0.9%)	506 (1.1%)	57.6%
Injuries to the thorax	1,537 (13.2%)	1,906 (5.7%)	3,443 (7.7%)	75.5%
Injuries to the abdomen, lower back, lumbar spine and pelvis	1,316 (11.3%)	4,231 (12.7%)	5,547 (12.3%)	69.7%
Injuries to the shoulder and upper arm	1,043 (9.0%)	3,794 (11.4%)	4,838 (10.8%)	70.2%
Injuries to the elbow and forearm	756 (6.5%)	5,171 (15.5%)	5,927 (13.2%)	83.9%
Injuries to the wrist and hand	216 (1.9%)	429 (1.3%)	645 (1.4%)	46.0%
Fractured neck of femur	4,461 (38.4%)	12,027 (36.1%)	16,488 (36.7%)	100.0%
Other hip and thigh injuries	329 (2.8%)	1,207 (3.6%)	1,536 (3.4%)	29.2%
Total injuries to the hip and thigh	*4,790 (41.3%)*	*13,234 (39.7%)*	*18,024 (40.1%)*	*82.9%*
Injuries to the knee and lower leg	794 (6.8%)	2,825 (8.5%)	3,619 (8.1%)	54.4%
Injuries to the ankle and foot	129 (1.1%)	338 (1.0%)	467 (1.0%)	49.2%
Other diagnoses	10 (0.1%)	21 (0.1%)	31 (0.1%)	4.5%
Total	**11,603 (100%)**	**33,351 (100%)**	**44,955 (100%)**	

* Persons includes two cases for which sex was not reported.

Severity

An ICD-based injury severity score (ICISS) of less than 0.941 is considered to represent a high threat to life (see Henley & Harrison 2009; Stephenson et al. 2003). On the basis of the injury diagnoses contained within the records for all fall injury cases, not just fracture cases, the average ICISS score (multiplicative method) was 0.939 (± 0.077 SD).

Geographical distribution

State or territory of usual residence

Age-standardised rates of hospitalised fall injury cases for people aged 65 and older in 2006–07 varied according to the jurisdiction of the person's usual residence (Figure 2.6). Older residents of Queensland, Western Australia, South Australia and Tasmania all had rates of hospitalised fall injuries that were lower than that for Australia as a whole. Conversely, older residents of New South Wales and Victoria had rates that were higher than that for Australia as a whole. This is a similar pattern to that observed in 2003–04 (Bradley & Harrison 2007).

Rates of hospitalised fall injuries involving females aged 65 and older in 2006–07 were substantially higher than those for males in all jurisdictions. The highest age-standardised rate for females was observed for Victoria (3,226 per 100,000 population) and the lowest for Tasmania (2,327 per 100,000). For males, the highest rate observed was for New South Wales (2,048 per 100,000) and, as for females, the lowest for Tasmania (1,280 per 100,000).

Age-standardised rates of hip fractures (principal diagnoses S72.0–S72.2) varied to a lesser degree by jurisdiction of residence than all fall injury cases (Figure 2.7). For most jurisdictions, 95% confidence intervals for the rates crossed, or approached, the national rate, suggesting that there is not a substantial difference between these rates of hospitalised hip fractures. The pattern of rates of hip fracture across the jurisdictions does not closely reflect that for all hospitalised falls (that is, Figure 2.6).

Similar to all fall cases, rates of hospitalised hip fractures for females aged 65 and older in 2006–07 were higher than those for males in all jurisdictions except the Northern Territory (largely due to small case numbers).

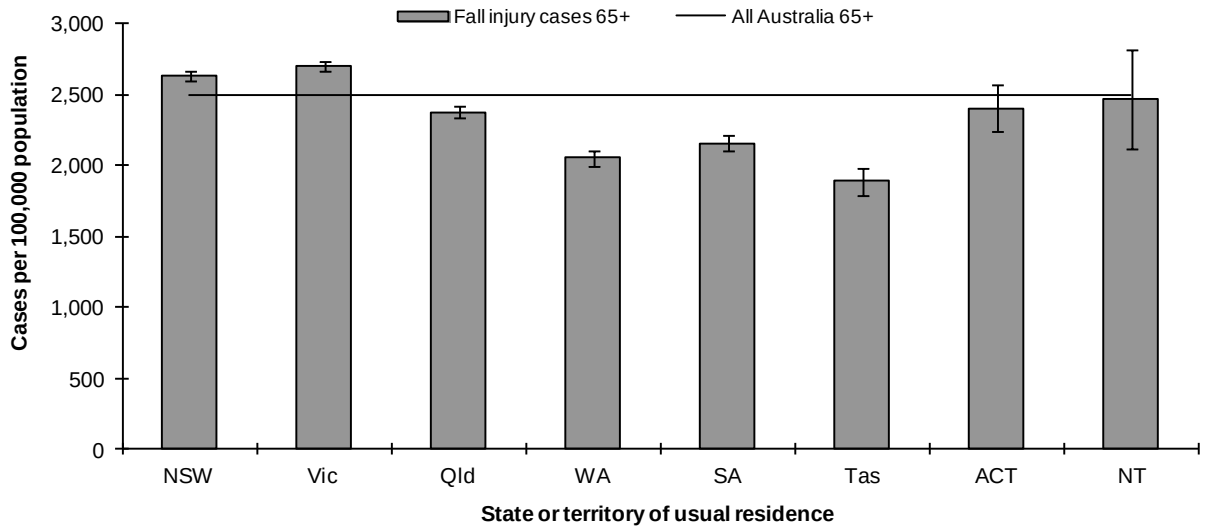


Figure 2.6: Age-standardised rates of fall injury cases (± 95% CI) by state of usual residence, persons aged 65+ 2006–07

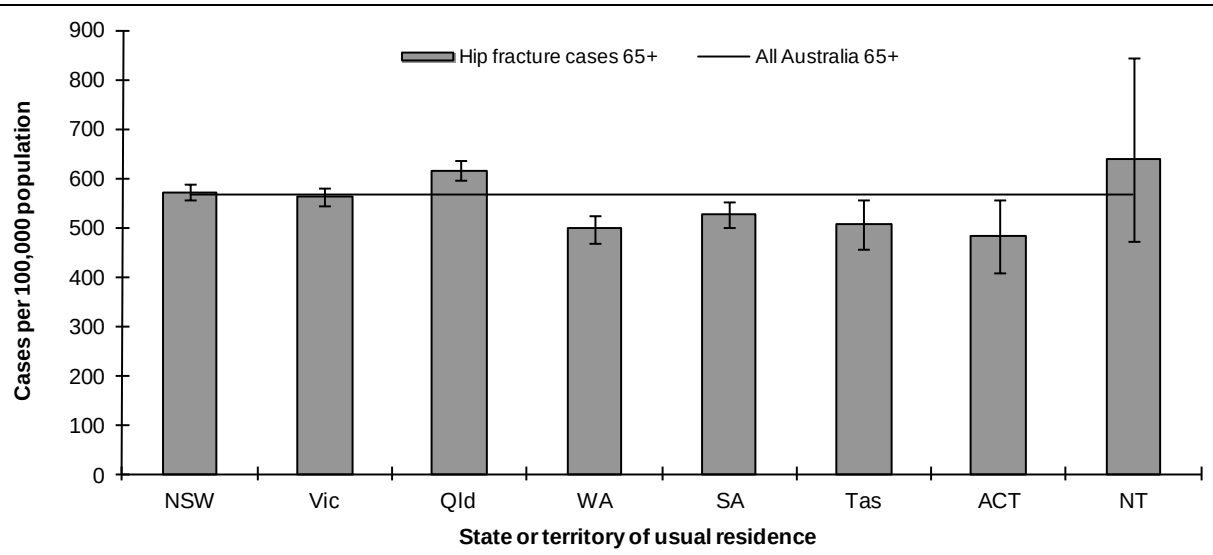


Figure 2.7: Age-standardised rates of hip fracture cases (± 95% CI) by state of usual residence, persons aged 65+ 2006–07

Remoteness of usual residence

Age-standardised rates of hospitalised falls involving people aged 65 and older were calculated according to the Australian Standard Geographical Classification of the remoteness of the place of usual residence (see ABS 2007). Rates were quite similar for all remoteness zones except for people whose recorded place of residence was classified as *Very remote* (Figure 2.8). The rate of hospitalised fall injuries involving residents of *Major cities* was higher than that for the whole of the nation (2,555 per 100,000 population) while the rates of falls for residents of *Inner regional* and *Very remote* areas (2,325 and 2,004 per 100,000, respectively) were lower than the national rate.

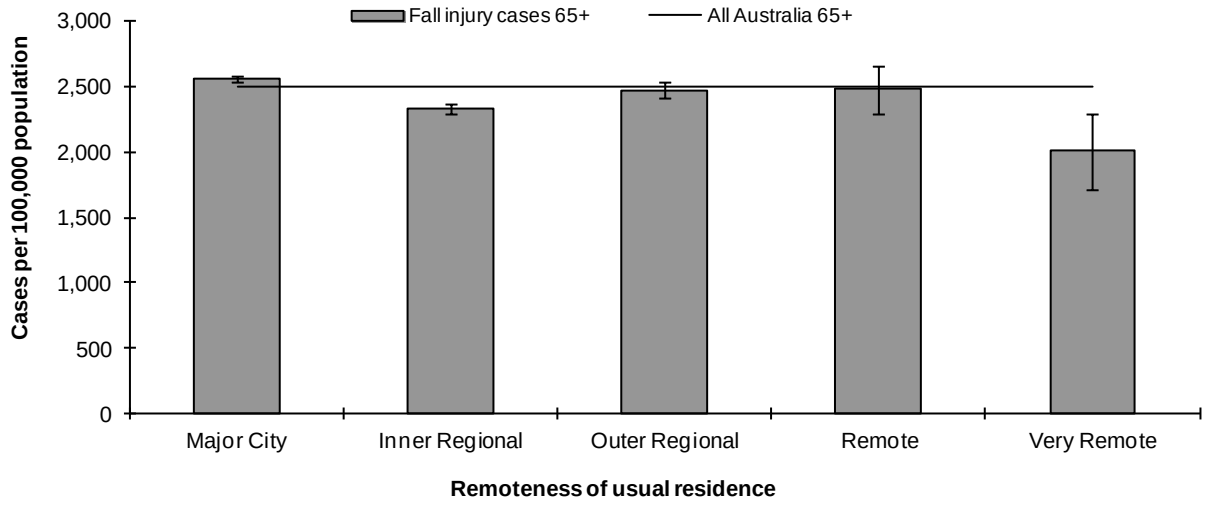


Figure 2.8: Age-standardised rates of fall injury cases (± 95% CI) by remoteness of usual residence, persons aged 65+ 2006–07

As in previous years, rates of falls increased with age similar to that for all fall injuries for all remoteness regions other than for residents of Australia's *Very remote* areas (Figure 2.9). The lack of a strong association between remoteness and hospitalised fall injury is noteworthy because a positive association has been found for other types of injury cases (for example; Bradley & Harrison 2008) but the reason or reasons for the sharp difference between the *Very remote* region and all other regions are not clear. Possible explanations include misclassification of place of residence for older people in either the hospital or population data, an increased likelihood that only the most healthy, robust older people remain resident in more remote areas (a 'survivor effect'), or an increased likelihood that falls in *Very remote* locations may result in the person's death before they can reach hospital (a 'non-survivor effect').

The rates of hospitalised hip fractures (principal diagnoses S72.0– S72.2) show a different pattern to that for all fall injury cases (see Figure 2.10). For hip fractures, the highest rate is observed for residents of *Outer regional* areas (614 per 100,000 population). Given the severity of this type of injury, this finding is not easily explained by a greater likelihood of admission.

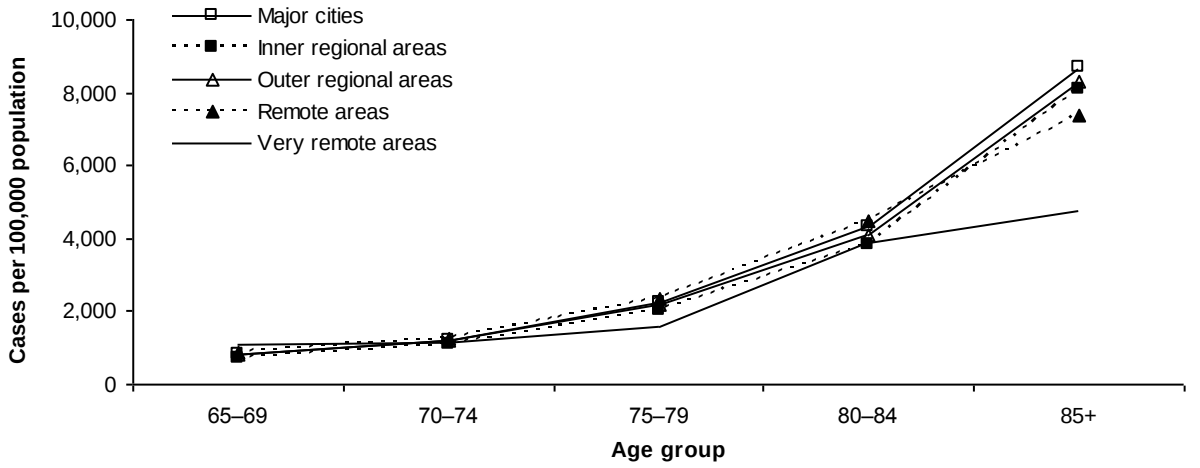


Figure 2.9: Age-specific rates of fall injury cases by remoteness of usual residence, persons aged 65+ 2006–07

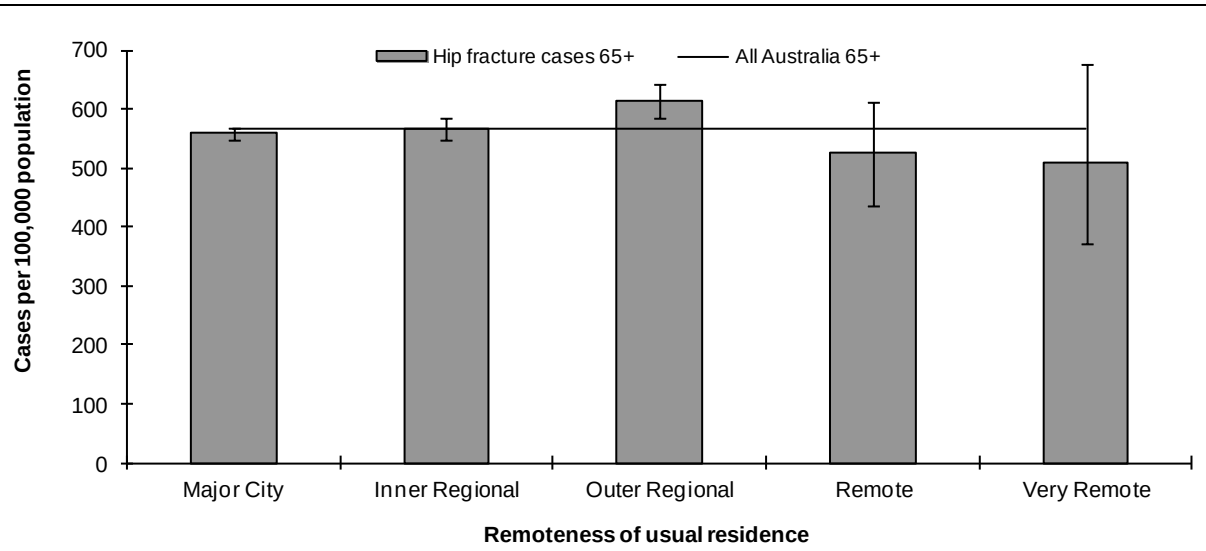


Figure 2.10: Age-standardised rates of hip fracture cases (± 95% CI) by remoteness of usual residence, persons aged 65+ 2006–07

3 Circumstances of fall injury cases

This chapter describes the circumstances of occurrence of the hospitalised fall injury cases for people aged 65 and older in 2006–07 (those included in Chapter 2).

July 2006 marked the introduction of the fifth edition of the ICD-10-AM (NCCH 2006). In this edition, additional fourth-character categories were introduced to some fall external cause codes W00–W19. Specifically, the (three-character) codes affected were W02 (falls involving pedestrian conveyances), W06 (falls involving beds), W07 (falls involving chairs), W08 (falls involving other furniture), W13 (falls from, out of or through building structures) and W18 (other falls on the same level). As an example, W18 now includes five fourth-character codes to describe falls from bumping against an object, falls from or off a toilet, falls in or into baths or showers, other specified falls on the same level and unspecified falls on the same level. Fourth-character falls coding from previous editions of the ICD-10-AM remained unchanged in the fifth edition, with the exception of W02 (to which further specific pedestrian conveyance codes were added, see NCCH 2006). The revision of these external cause codes allows a far greater level of detail as to the mechanism of older people's injurious falls to be recorded.

Nevertheless, as in previous years the majority of hospitalised fall injury cases for people aged 65 and older were recorded as falls on the same level from slipping, tripping and stumbling (32.4%, see Table 3.1). This was a slightly lower proportion of all fall cases than in previous years (Bradley & Harrison 2007; Bradley & Pointer 2008) however. Slips, trips and stumbles were proportionately more common for females than for males and, for both sexes, most of these types of falls were explicitly attributed to tripping.

As observed in previous years, the second- and third- most common types of injurious falls resulting in the hospitalisation of people aged 65 and over in 2006–07 were 'unspecified falls' (accounting for 28.6% of cases) and 'other falls on same level' (20.0%). These external causes accounted for a slightly higher proportion of the cases in 2006–07 than they did in either 2005–06 or 2003–04 (see Bradley & Harrison 2007; Bradley & Pointer 2008).

'Unspecified falls' do not have any additional fourth-character codes associated with them, but the fifth edition ICD-10-AM includes the five fourth-character codes for 'other falls on same level' described above. While most 'other falls on same level' were coded to the other or unspecified categories (89.6% of the 14,321 cases coded to W18), small proportions of cases were coded as falls due to bumping into objects (4.9% of cases coded to W18), on or from toilets (4.4%) and falls in or into baths or showers (not resulting in drowning, 1.1%).

Other fall codes with expanded fourth-characters in 2006–07 included falls involving beds, of which the most common specified bed was a conventional bed, and falls involving chairs, of which the most common specified chair was a stool (most household chairs—kitchen chairs, lounge chairs etc—do not have their own unambiguous category however). The expansion of the W13 (falls from, out of or through building or structure) code demonstrates that such falls are numerically and/or proportionately much more common for males than for females for nearly all subcategories.

Of interest, the additional fourth-character codes included for W02 (falls involving pedestrian conveyances) demonstrates that falls by older people of this type generally do not involve skate-boards or similar, but rather 'other and unspecified' pedestrian conveyances, most likely to be mobility scooters. There were 195 such cases involving people aged 65 and older recorded in 2006–07.

Table 3.1: Causes of hospitalised fall injury cases: first external cause code[(a)] for males, females and persons aged 65+, Australia 2006–07

External cause	Males	Females	Persons[(b)]
Fall on same level involving ice and snow (W00)	n.p. (0.0%)	n.p. (0.0%)	6 (0.0%)
Fall on same level from slipping (W01.0)	1,586 (7.4%)	4,565 (9.1%)	6,151 (8.6%)
Fall on same level from tripping (W01.1)	3,657 (17.1%)	11,056 (21.9%)	14,713 (20.5%)
Fall on same level from stumbling (W01.2)	714 (3.3%)	1,675 (3.3%)	2,389 (3.3%)
Total fall on same level from slipping, tripping and stumbling (W01)	*5,957 (27.9%)*	*17,296 (34.3%)*	*23,253 (32.4%)*
Fall involving pedestrian conveyances (W02)	108 (0.5%)	106 (0.2%)	214 (0.3%)
Other fall on same level due to collision with another person (W03)	63 (0.3%)	177 (0.4%)	240 (0.3%)
Fall while being carried or supported by other persons (W04)	n.p. (0.0%)	n.p. (0.0%)	12 (0.0%)
Fall involving wheelchair (W05)	186 (0.9%)	313 (0.6%)	499 (0.7%)
Fall involving special purpose bed (W06.1)	103 (0.5%)	242 (0.5%)	345 (0.5%)
Fall involving conventional bed (W06.6)	196 (0.9%)	463 (0.9%)	659 (0.9%)
Fall involving other and unspecified beds	675 (3.2%)	1,562 (3.1%)	2,237 (3.1%)
Total fall involving bed (W06)	*974 (4.6%)*	*2,267 (4.5%)*	*3,241 (4.5%)*
Fall involving stool (W07.3)	51 (0.2%)	137 (0.3%)	188 (0.3%)
Fall involving bath chair (W07.5)	20 (0.1%)	51 (0.1%)	71 (0.1%)
Fall involving commode chair (W07.6)	9 (0.0%)	99 (0.2%)	108 (0.2%)
Fall involving other and unspecified chair	560 (2.6%)	1,313 (2.6%)	1,873 (2.6 %)
Total fall involving chair (W07)	*640 (3.0%)*	*1,600 (3.2%)*	*2,240 (3.1%)*
Fall involving table (W08.2)	32 (0.1%)	47 (0.1%)	79 (0.1%)
Fall involving other and unspecified furniture	25 (0.1%)	73 (0.1%)	98 (0.1%)
Total fall involving other furniture (W08)	*57 (0.3%)*	*120 (0.2%)*	*177 (0.2%)*
Fall involving playground equipment (W09)	n.p. (0.0%)	n.p. (0.0%)	10 (0.0%)
Fall on and from stairs and steps (W10)	1,437 (6.7%)	3,118 (6.2%)	4,555 (6.3%)
Fall on and from ladder (W11)	908 (4.3%)	277 (0.5%)	1,185 (1.7%)
Fall on and from scaffolding (W12)	24 (0.1%)	n.p. (0.0%)	n.p. (0.0%)
Fall from or through balcony or verandah (W13.0)	38 (0.2%)	36 (0.1%)	74 (0.1%)
Fall from roof (W13.3)	87 (0.4%)	n.p. (0.0%)	n.p. (0.1%)
Fall through roof (W13.4)	33 (0.2%)	n.p. (0.0%)	n.p. (0.0%)
Fall from, out or through other and unspecified building structure	89 (0.4%)	61 (0.1%)	150 (0.2%)
Total fall from, out of or through building or structure (W13)	*247 (1.2%)*	*103 (0.2%)*	*350 (0.5%)*
Fall from tree (W14)	38 (0.2%)	n.p. (0.0%)	n.p. (0.1%)
Fall from cliff (W15)	25 (0.1%)	17 (0.0%)	42 (0.1%)
Diving or jumping into water causing injury other than drowning (W16)	8 (0.0%)	5 (0.0%)	13 (0.0%)
Other fall from one level to another (W17)	385 (1.8%)	383 (0.8%)	768 (1.1%)
Fall from bumping against object (W18.0)	227 (1.1%)	481 (1.0%)	708 (1.0%)
Fall from or off toilet (W18.1)	141 (0.7%)	484 (1.0%)	625 (0.9%)
Fall in or into bathtub or shower (W18.2)	62 (0.3%)	100 (0.2%)	162 (0.2%)
Other and unspecified other fall on same level	3,789 (17.7%)	9,035 (17.9%)	12,825 (17.9%)
Total other fall on same level (W18)	*4,219 (19.8%)*	*10,101 (20.0%)*	*14,321 (20.0%)*
Unspecified fall (W19)	6,065 (28.4%)	14,488 (28.7%)	20,554 (28.6%)
Total	**21,348 (100%)**	**50,396 (100%)**	**71,746 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

(a) Some (fourth-character) categories have been combined due to small case counts.

(b) Persons includes two cases for which sex was not reported.

Place of occurrence

As in previous years, half of all hospitalised fall injury cases involving people aged 65 and older in 2006–07 occurred in the home, including the driveway to the home (48.7%, see Table 3.2). Aged care facilities were the reported place of occurrence for a further 22.5% of hospitalised fall injury cases, with a greater proportion of cases involving females occurring here (24.3%) than for males (18.3%). Place of occurrence was not specified in 16.6% of records for fall injury cases.

Table 3.2: Place of occurrence for fall injury cases; males, females and persons aged 65+, Australia 2006–07

Place of occurrence	Males	Females	Persons*
Driveway to home	195 (0.9%)	344 (0.7%)	539 (0.8%)
Other and unspecified place in home	10,288 (48.2%)	24,114 (47.8%)	34,404 (48.0%)
Total home	*10,483 (49.1%)*	*24,458 (48.5%)*	*34,943 (48.7%)*
Aged care facilities	3,904 (18.3%)	12,232 (24.3%)	16,136 (22.5%)
Other and unspecified residential institutions	97 (0.5%)	206 (0.4%)	303 (0.4%)
Total residential institution	*4,001 (18.7%)*	*12,438 (24.7%)*	*16,439 (22.9%)*
School	11 (0.1%)	18 (0.0%)	29 (0.0%)
Health service area	361 (1.7%)	740 (1.5%)	1,101 (1.5%)
Other specified institution and public administrative area	99 (0.5%)	243 (0.5%)	342 (0.5%)
Total specified institution and public administrative area	*471 (2.2%)*	*1,001 (2.0%)*	*1,472 (2.1%)*
Sporting grounds (outdoor)	72 (0.3%)	89 (0.2%)	161 (0.2%)
Sporting hall (indoor)	9 (0.0%)	21 (0.0%)	30 (0.0%)
Other and unspecified sports and athletics areas	35 (0.2%)	32 (0.1%)	67 (0.1%)
Total sports and athletics areas	*116 (0.5%)*	*142 (0.3%)*	*258 (0.4%)*
Roadway	337 (1.6%)	491 (1.0%)	828 (1.2%)
Footpath	689 (3.2%)	1,523 (3.0%)	2,212 (3.1%)
Other and unspecified public highway, street or road	38 (0.2%)	83 (0.2%)	121 (0.2%)
Total public highway, street or road	*1,064 (5.0%)*	*2,097 (4.2%)*	*3,161 (4.4%)*
Shop and store	302 (1.4%)	1,046 (2.1%)	1,348 (1.9%)
Cafe, hotel and restaurant	266 (1.2%)	356 (0.7%)	622 (0.9%)
Other and unspecified trade and service area	113 (0.5%)	231 (0.5%)	344 (0.5%)
Total trade and service area	*681 (3.2%)*	*1,633 (3.2%)*	*2,314 (3.2%)*
Industrial and construction area	38 (0.2%)	11 (0.0%)	49 (0.1%)
Farm	96 (0.4%)	42 (0.1%)	138 (0.2%)
Areas of water (for example; streams, lakes)	20 (0.1%)	26 (0.1%)	46 (0.1%)
Beach	38 (0.2%)	53 (0.1%)	91 (0.1%)
Forest	20 (0.1%)	30 (0.1%)	50 (0.1%)
Other specified countryside	16 (0.1%)	26 (0.1%)	42 (0.1%)
Car park (parking lot)	70 (0.3%)	147 (0.3%)	217 (0.3%)
Other specified place of occurrence	232 (1.1%)	402 (0.8%)	634 (0.9%)
Total other specified place of occurrence	*396 (1.9%)*	*684 (1.4%)*	*1,080 (1.5%)*
Unspecified place of occurrence	4,000 (18.7%)	7,879 (15.6%)	11,879 (16.6%)
Total	**21,348 (100%)**	**50,396 (100%)**	**71,746 (100%)**

* Persons includes 13 cases for which place of occurrence was not reported and two cases for which sex was not reported.

Aged care facilities

Nearly one-quarter of injurious falls involving a person aged 65 or older that resulted in hospitalisation in 2006–07 were reported to have occurred in an aged care facility (Table 3.2).

The 2003–04 report in this series detailed the method by which the population of people aged 65 and older resident in aged care facilities is used to estimate the rate of falls in aged care facilities (Bradley & Harrison 2007, page 15). The present report similarly estimates the resident population in aged care facilities, however two years' of population data (30 June 2006 and 30 June 2007) have been averaged to derive a 31 December 2006 estimate better suited for comparison with other rates presented for the financial year. These data were obtained from the relevant *Residential aged care in Australia* reports (AIHW 2007, 2008b).

As in previous years, the rate of falls in aged care facilities involving people aged 65 and older resident in such facilities was more than five times higher than the rate of falls in the home involving people aged 65 and older resident in the community. The age-standardised rate of fall injury cases in aged care facilities for persons aged 65 and older living in residential facilities was 7,645 per 100,000 population while the age-standardised rate of falls in the home for older persons living at home was 1,421 per 100,000 population.

The age-specific rates of fall injury cases that occurred in the home or in aged care facilities in 2006–07 are presented in Figure 3.1. Unlike previous years, the rate of hospitalised falls for the oldest male residents of aged care facilities was higher than that for females. Age-specific rates of falls in aged care facilities for both males and females aged 75 and older were also much higher in 2006–07 than they were in previous years, more than 20% higher in some age groups (for example; males aged 95+; 13,998 per 100,000 population in 2006–07 compared with 11,511 per 100,000 in 2005–06, an increase of 21.6%). Such increases do not appear to be due to the slight change in population estimation methods.

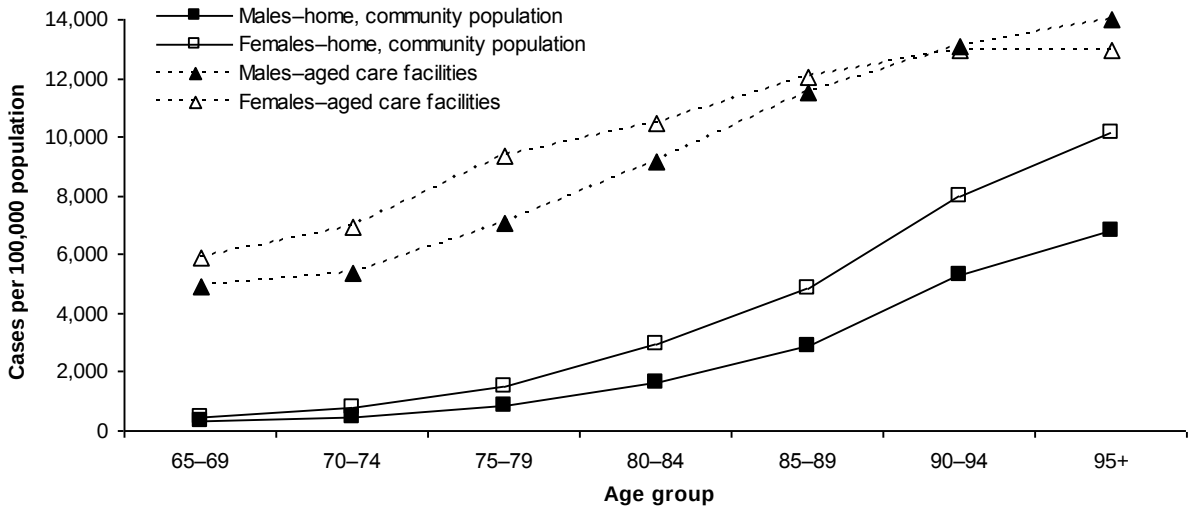


Figure 3.1: Age-specific rates of falls in the home and in aged care facilities calculated using the estimated population of people resident in the general community and residential care, males and females aged 65+, Australia 2006–07

Activity when fall occurred

About two-thirds of fall injury cases for people aged 65 and older in 2006–07 were assigned a U73.9 activity code—'unspecified activity' (68.2%, see Table 3.3).

Of the 22,778 cases with a specified activity code, the most common activity engaged in at the time of the injurious fall was 'resting, sleeping, eating or engaging in other vital activities' (42.7% of cases with a specified activity, *n* = 9,737). The reported activity for a further 8,042 cases (35.3% of cases with a specified activity) was 'other specified activity'. These proportions are similar to those observed in previous years (Bradley & Harrison 2007; Bradley & Pointer 2008).

The rate of falls while resting, sleeping, eating or engaging in other vital activities increased markedly with age, from 64 per 100,000 population for those aged 65–69 to 2,416 per 100,000 for those aged 95 or older. For this oldest age group, the rate of falls while resting, sleeping, eating or engaging in other vital activities was twice that of falls sustained while engaged in 'other specified' activities (1,193 per 100,000).

As in previous years, little difference between males and females was noted for the reported activity engaged in at the time of the injurious fall.

Unlike coding for sport-related or income-producing work activities, there is no sub-categorisation for the activity codes most commonly recorded for hospitalised fall cases involving people aged 65 and older (NCCH 2006). Accordingly, specific, and useful, information about the types of activity during which injurious falls are sustained is available for less than two per cent of injurious falls by older people.

Table 3.3: Reported activity for fall injury cases; males, females and persons aged 65+, Australia 2006–07

Activity	Males	Females	Persons*	Per cent specified
While engaged in sports	205 (1.0%)	346 (0.7%)	551 (0.8%)	2.4%
While engaged in leisure	188 (0.9%)	300 (0.6%)	488 (0.7%)	2.1%
While working for income	146 (0.7%)	79 (0.2%)	225 (0.3%)	1.0%
While engaged in other types of work	1,239 (5.8%)	2,496 (5.0%)	3,735 (5.2%)	16.4%
While resting, sleeping, eating or engaging in other vital activities	2,776 (13.0%)	6,960 (13.8%)	9,737 (13.6%)	42.7%
Other specified activity	2,356 (11.0%)	5,686 (11.3%)	8,042 (11.2%)	35.3%
Total specified	*6,910 (32.4%)*	*15,867 (31.5%)*	*22,778 (31.7%)*	*100.0%*
Unspecified activity	14,430 (67.6%)	34,499 (68.5%)	48,930 (68.2%)	
Total	**21,348 (100%)**	**50,396 (100%)**	**71,746 (100%)**	

*Persons includes 38 cases for which activity was not reported and two cases for which sex was not reported.

4 The burden of injury due to falls

Chapters Two and Three focused on the estimated number of new cases of hospitalised fall-related injury that occurred in the year to 30 June 2007. This chapter focuses on the nature and extent of hospital care provided in that period because of a fall-related injury. This includes analysis of the fall injury records omitted from the estimation of cases (having a mode of admission of transfer from another acute hospital), as well as records that describe episodes of fall-related follow-up care. Analyses of the patient days for fall-related episodes and the cost to the hospital system due to fall-related stays are also included in this chapter.

Fall injury inward transfers

To reduce multiple counting of fall cases in our de-identified dataset, a number of records were omitted from the analyses presented in the previous chapters. These records had a principal diagnosis in the range S00–T75 or T79 and a first external cause code in the range W00–W19 (that is, the same as fall injury cases), but also had a mode of admission denoting a transfer from another acute hospital. Hence, the records described here should not be regarded as representing additional fall cases. These separations are likely to have already generated a separation record describing the injury event.

A total of 8,618 fall injury inward transfer separations were generated in 2006–07 and, as in 2005–06, inward transfer separations represented 0.3% of the total number of hospitalisations for people aged 65 and older in this period. The mean age for fall injury inward transfer separations (82.0 years ± 7.6 SD) was similar to the mean age for fall injury cases (81.8 years ± 7.9 SD). Again, males hospitalised in a fall injury inward transfer (80.7 years ± 7.6 SD) were slightly younger than females (82.6 years ± 7.6 SD).

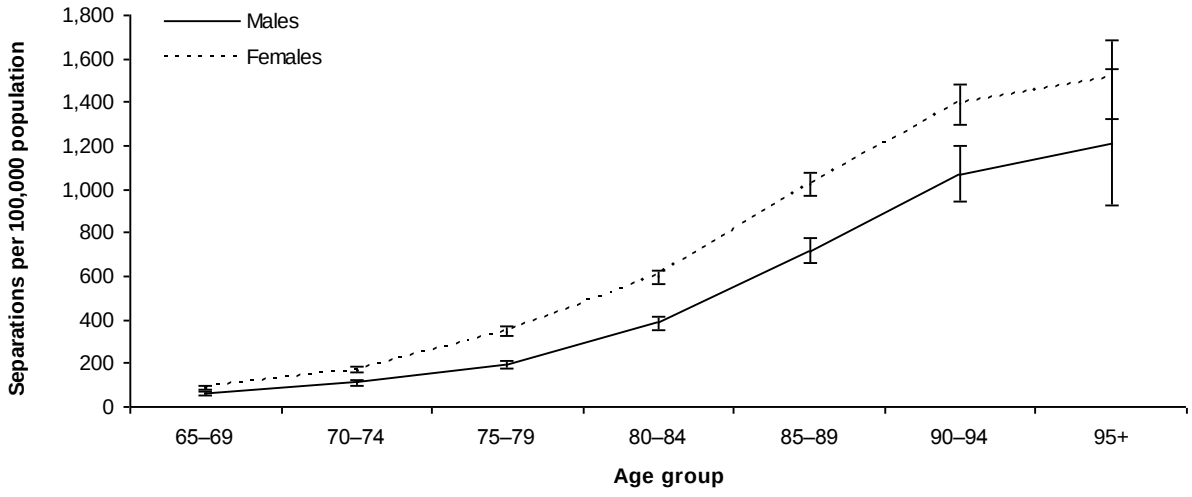


Figure 4.1: Age-specific rates of fall injury inward transfer separations (± 95% CI); males and females aged 65+, Australia 2006–07

The age-standardised rate of fall injury inward transfer separations for persons aged 65 and older was 301 separations per 100,000 population, a slight rise from that for 2005–06 (287 per 100,000, Bradley & Pointer 2008). As for fall injury cases, the rate for females (350 per 100,000) was substantially higher than for males (231 per 100,000). Age-specific rates by sex for fall injury transfer separations also showed a similar trend to that observed for fall injury cases (Figure 4.1), except that rates for females aged 95 and older were not higher than those for males.

Injury type for fall injury inward transfers

Similar to fall injury cases, principal diagnoses indicating injuries to the hip and thigh predominated for fall injury inward transfers (42.5%, see Table 4.1). Most of these separations had a principal diagnosis describing a fracture of the neck of the femur (35.3% of inward transfer separations overall). These proportions were much larger than for fall injury cases however (all hip and thigh injuries represented 30.3% of fall injury cases and fractures of the neck of the femur 23.0%, see Table 2.2.). Conversely, the proportion of fall injury transfer separations with a principal diagnosis of injuries to the head (10.8%) was considerably smaller than the proportion of such diagnoses for fall injury cases (18.0%).

As observed for fall injury cases, injuries to the head accounted for a larger proportion of fall injury inward transfer separations for males than for females (17.3% and 7.9%, respectively). Injuries to the neck and thorax were also proportionately more common for males than females. Fall injury transfer separations with principal diagnoses of injuries to the limbs, abdomen and the hip and thigh were more common for females than for males however (Table 4.1).

Table 4.1: Principal diagnosis injury types for fall injury inward transfer separations; males, females and persons aged 65+, Australia 2006–07

Principal diagnosis	Males	Females	Persons*
Injuries to the head	452 (17.3%)	475 (7.9%)	927 (10.8%)
Injuries to the neck	113 (4.3%)	106 (1.8%)	219 (2.5%)
Injuries to the thorax	179 (6.8%)	212 (3.5%)	391 (4.5%)
Injuries to the abdomen, lower back, lumbar spine and pelvis	265 (10.1%)	751 (12.5%)	1,016 (11.8%)
Injuries to the shoulder and upper arm	180 (6.9%)	602 (10.0%)	782 (9.1%)
Injuries to the elbow and forearm	102 (3.9%)	445 (7.4%)	547 (6.3%)
Injuries to the wrist and hand	39 (1.5%)	54 (0.9%)	93 (1.1%)
Fractured neck of femur	891 (34.0%)	2,149 (35.8%)	3,041 (35.3%)
Other hip and thigh injuries	163 (6.2%)	445 (7.4%)	608 (7.1%)
Total injuries to the hip and thigh	*1,054 (40.3%)*	*2,594 (43.2%)*	*3,649 (42.3%)*
Injuries to the knee and lower leg	184 (7.0%)	676 (11.3%)	860 (10.0%)
Injuries to the ankle and foot	22 (0.8%)	58 (1.0%)	80 (0.9%)
Injuries involving multiple body regions	n.p. (0.2%)	n.p. (0.1%)	8 (0.1%)
Injuries to unspecified parts of trunk, limb or body region	13 (0.5%)	16 (0.3%)	29 (0.3%)
Certain early complications of trauma	9 (0.3%)	8 (0.1%)	17 (0.2%)
Total	**2,617 (100%)**	**6,000 (100%)**	**8,618 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Persons includes one separation for which sex was not reported.

The average ICISS score for fall injury inward transfer separations, was 0.823 (± 0.169 SD). This compares with a score of 0.852 (± 0.153 SD) for fall injury cases. This suggests that the injuries involved in the transfer separations were more serious than those of hospitalised fall injury cases involving people aged 65 and older in 2006–07 (Mann Whitney U, $p < 0.001$).

External cause of fall injury inward transfers

Similar to fall injury cases, most fall injury transfer separations were the result of 'falls on the same level due to slipping, tripping and stumbling' (W01), 'other falls on the same level' (W18) and 'unspecified falls' (W19, see Table 4.2). However, unspecified falls accounted for a higher proportion of fall injury inward transfer separations (40.5%) than for fall injury cases (28.6%). Similarly, fall injury inward transfer separations due to slipping, tripping and stumbling were proportionately less common (26.1%) than for fall injury cases (32.4%), as were 'other falls on the same level' (16.6% of inward transfer separations compared with 20.0% of cases).

Table 4.2: Causes of fall injury inward transfer separations: first external cause code for males, females and persons aged 65+, Australia 2006–07

External cause	Males	Females	Persons*
Fall on same level from slipping (W01.0)	176 (6.7%)	461 (7.7%)	637 (7.4%)
Fall on same level from tripping (W01.1)	350 (13.4%)	1,024 (17.1%)	1,374 (15.9%)
Fall on same level from stumbling (W01.2)	70 (2.7%)	172 (2.9%)	242 (2.8%)
Total slipping, tripping and stumbling (W01)	*596 (22.8%)*	*1,657 (27.6%)*	*2,253 (26.1%)*
Fall involving pedestrian conveyances (W02)	16 (0.6%)	16 (0.3%)	32 (0.4%)
Other fall on same level due to collision with another person (W03)	n.p. (0.1%)	n.p. (0.2%)	16 (0.2%)
Fall while being carried or supported by other persons (W04)	n.p. (0.0%)	0 (0.0%)	n.p. (0.0%)
Fall involving wheelchair (W05)	14 (0.5%)	26 (0.4%)	40 (0.5%)
Fall involving bed (W06)	112 (4.3%)	228 (3.8%)	340 (3.9%)
Fall involving chair (W07)	56 (2.1%)	174 (2.9%)	230 (2.7%)
Fall involving other furniture (W08)	5 (0.2%)	12 (0.2%)	17 (0.2%)
Fall on and from stairs and steps (W10)	135 (5.2%)	329 (5.5%)	464 (5.4%)
Fall on and from ladder (W11)	118 (4.5%)	31 (0.5%)	149 (1.7%)
Fall on and from scaffolding (W12)	n.p. (0.2%)	0 (0.0%)	n.p. (0.0%)
Fall from, out of or through building or structure (W13)	47 (1.8%)	13 (0.2%)	60 (0.7%)
Fall from tree (W14)	5 (0.2%)	0 (0.0%)	5 (0.1%)
Fall from cliff (W15)	n.p. (0.1%)	n.p. (0.0%)	n.p. (0.0%)
Diving or jumping into water causing injury other than drowning (W16)	n.p. (0.0%)	0 (0.0%)	n.p. (0.0%)
Other fall from one level to another (W17)	44 (1.7%)	39 (0.7%)	83 (1.0%)
Other fall on same level (W18)	402 (15.4%)	1,029 (17.2%)	1,431 (16.6%)
Unspecified fall (W19)	1,056 (40.4%)	2,431 (40.5%)	3,488 (40.5%)
Total	**2,617 (100%)**	**6,000 (100%)**	**8,618 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Persons includes one separation for which sex was not reported.

Fall-related follow-up care

As in previous reports, the current work presents an analysis of a number of fall-related hospital separations we term 'fall-related follow-up care separations' (Bradley & Harrison 2007; Bradley & Pointer 2008; see also Kreisfeld & Newson 2006). Such records are numerous and must be considered in a valid estimation of the burden of hospitalised fall injury. Since people admitted for follow-up care related to a fall injury have usually been previously admitted for acute care for the injury (the fall injury cases described in previous sections of this report), these separations represent an additional part of the burden due to fall injury rather than additional cases.

These fall-related follow-up care records have a principal diagnosis from Chapter XXI of the ICD-10-AM; factors influencing health status and contact with health services, specifically;

- Z47—other orthopaedic follow-up care
- Z48—other surgical follow-up care
- Z50—care involving use of rehabilitation procedures and
- Z75.1—person awaiting admission to adequate facility elsewhere.

They also have an injury (S00–T75 or T79) and a falls external cause code (W00–W19) elsewhere in the record (see also Data issues).

Note that these fall-related follow-up care separations have not been identified on the basis of a 'rehabilitation' type of episode of care (rehabilitation/follow-up care is implied by the principal diagnosis, irrespective of the recorded type of episode of care). It is also possible that these separations describe an injurious fall in hospital while receiving care for another condition rather than post-acute care.

Nearly 27,000 fall-related follow-up care separations were identified for people aged 65 and older in 2006–07 (n = 26,828), an increase of 3,417 separations (14.6%) from 2005–06. These 26,828 separations represent 1.0% of all hospital separations for the older population in 2006–07. As in 2005–06, nearly three-quarters of these involved women (72.2%, n = 19,375).

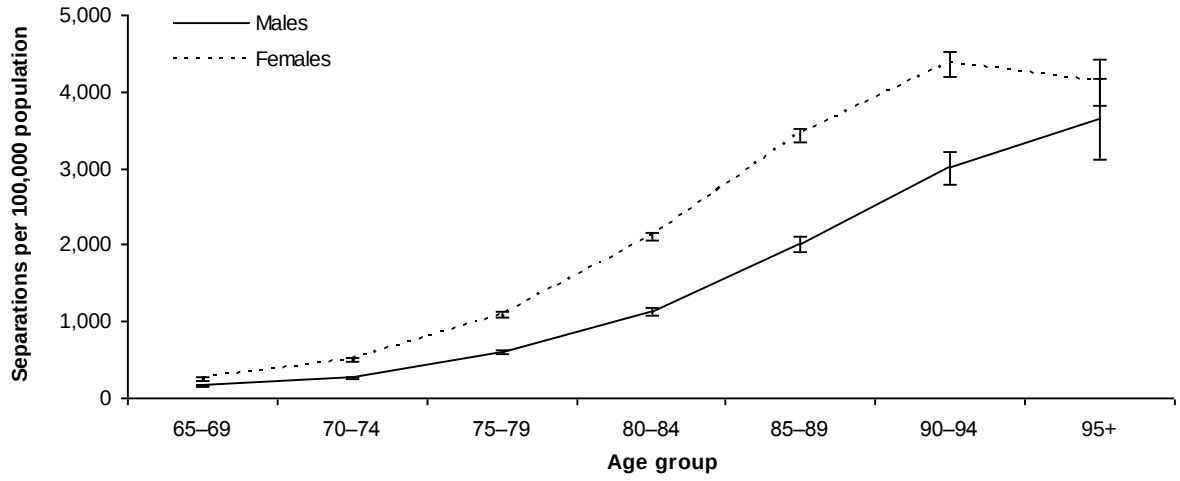


Figure 4.2: Age-specific rates of fall-related follow-up care separations (± 95% CI); males and females aged 65+, Australia 2006–07

The mean age of the person hospitalised in a fall-related follow-up care separation was 82.3 years (± 7.3 SD), slightly older than the average for both fall injury cases and inward transfers. The mean ages for males and females hospitalised in a follow-up care separation were the same as those in 2005–06—81.0 years (± 7.3 SD) and 82.8 years (± 7.2 SD), respectively.

The age-standardised rate of fall-related follow-up care separations for all people aged 65 and older was 933 separations per 100,000 population and the age-standardised rate for females (1,124 per 100,000) was much higher than for males (658 per 100,000). Age-specific rates of fall-related follow-up care separations generally increased with age for both males and females (Figure 4.2). As for fall injury cases, age-specific rates of fall-related follow-up care separations were higher for females than for males in every age group. For the group aged 95 and older, however, this difference was not significant.

Diagnoses for fall-related follow-up care

More than three-quarters (85.8%, *n* = 23,015) of fall-related follow-up care separations had a principal diagnosis of Z50 (care involving use of rehabilitation procedures). While Z50 accounts for the majority of separations in every age group (Figure 4.3), there is a notable rise in the proportion of follow-up care separations with Z75.1 (person awaiting admission to adequate facility elsewhere) as the principal diagnosis with increasing age.

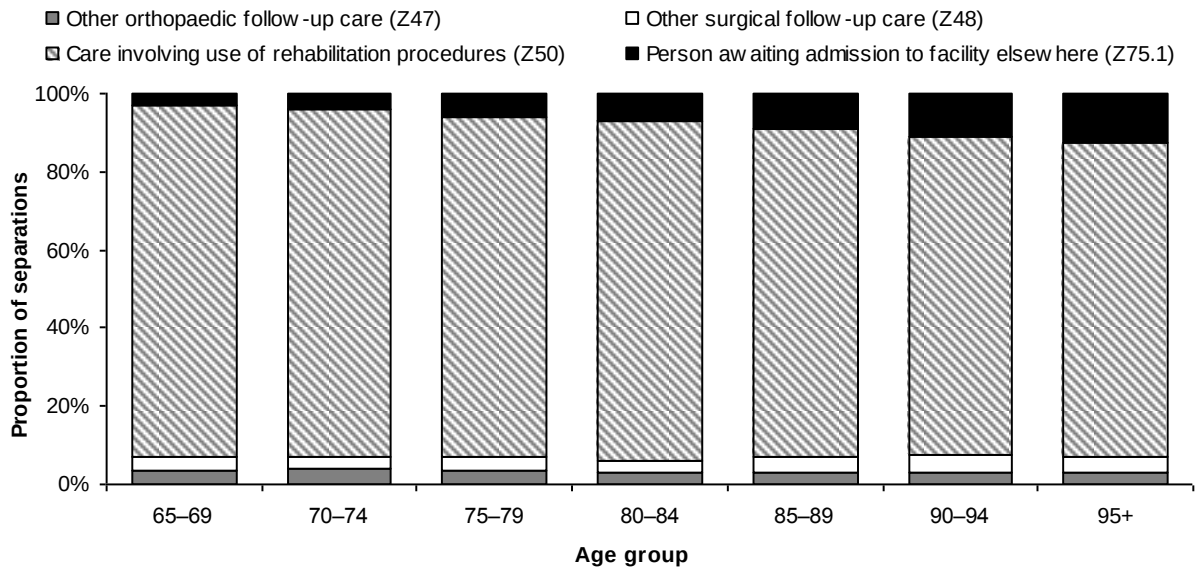


Figure 4.3: Principal diagnosis group for fall-related follow-up care separations by age, persons aged 65+, Australia 2006–07

Table 4.3 describes the specific principal diagnoses for fall-related follow-up care separations for people aged 65 and older in 2006–07. Most of these separations (78.4%, *n* = 21,026) had a principal diagnosis of Z50.9 (care involving use of rehabilitation procedures, unspecified). Another common principal diagnosis for fall-related follow-up care separations was Z75.11, which indicated that the person was awaiting admission to a residential aged care service

(7.0%, *n* = 1,873). As in 2005–06, a higher proportion of fall-related follow-up care separations for men (9.0%) had this principal diagnosis than separations for women (6.2%).

The first-listed injury diagnosis in fall-related follow-up care separation records was also identified for further analysis (Table 4.4). As for fall injury cases, the most common injury category was an injury to the hip or thigh (49.6%, *n* = 13,317) and most of these injuries were fractures of the neck of the femur (43.1% of all fall-related follow-up care separations). As observed for fall injury inward transfers, injuries to the hip and thigh (and fractures of the femur neck more specifically) accounted for a greater proportion of follow-up care separations than they did fall injury cases.

Table 4.3: Principal diagnosis for fall-related follow-up care separations; males, females and persons aged 65+, Australia 2006–07

Principal diagnosis	Males	Females	Persons*
Follow-up care involving removal of fracture plate and other internal fixation device (Z47.0)	0 (0.0%)	10 (0.1%)	10 (0.0%)
Other specified orthopaedic follow-up care (Z47.8)	69 (0.9%)	192 (1.0%)	261 (1.0%)
Orthopaedic follow-up care, unspecified (Z47.9)	145 (1.9%)	411 (2.1%)	556 (2.1%)
Total Z47	*214 (2.9%)*	*613 (3.2%)*	*827 (3.1%)*
Attention to surgical dressings and sutures (Z48.0)	n.p. (0.0%)	n.p. (0.1%)	16 (0.1%)
Other specified surgical follow-up care (Z48.8)	264 (3.5%)	695 (3.6%)	959 (3.6%)
Surgical follow-up care, unspecified (Z48.9)	5 (0.1%)	10 (0.1%)	15 (0.1%)
Total Z48	*272 (3.7%)*	*718 (3.7%)*	*990 (3.7%)*
Cardiac rehabilitation (Z50.0)	n.p. (0.0%)	n.p. (0.0%)	5 (0.0%)
Other physical therapy (Z50.1)	284 (3.8%)	1,025 (5.3%)	1,309 (4.9%)
Speech therapy (Z50.5)	0 (0.0%)	n.p. (0.0%)	n.p. (0.0%)
Orthoptic training (Z50.6)	0 (0.0%)	n.p. (0.0%)	n.p. (0.0%)
Occupational therapy and vocational rehabilitation, not elsewhere classified (Z50.7)	7 (0.1%)	29 (0.1%)	36 (0.1%)
Care involving use of other rehabilitation procedures (Z50.8)	162 (2.2%)	475 (2.5%)	637 (2.4%)
Care involving use of rehabilitation procedure, unspecified (Z50.9)	5,793 (77.8%)	15,229 (78.6%)	21,026 (78.4%)
Total Z50	*6,247 (83.9%)*	*16,764 (86.5%)*	*23,015 (85.8%)*
Person awaiting admission to acute hospital (Z75.10)	6 (0.1%)	9 (0.0%)	15 (0.1%)
Person awaiting admission to residential aged care service (Z75.11)	674 (9.0%)	1,199 (6.2%)	1,873 (7.0%)
Person awaiting admission to psychiatric facility/unit (Z75.12)	n.p. (0.0%)	n.p. (0.0%)	n.p. (0.0%)
Person awaiting admission to rehabilitation facility/unit (Z75.13)	9 (0.1%)	33 (0.2%)	42 (0.2%)
Person awaiting admission to palliative care facility/unit (Z75.14)	n.p. (0.0%)	n.p. (0.0%)	7 (0.0%)
Person awaiting admission to other health care facility (Z75.18)	15 (0.2%)	23 (0.1%)	38 (0.1%)
Person awaiting admission to adequate facility elsewhere, unspecified (Z75.19)	8 (0.1%)	11 (0.1%)	19 (0.1%)
Total Z75.1	*716 (9.6%)*	*1,280 (6.6%)*	*1,996 (7.4%)*
Total	**7,449 (100%)**	**19,375 (100%)**	**26,828 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Persons includes four separations for which sex was not reported.

Table 4.4: First-listed injury diagnosis for fall-related follow-up care separations; males, females and persons aged 65+, Australia 2006–07

Diagnosis	Males	Females	Persons*
Injuries to the head	800 (10.7%)	977 (5.0%)	1,777 (6.6%)
Injuries to the neck	224 (3.0%)	162 (0.8%)	386 (1.4%)
Injuries to the thorax	339 (4.6%)	750 (3.9%)	1,089 (4.1%)
Injuries to the abdomen, lower back, lumbar spine and pelvis	847 (11.4%)	2,593 (13.4%)	3,440 (12.8%)
Injuries to the shoulder and upper arm	491 (6.6%)	1,777 (9.2%)	2,268 (8.5%)
Injuries to the elbow and forearm	337 (4.5%)	879 (4.5%)	1,216 (4.5%)
Injuries to the wrist and hand	123 (1.7%)	196 (1.0%)	319 (1.2%)
Fractured neck of femur	2,971 (39.9%)	8,578 (44.3%)	11,553 (43.1%)
Other hip and thigh	510 (6.8%)	1,254 (6.5%)	1,764 (6.6%)
Total injuries to the hip and thigh	*3,481 (46.7%)*	*9,832 (50.7%)*	*13,317 (49.6%)*
Injuries to the knee and lower leg	622 (8.4%)	1,894 (9.8%)	2,516 (9.4%)
Injuries to the ankle and foot	61 (0.8%)	206 (1.1%)	267 (1.0%)
Injuries involving multiple body regions	7 (0.1%)	8 (0.0%)	15 (0.1%)
Injuries to unspecified parts of trunk, limb or body region	59 (0.8%)	55 (0.3%)	114 (0.4%)
Certain early complications of trauma	49 (0.7%)	31 (0.2%)	80 (0.3%)
Other injury diagnoses	9 (0.1%)	15 (0.1%)	24 (0.1%)
Total	**7,449 (100%)**	**19,375 (100%)**	**26,828 (100%)**

* Persons includes four separations for which sex was not reported.

External cause for fall-related follow-up care

As for fall injury cases and inward transfers, the most common external causes reported for fall-related follow-up care separations were slips, trips and stumbles, 'other falls on the same level' and unspecified falls (Table 4.5). Similar to fall injury transfer separations, however, the most common external cause for fall-related follow-up care separations was 'unspecified fall' (W19, 43.8% of separations). These observations suggest that some information regarding the circumstances of a fall is lost from records after the original hospitalisation for the injury event, compounding difficulties strategically targeting falls prevention programs and accurately attributing the hospitalisations due to particular types of falls.

Table 4.5: First-listed external cause for fall-related follow-up care separations; males, females and persons aged 65+, Australia 2006–07

External cause	Males	Females	Persons*
Fall on same level from slipping, tripping and stumbling	1,725 (23.2%)	5,407 (27.9%)	7,133 (26.6%)
Fall involving ice-skates, skis, rollerskates or skateboards	31 (0.4%)	37 (0.2%)	68 (0.3%)
Other fall on same level due to collision with, or pushing by, another person	11 (0.1%)	38 (0.2%)	49 (0.2%)
Fall while being carried or supported by other persons	0 (0.0%)	20 (0.1%)	20 (0.1%)
Fall involving wheelchair	45 (0.6%)	69 (0.4%)	114 (0.4%)
Fall involving bed	327 (4.4%)	611 (3.2%)	938 (3.5%)
Fall involving chair	193 (2.6%)	446 (2.3%)	639 (2.4%)
Fall involving other furniture	7 (0.1%)	25 (0.1%)	32 (0.1%)
Fall involving playground equipment	n.p. (0.3%)	n.p. (0.0%)	25 (0.1%)
Fall on and from stairs and steps	404 (5.4%)	981 (5.1%)	1,385 (5.2%)
Fall on and from ladder	179 (2.4%)	87 (0.4%)	266 (1.0%)
Fall from, out of or through building or structure	80 (1.1%)	19 (0.1%)	99 (0.4%)
Fall from tree	6 (0.1%)	0 (0.0%)	6 (0.0%)
Fall from cliff	n.p. (0.1%)	n.p. (0.0%)	7 (0.0%)
Diving or jumping into water causing injury other than drowning or submersion	n.p. (0.1%)	n.p. (0.0%)	5 (0.0%)
Other fall from one level to another	70 (0.9%)	112 (0.6%)	182 (0.7%)
Other fall on same level	1,138 (15.3%)	2,974 (15.3%)	4,112 (15.3%)
Unspecified fall	3,203 (43.0%)	8,540 (44.1%)	11,746 (43.8%)
Total**	**7,449 (100%)**	**19,375 (100%)**	**26,828 (100%)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Persons includes four separations for which sex was not reported.

** Total includes two cases from categories too small to publish.

‘Other fall-related’ hospitalisations

In previous reports, a fourth class of fall-related separations was identified for people aged 65 and older, in addition to those types already discussed above (Bradley & Harrison 2007; Bradley & Pointer 2008). These ‘other fall-related’ separations did not meet the criteria specified for fall injury cases, fall injury inward transfers or fall-related follow-up care separations, but did contain both a relevant injury code (S00–T75 or T79) and external cause code (W00–W19) within the record.

The exact nature of these ‘other fall-related’ separations is not known (Bradley & Harrison 2007; Bradley & Pointer 2008). Some possible circumstances for such cases include: chance (that is, a person admitted for a non-injury condition happened also to have an injury condition); co-morbid injury (for example; a person admitted due to a neoplasm had a pathological fracture); complication of care (for example; a person in hospital for treatment of a non-injury condition slipped and fell); and, injury during the onset of another condition (for example; a person fell and was injured during an acute myocardial infarction).

We still do not fully understand the role of fall injury in these cases and it continues to be difficult to assess the degree to which they impact on the total burden of hospitalised fall-related injury. Further insight may be gained when national hospital data coded with condition onset information becomes available (commencing with the 2007–08 data year). Lacking this information, we have examined these separations briefly in this report and provided limited results to enable comparisons with previous findings.

A further 22,160 hospital separations for people aged 65 and older were identified as being fall-related in 2006–07, in addition to those already discussed in the previous sections. These separations represent 0.8% of the total number of hospital separations for people aged 65 and older in this year. This is similar to the observations made in previous years; in 2003–04 there were 18,048 other fall-related separations identified, and 20,345 in 2005–06. In both years, these other fall-related separations accounted for 0.8% of all hospital separations for people aged 65 and older (Bradley & Harrison 2007; Bradley & Pointer 2008).

The age-standardised rate of 'other fall-related' separations was 776 per 100,000 population in 2006–07, and age-specific rates of 'other fall-related' separations showed a similar increasing trend to that observed previously in the main analysis (Figure 4.4). However, as in previous years, and unlike the fall injury classes analysed to this point, the age-specific rates for males were higher than those for females in every age group. The age-standardised rate of 'other fall-related' separations for males aged 65 and older was 872 per 100,000 while the rate for females was 715 per 100,000. The rate ratio was 1.2 'other fall-related' separations for males for every 1.0 'other fall-related' separation for females.

The majority of 'other fall-related' separations did not have an injury code of any type as the principal diagnosis (96.5% of 'other fall-related' separations, see Table 4.6). Of those that did, about half (47.1% n = 370) had 'complications of surgical and medical care' as the first-listed external cause code. One in five 'other fall-related separations' (20.8%) had a principal diagnosis from Chapter IX of the ICD-10-AM (diseases of the circulatory system). A further 16.1% of separations had a principal diagnosis from Chapter XVIII (symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified). Interestingly, the two most common principal diagnoses for 'other fall-related' separations in this group were R55 (syncope and collapse, 45.4% of these Chapter XVIII separations) and R29.6 (tendency to fall, not elsewhere classified, 13.3%). R29.6 is the equivalent code to R29.81 in previous editions of the ICD-10-AM. Separations containing the R29.6 diagnosis are discussed further in Chapter Five.

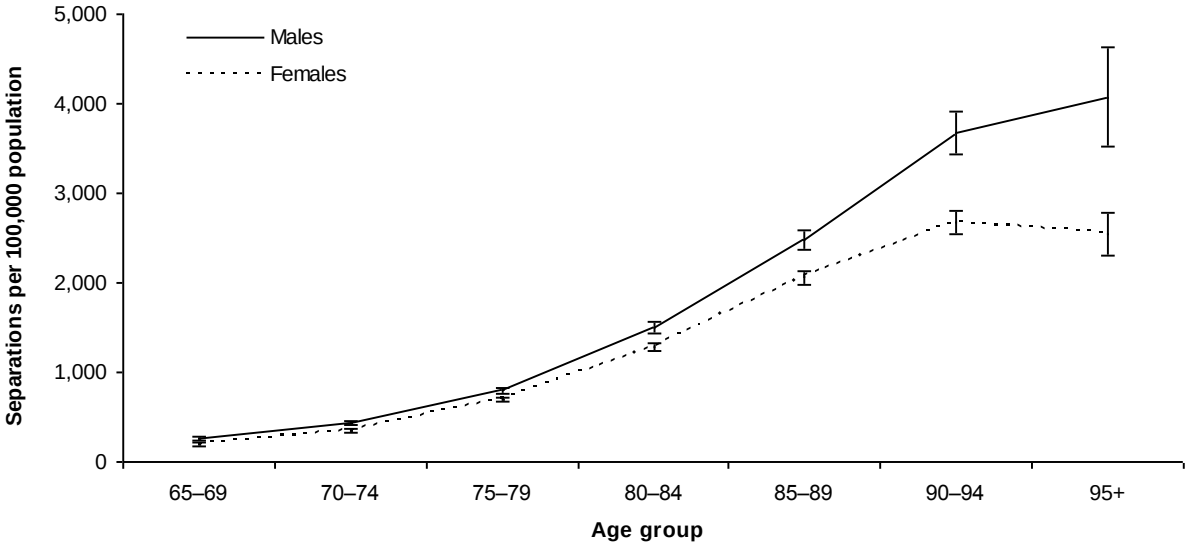


Figure 4.4: Age-specific rates of 'other fall-related' separations (± 95% CI); males and females aged 65+, Australia 2006–07

Table 4.6: ICD-10-AM chapter of principal diagnosis for 'other fall-related' separations; males, females and persons aged 65+, Australia 2006–07

ICD-10-AM chapter	Males	Females	Persons
Certain infectious and parasitic diseases	209 (2.1%)	270 (2.2%)	479 (2.2%)
Neoplasms	947 (9.5%)	668 (5.5%)	1,615 (7.3%)
Diseases of the blood, blood-forming organs, etc.	126 (1.3%)	171 (1.4%)	297 (1.3%)
Endocrine, nutritional and metabolic diseases	423 (4.2%)	509 (4.2%)	932 (4.2%)
Mental and behavioural disorders	609 (6.1%)	719 (5.9%)	1,328 (6.0%)
Diseases of the nervous system	553 (5.6%)	546 (4.5%)	1,099 (5.0%)
Diseases of the eye and adnexa	23 (0.2%)	23 (0.2%)	46 (0.2%)
Diseases of the ear and mastoid process	22 (0.2%)	45 (0.4%)	67 (0.3%)
Diseases of the circulatory system	2,120 (21.3%)	2,498 (20.5%)	4,618 (20.8%)
Diseases of the respiratory system	1,136 (11.4%)	946 (7.8%)	2,082 (9.4%)
Diseases of the digestive system	468 (4.7%)	625 (5.1%)	1,093 (4.9%)
Diseases of the skin and subcutaneous tissue	297 (3.0%)	389 (3.2%)	686 (3.1%)
Diseases of the musculoskeletal system and connective tissue	450 (4.5%)	752 (6.2%)	1,202 (5.4%)
Diseases of the genitourinary system	450 (4.5%)	862 (7.1%)	1,312 (5.9%)
Symptoms, signs, abnormalities not elsewhere classified	1,502 (15.1%)	2,069 (17.0%)	3,571 (16.1%)
Injury, poisoning and consequences of external causes	314 (3.2%)	472 (3.9%)	786 (3.5%)
Factors influencing health status	304 (3.1%)	638 (5.2%)	942 (4.3%)
Total *	**9,956 (100%)**	**12,204 (100%)**	**22,160 (100%)**

*Total includes five separations from categories too small to publish.

5 Length of stay

This chapter provides information on the average and total admitted patient care days due to fall-related hospital care.

Fall injury case separations

Fall injury case separations for people aged 65 and older accounted for 539,973 patient days in 2006–07. This represents 4.5% of all patient days for hospitalisations for this age group. The number of patient days for fall injury case separations in 2006–07 increased by 25,591 days (5.0%) on the corresponding figure for 2005–06.

The length of stay per fall injury case separation ranged from one day (34.2% n = 24,533) to more than 680 days (n = 1). Less than 0.1% of fall injury case separations had a length of stay of 100 days or more (n = 42). The mean length of stay for case separations was 7.5 days (± 10.2 SD). The mean length of stay for males (7.4 days ± 9.9 SD) was significantly shorter than that for females (7.6 days ± 10.2 SD. Mann Whitney U, $p < 0.001$).

Similar to the findings of previous reports (Bradley & Harrison 2007; Bradley & Pointer 2008), the mean length of stay for fall injury case separations differed significantly by age (Kruskal-Wallis X^2, $p < 0.001$). Mean lengths of stay increased with age for both males and females, although decreased slightly for those aged 95 and older (Figure 5.1).

Fall injury case separations with a principal diagnosis of an injury to the hip and thigh accounted for the greatest proportion of patient days in 2006–07 (40.1%). Injuries to the head accounted for a further 10.5% of the patient days for case separations. Unsurprisingly, the three most common causes of fall injury cases (falls due to tripping, slipping and stumbling, other falls on the same level and unspecified falls) accounted for the vast majority of the patient days for case separations in 2006–07 (82.7% combined).

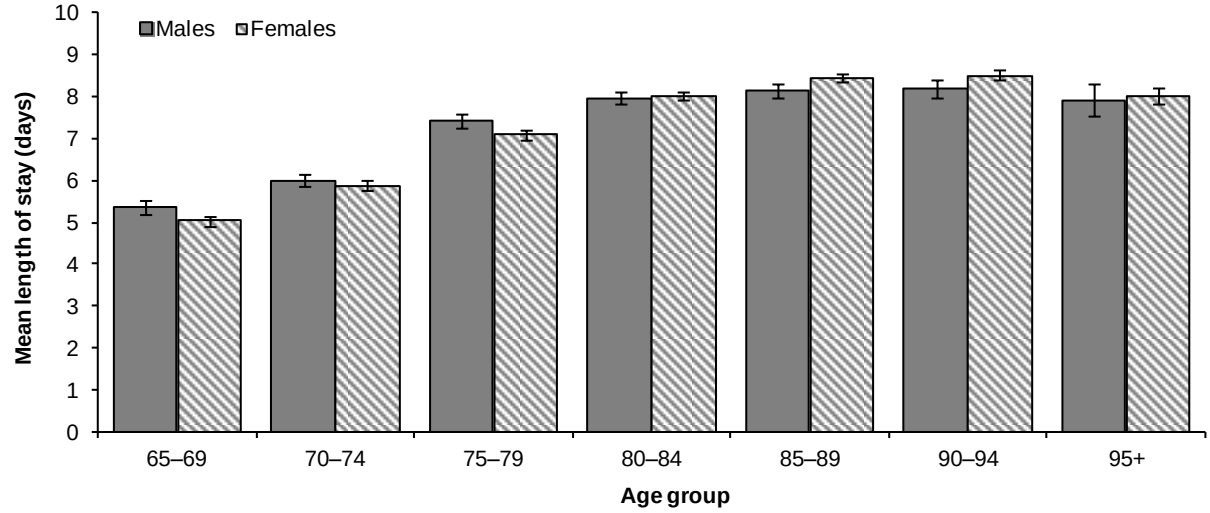


Figure 5.1: Mean length of stay (days ± SE) for fall injury case separations; males and females aged 65+, Australia 2006–07

Fall injury inward transfer separations

Fall injury inward transfer separations for people aged 65 and older accounted for 119,293 patient days in 2006–07. This represents 1.0% of all patient days for hospitalisations for this age group. The number of patient days for inward transfer separations in 2006–07 increased by 13,158 days (12.4%) from the corresponding number for 2005–06.

The proportion of fall injury inward transfer separations having only one day stay was much smaller than that for fall injury case separations (7.9% and 34.2% respectively). Similarly, a greater proportion of inward transfer separations had a length of stay of 100 days or more compared with case separations (0.3% and 0.1% respectively). Accordingly, the mean length of stay for fall injury inward transfer separations (13.8 days ± 15.7 SD) was substantially longer than that for fall injury case separations. These observations are likely due to the higher injury severity for transferred cases.

The mean length of stay for fall injury inward transfers involving males was 13.5 days (± 15.7 SD) while the mean length of stay for females was 14.0 days (± 15.7 SD), a difference which was not significant (Mann Whitney U, $p = 0.17$). Lengths of stay did differ significantly according to age, however (Kruskal-Wallis X^2, $p < 0.001$). Mean lengths of stay for all persons hospitalised for a fall injury inward transfer generally increased with age for females (Figure 5.2).

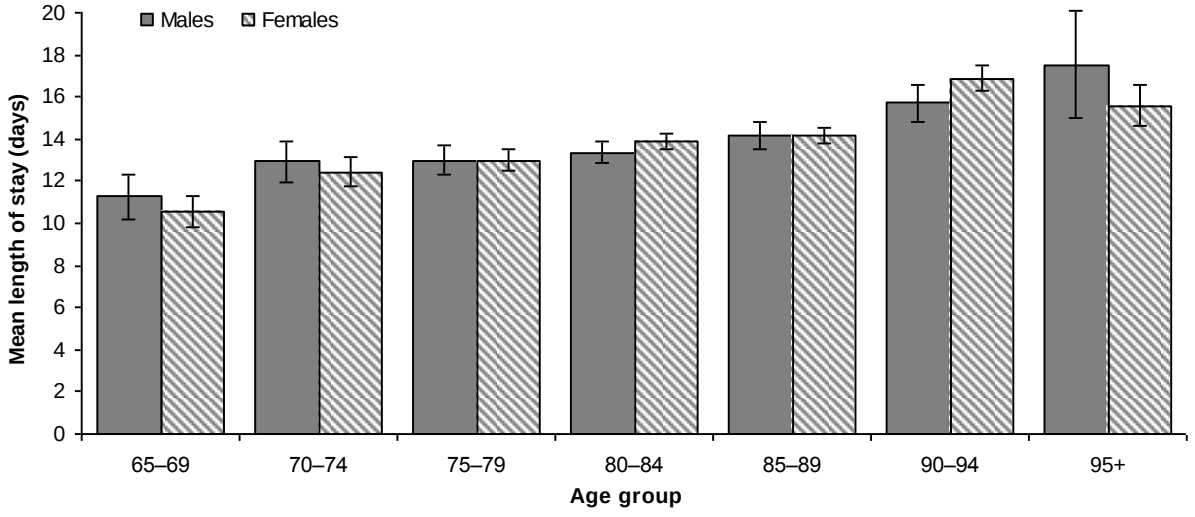


Figure 5.2: Mean length of stay (days ± SE) for fall injury inward transfer separations; males and females aged 65+, Australia 2006–07

Fall-related follow-up care separations

Fall-related follow-up care separations for people aged 65 and older accounted for 510,871 patient days in 2006–07, an increase of 44,570 days (9.6%) on the corresponding number for 2005–06. These half-million patient days are almost as numerous as those for case separations, despite the fact that the number of follow-up care separations is only about one-third of the number of fall injury cases. The patient days for fall-related follow-up care separations in 2006–07 represent 4.3% of all patient days for hospitalisations for people aged 65 and older in this period.

The proportion of fall-related follow-up care separations with a length of stay of one day was much smaller than that for fall injury case separations (17.3% and 34.2% respectively). Also, a greater proportion of follow-up care separations had a length of stay of 100 days or more compared with case and transfer separations (0.8%).

Overall, the mean length of stay for fall-related follow-up care separations was 19.0 days (± 22.2 SD). This is substantially longer than the means for both fall injury case separations and fall injury inward transfers. The mean length of stay for follow-up care separations involving males (19.9 days ± 26.3 SD) was longer than the mean length of stay for females (18.7 days ± 20.4 SD), although this difference was not significant (Mann Whitney U, $p = 0.72$). Mean lengths of stay for fall-related follow-up care separations increased relatively consistently with increasing age for both males and females (Figure 5.3).

Not surprisingly, the most common type of fall-related follow-up care separation—those with a principal diagnosis of Z50 (care involving use of rehabilitation procedures)—accounted for most patient days (82.4%). However, separations with a principal diagnosis of Z75.1 (person awaiting admission to adequate facility elsewhere) accounted for a greater number of patient days (11.4%) than expected from separation counts (7.4% of follow-up care separations). As observed in previous reports (Bradley & Harrison 2007; Bradley & Pointer 2008), mean lengths of stay for fall-related follow-up care separations were strongly associated with principal diagnosis; separations with principal diagnoses of Z47, Z48 or Z50 had similar mean lengths of stay (16.6–18.3 days) while separations with Z75.1 principal diagnoses had a much longer mean length of stay (29.8 days ± 51.1 SD). This pattern was more pronounced for males hospitalised in a fall-related follow-up care separation (Figure 5.4).

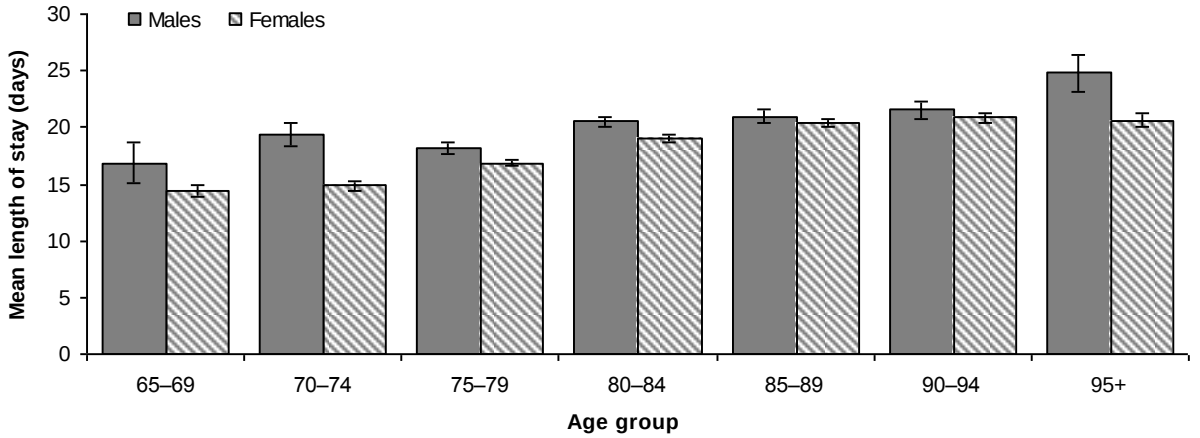


Figure 5.3: Mean length of stay (days ± SE) for fall-related follow-up care separations; males and females aged 65+, Australia 2006–07

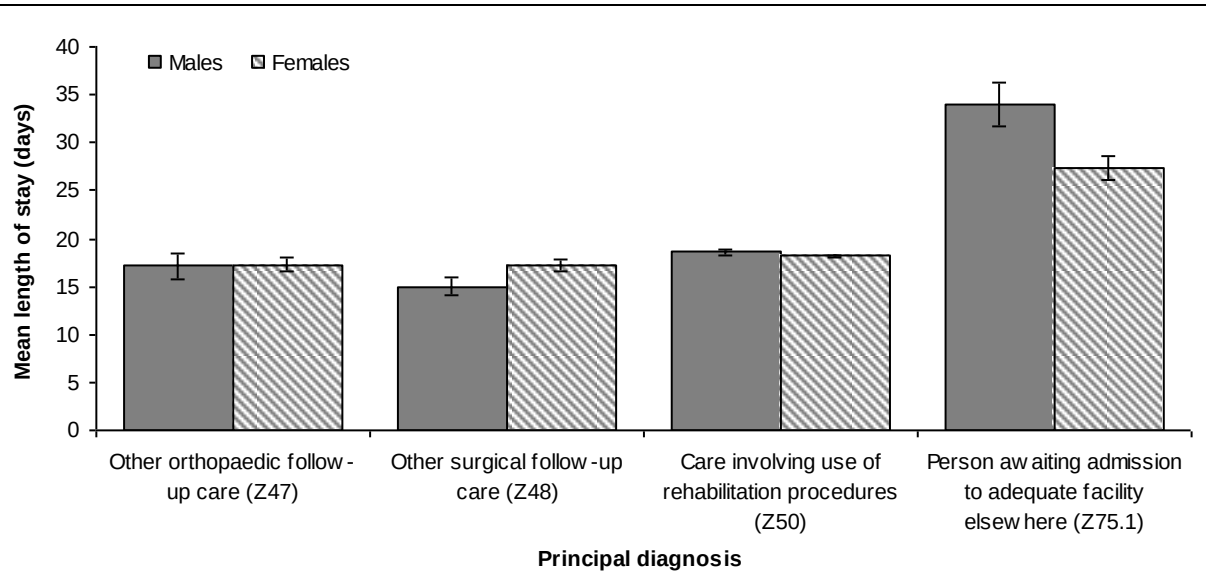


Figure 5.4: Mean length of stay (days ± SE) for fall-related follow-up care principal diagnosis groups; males and females aged 65+, Australia 2006–07

All fall-related hospitalisations

The total number of patient days for fall-related separations (cases, inward transfers and follow-up care) by people aged 65 and older in 2006–07 was 1,170,137 (Table 5.1). This figure represents 9.9% of all patient days for this population and some 83,319 more patient days than used in 2005–06 (7.7%).

A further 575,337 patient days were attributed to 'other fall-related' separations (n = 337,677 days) and separations containing the diagnosis code R29.6 (tendency to fall, not elsewhere classified; n = 237,660 days). However, as the relationship between the injurious fall and the principal reason for hospitalisation, or the use of the tendency to fall code, is not fully understood, the patient days for such separations have been omitted from the following analyses.

Table 5.1: Patient days for fall-related hospitalisations, males, females and persons aged 65+, Australia 2006–07

Fall injury separation type	Males	Females	Persons*
Fall injury case separations	156,952	382,999	539,973
Fall injury inward transfer separations	35,425	83,862	119,293
Fall-related follow-up care separations	148,057	362,730	510,871
Total	**340,434**	**829,591**	**1,170,137**

* Persons includes 112 patient days for which sex was not reported.

Fall-related hospital separations accounted for 6.2% of all patient days for males aged 65 and older while fall-related hospital separations accounted for a much higher proportion of all patient days for females in the same age range—13.1%. These proportions increased compared with 2005–06, indicating that injurious falls were becoming a greater burden to the hospital system. These findings are not unexpected given the increasing mean age of the Australian population and, accordingly, the population at risk of serious falls.

As observed in previous reports (Bradley & Harrison 2007; Bradley & Pointer 2008), the patient days for all fall-related separations in 2006–07, as a proportion of all patient days for any cause, increased with age for both males and females (Figure 5.5). For persons 85 and older, fall-related separations accounted for nearly one-fifth of the total number of patient days for this population (17.8%).

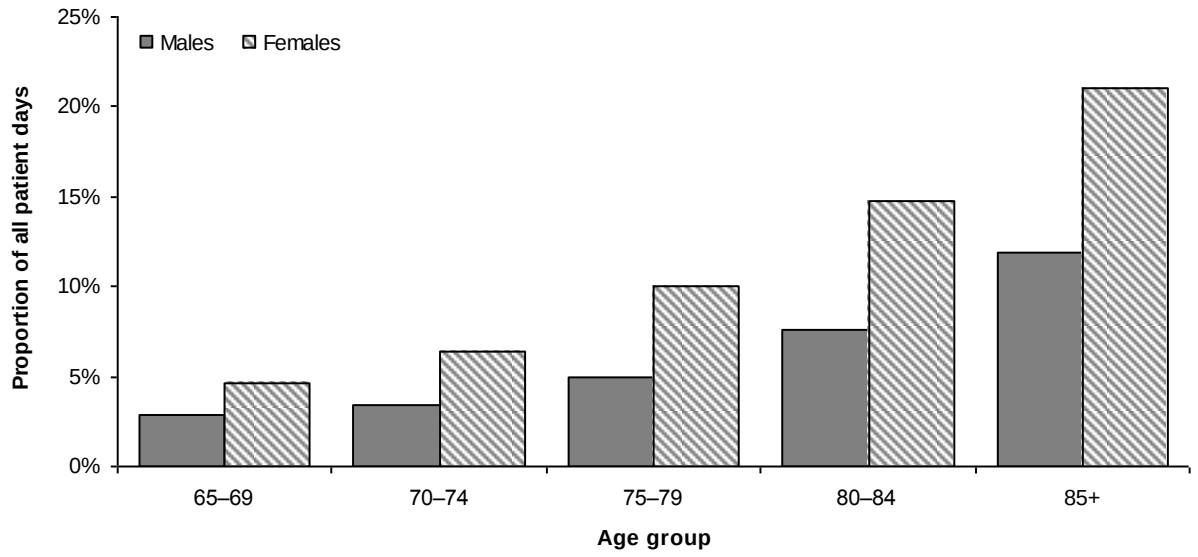


Figure 5.5: Total patient days for fall-related hospitalisations as a proportion of all patient days for the population aged 65+, males and females, Australia 2006–07

Total mean length of stay

The length of stay analysis presented above considers three groups of fall-related separation records separately. The fall injury inward transfers and fall-related follow-up care episodes discussed in Chapter Four are typically preceded by an initial episode for acute care (the cases of Chapters Two and Three). Hence, a valid estimate of the average total duration of hospital care for admitted incidents of fall-related injury should include the patient days for all phases of care. On this basis, the estimated total mean length of stay for fall cases (n = 71,746 cases) is 16.3 days if patient days for case separations, inward transfers and fall-related follow-up care are included (n = 1,170,137 days). This estimate is the same as that for cases hospitalised in 2005–06 (Bradley & Pointer 2008).

6 Estimated costs

This chapter presents estimated costs for fall-related hospital care, based on the Australian Refined Diagnosis Related Groups reported for the separations.

Methods

The Australian Refined Diagnosis Related Groups (AR-DRGs) classification system categorises admitted patient episodes of care into groups with similar conditions and similar expected usage of hospital resources. This categorisation is based on information contained in the separation record such as the diagnoses, procedures and demographic characteristics of the patient (AIHW 2008a). Expenditure can then be estimated by applying cost weights to the AR-DRGs. Cost weights are defined by the Department of Health and Ageing (DoHA) as 'a measure of the relative cost of a DRG'. Usually, the average cost across all DRGs is chosen as the reference value, and given a weight of 1 (DoHA 2008b).

Estimates in this report were calculated by applying AR-DRG Version 5.1 cost weights, and estimated average costs, to both public sector and private sector fall-related acute episodes of hospital care.

As in the report presenting cost estimates for hospitalised falls for the 2003–04 financial year (Bradley & Harrison 2007), only acute episodes of care have been included in the cost analyses presented here. AR-DRG cost weights are only appropriate for acute episodes of care as, in part, they are based on length of stay data, and it is recognised that other types of episode (rehabilitation for example) often require much longer (or shorter) hospital stays. The DoHA refers to these other episodes of care as 'non-acute products'. However, detailed analysis of admitted patient rehabilitation care, the 'non-acute product' of most interest for this report, was not provided for the 2006–07 financial year (DoHA 2008b).

The current cost analysis was able to make use of cost weights specific to episodes of care in private hospitals, unlike that for 2003–04. Separate cost weights for acute episodes of care in public and private institutions were not published for National Hospital Cost Data Collection (NHCDC) Rounds 8–10 (2003–04 to 2005–06, see DoHA 2008b) and for the analysis of fall-related hospitalisations in 2003–04 we applied public sector cost weights to private episodes of care. However, private sector cost weights for 2006–07 hospitalisations (Round 11) were published (see DoHA 2008a) and these have been applied where appropriate in the current analyses. In this respect, the analyses presented here give a more accurate estimate of hospital costs due to falls by older people than those presented for the 2003–04 financial year. A similar method was used by Potter-Forbes and Aisbett (2003) to estimate the direct hospital cost component in their study of the cost (and burden) of injury in New South Wales.

The method used to estimate the cost of fall-related hospitalisations in the present report is different from that employed by some Australian fall-injury researchers. Hall and Hendrie (2003) estimated the national cost of falls in older people by using a 'bottom-up' approach. In their prospective study, older fallers presenting to emergency departments in Western Australia were recruited to complete a diary of the community and informal care they received due to their fall (and any associated expenses) for the three months following their fall. Clinical costing database information for the study's participants was added to the diary information. Total care costs, both direct and indirect, for the three month post-fall period were then extrapolated to give state and national cost estimates (Hall & Hendrie 2003). Some

of the cost estimates identified in this work were then used in a wider study of the health system costs due to injurious falls by the older Western Australian population (Hendrie et al. 2003). More recently, a similar 'bottom-up' approach was used by Tiedemann et al. (Tiedemann et al. 2008) in New South Wales. This study, however, also accounted for the costs incurred due to less severe fall injuries (for example; requiring treatment by medical practitioners only) and so the overall estimate of cost per fall was lower than that reported by other Australian studies (Tiedemann et al. 2008).

Moller (2003), on the other hand, followed the methodology of Mathers and Penm (1999) and used a 'top-down' approach to estimate the cost of fall-related injury as a proportion of the total (known) national healthcare expenditure. Age-specific health systems costs for fall-related injury, as estimated by Mathers and Penm (1999), were multiplied by population projections provided by the Australian Bureau of Statistics (ABS). The results of this work forecast a three-fold increase in the total health cost attributed to injurious falls, to $1.4 billion annually, by 2051 (Moller 2003).

Other studies have used a 'Global Burden of Disease' approach to measure the impact of injuries due to falls. Some studies of this type measure the burden of falls injuries in terms of 'disability-adjusted life years', a measure that accounts for the years of life lost (prematurely) due to fatal conditions and the years of life lived with disability for non-fatal conditions. Measured in this way, fall injuries frequently rank as less burdensome than suicide and self-inflicted injuries and injuries due to road traffic crashes, largely due to the older age of the population most at risk of serious falls. Even so, Begg et al. (2007) reported that fall injuries accounted for 1% of the *total* burden of disease and injury in Australia in the calendar year 2003. Other studies add a cost component to their burden studies, applying an estimated dollar-cost per disability-adjusted life year of burden (for example; Moller 1998; Potter-Forbes & Aisbett 2003). Using this methodology, the high cost of hospital care for fall-related injuries frequently results in falls being ranked as *more* burdensome than other types of injuries, including self-inflicted injuries and those due to road traffic crashes.

Unlike some of these studies, however, it was beyond the scope of the current work to consider the wider health resource costs (for example; the costs associated with general practitioner, emergency department or outpatient treatment) or the indirect costs (for example; premature death, lost productivity, informal nursing care, pain and suffering) related to fall-related injury.

It must be remembered that we have had to omit some fall-related episodes of care from our estimate (because appropriate cost weights for non-acute episodes are not available) and, accordingly, present an underestimate of the total cost of direct admitted patient hospital care due to fall-related injury in Australia.

The cost of hospital care for falls by older people

A total of 80,668 fall-related hospital separations for people aged 65 and older in 2006–07 were considered in the current cost estimate (Table 6.1). This is a smaller number of separations than used in the 2003–04 report due to the exclusion of 'other fall-related' separations from the analysis. As outlined in previous sections, we do not fully understand the relationship between the injurious fall and the principal reason for hospital care for 'other fall-related' separations, so it seems conservative to omit these here, just as they were omitted from the estimation of the total length of hospital stay presented above.

All of the separations included in the analysis had been coded with an acute type of episode of care. Most separations were from public hospitals (82.2%, *n* = 66,278). The remaining separations included in this analysis were for acute care in other types of hospital (that is, the private sector). Together, acute care separations from public and other types of hospitals represent 75.3% of the total number of fall-related hospitalisations for people aged 65 and older in 2006–07 (Table 6.1).

As observed for 2003–04 data (Bradley & Harrison 2007), the majority of the fall-related follow-up care separations were omitted from the analysis due to being coded as rehabilitation and other types of non-acute care (Table 6.1). Accordingly, the following analyses greatly underestimate the costs associated with this type of fall-related separation.

Table 6.1: Episodes of fall-related hospital care by type and institution; persons aged 65+, Australia 2006–07

Type of episode of care		Public sector	Private sector	Total
Fall injury cases	Acute care	59,358 (98.5%)	11,473 (99.8%)	70,831 (98.7%)
	Other types of care*	888 (1.5%)	27 (0.2%)	915 (1.3%)
Fall injury inward transfer separations	Acute care	5,471 (86.3%)	2,269 (99.4%)	7,740 (89.8%)
	Other types of care*	865 (13.7%)	13 (0.6%)	878 (10.2%)
Fall-related follow-up care separations	Acute care	1,449 (8.4%)	648 (6.8%)	2,097 (7.8%)
	Other types of care*	15,802 (91.6%)	8,929 (93.2%)	24,731 (92.2%)
Total	**Acute care**	**66,278 (79.1%)**	**14,390 (61.6%)**	**80,668 (75.3%)**
	Other types of care*	**17,555 (20.9%)**	**8,969 (38.4%)**	**26,524 (24.7%)**

* Other types of care may include rehabilitation, palliative care, geriatric evaluation and management, psychogeriatric care, maintenance care and other and unknown types of care.

The total estimated direct cost to the hospital system for the 80,668 acute fall-related hospitalisations involving people aged 65 and older in 2006–07 was $600.3 million (Table 6.2). Of this, $504.4 million (84.0%) was due to the cost of fall-related acute episodes of care in public hospitals, while $95.9 million was due to care in the private sector. (It is important to note that the range of costs included in these estimates differ between the two sectors, see DoHA 2008b.) This figure of $600.3 million compares to a total estimated cost of $566.0 million for fall-related hospitalisations in 2003–04 (Bradley & Harrison 2007).

Table 6.2: Estimated cost to the hospital system for fall-related acute episodes of care ($ million): males, females and persons aged 65+, Australia 2006–07

Hospital sector		Fall injury cases ($)	Fall injury inward transfers ($)	Fall-related follow-up care ($)*	Total ($)
Males	Public sector	129.0	21.6	3.7	154.3
	Private sector	20.4	4.8	0.8	26.0
	Total	149.4	26.4	4.5	180.3
Females	Public sector	301.3	39.7	9.2	350.1
	Private sector	55.8	11.9	2.2	69.9
	Total	357.1	51.6	11.3	420.0
Persons**	Public sector	430.3	61.3	12.8	504.4
	Private sector	76.2	16.7	3.0	95.9
Total		**506.5**	**78.0**	**15.8**	**600.3**

* Excludes the majority of fall-related follow-up care separations as most (92%) do not have an assigned case-type of 'acute care'.

** Persons include costs of separations for which sex was not reported: fall injury cases, *n* = 2; fall injury inward transfers, *n* = 1.

The increase in the estimated total cost of fall-related hospitalisations between 2003–04 and 2006–07 ($34.4 million) was smaller than expected given the increase in the number (and rate) of fall-related hospitalisations in 2006–07. This is largely due to the omission of 'other fall-related' separations in the current analysis. If these episodes of 'other fall-related' care were similarly omitted from the 2003–04 analysis, that cost estimate would have been $455,480,326 (see Bradley & Harrison 2007, Table 17). Comparing like with like, then, the increase in the cost to the hospital system for episodes of acute care directly related to falls by older people in 2006–07 was $144.8 million compared with the cost of such care in 2003–04.

The mean cost of hospital care per fall injury case can be estimated in a similar way to the mean length of stay per case presented in the previous chapter; the total cost for all fall-related hospitalisation divided by the estimated number of cases in 2006–07. This results in an estimated mean cost to the hospital system of $8,367 per fall injury case. The mean cost for cases involving males was slightly higher ($8,444) than that for females ($8,335). However, these values are certain to underestimate the actual cost of hospital care due to falls given the omission of such a large proportion of the often lengthy fall-related follow-up care separations from the analysis.

Length of stay comparisons

As mentioned above, AR-DRG cost weights are calculated, in part, on the basis of average lengths of stay for separations included in the NHCDC studies, which are published along with cost weights (DoHA 2008a). The observed lengths of stay for fall-related acute episodes of care in 2006–07 were generally longer than in the NHCDC.

While older people commonly have longer lengths of stay in hospital than younger people, many of the AR-DRGs assigned to fall-related acute-care hospitalisations explicitly or implicitly accounted for age-related factors. For example, some AR-DRGs specified an age range for the separations to which they may be applied (for example; AR-DRG X60B: 'Injuries, age greater than 64 years without complications or co-morbidities'). In other situations, the AR-DRGs did not specify a particular age range, but were for conditions

strongly associated with older ages (for example; AR-DRG I03B: 'Hip replacement with catastrophic/severe complications or co-morbidities or Hip revision without catastrophic/severe complications or co-morbidities'). Further work, beyond the scope of this report, would be required to determine the extent to which the relatively long mean length of stay observed for fall cases is due to a residual age-effect, not accounted for in the specification of AR-DRGs, and the extent to which it is due to other characteristics of fall cases.

The lengths of stay observed for fall injury case separations were longer than the NHCDC length of stay for the AR-DRG by 0.8 days on average (± 8.4 SD). While the observed lengths of stay varied widely, from –27 days to +224 days in relation to the expected values, the median difference was –1.2 days.

Observed lengths of stay for fall injury inward transfer separations exceeded the expected lengths of stay by a greater degree than case separations; the lengths of stay observed for transfers were longer than the expected length of stay for the AR-DRG by 3.2 days on average (± 12.7 SD). The difference between observed lengths of stay for inward transfer separations and those expected according to the AR-DRG ranged from –27 days less to +182 days more and the median difference was –0.2 days.

The lengths of stay observed for acute-type fall-related follow-up care separations were also generally longer than expected; a difference of 4.3 (± 21.0 SD) days longer on average than expected for these AR-DRGs (range: –21 to +538 days; median difference: 0.0 days). It is likely that the true cost of these follow-up care separations was much higher, in actual terms, than is indicated by estimates based on cost weights for episodes of expected duration.

Cost components

The major cost components contributing to the 2006–07 total estimate are described in Tables A2–A4 (Appendix B). Again, note that the relatively small cost estimate for fall-related follow-up care reflects the fact that available cost weights were not appropriate to apply to non-acute episodes of care.

Tables 6.3 to 6.5 list the ten most costly AR-DRGs for acute-type fall injury case separations, inward transfer separations and fall-related follow-up care separations for people aged 65 and older in 2006–07. It must be remembered, however, that acute-type episodes of care made up only 7.8% of all fall-related follow-up care separations in the period. Separations from both public hospitals and those in the private sector are combined for these tables.

Some of these AR-DRGs rank highly for cost because, while the number of separations with the particular AR-DRG was relatively low, the condition is serious and the care provided expensive (for example; I03C; about 1,600 case separations had this AR-DRG, but at an average cost per episode of care of $16,103). Others rank highly for cost due to the volume of separations that had a particular, although relatively inexpensive, AR-DRG (for example; I75B; had an average cost of $3,297, but more than 4,100 case separations had this AR-DRG in 2006–07).

The most expensive AR-DRGs for fall injury case and inward transfer separations in 2006–07 were very similar to those identified in 2003–04 (Bradley & Harrison 2007); hip, femur and pelvis procedures predominated and injuries with associated complications or co-morbidities were common. The most expensive AR-DRGs for inward transfer separations also included A06Z (tracheostomy or ventilation, greater than 95 hours) and B78A (intracranial injury with catastrophic/severe complications or co-morbidities), indicative of the more severe nature of transferred cases.

Due to the small proportion of fall-related follow-up care separations coded as acute episodes of care in 2006–07, the data presented in Table 6.3 should be viewed as an indication only of the types of AR-DRGs such separations have rather than as an accurate presentation of costs. As expected, 'aftercare' and rehabilitation-related AR-DRGs were most common. As in 2003–04, two AR-DRGs, I73A and Z63A, accounted for more than half of the acute-type follow-up care separations, and more than three-quarters of the costs, considered in this analysis. Common and/or costly AR-DRGs for 'other fall-related' separations were not analysed.

Table 6.3: The ten most costly AR-DRGs for acute-type fall injury case separations; persons aged 65+, Australia 2006–07

AR-DRG v5.1	Description	Count	Cost ($ m)
I08A	Other hip and femur procedure with catastrophic/severe complications or co-morbidities	5,027	$90.8
I03B	Hip replacement with catastrophic/severe complications or co-morbidities or Hip revision without catastrophic/severe complications or co-morbidities	2,924	$56.7
I08B	Other hip and femur procedure without catastrophic/severe complications or co-morbidities	3,259	$34.0
X60A	Injuries, age greater than 64 years, with complications or co-morbidities	6,446	$28.4
I03C	Hip replacement without catastrophic/severe complications or co-morbidities	1,603	$25.8
I75A	Injury to the shoulder, arm, elbow, knee, leg or ankle, age greater than 64 years, with complications or co-morbidities	3,273	$25.3
I77A	Fracture of pelvis with catastrophic/severe complications or co-morbidities	1,702	$19.4
J65A	Trauma to the skin, subcutaneous tissue and breast, age greater than 69 years	4,587	$16.0
I19Z	Other elbow or forearm procedures	2,355	$14.1
I75B	Injury to the shoulder, arm, elbow, knee, leg or ankle, age greater than 64 years, without complications or co-morbidities	4,157	$13.7

Table 6.4: The ten most costly AR-DRGs for acute-type fall injury inward transfer separations; persons aged 65+, Australia 2006–07

AR-DRG v5.1	Description	Count	Cost
I08A	Other hip and femur procedure with catastrophic/severe complications or co- morbidities	865	$15.5
I03B	Hip replacement with catastrophic/severe complications or co-morbidities or Hip revision without catastrophic/severe complications or co-morbidities	522	$10.1
I08B	Other hip and femur procedure without catastrophic/severe complications or co- morbidities	624	$6.6
I03C	Hip replacement without catastrophic/severe complications or co-morbidities	302	$5.0
I75A	Injury to the shoulder, arm, elbow, knee, leg or ankle, age greater than 64 years, with complications or co-morbidities	491	$3.6
A06Z	Tracheostomy or ventilation, greater than 95 hours	40	$3.6
I77A	Fracture of pelvis with catastrophic/severe complications or co-morbidities	255	$2.8
I78A	Fracture of the neck of femur with catastrophic/severe complications or co-morbidities	279	$2.0
B78A	Intracranial injury with catastrophic/severe complications or co-morbidities	160	$1.9
I68A	Non-surgical spinal disorders with complications or co-morbidities	242	$1.8

Table 6.5: The ten most costly AR-DRGs for acute-type fall-related follow-up care separations*; persons aged 65+, Australia 2006–07

AR-DRG v5.1	Description	Count	Cost
I73A	Aftercare of musculoskeletal implants/prostheses, age greater than 59, with catastrophic/severe complications or co-morbidities	562	$7.0
Z63A	Other aftercare with catastrophic/severe complications or co-morbidities	708	$5.1
Z60A	Rehabilitation with catastrophic/severe complications or co-morbidities	139	$1.3
I73B	Aftercare of musculoskeletal implants/prostheses, age greater than 59, without catastrophic/severe complications or co-morbidities	170	$0.6
Z60B	Rehabilitation without catastrophic/severe complications or co-morbidities	44	$0.5
Z63B	Other aftercare without catastrophic/severe complications or co-morbidities	158	$0.3
A06Z	Tracheostomy or ventilation, greater than 95 hours	n.p.	$0.3
Z64A	Other factors influencing health status	66	$0.3
Z60C	Rehabilitation, same-day admission	208	$0.1
Z01A	OR procedures with diagnoses of other contacts with health services with catastrophic/severe complications or co-morbidities	10	$0.1

* As described above, acute-type episodes of care contribute less than 8% of all fall-related follow-up care separations.

n.p. Small cell counts have been suppressed to prevent patient identification.

7 'Tendency to fall' hospitalisations

This chapter presents an analysis of hospital separations coded with the diagnosis R29.6 (tendency to fall, not elsewhere classified). This analysis is new for the report series.

In the fifth edition of the ICD-10-AM the diagnosis code R29.6 replaces the diagnosis code R29.81 'other and unspecified symptoms and signs involving the nervous and musculoskeletal systems—falls' that was used in previous editions of the ICD-10-AM (see NCCH 2004). The wording in the coding manual for R29.6 reads "tendency to fall because of old age or other unclear health problems" (NCCH 2006, Tabular List p. 382) and falls due to accidents, difficulty in walking, dizziness and giddiness, syncope and collapse or causing injury are explicitly excluded. Further, the ICD-10-AM coding standards regarding both the R29.6 and R29.81 diagnoses (that is, across editions) state; "[the code] should be assigned only in those cases where a patient (usually elderly) is admitted because of falls of unknown aetiology and no cause is found during the episode of care. It should not be used in cases of known trauma associated with a fall or with a known medical condition which is found to be the cause of the recurrent falls, for example, Parkinson's disease" (see NCCH 2006, Australian Coding Standards p. 227).

A total of 21,687 hospital separations for people aged 65 and older in 2006–07 included a 'tendency to fall' diagnosis. A small number of the fall injury separations already discussed in this report included at least one such diagnosis (Table 7.1). Omitting these separations, as they have already been considered in previous sections, left 16,828 separations containing a 'tendency to fall' diagnosis, but which were not explicitly coded as injurious falls, in the analysis. Some of these separations, contrary to the coding instructions outlined above, also contained either, but not both, a community injury diagnosis (S00–T75 or T79, *n* = 455) or an external cause signifying a fall (W00–W19, *n* = 241).

Table 7.1: Records containing at least one R29.6 diagnosis by separation type; males, females and persons aged 65+, Australia 2006–07

Separation type	Males	Females	Persons	Per cent of type
R29.6 in record (no injury diagnosis with W00–W19 external cause)	7,373	9,455	16,828	100.0%
Fall injury case	605	1,250	1,855	2.6%
Fall injury inward transfer	86	167	253	2.9%
Fall-related follow-up care	391	902	1,293	4.8%
Other fall-related separation (any injury diagnosis with W00–W19 external cause)	634	824	1,458	6.6%
Total	**9,089**	**12,598**	**21,687**	

Of the 16,828 'tendency to fall' hospital separations for people aged 65 and older in 2006–07, the majority (56.2%, *n* = 9,455) involved females. This is a lower proportion for females than that noted for other types of fall-related separation in this report. Further, the age-standardised rate of 'tendency to fall' separations was higher for males (656 per 100,000 population) than for females (540 per 100,000, persons overall; 584 per 100,000). These observations may be related to the injury-risk; older females may be more likely to be injured than older males, thus appear in our dataset as a fall injury case (or other fall-related separation) rather than in this set of records.

After the age of 69, age-specific rates of 'tendency to fall' separations for males were higher than those for females for all age groups (Figure 7.1).

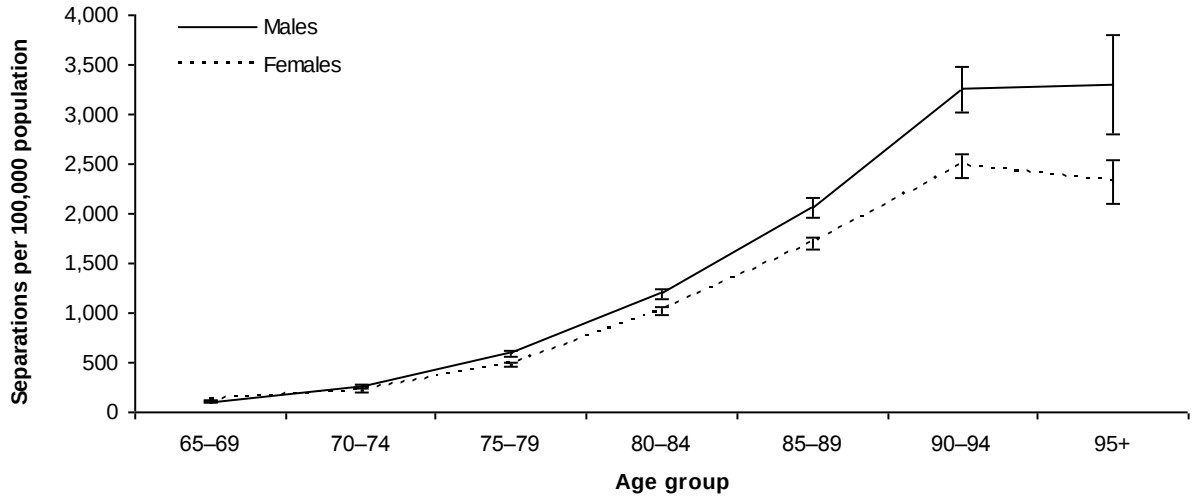


Figure 7.1: Age-specific rates of R29.6 separations* (± 95% CI); males and females aged 65+, Australia 2006–07

* Includes only those R29.6 separations not already classified as fall injury cases, inward transfers, follow-up care or 'other fall-related separations'.

A little over one-quarter (28.7%) of 'tendency to fall' separations had a principal diagnosis from Chapter XXI of the ICD-10-AM—factors influencing health status and contact with health services (see Table 7.2). This is the same chapter from which 'fall-related follow-up care separations' were drawn, if they had a principal diagnosis of Z47, Z48, Z50 or Z75.1 plus an additional diagnosis of injury (S00–T75 or T79) and an external cause signifying a fall (W00–W19). The Chapter XXI 'tendency to fall' separations, then, either had a different principal diagnosis and/or lacked both an injury and a falls code. Similarly to fall-related follow-up care separations, most, however, had Z50.9 (care involving use of rehabilitation procedures, unspecified) as the principal diagnosis (66.8%, *n* = 3,225). Z75.11 (person awaiting admission to residential aged care service) was another frequent principal diagnosis for this group.

Principal diagnoses from Chapter XVIII (symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified) of the ICD-10-AM were also common for 'tendency to fall' separations, accounting for a further quarter of these records (26.3%). Of these 4,432 records, most (70.6%, *n* = 3,129) had R29.6 as the principal diagnosis.

The 16,828 'tendency to fall' separations discussed in this section used 237,660 patient days in 2006–07 and separations involving females contributed more than half of these days (54.8%). The mean length of stay for an R29.6 separation was 14.1 days (± 23.4 SD). This average is quite a bit longer than that observed for fall injury case separations (7.5 days ± 10.2 SD) but shorter than that for fall-related follow-up care separations (19.0 days ± 22.2 SD). Mean lengths of stay did not differ by sex (Mann-Whitney U, *p* = 0.99). About one in seven 'tendency to fall' separations had a length of stay of one day (15.8%, *n* = 2,653) and 0.6% of such separations had a length of stay of 100 days or more (*n* = 94).

Two-thirds of the 'tendency to fall' separations were coded as acute episodes of care (66.3%, *n* = 11,151) and 80.2% (*n* = 8,941) of these were episodes of care in public hospitals. On average, the lengths of stay observed for 'tendency to fall' separations exceeded the NHCDC length of stay for the AR-DRGs by 4.2 days (± 13.0 SD).

The total cost to the hospital system for these (public and private sector) acute-care episodes was estimated at $69,717,039. Three specific AR-DRGs accounted for about one-third of these costs; B81A (other disorders of the nervous system with catastrophic/severe complications or co-morbidities, 17.5%), B63Z (dementia and other chronic disturbances of cerebral function, 7.9%) and B81B (other disorders of the nervous system without catastrophic/severe complications or co-morbidities, 6.6%).

Table 7.2: ICD-10-AM chapter of principal diagnosis for 'tendency to fall' separations*; males, females and persons aged 65+, Australia 2006–07

ICD-10-AM chapter	Males	Females	Persons
Certain infectious and parasitic diseases	79 (1.1%)	86 (0.9%)	165 (1.0%)
Neoplasms	322 (4.4%)	229 (2.4%)	551 (3.3%)
Diseases of the blood, blood-forming organs, etc.	58 (0.8%)	80 (0.8%)	138 (0.8%)
Endocrine, nutritional and metabolic diseases	187 (2.5%)	220 (2.3%)	407 (2.4%)
Mental and behavioural disorders	380 (5.2%)	496 (5.2%)	876 (5.2%)
Diseases of the nervous system	356 (4.8%)	314 (3.3%)	670 (4.0%)
Diseases of the circulatory system	638 (8.7%)	790 (8.4%)	1,428 (8.5%)
Diseases of the respiratory system	463 (6.3%)	372 (3.9%)	835 (5.0%)
Diseases of the digestive system	170 (2.3%)	215 (2.3%)	385 (2.3%)
Diseases of the skin and subcutaneous tissue	92 (1.2%)	134 (1.4%)	226 (1.3%)
Diseases of the musculoskeletal system and connective tissue	282 (3.8%)	538 (5.7%)	820 (4.9%)
Diseases of the genitourinary system	298 (4.0%)	562 (5.9%)	860 (5.1%)
Symptoms, signs, abnormalities not elsewhere classified	1,892 (25.7%)	2,540 (26.9%)	4,432 (26.3%)
Injury, poisoning and consequences of external causes	78 (1.1%)	96 (1.0%)	174 (1.0%)
Factors influencing health status	2,067 (28.0%)	2,758 (29.2%)	4,825 (28.7%)
Other principal diagnoses	11 (0.1%)	25 (0.3%)	36 (0.2%)
Total	**7,373**	**9,455**	**16,828**

* Includes only separations not already classified as fall injury cases, inward transfers, follow-up care or 'other fall-related separations'.

8 Trends in fall hospitalisations

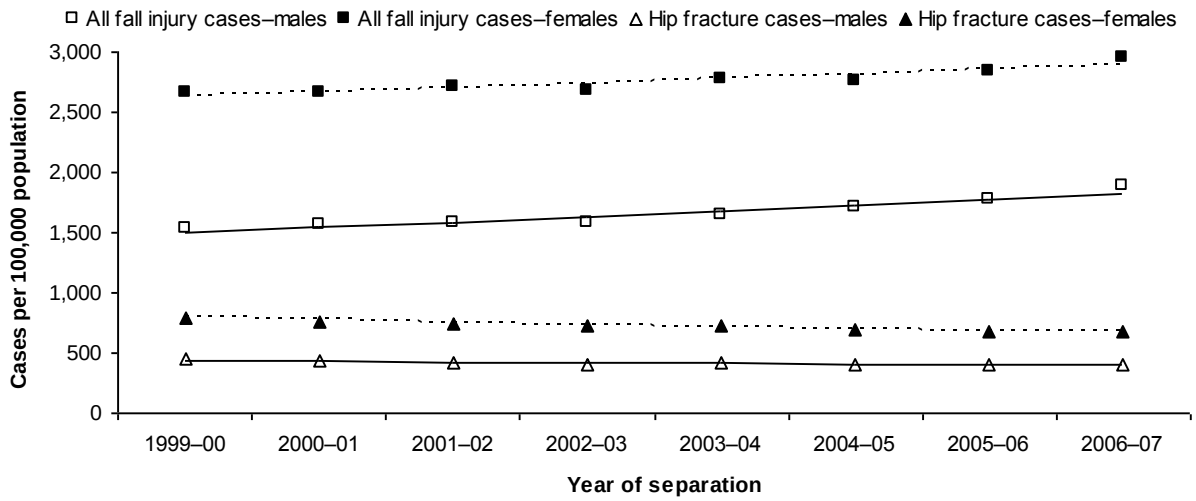
This chapter presents a detailed analysis of rates of fall-related hospitalisations over the eight-year period 1999–2007, including analyses by injury type and external cause.

In the previous report in this series we presented the findings of a brief trends analysis for fall-related hospital data since 1999–00 (Bradley & Pointer 2008). While we observed that age-standardised rates of fall injury cases, as a whole, had increased between 1999–00 and 2005–06, rates of fall-related femur fractures had declined over this period. Rates of fall injury inward transfer separations and fall-related follow-up care separations had also increased since 1999–00, negating the possibility that changes in admission and/or coding practices had spuriously affected rate estimates for the different types of fall-related separations. Changes in admission and/or coding practices over time, however, may account for our observation that while the average length of stay per fall-related separation had decreased since 1999–00, the estimated (average) *total* length of stay per fall injury case (including patient days for case separations, transfers and follow-up care) had increased in the period to 2005–06 (Bradley & Pointer 2008).

This section of the report expands upon the previous trends analysis, including the 2006–07 data year in calculations and undertaking further analysis of more specific groups of fall-related hospitalisations.

Our analysis confirms that age-standardised rates of hospitalised fall injury cases for both males and females aged 65 and older increased in the period 1999–00 to 2006–07 (Figure 8.1). Using negative binomial regression techniques, these increases in rate are of the order of 2.9% (males) and 1.4% (females) per year (persons; 1.7% per year). These are similar to the values stated in the previous report (Bradley & Pointer 2008), but the extra year of data here has increased the magnitude of the rate increases slightly. Based on these observations, we estimate that an extra 7,754 fall injury cases involving people aged 65 and older (10.8%) separated from hospital in 2006–07 than would have occurred if the age-standardised rate had remained stable since 1999–00.

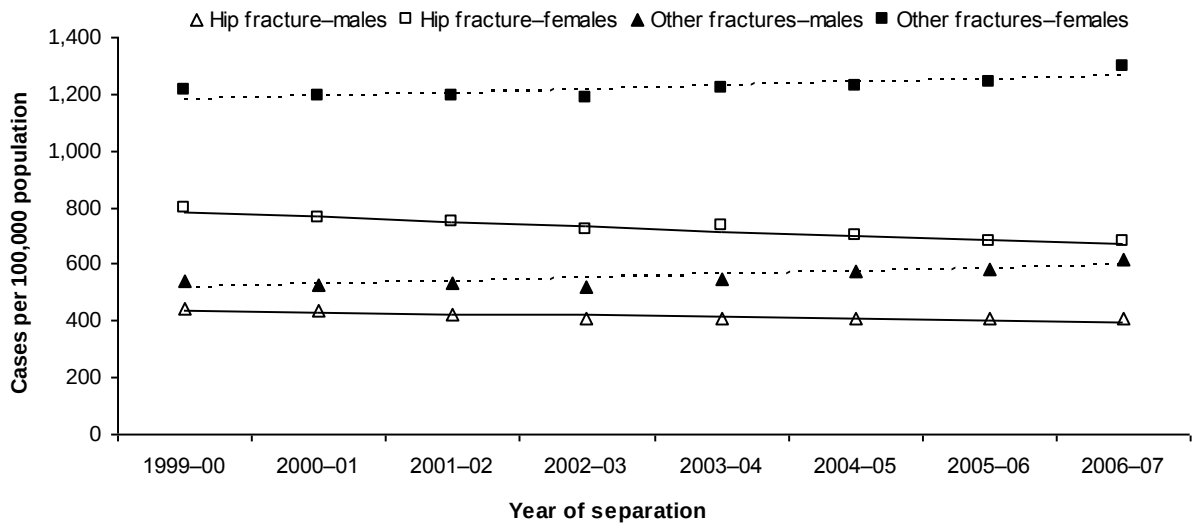
In contrast, the rates of hospitalised cases of hip fracture (principal diagnoses S72.0–S72.2) due to falls in people aged 65 and older decreased since 1999–00 (also presented in Figure 8.1). While the rate of all hospitalised falls injury cases may be affected by changes in admission practices over time, it is thought that hip fractures are serious enough to be admitted to hospital in nearly every instance. Hence, rates of admission should provide a relatively reliable indicator of rates of severe falls (see Boufous et al. 2007). Decreases in the rates of hip fracture since 1999–00 were estimated to be –1.3% per year for males and –2.2% per year for females (persons; –2.2% per year). These values are the same as those reported for the 1999–2006 period (Bradley & Pointer 2008). Accordingly, we estimate that 2,613 (15.8%) fewer hip fracture cases involving older people separated from hospital in 2006–07 occurred than would have if the age-standardised rate had remained stable since 1999–00.



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.1: Age-standardised rates for fall injury cases and cases with hip fracture as the principal diagnosis (S72.0–S72.2); males and females aged 65+, Australia 1999–2007

Rates of other types of fractures (that is, any other bones but the neck of the femur) were estimated to have increased over the study period, however, particularly for males (see Figure 8.223). These increases were estimated to be 2.1% per year for males and 1.0% per year for females (persons; 1.1% per year).



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.2: Age-standardised rates of hip fracture cases (principal diagnosis S72.0–S72.2) versus other fractures due to falls; males and females aged 65+, Australia 1999–2007

Increases in the rate of hospitalised falls were not consistent across all age-groups in the older population. Figure 8.3 shows that the annual increases in the rate of hospitalised fall injury cases were of greater magnitude for the oldest old. The rate for males aged 65–74 increased by 2.1% per year while the rate for males aged 75–84 increased by 2.7% per year. The rate for the oldest males, aged 85 and over, showed the greatest increase at 3.6% per year. Similarly, the rate of fall injury cases for females aged 65–74 increased by 1.0% per year and that for females aged 75–84 increased by 1.1% per year. The increase in rate for the oldest females, aged 85 and over, was 2.0% per year. All these increases were statistically significant ($p < 0.001$).

Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.3: Age-standardised rates for fall injury cases for three age groups, males and females aged 65+ Australia 1999–2007

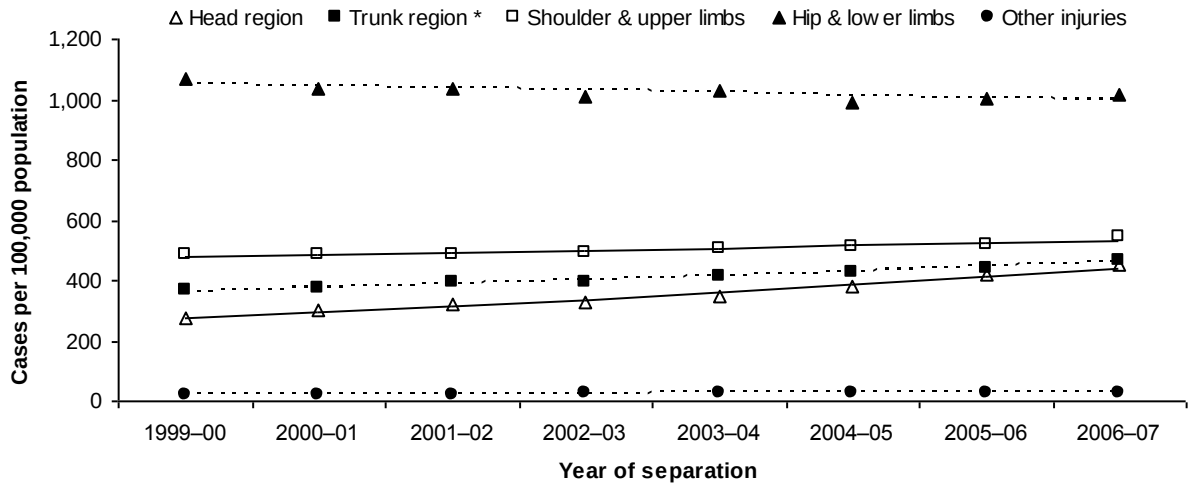
The decreases observed in the rates of hip fractures due to falls over the period 1999–2007 present a different picture by age group however, with the greatest decreases observed for people aged 75–84 not the oldest age group (data not shown). The rate of hip fractures for persons aged 65–74 decreased by –2.3% per year while the rate of hip fractures for persons aged 75–84 decreased by –2.5% per year. The decrease in the rate of hip fractures due to falls for people aged 85 and older was lower than both of these, at an estimated –1.8% per year.

These results are puzzling. While the rate of hip fractures—likely to be the most serious type of fall injury for an older person—are strongly declining over time, the rate of all hospitalised fall injuries are increasing markedly. So, while it is tempting to attribute the decline in rates of hip fracture to increased use of anti-osteoporotic treatments (for example; Fisher et al. 2009), if such explanations do not adequately account for the increasing trend for other fractures, and all serious fall injuries, they must be viewed with some scepticism.

Diagnosis types

As discussed above, age-standardised rates of hospitalised fall injury cases involving a person aged 65 and older with a principal diagnosis of a hip fracture decreased over the period 1999–00 to 2006–07 while rates of all other types of fractures (combined) increased over this time. It was of interest, then, to examine rates over time according to the body region of the principal injury, whether or not a fracture was sustained.

Analyses of fall injury cases hospitalised over the 1999–2007 period according to the body part injured demonstrate increasing age-standardised rates for all body regions other than the hip and lower limbs (Figure 8.4). Rates of injuries to the head increased over time most substantially; 7.0% per year ($p < 0.001$). Rates of injuries to the trunk region and the shoulders and upper limbs also increased significantly over the eight-year study period (by 3.3% and 1.5% per year, respectively). Only 1.0% of fall cases in the study period were classed as 'other injuries not specified by body region' (for example; injuries to multiple body regions); nonetheless, rates of cases of this type increased by 4.8% per year. Conversely, injuries to the hip and lower limb region significantly decreased over the study period (–0.7% per year, $p < 0.01$). This was largely due to the decrease in rates of hip fracture, discussed above.



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

* Trunk includes neck, thorax, abdomen, lower back, lumbar spine & pelvis.

Figure 8.4: Age-standardised rates for fall injury cases by body region of injury; persons aged 65+ years, Australia 1999–2007

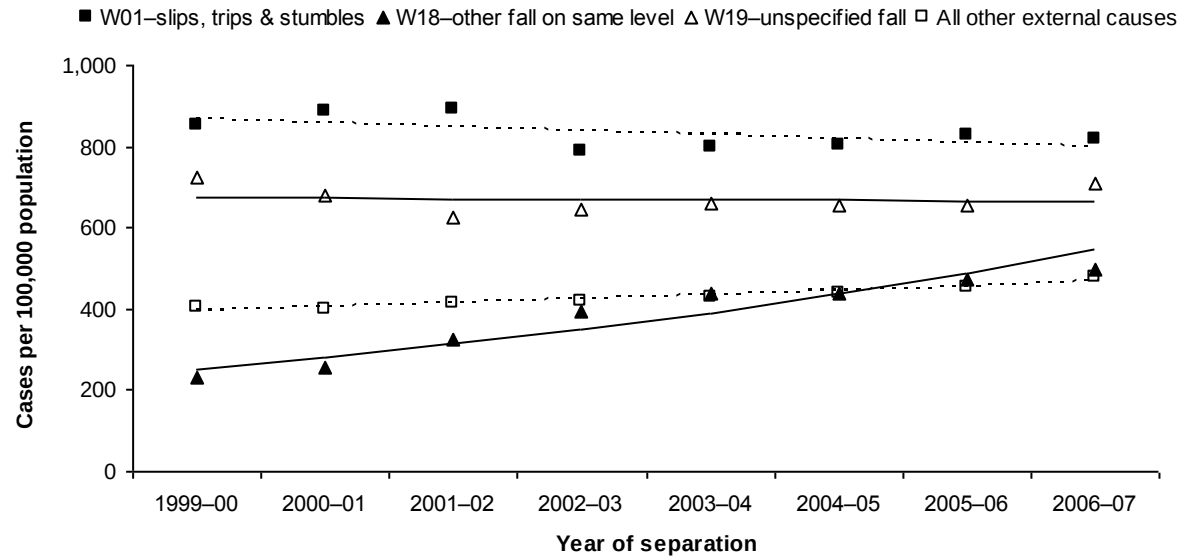
External causes

Three external cause codes accounted for four in five (81.5%) fall injury cases for the eight year study period 1999–2007 (W01: fall due to slipping, tripping and stumbling, 35.8%; W18: other fall on same level, 16.8%; and W19: unspecified fall, 28.9%). Over this period, rates of falls due to slipping, tripping and stumbling significantly decreased by –1.2% per year ($p < 0.05$) while rates of 'other fall on the same level' significantly increased by 11.8% per year ($p < 0.001$, see Figure 8.5). The rate of unspecified falls remained stable between 1999–00

and 2006–07 (–0.2% change per year, $p = 0.81$). This last finding suggests that observed changes in rates over time are not due to changes in the specificity of external cause coding.

Falls due to all other external causes combined (18.5% of cases for 1999–2007) increased over the study period by an estimated 2.4% per year. This increase was statistically significant ($p < 0.001$). Included in this group were falls on or from stairs and steps (5.9% of cases over 1999–2007), which increased by an estimated 3.7% per year, and falls involving beds (4.4% of cases for 1999–2007), which increased by 2.8% per year.

Since 2002–03 the W01 external cause code has included a fourth digit to explicitly differentiate between falls due to slipping, tripping and stumbling (NCCH 2002). Over the five years to 2006–07, rates of falls due to slipping (27.6% of all W01 fall injury cases in this period) were estimated to have significantly decreased by –1.1% per year ($p < 0.05$). Rates of falls due to stumbling (11.9% of all W01 fall injury cases in 2002–07) were also estimated to have decreased, by –5.2% per year ($p < 0.001$). Conversely, falls due to tripping, which accounted for three in five W01 fall injury cases over the study period, significantly increased by 3.4% per year ($p < 0.001$).



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the actual age-standardised rate value for each year.

Figure 8.5: Age-standardised rates for fall injury cases by selected external causes; persons aged 65+ years, Australia 1999–2007

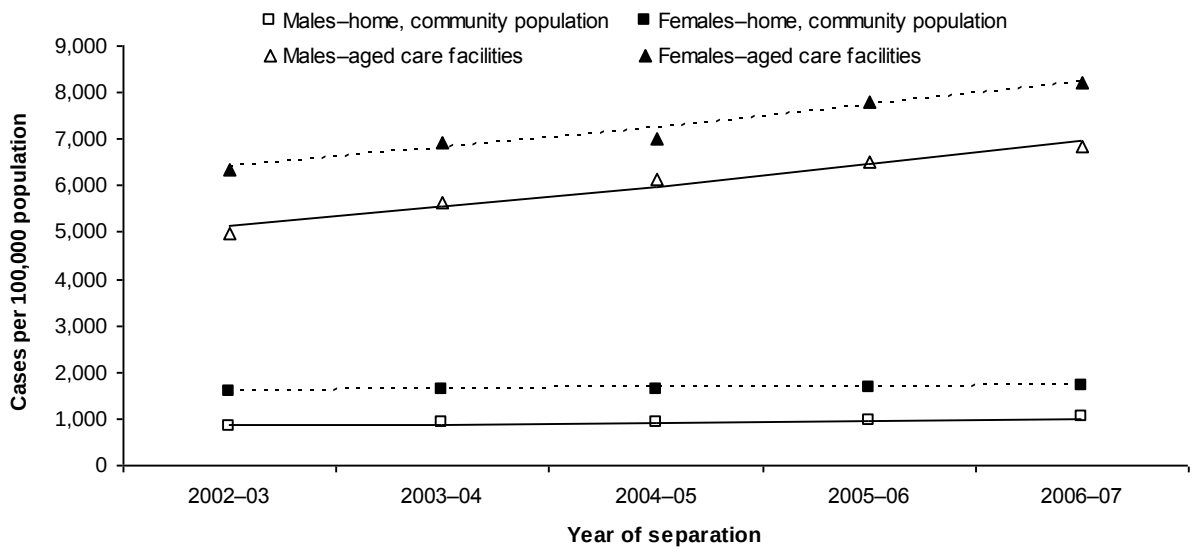
Place of occurrence

As discussed in Chapter Three, the two most common places of occurrence recorded for hospitalised fall injury cases for people aged 65 and older are the home and aged care facilities. Over the five year period 2002–2007 (when the ICD-10-AM included an explicit 'aged care facility' place of occurrence code) 49% of falls were reported to have occurred in the home and a further 21% in aged care facilities. The same method underlying Figure 3.1 (that is, the estimated population of older people living in the community versus aged care facilities as the rate denominators), has been used to create Figure 8.6. It describes the rates

over time for fall injury cases resulting in hospitalisation that were recorded as occurring in the home or in aged care facilities.

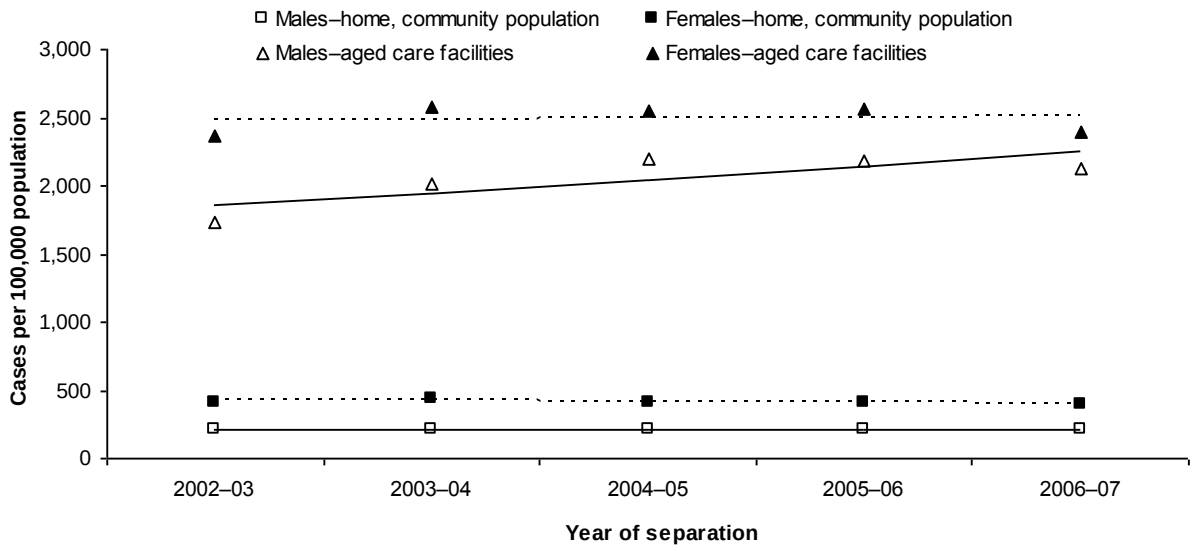
In each year of the analysis, residents of aged care facilities had significantly higher rates of hospitalised falls than community residents falling in the home, and both sets of rates increased significantly over the study period. However, while age-standardised rates of falls occurring in the home, involving older people resident in the community, significantly increased between 2002–03 and 2006–07 (males; 4.4% per year, females; 2.2% per year), rates of falls occurring in aged care facilities increased by a greater magnitude. The age-standardised rate of falls requiring hospitalisation for male residents of aged care facilities increased by 7.9% per year, while the equivalent rate for female aged care residents increased by 6.5% per year.

These findings may indicate the increasing frailty of the residential aged care population relative to that of the population aged 65 and older remaining resident in the community. Male residents of aged care facilities, in particular, appear to be at increasing risk of serious falls, with rates of hip fractures due to falls increasing by 4.9% per year since 2002–03 ($p < 0.01$). Rates of hip fracture for female residents of aged care facilities and both males and females resident in the community (and falling in the home) either remained stable or significantly decreased over the same period (Figure 8.7).



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.6: Age-standardised rates for falls in the home and in aged care facilities calculated using the estimated population of people resident in the general community and residential care; males and females aged 65+, Australia 2002–2007



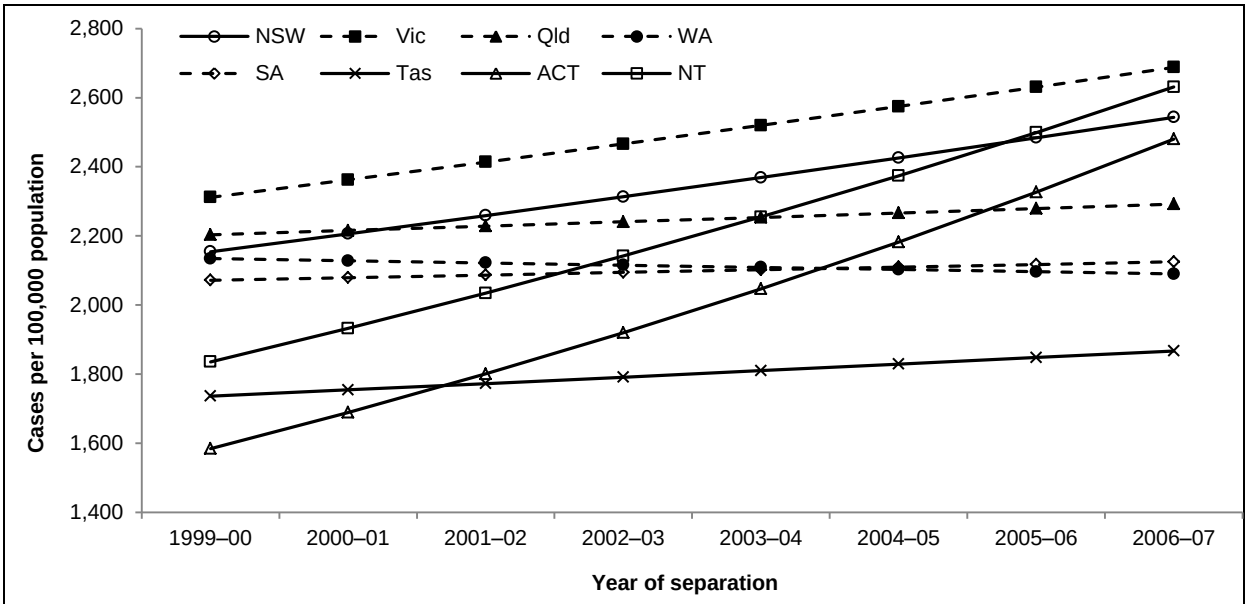
Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.7: Age-standardised rates of hip fractures (S72.0–S72.2) due to falls in the home and in aged care facilities calculated using the estimated population of people resident in the general community and residential care; males and females aged 65+, Australia 2002–2007

State or territory of usual residence

Significant increases in the rate of fall injury cases (persons per 100,000 population) were not observed in all jurisdictions (Figure 8.8). Modelled rate increases of 2.4% per year in New South Wales and 2.2% per year in Victoria were significant at the $p < 0.001$ level. Rates in most other jurisdictions were observed to be stable over the eight year study period however (Tasmania; 1.0%, $p = 0.10$, Queensland; 0.6%, $p = 0.14$, South Australia; 0.4%, $p = 0.23$, Western Australia; –0.3%, $p = 0.51$).

The largest modelled increases in rates of fall injury cases over time were observed for the Australian Capital Territory (at 6.6% per year) and the Northern Territory (5.3% per year). While both were ostensibly significant (at the $p < 0.05$ level), it is thought that these results are more likely due to small number issues for these populations.

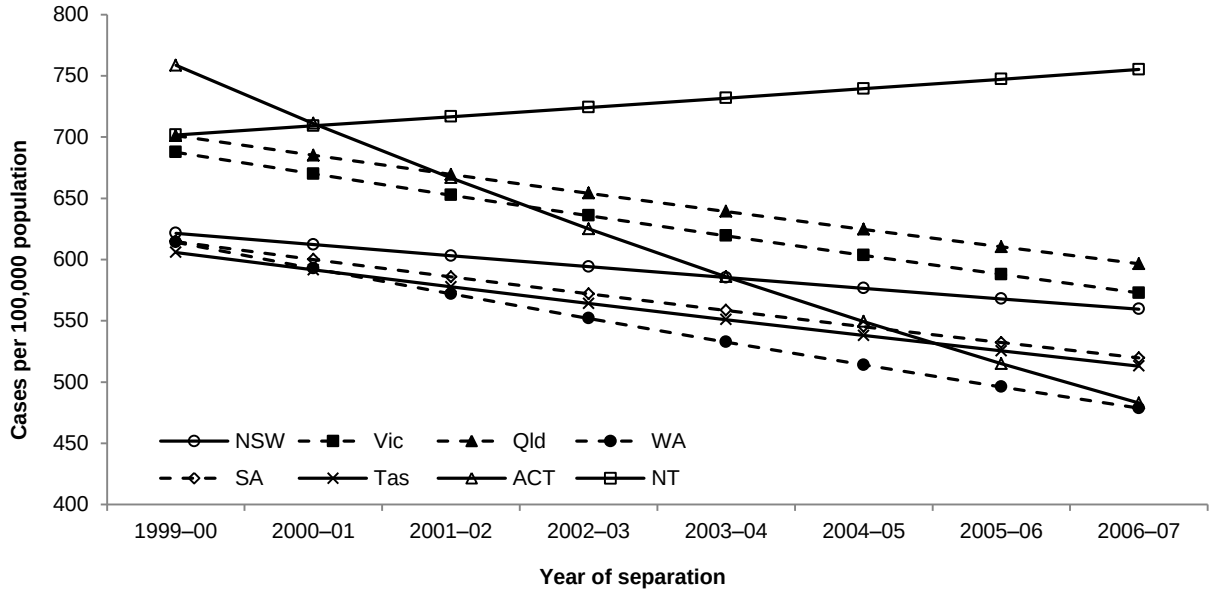


Notes

1. Y-axis scale starts at 1,400 (not zero).
2. Lines and symbols represent the modelled rates over the 8-year period.
3. Rates for Queensland account for all people aged 85 and older assigned '85' as age in hospital records in 1999–00 data year.

Figure 8.8: Age-standardised rates for fall injury cases by state or territory of usual residence, persons aged 65+ 1999–2007

Further, significant decreases ($p < 0.05$) in rates of hip fractures (cases with principal diagnosis S72.0–S72.2) were observed in most jurisdictions (Figure 8.9). These decreases ranged from –1.5% per year for New South Wales to –3.5% per year in Western Australia. Again, small number issues are thought to have driven the observation of a particularly large decrease in rates of hip fracture in the Australian Capital Territory (–6.3% per year) and a slight, not significant, increase for rates in the Northern Territory (1.1% per year, $p = 0.64$).



Note

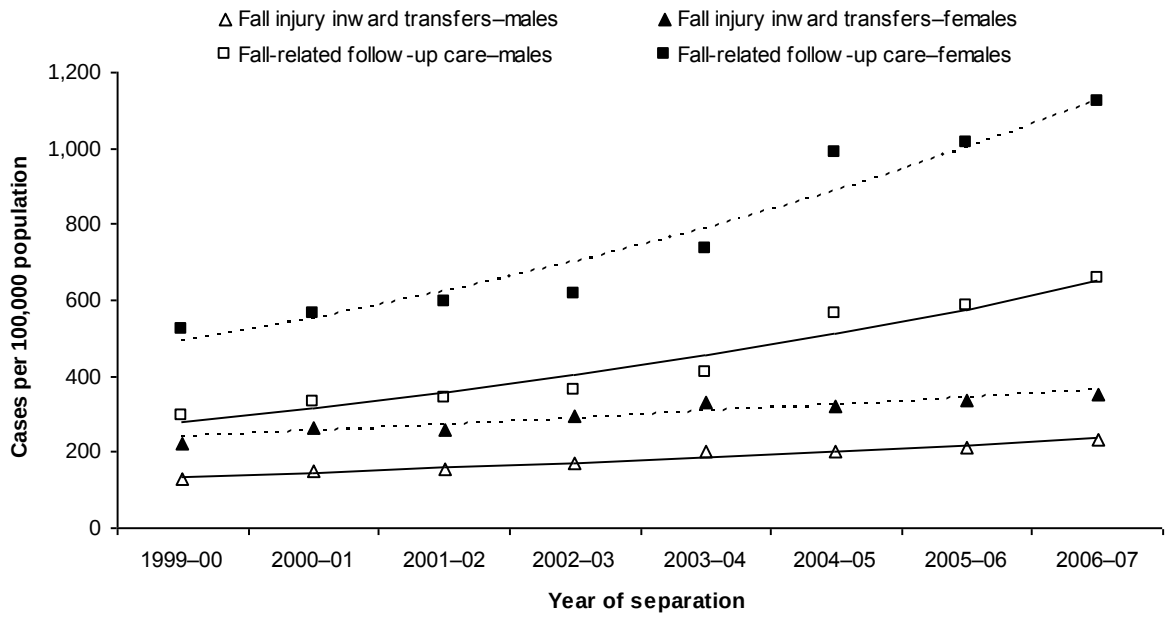
1. Y-axis scale starts at 400 (not zero).
2. Lines and symbols represent the modelled rates over the eight-year period.
3. Rates for Queensland account for all people aged 85 and older assigned '85' as age in hospital records in 1999–00 data year.

Figure 8.9: Age-standardised rates for femur fracture cases by state or territory of usual residence, persons 65+ 1999–2007

Transfers and follow-up care

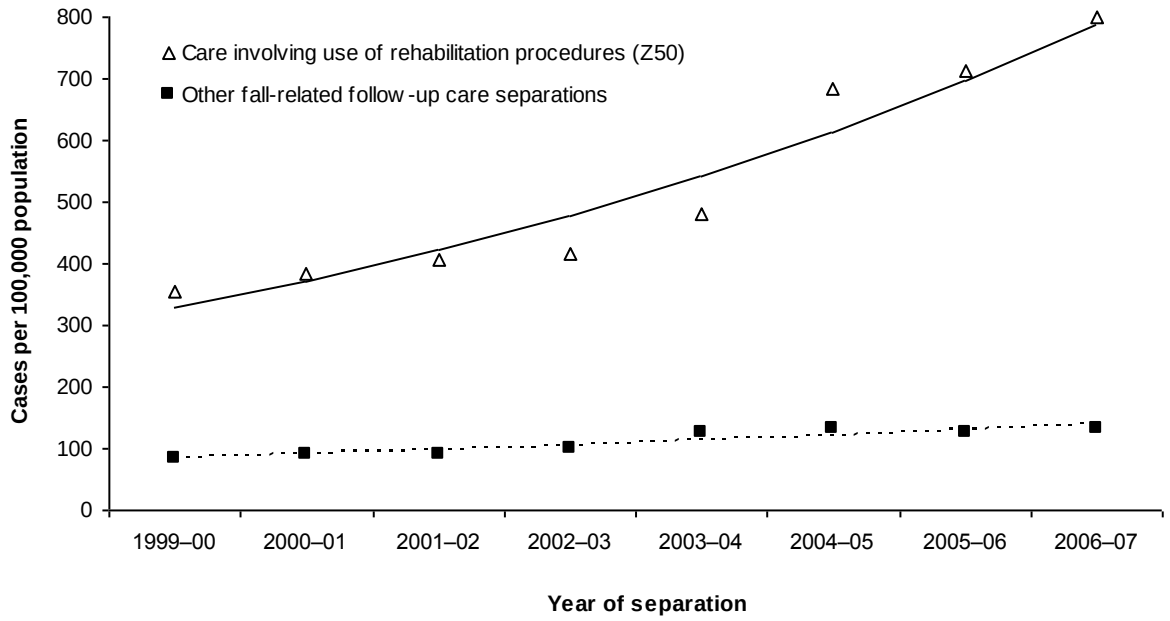
Age-standardised rates of both fall injury inward transfer separations and fall-related follow-up care separations were observed to substantially increase over the eight-year period to June 2007 (Figure 8.10). As for fall injury cases, rates of injury transfer separations involving males increased by the greatest magnitude; 8.3% per year, compared with 6.2% per year for females (persons; 6.6% per year). Increases in rates of fall-related follow-up care separations were similar for both sexes however; 12.7% per year for males and 12.6% per year for females. All these increases were highly significant ($p < 0.001$).

Of the four types of fall-related follow-up care separations (principal diagnoses Z47, Z48, Z50 and Z75.1), the largest increase in rate was observed for Z47; other orthopaedic follow-up care') which increased by an estimated 22.3% per year. These separations were relatively low in number, however, and accounted for only 3.0% of all follow-up care separations over the 1999–2007 period. Far more numerous were the fall-related follow-up care separations with Z50 (care involving use of rehabilitation procedures) as the principal diagnosis (82.9% of all follow-up care separations). The rate for these episodes of hospital care increased by an estimated 13.3% per year (Figure 8.11). Rates of fall-related hospitalisations with the principal diagnosis Z75.1 (person awaiting admission to adequate facility elsewhere) increased by 9.7% per year between 1999 and 2007 while rates of fall-related follow-up care coded to Z48 (other surgical follow-up care) remained statistically stable (a change of –1.5% per year, $p = 0.25$).



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.10: Age-standardised rates for fall injury inward transfer separations and fall-related follow-up care separations; males and females aged 65+, Australia 1999–2007



Note: Lines represent the modelled rates for the eight-year period, while symbols represent the age-standardised rate value for each year.

Figure 8.11: Age-standardised rates for fall-related follow-up care separations: those with principal diagnosis Z50 versus other fall-related follow-up care diagnoses; persons aged 65+, Australia 1999–2007

9 Discussion

Falls are common among older people and often result in fractures or other serious injuries (Lord et al. 2001; Sattin 1992; Tinetti et al. 1988). About three-quarters of all hospitalised injuries involving older Australians are due to falls (for example; Bradley & Harrison 2008). This report confirms that the rate of hospitalised falls for people aged 65 and older remains high, increasingly so, and that hospitalisations for injuries due to falls and other fall-related conditions continue to constitute a substantial proportion of Australia's burden of disease and health expenditure.

In total, 107,192 separations were identified as being directly related to injurious falls by people aged 65 and older in 2006–07 (including case separations, inward transfer separations and follow-up care separations). This represents 3.9% of all hospital separations for any cause for this population. Further, these fall-related hospitalisations accounted for 1.2 million patient days in 2006–07, representing 9.9% of all hospital patient days for the population aged 65 and older.

An additional 22,160 hospital separations for people aged 65 and older were identified as having something to do with injurious falls (termed 'other fall-related separations' in this report) and a further 16,828 separations in 2006–07 included a diagnosis describing a tendency to fall (R29.6). Separations of these types contributed 0.6 million additional patient days (4.8%) to the burden to the hospital system for people aged 65 and older.

Fall injuries and circumstances

There were an estimated 71,746 fall injury cases involving people aged 65 and older that resulted in hospitalisation in 2006–07. The age-standardised rate of fall injury cases was 2,503 per 100,000 population compared with 2,415 per 100,000 population in 2005–06. As in previous years, and reflective of the general population aged 65 and older, females made up a higher proportion of fall-related hospitalisations in 2006–07. In addition, age-specific rates of hospitalised fall injury cases suggest that older females continue to have a higher risk of serious falls than males. Analyses of trends over time for fall injury cases (discussed further below) have found, however, that rates of falls involving males are increasing faster than those for females.

While injuries to the hip and thigh were the most common type of injury sustained in a serious fall case for both males and females, a high proportion of hospitalised falls, particularly for males, resulted in head injuries. Head injuries accounted for a slightly larger proportion of fall injury cases in 2006–07 than in 2005–06 (18% and 17% respectively) and a similar increase in head injuries was observed for fall injury inward transfers (11% in 2006–07 and 10% in 2005–06). Of note, head injuries are proportionately more common for older males than for older females. This may affect the design of any intervention developed to specifically reduce these injuries.

As in previous years, the most common type of fall for fall injury cases in 2006–07 was a fall on the same level due to slipping, tripping and stumbling (W01). This was the most common cause of a fall-related injury for both males and females. The second most common type of fall injury case was an 'unspecified fall' (W19) and the third most common, an 'other fall on same level' (W18). Similarly, W01, W18 and W19 were also the most commonly listed external causes for other types of fall-related hospitalisations. Of the 23,253 cases coded as

slips, trips and stumbles in 2006–07, most were attributed to trips. This may have relevance for falls prevention interventions.

In 2006–07, hospital data were coded to the fifth edition of the ICD-10-AM. In this edition, additional sub-category coding for fall external causes was introduced, similar to that for slips, trips and stumbles and for falls involving playground equipment in previous editions. New subcategory coding was used to describe falls involving beds, chairs and other furniture. New subcategory coding was also used to describe 'other falls on the same level', a code that has previously been difficult to interpret. Nevertheless, most fall cases of these types were coded to the relevant 'other' and/or 'unspecified' sub-categories and so little has been gained from introducing the new coding as far as our understanding of the circumstances of older people's injurious falls goes.

Seven out of ten fall injury cases were recorded as having occurred in the home or in aged care facilities (place was recorded as 'unspecified' for a further 17% of fall cases, similar to previous years). Rates of fall injury cases in aged care facilities in 2006–07 remained markedly higher than the corresponding rates of fall injury cases in the home for people resident in the general community. Similar findings for residents of aged care facilities in a region of New South Wales have been described by Gibson et al. (2008).

Activity coding for fall injury cases in 2006–07 continued to be affected by a high proportion of 'unspecified activity' codes in the records (68% of cases, compared with 67% and 62% of fall injury case separations in 2005–06 and 2003–04 respectively). As discussed in previous reports, prevention programs would greatly benefit from more detailed information on the activity older fallers were engaged in when they fell so that program resources can be better targeted. It is suggested that future revisions of the ICD-10-AM activity codes explicitly address activities such as housework, home maintenance and/or DIY, gardening and volunteer work in fourth- or fifth-character subcategories and/or provide more specific information regarding the activities included in extant codes.

The burden of fall-related injury

The additional types of separations identified in this report as being fall-related significantly increased the already substantial burden of hospitalised fall injury cases among people aged 65 and older in 2006–07. Fall-related follow-up care separations contributed almost as many patient days as those due to initial episodes of hospital care for fall injury cases and inward transfers. These episodes of hospital care brought the total number of fall-related hospital patient days for people aged 65 and older in 2006–07 to nearly 1.2 million.

Previous work by the National Injury Surveillance Unit (NISU) using person-linked data suggests that a large proportion of fall injury cases in Western Australia that resulted in injuries to the hip and thigh were associated with subsequent separations coded to four specific principal diagnoses from Chapter XXI of the ICD-10-AM—factors influencing health status and contact with health services (Kreisfeld & Newson 2006). This report provides further confirmation that a large number of additional fall-related separations can be identified using this criterion in the national (de-identified) hospital data collection. The principal diagnosis Z50.9 (care involving use of rehabilitation procedure, unspecified), in conjunction with an injury and a falls external cause, was again found to be a particularly common type of follow-up care separation in 2006–07. Four in five falls-related follow-up care separations had this principal diagnosis.

A further 7% (n = 1,996) of fall-related follow-up care separations had Z75.1 principal diagnoses, indicating that the person was awaiting admission to a facility elsewhere. Most of these (n = 1,873) specified that the person was awaiting admission to a residential aged care service and it is thought that patients of this type are additional to the 21–23% of older people who are admitted to residential aged care directly following a hospitalised fall (defined as separations with a principal diagnosis S00–T98 plus an external cause W00–W19, see Karmel et al. 2008).

This report also assesses the burden of serious falls in terms of the cost to the hospital system due to fall-related episodes of care. The total estimated cost to the hospital system for acute fall-related hospitalisations involving people aged 65 and older in 2006–07 was $600.3 million. This, however, is certainly an underestimate due to the omission of non-acute episodes of care from the cost analysis. Moreover, the $34.4 million increase in the cost of falls in 2006–07 compared with our previous estimate for 2003–04 undervalues the increasing expenditure on falls as it does not account for the omission of 'other fall-related' separations from the current analysis. If these episodes of 'other fall-related' care had been similarly omitted from the 2003–04 analysis, that total cost estimate is reduced to $455.5 million. Accordingly, the cost of directly fall-related episodes of acute care in 2006–07 increased by $144.8 million compared with this cost in 2003–04. Even excluding some known fall-related episodes of hospital care (non-acute care) and suspected fall-related care ('other fall-related separations'), our estimate that falls cost the hospital system at least $600.3 million in 2006–07 is much larger than figures reported by other authors (for example; Hall & Hendrie 2003; Moller 1998, 2003).

This report also presents an estimate of the mean cost of hospitalisation per fall injury case, accounting for case, transfer and follow-up care separations: $8,367 per case. This is a higher figure than that produced by some recent Australian analyses. A prospective study by Tiedemann et al. (2008) reported a cost estimate of $1,600 per fall but this accounted for falls that did not require admission to hospital. Potter-Forbes and Aisbett (2003), however, estimated an average cost of $5,688 (cited in Tiedemann et al. 2008) for falls of a severity more comparable to those included in the present report, although this estimate did not appear to assess the burden of hospital care due to fall-related follow-up care. Cost estimates from work conducted in Western Australia, however, are much more like that reported here, with an estimated average cost per hospitalised fall of about $6,500–$6,800 (Hall & Hendrie 2003; Hendrie et al. 2003). Importantly, the inclusion criteria for these two studies were very similar (for hospitalised cases) to those applied in our present work. That our estimate is slightly higher than that of these authors may be a result of (a) the observed increase in rates of fall-related follow-up care separations in recent years, although most of these separations were excluded from our cost estimates, and (b) inflation over time.

Trends in falls hospitalisations

A brief analysis of trends in fall-related hospitalisations since July 1999 was presented in the 2005–06 report (Bradley & Pointer 2008). The present report has provided a more detailed analysis of trends including the additional year of data. The analysis confirms the finding that the rate of injurious falls requiring admission to hospital is increasing, but the reasons for it are unclear.

Age-standardised rates of fall injury cases, inward transfers and fall-related follow-up care separations involving people aged 65 and older all significantly increased over the eight-year study period—fall-related follow-up care separations in particular. The rate of serious falls

(cases) for older males increased by a greater magnitude than that for older females, and the rate of fall injury cases for the oldest old (people aged 85 and older) is increasing faster than that for younger age groups. However, rates of falls resulting in hip fractures, arguably the most serious injury sustained in a fall, decreased over time despite rates for all other types of fracture increasing. Similar findings have been previously reported for New South Wales (Dowling & Finch 2009) and the Australian Capital Territory (Fisher et al. 2009), and the jurisdiction-specific analyses in the present report confirm the analyses of these authors.

Rates for most specific injury types (body regions injured, external cause etc.) were also observed to have increased between 1999–00 and 2006–07. That is, there does not appear to be one particular type of injury or cause of injury that singularly explains the overall rise. While rates of injuries to the hips and lower limbs, driven largely by the rate of hip fractures, decreased, rates of fall-related injuries involving other body regions increased over the eight year study period. In particular, rates of head injuries increased markedly over the period. Similar results have been noted globally (for example; Kannus et al. 2007). Head injuries can have extremely serious outcomes and these observations suggest that concerted effort in preventing such injuries is warranted.

Rate of falls due to slips, trips and stumbles, which account for about one-third of all hospitalised fall cases, decreased between 1999–00 and 2006–07. This suggests that falls prevention interventions, which commonly target such falls, have been successful to some extent. However, rates for many other types of fall increased. In particular, rates of 'other falls on same level' (about 17% of cases) substantially increased in the eight years to June 2007, by an estimated 12% per year. Changes in the ICD-10-AM coding structure will allow more specific coding of this type of fall in future (from the sixth edition), but we are unable to glean any further detail for cases that occurred before July 2007. Future analyses may be able to determine whether the increase in the rate of 'other falls on same level' (if it continues) can be explicitly attributed to increasing numbers of falls due to bumping against objects, from or off toilets, or in or into bath-tubs or showers. If this proves to be the case, such information would be invaluable for developing specific interventions. If such work can also give insight into the interaction between the changes in the rates of certain types of falls and rates by age, sex and injury type, this would be of even greater benefit in developing interventions.

It is of note that this analysis has estimated that rates of 'unspecified' falls (about 28% of all cases) remained stable over this period. This suggests that there has not been a change in coding specificity that accounts for our observations of trend.

Further analyses of trends in fall injuries and/or falls risk according to place of occurrence are also warranted. We have observed that while fall injury cases overall are increasing, much of this may be due to large increases in serious fall-related injuries occurring in residential aged care facilities. While rates of fall injury cases involving males and females falling in the home (being resident in the community) increased significantly, rates of falls in residential aged care facilities (assuming these are residents of aged care facilities) increased by a greater magnitude. This may indicate an increasing degree of frailty in Australia's residential aged care population. That rates for males resident both in the community and in aged care increased more so than the rates for females in these settings further suggests that interventions may need to be developed that specifically target men.

Similarly, while rates of hip fracture overall declined, and are stable for female residents of aged care facilities, rates of hip fracture in male residents of aged care facilities significantly increased. This suggests that research addressing falls risk for males specific to the aged care setting is also warranted.

Rates of other fall-related separations (transfers, fall-related follow-up care) also increased markedly over the period 1999–2007. While overall numbers of such episodes of care are smaller than the number of hospitalised fall injury cases, these rates are estimated to have increased by a much larger magnitude; about 7% per year for fall injury transfers and about 13% for fall-related follow-up care. These findings immediately suggest two things: firstly, the severity of hospitalised falls may be increasing and, secondly, that the burden to the hospital system due to injurious falls is increasing to a greater extent than increases in the rate of fall injury cases themselves indicate. Trends in the mean severity of injury cases or burden in terms of bed days were not explicitly analysed in this report. Nevertheless, comparisons between the three reports in this series suggest that there is some evidence that the mean total hospital stay per fall injury case, at least, is increasing.

The trends analyses presented here by jurisdiction (that is, state of usual residence) suggest that national findings may not reflect the situation in some states. It is recommended that the fall indicator work being undertaken in many jurisdictions include state-specific analysis of trends over time, as Dowling and Finch (2009) have done, in order to fully understand the local situation.

All analyses in this report are based on the unit record data contained within the NHMD. Better (more reliable, more informative) use could be made of these data if internal person-based linkage were done (for example; Boufous & Finch 2005). Linked data would enable improved enumeration of unique fall injury events (cases) and better account for all episodes of hospital care per person, per fall. Such analyses would be further enhanced if linkage to national deaths data were possible, given that injurious falls by older people are known to contribute to premature mortality (see Bliuc et al. 2009; Center et al. 1999).

Appendix A: Data issues

Data sources

Hospital separations data were provided by the AIHW (see AIHW 2008a). Less than 1% of injury and poisoning separations are thought to be missing from the data reported, representing minimal risk of sampling error.

Estimated resident population data by age, sex and place of usual residence was also obtained from the AIHW. Population estimates of residents of aged care facilities were obtained from the AIHW report series *Residential aged care in Australia* (for example; AIHW 2007, 2008b). The number of people aged 65 and older resident in the community (that is, in the home) was estimated by subtracting the number of residents of aged care facilities from the general population data.

ICD-10-AM

The 2006–07 data in this report are based on hospital separations data coded according to the fifth edition of the Australian clinical modification of ICD-10, the ICD-10-AM (NCCH 2006).

Selection criteria

Fall cases and inward transfer separations

Fall cases were defined as all NHMD unit records with a date of separation between 1 July 2006 and 30 June 2007 that met the following specifications:

- The patient was aged 65 or older
- The principal diagnosis was in the range S00–T75 or T79
- The first external cause code was in the range W00–W19 and,
- The mode of admission was not a transfer from another acute hospital.

Diagnoses S00–T75 or T79 have been used to specify 'community injury' in recent NISU reports (Bradley & Harrison 2008, for example). Selection has been based on principal diagnosis because this refers to the condition chiefly accounting for the episode in hospital. The first-listed external cause code was chosen as a selection criterion as this is considered to be most likely to be associated with the separation's principal diagnosis (see Table A1).

Inward transfers from other acute hospitals were omitted from incidence estimates as this reduces multiple counting of cases that generate more than one separation record. The NHMD unit records are de-identified and do not contain information relating to a separation's place in a sequence of hospital episodes. As such, a sequence of separations in which an individual is admitted to hospital and then transferred to another hospital results in two (not linked) unit records. Further, readmissions relating to the same case are not flagged, again generating multiple entries in the database. As such, the number of hospital separations meeting our definition of injury overestimates the number of injury cases that led to hospitalisation.

Separations with a principal diagnosis S00–T75 or T79, a first reported external cause code W00–W19 and a mode of admission indicating a transfer from another acute hospital were omitted from injury incidence enumeration and analysed separately as 'falls injury inward transfers'.

Follow-up care separations due to falls

Analysis of person-linked data suggests that many separations following an episode of care for an injury, particularly for older people with falls injuries, are coded with a principal diagnosis from Chapter XXI of the ICD-10-AM—factors influencing health status and contact with health services. More specifically, most such cases are coded as Z50—care involving use of rehabilitation procedures. These cases contribute to a non-negligible proportion of the burden of injury due to falls by older people.

In this report, follow-up care separations due to falls were defined as NHMD unit records with a date of separation between 1 July 2006 and 30 June 2007 that met the following specifications:

- The patient was aged 65 or older
- The principal diagnosis was:
    - Z47 (other orthopaedic follow-up care)
    - Z48 (other surgical follow-up care)
    - Z50 (care involving use of rehabilitation procedures) or
    - Z75.1 (person awaiting admission to adequate facility elsewhere)
- Any diagnosis variable contained a code in the range S00–T75 or T79 and,
- Any external cause code variable contained a code in the range W00–W19 falls.

The principal diagnoses specified above accounted for over 96% of the total number of separations with a principal diagnosis from Chapter XXI containing a W00–W19 code for people aged 65 and over.

It is possible that the injurious falls described in these records may have occurred while the person was receiving hospital care for another, unrelated condition. This possibility will be examined further in later editions in this series, once national condition onset data become available for analysis (see AIHW 2009).

Other separations related to falls

A further group of fall-related separations was specified, which includes all separation records containing a diagnosis code for injury (S00–T75 or T79) and an external cause code for an unintentional fall (W00–W19) and which are not included in any of the groups above. This group includes separations where:

- The patient was aged 65 or older
- Any diagnosis variable contained a code in the range S00–T75 or T79
- Any external cause code variable (1–31) contained a code in the range W00–W19
- The separation was not classed as a fall injury incident case or inward transfer and,
- The separation was not classed as a fall-related follow-up care separation

Most of these 'other fall-related' separations had a principal diagnosis for a non-injury condition. This category also included separations with a principal diagnosis in the range S00–T75 or T79 that had a fall code W00–W19 (but not as the first reported external cause)

and injury separations that had a principal diagnosis from Chapter XXI (factors influencing health status and contact with health services) other than those designated as fall-related follow-up care separations. Some of these additional cases had first external cause codes denoting complications of medical and surgical care.

As for fall-related follow-up care separations, it is possible that the injurious falls described in these 'other fall-related' records may have occurred while the person was receiving hospital care for another, unrelated condition. This possibility will be examined further in later editions in this series, once national condition onset data becomes available for analysis (see AIHW 2009).

Tendency to fall separations

The fifth edition of the ICD-10-AM includes the diagnosis code R29.6 (tendency to fall, not elsewhere classified). R29.6 replaces the R29.81 code used in previous editions of the ICD-10-AM (see NCCH 2004). The entry in the coding manual for R29.6 reads "tendency to fall because of old age or other unclear health problems" (NCCH 2006, Tabular List p. 382) and falls due to accidents, difficulty in walking, dizziness and giddiness, syncope and collapse or causing injury are explicitly excluded. Further, the ICD-10-AM coding standards regarding both the R29.6 and R29.81 codes (that is, across editions) specify that these codes should not be applied in cases of known injury or when a medical condition is found to be the cause of the recurrent falls.

The 2006–07 data year is the first year for which the AIHW has provided all records containing any R29.6 diagnosis codes to the NISU.

In this report, R29.6 separations were analysed separately from other fall-related episodes of hospital care and were defined as separations that met the following specifications:

- The patient was aged 65 or older
- Any diagnosis variable contained an R29.6 code
- The separation was not classed as a fall injury incident case or inward transfer
- The separation was not classed as a fall-related follow-up care separation and,
- The separation was not classed as an 'other fall-related' separation.

Calculation of rates

Age-specific rates were calculated for age groups (five-year bands up to age 90–94, and a group for ages 95 and older) using national and jurisdictional population estimates as at 31 December 2006 (the mid-point of the financial year). These data were obtained from the AIHW and are similar to data presented in the *Australian demographic statistics* series (ABS 2007).

Population estimates according to the Australian Standard Geographical Classification of remoteness are available only from the ABS for the year ending 30 June. Values for 31 December were calculated using the mean of the population estimates for 2006 and 2007.

The rates of falls occurring in the home and in aged care facilities were calculated using denominator data reflecting the estimated place of residence for the population. Population estimates of residents of aged care facilities were obtained from the AIHW report series *Residential aged care in Australia* (for example; AIHW 2007, 2008b). We estimated the resident population in aged care facilities as at 31 December 2006 by averaging two years' population data (as at 30 June 2006 and 30 June 2007). The number of people aged 65 and older resident

in the community at 31 December 2006 were then estimated by subtracting the number of residents of aged care facilities from the general population.

The age distribution of the population aged 65 and older differs between jurisdictions, remoteness zones and sex, and is changing over time. In this report most rates for the whole age range 65 and older have been standardised using the direct method to facilitate valid comparisons. The Australian population at 30 June 2001 has been used as the standard.

Quantifying variability in the counts presented in this report

The data presented in this report are subject to two types of statistical error, non-random and random. (A third type of statistical error, sampling error, does not apply here because none of the data sources used involved probability sampling.)

Non-random error: Some amount of non-random error is to be expected in administrative data collections such as the hospital inpatient data on which this report relies. For example, non-random error could occur if the approach to assigning cause codes to cases were to differ systematically between jurisdictions or over time. Systems are in place to encourage uniform data collection and coding and scrutiny of data during analysis includes checking for patterns that might reflect non-random error. Nevertheless, some non-random error is likely to remain. Identified or suspected non-random errors large enough to materially affect findings are mentioned in reports.

Random error: The values presented in the report are subject to random error, or variation. Variation is relatively large when the case count is small (especially if less than about 10) and small enough to be unimportant in most circumstances when the case count is larger (i.e. more than a few tens of cases).

Some of the topics for which results are reported compare groups that vary widely in case count, largely due to differences in population size (e.g. the population of NSW is more than 30 times as large as the NT population and the Major City zone population is nearly 90 times as large as that of the Very Remote zone). In this situation, year-to-year changes in counts or rates for the smaller-population groups may be subject to large random variation. There is potential to misinterpret such fluctuations as meaningful rises or falls in occurrence.

In this situation, and similar ones, guidance is provided to readers concerning how much variation of values can be expected due to random variation of small counts. Confidence Intervals (CIs) are calculated for this purpose.

Confidence intervals

The AIHW is presently undertaking a review to assess the provision of confidence intervals and statistical tests when data arise from sources that provide information on all subjects, rather than from those in a sample survey. This review will include analysis of the methods used to calculate confidence intervals, as well as of the appropriateness of reporting confidence intervals and undertaking statistical testing for such data. This review aims to ensure that statistical methods used in AIHW reports remain robust and appropriately inform understanding and decision making. As a consequence, the type of information reported in future editions of this publication may change.

Trends analysis

Trends in age-standardised rates over time were analysed using the negative binomial distribution regression technique, as described in Berry and Harrison (2006). As for 2006–07 annual rates, the Australian population at 30 June 2001 has been used as the standard.

Costs

This report has applied estimated cost weights, and estimated costs, based on AR-DRG Version 5.1 to both public sector and private sector fall-related acute episodes of hospital care (see DoHA 2008b). These cost weights are appropriately applied only to acute episodes of care.

The estimated total cost for AR-DRG W01Z in the private sector was not available for 2006–07, suppressed due to the small number of such separations. One such separation was identified in the fall-related data extract and the public sector cost estimate applied to this case.

Small case count issues

Cell counts in tables that are five cases or fewer have been suppressed to protect patient confidentiality. In instances where only one cell in a row or column has a count of five or less, all other cells in the same row or column have also been suppressed. The abbreviation 'n.p.' has been used in these tables to denote these suppressions. For these tables, the totals include the suppressed information.

Errors, inconsistencies and uncertainties

This report uses data collected from state and territory hospitals. After coding and collection from the states and territories, the data are further processed by the AIHW and the NISU. The geographical spread of the data and the large number of people involved in its processing increases the risk of inconsistencies across time and place in the data. Variations in reporting and coding continue to exist across jurisdictions, although National Minimum Data Sets have been in place for some considerable amount of time.

As outlined above, incidence is not equivalent to number of hospital separations. Methods to extract actual cases of incidence produce estimates only.

Table A1: Case selection criteria for fall-related separations for persons aged 65+, Australia 2006–07

Separation type	Males	Females	Persons*
Fall injury cases:			
• Principal diagnosis is S00–T75 or T79,			
• First external cause is W00–W19, and			
• Mode of admission is not a transfer from another acute hospital.	21,348	50,396	71,746
Fall injury inward transfer separations:			
• Principal diagnosis is S00–T75 or T79,			
• First external cause is W00–W19, and			
• Mode of admission is a transfer from another acute hospital.	2,617	6,000	8,618
Fall-related follow-up care separations:			
• Principal diagnosis is Z47, Z48, Z50 or Z75.1, and			
• Any external cause is W00–W19.	7,449	19,375	26,828
'Other fall-related' separations:			
• Any diagnosis is S00–T75 or T79,			
• Any external cause is W00–W19,			
• Is not an incident case or inward transfer, and			
• Is not a follow-up care separation.	9,956	12,204	22,160
Tendency to fall separations:			
• Any diagnosis is R29.6,			
• Is not an incident case or inward transfer,			
• Is not a follow-up care separation, and			
• Is not an 'other fall-related' separation.	7,373	9,455	16,828
Total number of fall-related separations in 2006–07	**48,743**	**97,430**	**146,180**

* Persons includes seven separations for which sex was not reported: fall injury cases, *n* = 2; fall injury inward transfers, *n* = 1, fall-related follow-up care separations, *n* = 4.

Appendix B: Additional tables

Table A2: Major Diagnostic Category cost estimates for (acute care) fall injury cases; males, females and persons aged 65+, Australia 2006–07

Major Diagnostic Category	AR-DRG v5.0	Males (*n*)	Females (*n*)	Persons (*n*)
Major procedures where the principal diagnosis may be associated with any MDC	A01Z–A41Z	$5,981,273 (67)	$2,781,677 (32)	$8,762,950 (99)
Diseases and disorders of the nervous system	B01Z–B81B	$12,639,989 (1,917)	$11,722,421 (2,163)	$24,362,410 (4,080)
Diseases and disorders of the eye	C01Z–C63B	$747,046 (359)	$1,334,914 (644)	$2,081,960 (1,003)
Diseases and disorders of the ear, nose, mouth and throat	D01Z–D67Z	$1,049,148 (450)	$1,466,733 (677)	$2,515,881 (1,127)
Diseases and disorders of the respiratory system	E01A–E75C	$7,074,574 (1,324)	$7,259,116 (1,348)	$14,333,690 (2,672)
Diseases and disorders of the digestive system	G01A–G70B	$35,785 (n.p.)	$74,034 (n.p.)	$109,819 (9)
Diseases and disorders of the hepatobiliary system and pancreas	H01A–H64B	$20,964 (n.p.)	$17,067 (n.p.)	$38,031 (n.p.)
Diseases and disorders of the musculoskeletal system and connective tissue	I01Z–I78C	$94,782,207 (10,221)	$282,093,258 (31,996)	$376,883,472 (42,218)
Diseases and disorders of the skin, subcutaneous tissue and breast	J01Z–J67B	$5,396,982 (1,610)	$11,785,345 (3,371)	$17,182,327 (4,981)
Diseases and disorders of the kidney and urinary tract	L01A–L67C	$90,343 (26)	$69,837 (16)	$160,180 (42)
Diseases and disorders of the male reproductive system	M01Z–M64Z	$8,394 (6)	$0 (0)	$8,394 (6)
Diseases and disorders of the female reproductive system	N01Z–N62B	$0 (0)	$22,737 (6)	$22,737 (6)
Diseases and disorders of the blood and blood forming organs and immunological disorders	Q01Z–Q62B	$68,425 (12)	$59,338 (8)	$127,763 (20)
Infectious and parasitic diseases	S60Z–T64B	$19,937 (n.p.)	$158,581 (n.p.)	$178,518 (22)
Injuries, poisoning and toxic effects of drugs	W01Z–X64B	$20,816,837 (5,038)	$37,621,688 (9,394)	$58,440,122 (14,433)
Burns	Y01Z–Y62B	$6,482 (n.p.)	$10,690 (n.p.)	$17,172 (n.p.)
Error DRGs	901Z–963Z	$699,831 (54)	$600,274 (49)	$1,300,105 (103)
Total*		**$149,438,217 (21,095)**	**$357,077,710 (49,734)**	**$506,525,531 (70,831)**

n.p. Small cell counts have been suppressed to prevent patient identification.

* Total includes costs for two cases for which sex was not reported.

Table A3: Major Diagnostic Category cost estimates for (acute care) fall injury inward transfers; males, females and persons aged 65+, Australia 2006–07

Major Diagnostic Category	AR-DRG v5.0	Males (*n*)	Females (*n*)	Persons (*n*)
Major procedures where the principal diagnosis may be associated with any MDC	A01Z–A41Z	$2,897,605 (32)	$699,042 (8)	$3,596,647 (40)
Diseases and disorders of the nervous system	B01Z–B81B	$3,731,108 (312)	$2,594,146 (258)	$6,325,254 (570)
Diseases and disorders of the eye	C01Z–C63B	$50,755 (22)	$88,641 (32)	$139,396 (54)
Diseases and disorders of the ear, nose, mouth and throat	D01Z–D67Z	$40,507 (20)	$111,335 (41)	$151,842 (61)
Diseases and disorders of the respiratory system	E01A–E75C	$600,657 (102)	$573,591 (112)	$1,174,248 (214)
Diseases and disorders of the hepatobiliary system and pancreas	H01A–H64B	$31,458 (n.p.)	$30,693 (n.p.)	$62,151 (n.p.)
Diseases and disorders of the musculoskeletal system and connective tissue	I01Z–I78C	$16,985,075 (1,570)	$43,701,544 (4,241)	$60,702,206 (5,812)
Diseases and disorders of the skin, subcutaneous tissue and breast	J01Z–J67B	$211,525 (58)	$469,234 (136)	$680,759 (194)
Diseases and disorders of the kidney and urinary tract	L01A–L67C	$27,401 (n.p.)	$0 (0)	$27,401 (n.p.)
Diseases and disorders of the male reproductive system	M01Z–M64Z	$1,399 (n.p.)	$0 (0)	$1,399 (n.p.)
Diseases and disorders of the blood and blood forming organs and immunological disorders	Q01Z–Q62B	$0 (0)	$16,157 (n.p.)	$16,157 (n.p.)
Infectious and parasitic diseases	S60Z–T64B	$0 (0)	$5,417 (n.p.)	$5,417 (n.p.)
Injuries, poisoning and toxic effects of drugs	W01Z–X64B	$1,650,212 (255)	$3,255,375 (510)	$4,905,587 (765)
Error DRGs	901Z–963Z	$153,897 (11)	$78,073 (7)	$231,970 (18)
Total[(a)]		**$26,381,599 (2,388)**	**$51,623,248 (5,351)**	**$78,020,434 (7,740)**

n.p. Small cell counts have been suppressed to prevent patient identification.

(a) Total includes costs for one separation for which sex was not reported.

Table A4: Major Diagnostic Category cost estimates for (acute care) fall-related follow-up care separations; males, females and persons aged 65+, Australia 2006–07

Major Diagnostic Category	AR-DRG v5.0	Males (*n*)	Females (*n*)	Persons (*n*)
Major procedures where the principal diagnosis may be associated with any MDC	A01Z–A41Z	$217,366 (n.p.)	$153,024 (n.p.)	$370,390 (n.p.)
Diseases and disorders of the musculoskeletal system and connective tissue	I01Z–I78C	$2,005,234 (191)	$5,661,282 (549)	$7,666,516 (740)
Factors influencing health status and other contacts with health services	Z01A–Z65Z	$2,224,276 (390)	$5,513,348 (961)	$7,737,624 (1,351)
Error DRGs	901Z–963Z	$5,123 (n.p.)	$0 (n.p.)	$5,123 (n.p.)
Total		**$4,451,999 (585)**	**$11,327,654 (1,512)**	**$15,779,653 (2,097)**

n.p. Small cell counts have been suppressed to prevent patient identification.

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