



# The problem of osteoporotic hip fracture in Australia

## Key points

- ♦ The age-adjusted incidence rate of osteoporotic hip fracture in Australia decreased over the 10 years to 2006–07, by 14% among males and by 20% among females. However, the actual number of cases continued to increase in both sexes due to population growth and ageing.
- ♦ There were an estimated 16,518 osteoporotic hip fractures among Australians aged 40 years or over in 2006–07 (175 per 100,000 persons). Almost three-quarters of these occurred in females, who on average were aged 83 years (compared with 81 years for males).
- ♦ Around 1 in 9 people hospitalised with the principal diagnosis of osteoporotic hip fracture in 2006–07 were discharged to a residential aged care service, where this had not previously been their place of residence.
- ♦ Aboriginal and Torres Strait Islander Australians were much more likely than other Australians to be hospitalised for an osteoporotic hip fracture. They were also on average much younger at the time of their fracture.
- ♦ Osteoporosis and osteoporotic fractures can be prevented through lifestyle changes and by taking action to reduce the risk of falls.
- ♦ Males in particular may benefit from increased attention to hip fracture prevention.

## Contents

Key points .....	1
Introduction .....	2
Osteoporotic hip fractures in 2006–07 .....	5
Trends .....	14
Preventing osteoporotic hip fractures.....	20
Conclusions.....	21
Appendix 1: Methods and data sources.....	22
Appendix 2: Data tables .....	26
Abbreviations .....	27
References .....	28
Acknowledgments .....	29

## Introduction

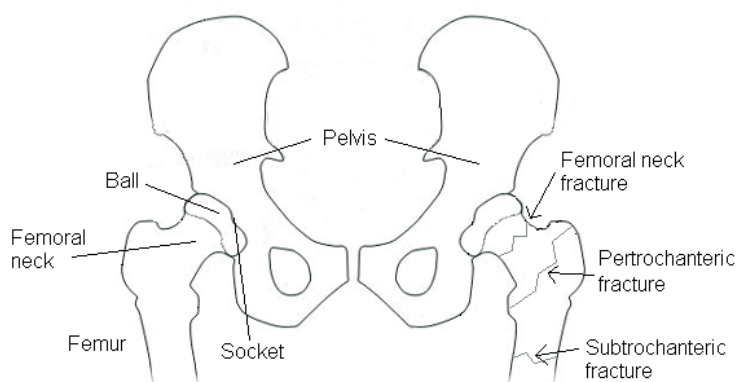
Every day, more than 40 Australians break their hip. Most are aged 65 years or over, and more than half are aged 85 or over. Virtually all of these people will be admitted to hospital, and most will have some kind of surgery. Two people will die in the hospital, and at least four will need to go into a residential aged care facility, either while they recover or permanently. A year later, less than half of those original 40 people will be able to walk as well as they did before the fracture, and another six or seven will have died.

Osteoporotic hip fractures are a considerable burden on Australians and the Australian health system. Because they are more common in older people, the ageing of the Australian population means that over time more people will be at risk of having a hip fracture. Despite this, however, the incidence rate of osteoporotic hip fracture is falling.

This bulletin presents the latest data on the incidence of osteoporotic hip fracture in Australia, as well as key consequences of the fracture such as surgery, placement in a residential aged care facility and death. Information about recent trends in osteoporotic hip fracture incidence and variation across the population is also presented.

## What is an osteoporotic hip fracture?

A hip fracture is a break occurring at the top of the thigh bone (femur), near the hip (Figure 1). In a person with healthy bones, a strong force is usually needed to cause a fracture. But some diseases and conditions can make bones fragile, so that a fracture can occur with a small amount of force—for example, a fall from a standing height or less. This type of fracture is called a ‘minimal trauma fracture’.



**Figure 1: Bones of the hip and sites of hip fracture**

Osteoporosis is a condition where the bones weaken and lose their structural integrity. It is most common in older females but also affects males. People who have osteoporosis are at high risk of minimal trauma fractures, which are therefore sometimes called ‘osteoporotic fractures’. The term ‘osteoporotic hip fracture’ is used in this report to mean a hip fracture that has occurred with a relatively small amount of force.

Although osteoporotic fractures can occur anywhere in the body, they occur more frequently at certain sites, such as the hip, pelvis, spine, wrist and forearm. Hip fractures are generally more serious and debilitating than fractures at other sites. They are divided into three subtypes depending on where the thigh bone breaks: femoral neck fracture, pertrochanteric fracture and subtrochanteric fracture (Figure 1).

### Causes and risk factors

Most osteoporotic hip fractures result from a fall (Cummings & Melton 2002; Kannus et al. 2005; Reginster et al. 2005). Others are caused when the hip strikes (or is struck by) a solid object—for example, colliding with a table. Sometimes the fracture occurs without obvious trauma, when an ordinary activity may put strain on a bone (such as when getting up from a chair). This is more likely to happen in people with severe osteoporosis.

#### *Risk factors for falls*

Risk factors for falls may be intrinsic (factors related to the individual) or extrinsic (factors relating to a person's environment). Intrinsic risk factors include problems with vision, muscle weakness, poor balance, older age, cognitive impairment, a history of falling, fear of falling, use of medications causing drowsiness or confusion and conditions affecting bone structure (such as osteoporosis) (Stevens & Olson 2000). Extrinsic risk factors include tripping hazards (such as uneven ground, loose rugs or clutter), wet or slippery surfaces, slippery footwear, poor lighting and lack of handrails on stairs (AIHW 2008a; Kanis et al. 2004; Osteoporosis Australia 2006; Stevens & Olson 2000).

#### *Risk factors for osteoporosis*

The modifiable risk factors for osteoporosis include calcium and vitamin D deficiencies, physical inactivity, smoking and being substantially underweight. Non-modifiable risk factors include a family history of the condition, older age and genetic predisposition. Certain diseases and conditions also increase the risk of osteoporosis, either as a direct complication of the disease or as a side-effect of the medication used to manage it (AIHW 2008a). These include rheumatoid arthritis, chronic kidney disease, eating disorders, coeliac disease and asthma.

#### *Other risk factors for hip fracture*

Factors that increase the risk of hip fracture independently of any effect on osteoporosis and falls include a history of corticosteroid use and previous minimal trauma fractures. People who have had a minimal trauma fracture are at increased risk of subsequent fractures, an effect known as the 'fracture cascade'. Data from the Dubbo Osteoporosis Epidemiology Study show that the increase in risk persists for up to 10 years, and that 40% of women and 60% of men will experience a second fracture within this period (Center et al. 2007)

## Consequences

Hip fractures cause considerable functional impairment and nearly always require surgery. They may also give rise to ongoing pain and disability—less than 50% of individuals regain their pre-fracture walking ability one year after such fractures (Osnes et al. 2004; Sernbo & Johnell 1993). Quality of life may be substantially reduced, particularly in relation to physical function, social function and role responsibilities (Hallberg et al. 2004; Randell et al. 2000; Willig et al. 2001). The ability to undertake activities of daily living may be compromised and, for some, this may necessitate a move from independent accommodation to a residential aged care facility, a change that may lead to reduced social interaction, emotional distress, reduced self-confidence and loss of dignity (Illinois Council on Long Term Care 2008; Osnes et al. 2004).

Anxiety about having another fracture and fear of the consequences of fracture, such as dependence and institutionalisation, may be considerable (Salkeld et al. 2000). In some cases, the person may develop a fear of falling and restrict their activities to avoid further falls. Furthermore, the risk of death is raised for several years following a hip fracture, particularly in men (Bliuc et al. 2009; Farahmand et al. 2005; Johnell et al. 2004; Piirtola et al. 2008).

## Costs

Hip fractures are expensive to treat, with hospital episodes for procedures such as partial joint replacement costing on average \$15,500–\$19,500 (Table 1). Hip fractures also incur indirect costs for rehabilitation, outpatient visits for follow-up treatment, temporary residential aged care facility placement if required, and assistance with activities of daily living at home during the recovery period. For those whose fracture results in long-term functional limitations or disability, the cost of permanent residential aged care facility placement or help to live independently may be considerable.

No Australian data on the overall costs of hip fracture are currently available. In 2000, Steve Parrott estimated that the total annual cost to society in the UK associated with hip fractures was £726 million (AU\$1,832 million) (Parrott 2000). This figure represents an expenditure of £31 (AU\$78) per person aged 45 and over. The total cost is comprised of 32% in direct hospital and ambulance costs, 1% in other health service costs and 67% in social care costs (including residential care and social support services for those at home).

**Table 1: Estimated cost of hospital treatment for osteoporotic hip fracture, by sector, 2006–07**

DRG <sup>(a)</sup>	Public hospitals			Private hospitals		
	Number of hip fracture separations <sup>(b)</sup>	Average length of stay (days) <sup>(c)</sup>	Average cost for this DRG (AU\$) <sup>(d)</sup>	Number of hip fracture separations <sup>(b)</sup>	Average length of stay (days) <sup>(c)</sup>	Average cost for this DRG (AU\$) <sup>(d)</sup>
I03B	2,775	14.4	19,472	583	16.6	19,100
I03C	1,393	8.8	15,587	480	10.7	17,719
I08A	4,486	14.4	18,743	803	17.7	14,235
I08B	2,844	8.6	11,321	705	10.8	7,128
I78A	1,386	13.9	7,244	196	16.0	6,841
I78B	3,062	4.1	2,182	270	7.7	3,068

(a) DRG = diagnosis related group—a way of classifying hospital admissions into groups with similar clinical conditions and resource usage.

(b) Number of separations for osteoporotic hip fracture assigned to this DRG.

(c) Average length of stay associated with separations in previous column.

(d) Average cost for all separations assigned to this DRG.

*Note:* Data for the top 6 DRGs are presented, accounting for 97% of osteoporotic hip fracture separations in 2006–07.

I03B—hip replacement with complications or uncomplicated revision hip replacement

I03C—uncomplicated hip replacement

I08A—other hip and femur procedures with complications

I08B—other uncomplicated hip and femur procedures

I78A—fracture of neck of femur with complications (no procedures)

I78B—uncomplicated fracture of neck of femur (no procedures)

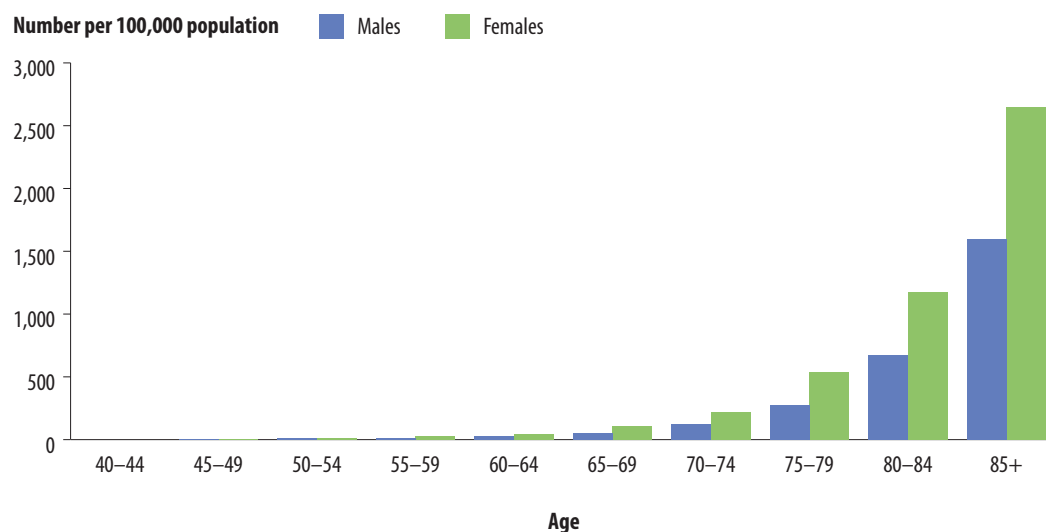
*Source:* AIHW National Hospital Morbidity Database and DoHA 2008.

## Osteoporotic hip fractures in 2006–07

### Incidence

There were an estimated 16,518 hospitalisations for osteoporotic hip fracture among Australians aged 40 years or over in 2006–07, equating to 175 per 100,000 persons. Almost three-quarters of these (12,006 fractures) occurred in females. The incidence was higher among females than males across all age groups except 40–49 years, where the rate in males was around twice that in females (see Appendix 2, Table A2.1).

The average age at hospitalisation was 81 years for males and 83 years for females.



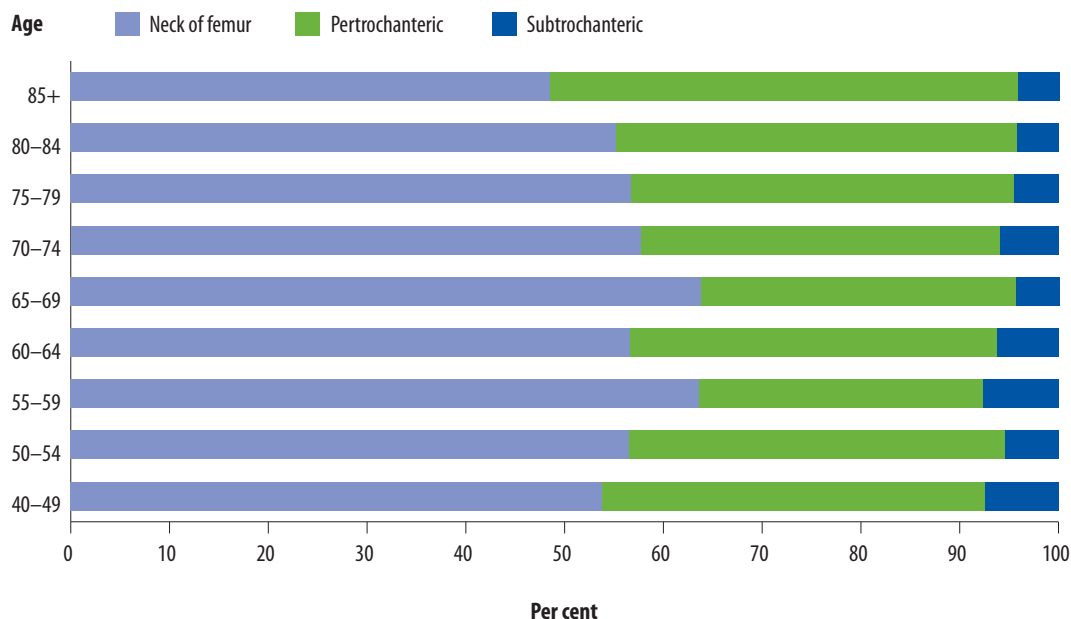
Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Figure 2: Estimated incidence of osteoporotic hip fracture, 2006-07**

## Fracture site

The most common fracture site recorded was neck of femur, accounting for around 53% of all cases. Pertrochanteric fractures accounted for another 43% of cases, with subtrochanteric fractures the least common at 4%. These proportions did not vary between males and females, but did vary somewhat by age, with a tendency for pertrochanteric fractures to become more common with age (Figure 3). People with pertrochanteric fractures were 83 years old on average, compared with 82 and 81 years for neck of femur and subtrochanteric fractures, respectively.



#### Notes

1. Persons aged 40 years or over.
2. The age groups 40-44 years and 45-49 years have been combined due to the small number of cases.

Source: AIHW National Hospital Morbidity Database.

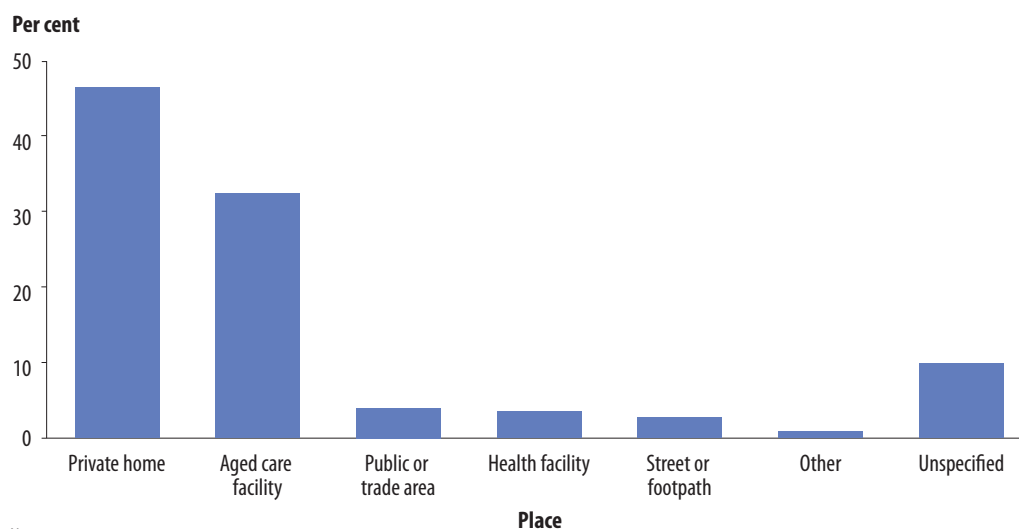
**Figure 3: Distribution of sites of hip fracture, by age, 2006-07**

### Events causing fractures

The most commonly recorded external causes of osteoporotic hip fractures in 2006-07 were 'fall on same level from slipping, tripping and stumbling' (38% of cases), 'other fall on same level' (21% of cases) and 'unspecified fall' (30% of cases). Falls from a bed or chair accounted for most of the remaining cases (9%), with other events (such as collision with another person, an animal or other furniture) making up just 2% of the total. Recording of 'unspecified fall' became slightly more common with age.

### Place of occurrence

The majority of fractures occurred at the person's place of residence, with almost half (47%) happening in private homes (Figure 4). A further 32% of cases occurred in residential care facilities (including residential aged care facilities and retirement villages). In almost 600 cases (3%), the place of occurrence was a health facility, such as a hospital, health centre or outpatient clinic.



## Notes

1. 'Public or trade areas' include shops, offices, train stations, restaurants, sporting and recreational facilities, schools, libraries and places of worship. 'Other' places include industrial premises, construction sites, farms, prisons, beaches and bushland.
2. Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Figure 4: Place of occurrence of osteoporotic hip fractures, 2006–07**

## Population variation

Health status and use of health services varies across the population. In Australia, groups who often have relatively poor health or are disadvantaged in relation to access to health services include people living in remote areas, those who are socioeconomically disadvantaged, overseas-born persons and Aboriginal and Torres Strait Islander people. The incidence of osteoporotic hip fracture across some of these population groups is described below.

### Remoteness

Females living outside of the major cities were slightly more likely to have an osteoporotic hip fracture compared with females in major cities (Table 2). Rates among males did not vary significantly by remoteness. Those living in remote Australia tended to be younger at the time of their fracture, 75 years for males and 79 years for females, compared with 81 and 83 years for males and females, respectively, in non-remote areas.



**Table 2: Incidence of osteoporotic hip fracture by remoteness, 2006–07**

Region	Observed number		Expected number <sup>(a)</sup>		Rate ratio <sup>(b)</sup> (95% confidence interval)	
	Males	Females	Males	Females	Males	Females
Major cities	2,980	7,989	..	..	1.00	1.00
Regional Australia	1,449	3,820	1,440	3,558	1.01 (0.96, 1.05)	1.07 (1.05, 1.10)
Remote Australia	63	149	65	132	0.97 (0.78, 1.19)	1.13 (0.98, 1.30)

.. not applicable

(a) Number of cases that would be expected if people in the area experienced the same age- and sex-specific fracture rates as those living in major cities.

(b) Ratio of the number of cases observed to the number expected.

Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

### Socioeconomic disadvantage

There was a small but significant difference between the least disadvantaged and second most disadvantaged groups for females (Table 3). For males, those in the most disadvantaged group and the middle group were significantly more likely to have an osteoporotic hip fracture than those in the least disadvantaged group, but again the differences were small. However, age at fracture did increase with decreasing level of disadvantage. At the time of fracture, males were aged 79 years on average in the most disadvantaged group and 82 years on average in the least disadvantaged group. Females were aged 82 years on average in the most disadvantaged group and 84 years on average in the least disadvantaged group.

**Table 3: Incidence of osteoporotic hip fracture by socioeconomic disadvantage, 2006–07**

Socioeconomic category	Observed number		Expected number <sup>(a)</sup>		Rate ratio <sup>(b)</sup> (95% confidence interval)	
	Males	Females	Males	Females	Males	Females
Least disadvantaged	960	2,854	..	..	1.00	1.00
Second least disadvantaged	746	2,079	739	2,047	1.01 (0.95, 1.07)	1.02 (0.98, 1.05)
Middle group	944	2,285	826	2,253	1.14 (1.08, 1.21)	1.01 (0.98, 1.05)
Second most disadvantaged	920	2,460	891	2,352	1.03 (0.98, 1.09)	1.05 (1.01, 1.08)
Most disadvantaged	922	2,280	848	2,269	1.09 (1.03, 1.15)	1.01 (0.97, 1.04)

.. not applicable

(a) Number of cases that would be expected if people in each group experienced the same age- and sex-specific fracture rates as people in the least disadvantaged group.

(b) Ratio of the number of cases observed to the number expected.

Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

## Indigenous status

Aboriginal and Torres Strait Islander people were more likely to be hospitalised for an osteoporotic hip fracture than other Australians. In the two-year period 2005–07, Indigenous males were twice as likely to have a hip fracture as other Australian males, whereas Indigenous females were 26% more likely to have a hip fracture than other Australian females (Table 4).

Indigenous Australians were on average much younger than other Australians at the time of their hip fracture, aged 65 years (compared with 81 years) for males and 74 years (compared with 83 years) for females.

**Table 4: Incidence of osteoporotic hip fracture by Indigenous status, 2005–07**

Indigenous status	Observed number		Expected number <sup>(a)</sup>		Rate ratio <sup>(b)</sup> (95% confidence interval)	
	Males	Females	Males	Females	Males	Females
Other Australians	8,492	22,761	..	..	1.00	1.00
Indigenous Australians	73	113	35	90	2.01 (1.70, 2.54)	1.26 (1.07, 1.47)

.. not applicable

(a) Number of cases that would be expected if Indigenous people experienced the same age- and sex-specific fracture rates as other Australians.

(b) Ratio of the number of cases observed to the number expected.

### Notes

1. Data are for New South Wales, Victoria, Queensland, South Australia, Western Australia and public hospitals in the Northern Territory only, and may not be representative of other jurisdictions.
2. Persons aged 40 years or over.
3. The group 'other Australians' includes both those identified as non-Indigenous and those whose Indigenous status was unknown.

Source: AIHW National Hospital Morbidity Database.

## Interventions and outcomes

### Treatment provided in hospital

A single fracture can generate more than one discrete episode of care in hospital (each known as a 'separation'), as the injured person is transferred between hospitals and from one type of care to another. The full treatment for a single fracture may be recorded across several separations in the hospitals database. Because the database does not include any identifying information, it is not possible to link separations together to examine the overall treatment for each fracture. This analysis therefore looks at treatments provided as a proportion of all hip fracture separations and not as a proportion of all hip fractures.

Note also that the analysis in this section refers to hospital separations with the principal diagnosis of hip fracture. A person initially hospitalised for osteoporotic hip fracture may generate another separation with a different principal diagnosis, for example, when they are transferred to a rehabilitation unit. The inability to link individual separations together means that it is not possible to examine the interventions and outcomes of these other separations as part of this analysis.

The 16,518 osteoporotic hip fractures in 2006–07 generated 19,611 hospital separations with the principal diagnosis of hip fracture. Surgical procedures were carried out in more than three-quarters of these separations. The most common were:

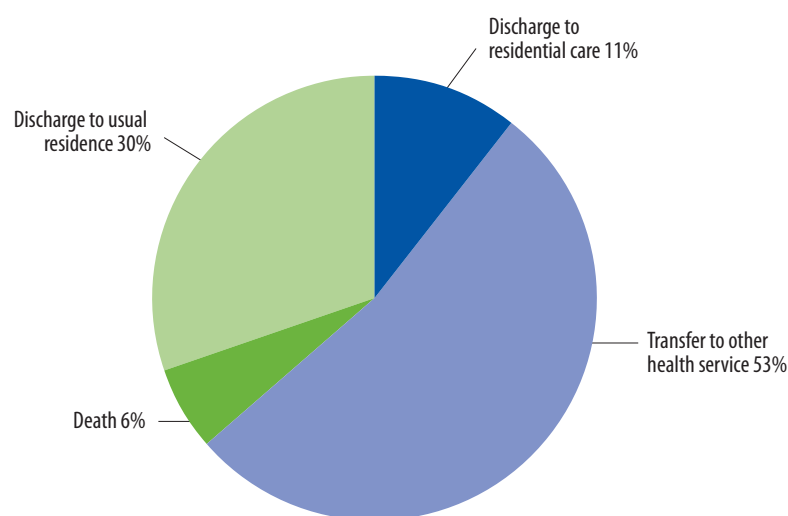
- fixation of the fractured bone (46% of separations)—this involves a procedure to hold the ends of the bone in place to help it heal correctly
- primary or revision joint replacement (28% of separations)—the first time a joint replacement occurs it is called a primary joint replacement, and any subsequent replacement procedure on the same site is called a revision joint replacement.

Joint replacement was most common in people with neck of femur fractures. Three types of joint replacement surgery can be performed for a hip fracture. Hemiarthroplasty involves the replacement of the head of the femur. Partial arthroplasty involves partial replacement or resurfacing of the head of the femur. Total arthroplasty involves the replacement of the head of the femur, as well as the hip socket. Hemiarthroplasty was the most common type of primary joint replacement performed, accounting for 83% of such procedures.

Allied health interventions were also frequently provided in separations for osteoporotic hip fracture. Physiotherapy (in 78% of separations), occupational therapy (36%), social work and dietetics (each 20%) were the most common allied health interventions provided.

### *Short-term outcomes*

At the conclusion of a hospital episode, persons may be transferred to another type of care within the same hospital, moved to another hospital or health service, discharged to a residential aged care service (as a new resident) or discharged to their usual residence (which may have been a residential care facility or welfare institution). Some leave hospital against medical advice and some die in hospital. The pattern of these short-term outcomes for the estimated 16,518 incident hip fracture cases in 2006–07 is described below.



## Notes:

1. Persons aged 40 years or over.
2. The group 'discharge to usual residence' includes those persons who left against medical advice.
3. Only includes separations with the principal diagnosis of hip fracture.

Source: AIHW National Hospital Morbidity Database.

**Figure 5: Outcomes of hospitalisation for osteoporotic hip fracture, 2006–07**

## Discharge

In almost 11% (1,757) of cases, the patient was discharged to a residential aged care service where this had not previously been their place of residence. The average age of these patients was 86 years. It was not possible to determine whether the placement was temporary or permanent.

In just over 30% of cases, the person was discharged to their usual place of residence, or left the hospital against medical advice.

## In-hospital deaths

There were 1,029 people (6%) with the principal diagnosis of osteoporotic hip fracture in 2006–07 who died in hospital. Males were almost twice as likely to die as females (9% compared with 5%). The average age of those who died in hospital was 85 years, compared with 82 years for the remaining cases.

## Transfer to other health care services

Just over half (53%) of people with the principal diagnosis of osteoporotic hip fracture were transferred to other health care services. Almost three-quarters of these were transferred to another acute hospital, and one-quarter were moved to another type of care within the same hospital (for example, to the rehabilitation unit). A small proportion were moved to non-hospital health care facilities.

Although the majority of people transferred between or within hospitals after their hip fracture would have eventually been discharged, the principal diagnosis (that is, the problem chiefly responsible for the episode of care) recorded for their later separations would not necessarily have been hip fracture. For example, they may stay in hospital chiefly for rehabilitation, or they may be waiting for a place to become available in an appropriate outside care facility. As previously noted, it is not possible, using these data, to determine the eventual outcome of these cases because the separations cannot be linked to track individuals through the hospital system.

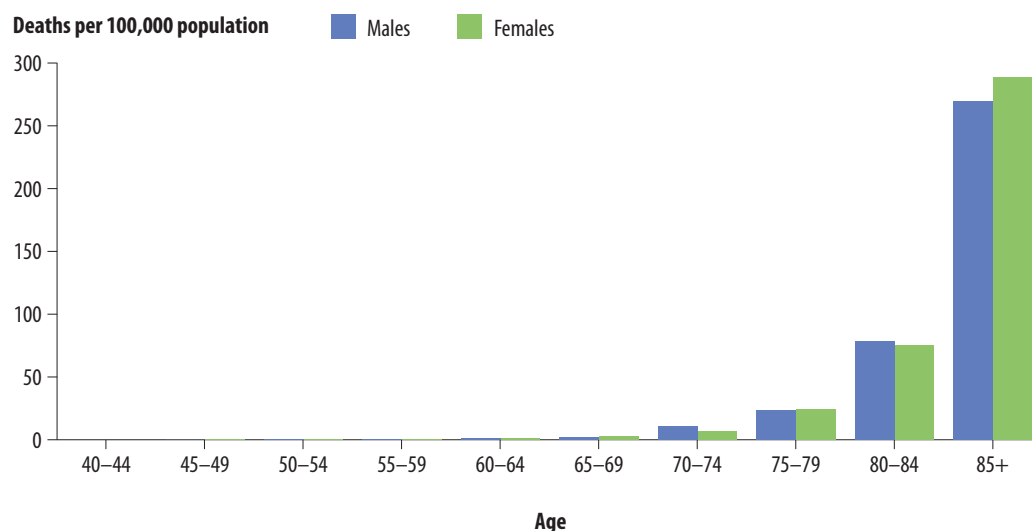
### Hip fracture mortality

According to the coding rules used for deaths data, injuries cannot be listed as the underlying (primary) cause of death. Rather, the condition or event leading to the injury—for example, a fall—is listed as the underlying cause and the injury as an associated cause. Hip fracture was recorded as an associated cause of 1,448 deaths among people aged 40 years or over in 2006, a rate of 14 deaths per 100,000 persons. Death rates were similar between the sexes, though slightly higher among females in the oldest age group (Figure 6).

The vast majority of deaths (98%) were of people aged 65 years or over, with 63% of deaths in people aged 85 years or over. The average age at death was 87 years for females and 84 years for males.

Common underlying causes recorded in these cases included cardiovascular disease (in 25% of deaths), minimal trauma falls (24%) and 'exposure to unspecified factor' (18%). Previous investigation by the AIHW National Injury Surveillance Unit has established that most deaths at older ages with 'exposure to unspecified factor' as the underlying cause and a fracture as an associated cause probably involved a fall (Kreissfeld & Harrison 2005).

Very few deaths (less than 0.5%) were the result of major trauma (such as transport accidents or high falls).



Note: Persons aged 40 years or over.

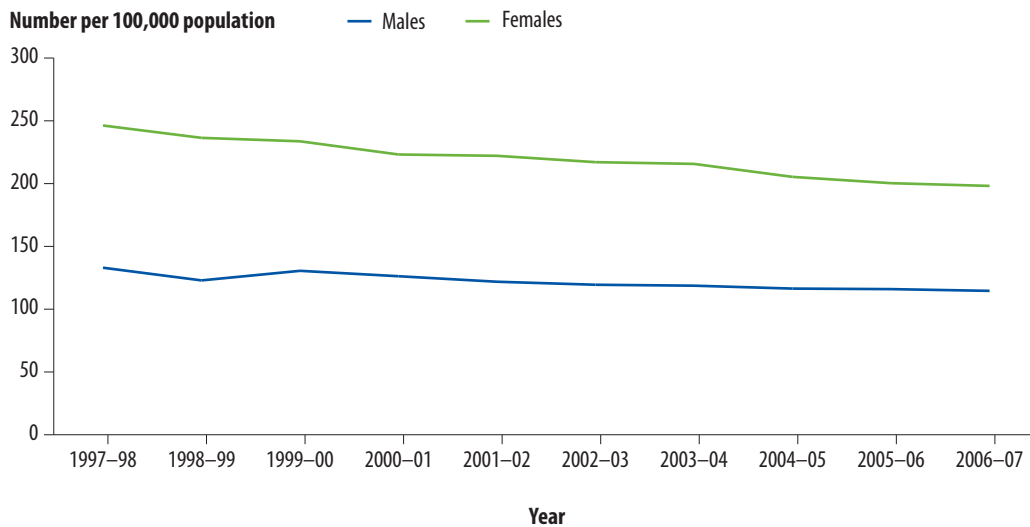
Source: AIHW National Mortality Database.

**Figure 6: Deaths with hip fracture as an associated cause, 2006**

## Trends

### Incidence

The estimated incidence rate of osteoporotic hip fracture in Australia is on the decline. Over the 10-year period 1997-98 to 2006-07, the age-standardised rate fell by 14% in males (from 133 to 114 per 100,000) and by 20% in females (from 246 to 198) (Figure 7; Table A2.2). The decreases mainly occurred among males aged 65-84 years and females aged 60 years or over; little change was seen in the 40-59 years age group, though the number of cases in people of this age was relatively small. The average age at hospitalisation increased from 78 to 81 in males and from 81 to 83 in females.



#### Notes

1. Data have been age-standardised to the Australian population at 30 June 2001.

2. Persons aged 40 years or over.

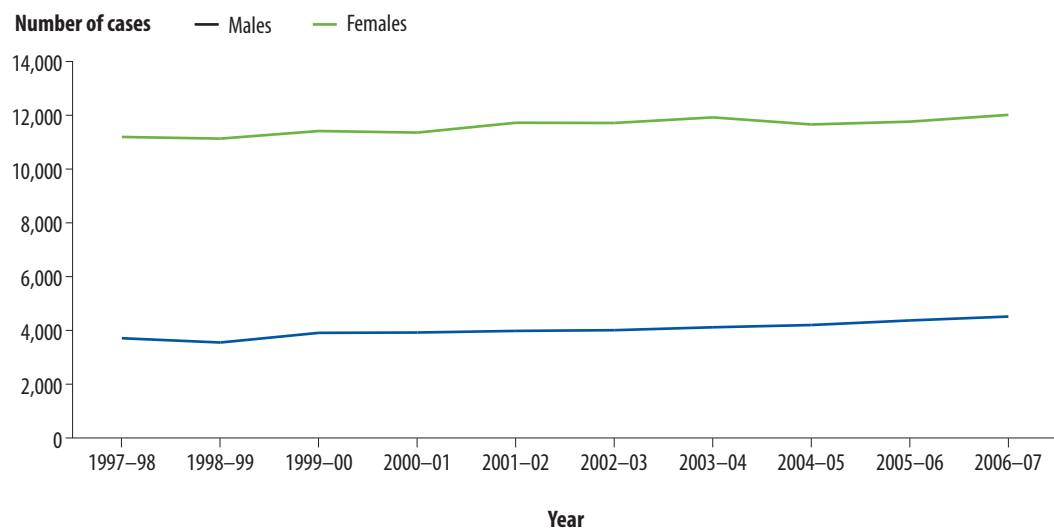
Source: AIHW National Hospital Morbidity Database.

**Figure 7: Trends in osteoporotic hip fracture incidence, 1997-98 to 2006-07**

The rate of fractures at all three sites (neck of femur, pertrochanteric and subtrochanteric) decreased significantly in females over the period, and there was a significant decrease in neck of femur fractures in males.

### Number of cases

Although the age-standardised rate of osteoporotic hip fracture has fallen over time in both sexes, the actual number of cases has continued to rise as a result of growth of the population at risk. Ageing of the population has increased the number of people aged 40 years or over by 23% over the 10 year period, from almost 7.6 million in 1997 to over 9.3 million in 2006. The increase among those aged 75 years or over has been even greater at 35% (from 948,000 to almost 1.3 million). These population increases have led to a rise in the number of osteoporotic hip fracture cases in both sexes between 1997-98 and 2006-07, by 22% in males and 7% in females, or 11% overall (Figure 8; Table A2.2).



Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Figure 8: Trends in the number of osteoporotic hip fractures, 1997-98 to 2006-07**

## Interventions and outcomes

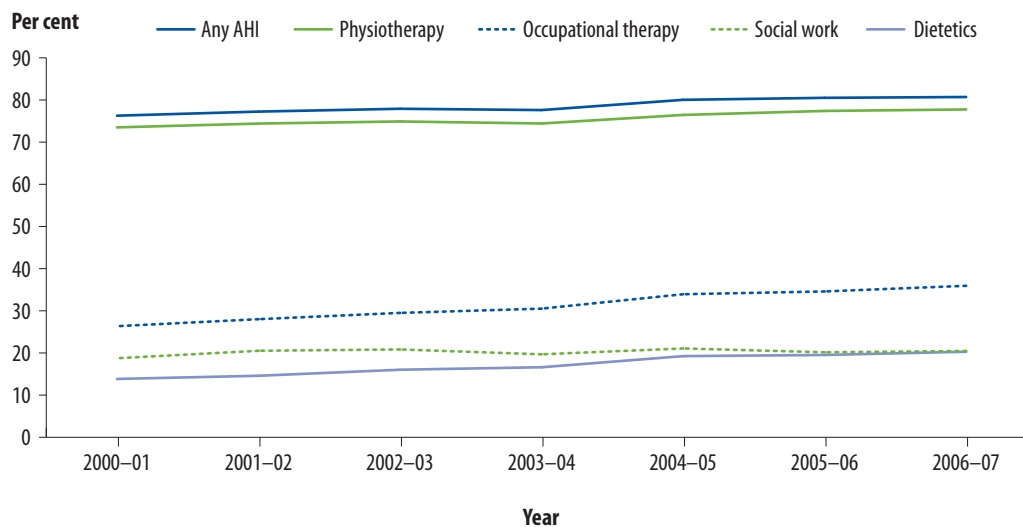
Due to changes in coding over time, hospital treatments and most short-term outcomes were only able to be compared for the period 2000-01 to 2006-07. In-hospital death was the only outcome able to be compared for the full decade from 1997-98 to 2006-07.

### Treatment provided in hospital

#### Allied health interventions

Provision of allied health interventions in separations with the principal diagnosis of osteoporotic hip fracture significantly increased between 2000-01 and 2006-07, from 76% to 81% of separations. In particular, occupational therapy, dietetics and physiotherapy became more common (Figure 9).





AHI - allied health intervention

*Notes*

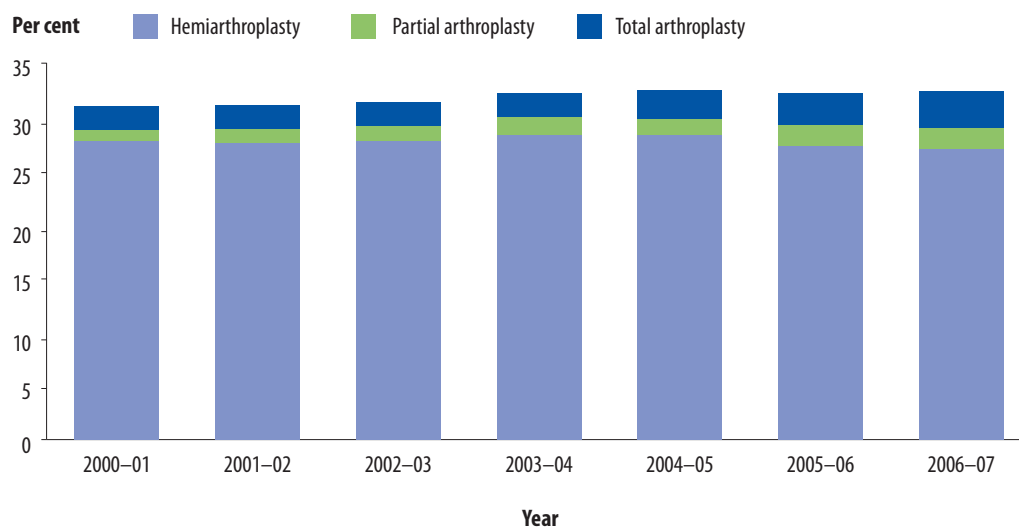
1. Per cent of osteoporotic hip fracture separations (not cases) where the procedure was performed.
2. Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Figure 9: Trends in allied health interventions for osteoporotic hip fracture, 2000-01 to 2006-07**

### Joint replacement

As described earlier, each fracture can generate more than one hospital separation, and treatment may be provided in any of these separations. Some treatments, like physiotherapy, may be provided more than once for a single fracture. Other treatments, like joint replacement, will only occur once per fracture, so we can assume that each occurrence of these treatments corresponds to a single fracture. In this situation it is possible to consider treatments provided as a proportion of all hip fractures.



## Notes

1. Per cent of osteoporotic hip fractures where the procedure was performed.

2. Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Figure 10: Trend in use of joint replacement for osteoporotic hip fracture, 2000-01 to 2006-07**

The use of joint replacement increased slightly between 2000-01 and 2006-07, from 31.0% to 32.4% of all hip fractures. Hemiarthroplasty was by far the most common type, and its use was fairly constant at around 27% of cases (Figure 10). The proportion of cases where partial and total arthroplasty were performed increased over the period, from 1.1% to 1.9% and from 2.2% to 3.5%, respectively.

## Short-term outcomes

### Discharge to residential aged care services

The proportion of osteoporotic hip fracture cases where the patient was transferred to a residential aged care service (as a new resident) fell significantly between 2000-01 and 2006-07, from 12.5% to 10.6%. The average age of people transferred to residential care rose significantly over the period, from 84.8 to 85.6 years.

### In-hospital deaths

The proportion of osteoporotic hip fractures in which the patient died in hospital increased slightly between 1997-98 and 2006-07, from 5.8% to 6.2%. The average age at in-hospital death also increased, from 83.7 to 85.5 years.

### Transfer to other health care services

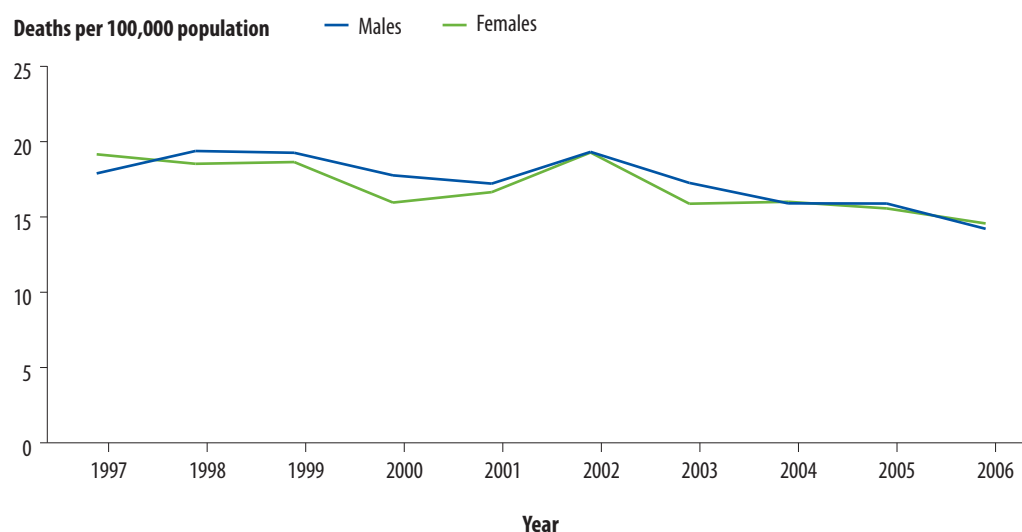
The proportion of persons with osteoporotic hip fracture that were transferred to other health care services increased from 48.5% in 2000–01 to 53.1% in 2006–07. This trend was largely driven by an increase in the number of patients transferred between acute hospitals.

### Hip fracture mortality

Over the 10 years from 1997 to 2006, the age-standardised rate of deaths with hip fracture as an associated cause decreased by 20.6% among males, from 18 to 14 deaths per 100,000 population (Figure 11; Table A2.3). The death rate among females decreased by 24.0%, from 19 to 15 per 100,000.

During this period, the proportion of these deaths assigned to various underlying causes changed considerably. The proportion of deaths with an underlying cause of a minimal trauma fall rose from 4% to 24%, while the proportion with an underlying cause of 'exposure to unspecified factor' fell from 35% to 18%. The proportion of deaths attributed to cardiovascular disease also decreased, from 34% to 25%. The bulk of these shifts occurred toward the end of the period, and are likely to be related to changes in death certification practices in Australia in recent years, as well as increased awareness among medical professionals of osteoporosis and associated hip fractures.

According to the AIHW National Injury Surveillance Unit, in the early part of the decade, most hip fracture deaths were certified by a medical practitioner rather than by a coroner, which was contrary to the usual practice for other injury deaths (Kreissfeld & Newson 2006). Over the past few years some jurisdictions have changed their coronial referral requirements; consequently more hip fracture deaths would now be certified by a coroner. This may have led to more information being made available about the circumstances of death, thus reducing the number of deaths being assigned the underlying cause of 'exposure to unspecified factor'.



## Notes

1. Rates have been age-standardised to the Australian population at 30 June 2001.

2. Persons aged 40 years or over.

Source: AIHW National Mortality Database.

**Figure 11: Hip fracture as an associated cause of death, 1997 to 2006**

## Preventing osteoporotic hip fractures

The prevention of osteoporotic hip fractures lies in two main strategies: to prevent the most common event resulting in fracture—namely, falls—and to decrease the risk of the bone breaking if a fall should occur, mainly by preventing or appropriately managing osteoporosis.

### Preventing falls

As previously noted, many things can lead to falls. Prevention therefore may include:

- ✦ exercises to improve balance and posture
- ✦ a review of medications, as some may cause dizziness or drowsiness
- ✦ attending a falls prevention class
- ✦ repairing/removing trip hazards and installing safety rails and non-slip floor strips as appropriate
- ✦ avoiding excessive alcohol intake.

More information about preventing falls is available from the Australian Government Department of Health and Ageing ([www.health.gov.au](http://www.health.gov.au)), HealthInsite ([www.healthinsite.gov.au](http://www.healthinsite.gov.au)) or Osteoporosis Australia ([www.osteoporosis.org.au](http://www.osteoporosis.org.au) or freecall 1800 242 141).

## Preventing and managing osteoporosis

Prevention of osteoporosis centres around lifestyle factors: a healthy diet and regular exercise. A diet that incorporates sufficient amounts of calcium is vital, as this mineral helps build and maintain bone density. Calcium is found in dairy products, fish with edible bones and, in smaller amounts, in plant foods such as green leafy vegetables. Judicious exposure to sunlight (keeping in mind the risk of skin cancer) is necessary for producing vitamin D, which enables the body to use calcium. Dietary intakes of calcium and vitamin D levels can be increased through supplementation if necessary. Regular weight-bearing exercise also helps to strengthen the bones and muscles and, combined with a balanced diet, will help to achieve and maintain a healthy weight.

These factors are important throughout life, but particularly in childhood and adolescence, when large amounts of bone are formed. Bone mass and density are generally maintained at a constant level during early- to mid-adulthood, but begin to decline from around the age of 50 years. Achieving a high bone density early in life means that this progressive loss does not rapidly reach osteoporotic levels.

For those who have osteoporosis, management strategies incorporate both the positive lifestyle choices noted above, as well as the use of medications that can help maintain or improve bone density. Bisphosphonate medications (for example, alendronate and risedronate) reduce the rate of bone loss by slowing the reabsorption of minerals from the bones. Sufficient levels of calcium and vitamin D are also needed and combination bisphosphonates are now available that incorporate a calcium and/or vitamin D supplement. More recently, medications that directly promote bone formation have become available: strontium ranelate and parathyroid hormone.

Fall prevention measures are also an important aspect of managing osteoporosis.

## Conclusions

The age-standardised incidence of hip fracture in Australia is falling, though population growth means that the actual number of cases continues to rise. The hip fracture death rate has also decreased significantly in both sexes since 1997.

This bulletin highlights several important differences in hip fracture incidence between males and females:

- ✦ The hip fracture incidence rate among males has decreased more slowly than among females in the last decade.
- ✦ Indigenous Australian males are twice as likely to have a hip fracture as other Australian males, whereas the corresponding gap between Indigenous and other Australian females is only 26%.
- ✦ Males in the most disadvantaged and middle socioeconomic groups are more likely to have a hip fracture than those in the least disadvantaged group, but no such socioeconomic-related differences are seen among females.

- ♦ In all population groups, males are significantly younger than females at the time of their hip fracture.
- ♦ In-hospital mortality following hip fracture is more common in males than in females.

These results, in conjunction with other Australian data showing that males are less likely than females to undergo bone densitometry testing (Ewald et al. 2009) or to take action to manage diagnosed osteoporosis (AIHW 2008c), suggest that males should be a focus for targeted hip fracture prevention efforts in the future.

## Appendix 1: Methods and data sources

### Methods

Virtually all hip fractures require hospital care. Therefore, hospital separations data can be reliably used to estimate the incidence of osteoporotic hip fracture in Australia. Data were obtained from the AIHW National Hospital Morbidity Database (NHMD) for the financial years 1997–98 to 2006–07. Cases of osteoporotic hip fracture were identified by selecting separations of persons aged 40 years or over where the principal diagnosis was fracture of the upper femur and the external cause code indicated a low trauma event.

A person may have more than one separation directly following on from their initial admission to hospital for a given fracture—for example, when they are transferred to another hospital for further treatment. To estimate incidence, records where the patient had been transferred in from another hospital were excluded to minimise double-counting. However, all records were included in analysis of hospital procedures and interventions, as these may occur at any point during the time spent in hospital. This method is consistent with that used by the National Injury Surveillance Unit (Kreissfeld & Newson 2006).

Outcomes of the stay in hospital were derived from the mode of separation recorded in the NHMD. Outcomes considered were death, discharge to a residential aged care facility (where the person was not previously resident), transfers to other medical care, and other (including discharge to usual residence). Relevant ICD-10-AM codes for diagnoses and procedures are listed in Table A1.1.

Simple linear regressions were applied to examine trends over time (Boyle & Parkin 1991).

### Comparing different populations

The Statistical Local Area code for each separation was mapped to the Australian Standard Geographic Classification Remoteness Structure and to the Index of Disadvantage, as defined by the Australian Bureau of Statistics (ABS 2004; 2005). This mapping allows assignment of the remoteness and relative level of disadvantage of the person's area of residence.

For analysis by remoteness, Australia was divided into three regions: major cities, regional Australia and remote Australia. The incidence of osteoporotic hip fracture in each region was indirectly age-standardised to the major cities region and rate ratios calculated.

For analysis by level of disadvantage, comparisons were made between the most and least disadvantaged fifths of the population. The rates were indirectly age-standardised to the least disadvantaged fifth and rate ratios calculated.

For analysis of variation by Indigenous status, data for two financial years were combined in order to obtain a sufficient sample size for reliable estimates. The reliability of Indigenous identification varies across jurisdictions; the results presented here exclude the Australian Capital Territory, Tasmania and private hospitals in the Northern Territory as the Indigenous identifier was not considered sufficiently reliable for analysis in these jurisdictions.

For all three analyses, 95% confidence intervals for the rate ratios were calculated using the square root transform method (AIHW 2008a; Breslow & Day 1987).

### *Counting deaths*

For this analysis, records of deaths of persons aged 40 years or over where hip fracture was recorded as an associated cause of death were extracted from the AIHW National Mortality Database. The underlying causes of death were broadly grouped as minimal trauma falls, 'exposure to unspecified factor', other external causes, cardiovascular disease, respiratory disease, cancer and other causes.

Deaths registered in the calendar years 1997 to 2006 were analysed. Simple linear regressions were applied to examine trends in death rates and assignment of underlying causes of death (Boyle & Parkin 1991).

### *Data sources*

The data used in this study were derived from the NHMD and the National Mortality Database. The analysis was restricted to people aged 40 years and over, as less than 1% of minimal trauma hip fractures occur in people younger than 40 years.

### *The National Hospital Morbidity Database*

The NHMD, maintained at the AIHW, covers almost all public and private hospitals in Australia (AIHW 2008b). The data are supplied to the AIHW by state and territory health authorities and the Department of Veterans' Affairs using standard definitions contained in the National Health Data Dictionary. The information in the NHMD is not person-based; instead it relates to episodes of care in a hospital, known as 'hospital separations'. An individual attending hospital more than once will generate multiple records within the database.

Information available within the NHMD includes dates and modes of admission and separation, diagnoses, procedures performed, and patient demographics including age, sex,

Indigenous status and area of residence. Diagnoses and procedures are coded based on the International Statistical Classification of Diseases and Related Health Problems, Clinical Modification, 9th Revision from 1993–94 to 1998–99 and Australian Modification, 10th Revision from 1998–99 onwards (ICD-9-CM and ICD-10-AM).

### *The National Mortality Database*

The AIHW National Mortality Database contains information about deaths registered in Australia. Deaths are registered by the state and territory registrars of births, deaths and marriages. The information is provided to the Australian Bureau of Statistics for coding of the cause of death and compilation into aggregate statistics.

Information available includes sex, age at death, date of death, area of usual residence, Indigenous status, country of birth and cause of death. The cause of death is certified by the medical practitioner or the coroner and coded using the International Classification of Diseases, 9th Revision from 1979 to 1996 and 10th Revision from 1997 (ICD-9 and ICD-10). Multiple causes of death, including the underlying and all associated causes of death recorded on the death certificate, are available from 1997 onwards.



**Table A1.1: ICD codes used for data extraction and analysis**

ICD-10 or ICD-10-AM code	ICD-9 or ICD-9-CM code	Definition
<b>Injury</b>		
S72.0	820.0, 820.1, 820.8, 820.9	Fracture of neck of femur
S72.1	820.20, 820.21, 820.30, 820.31	Pertrochanteric fracture
S72.2	820.22, 820.32	Subtrochanteric fracture
<b>External cause of injury</b>		
W00	E888 <sup>(a)</sup>	Fall on same level involving ice and snow
W01	E885	Fall on same level from slipping, tripping and stumbling
W03	E886	Other fall on same level due to collision with, or pushing by, another person
W04	E888 <sup>(a)</sup>	Fall while being carried or supported by other persons
W05	E884.6	Fall involving wheelchair
W06	E884.4	Fall involving bed
W07	E884.2	Fall involving chair
W08	E884.9	Fall involving other furniture
W18	E884.7, E888 <sup>(a)</sup>	Other fall on same level
W19	E888 <sup>(a)</sup>	Unspecified fall
W22	E917.2, E917.9 <sup>(a)</sup>	Striking against or struck by other objects
W50	E917.9 <sup>(a)</sup>	Hit, struck, kicked, twisted, bitten or scratched by another person
W51	E917.9 <sup>(a)</sup>	Striking against or bumped into by another person
W54.8	E906.0	Struck by dog
<b>Procedures and interventions</b>		
47522-00	81.52	Hemiarthroplasty of hip
49315-00	81.52	Partial arthroplasty of hip
49318-00	81.51	Total arthroplasty of hip, unilateral
49319-00	81.51	Total arthroplasty of hip, bilateral
95550-00	Not comparable	Allied health intervention, dietetics
95550-01	Not comparable	Allied health intervention, social work
95550-02	Not comparable	Allied health intervention, occupational therapy
95550-03	Not comparable	Allied health intervention, physiotherapy

(a) The ICD-10 coding system provides finer detail for falls compared with ICD-9. Separation of ICD-9 codes which span multiple ICD-10 categories is not possible.

## Appendix 2: Data tables

**Table A2.1: Estimated incidence of osteoporotic hip fracture, by age, 2006–07**

Age	Males		Females		Persons	
	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>
40–44	26	3	11	1	37	2
45–49	43	6	26	3	69	5
50–54	58	8	89	13	147	11
55–59	92	15	155	24	247	19
60–64	161	31	219	43	380	37
65–69	201	51	442	110	643	81
70–74	374	122	725	219	1,099	172
75–79	689	272	1,599	535	2,288	415
80–84	1,133	670	2,827	1,175	3,960	966
85+	1,735	1,589	5,913	2,642	7,648	2,297
40+ (crude rate)	4,512	99	12,006	247	16,518	175

(a) Number of cases per 100,000 population within age group.

Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Table A2.2: Estimated incidence of osteoporotic hip fracture, 1997–98 to 2006–07**

Year	Males		Females		Persons	
	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>
1997–98	3,706	133	11,186	246	14,892	204
1998–99	3,547	123	11,124	236	14,671	193
1999–00	3,906	131	11,406	234	15,312	194
2000–01	3,918	126	11,348	223	15,266	186
2001–02	3,978	122	11,714	222	15,692	184
2002–03	4,005	119	11,705	217	15,710	179
2003–04	4,113	119	11,913	216	16,026	177
2004–05	4,197	116	11,650	205	15,847	170
2005–06	4,367	116	11,755	200	16,122	167
2006–07	4,512	114	12,006	198	16,518	164

(a) Number of cases per 100,000 population, age-standardised to the Australian population at 30 June 2001.

Note: Persons aged 40 years or over.

Source: AIHW National Hospital Morbidity Database.

**Table A2.3: Deaths with hip fracture as an associated cause of death, 1997 to 2006**

Year	Males		Females		Persons	
	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>	Number	Rate <sup>(a)</sup>
1997	445	18	880	19	1,325	19
1998	504	19	882	19	1,386	19
1999	522	19	927	19	1,449	19
2000	502	18	832	16	1,334	17
2001	507	17	904	17	1,411	17
2002	599	19	1076	19	1,675	19
2003	551	17	916	16	1,467	16
2004	528	16	941	16	1,469	16
2005	546	16	955	16	1,501	16
2006	521	14	927	15	1,448	14

(a) Number of deaths per 100,000 population, age-standardised to the Australian population at 30 June 2001.

Note: Persons aged 40 years or over.

Source: AIHW National Mortality Database.

## Abbreviations

ABS	Australian Bureau of Statistics
AHI	allied health intervention
AIHW	Australian Institute of Health and Welfare
DRG	diagnosis related group
ICD-9	International Classification of Diseases, 9th Revision
ICD-9-CM	International Statistical Classification of Diseases and Related Health Problems, 9th Revision, Clinical Modification
ICD-10	International Classification of Diseases, 10th Revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
NHMD	National Hospital Morbidity Database

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# bulletin 76

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