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Hip fracture incidence and hospitalisations in Australia

2015–16

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Contents

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ACSQHC	Australian Commission on Safety and Quality in Health Care
ANZHFR	Australian and New Zealand Hip Fracture Registry
DALY	disability-adjusted life years
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification
NMHD	National Hospital Morbidity Database
SES	socioeconomic status

Summary

Hip fractures are breaks occurring at the top of the thigh bone (femur). They place considerable burden on the wellbeing of the individual, their family, and carers, and represent a substantial cost to the health-care system in Australia.

This report provides national data on the incidence and hospital-based treatment of hip fractures in Australia, using data from the National Hospital Morbidity Database for 2015–16.

It complements available subnational and cohort clinical register data, and provides a national baseline for future population monitoring work on hip fracture prevention, risk, incidence, management, and outcomes.

In 2015–16, hip fractures were managed in a total of 50,900 episodes of hospital care, for both new (incident) hip fractures, and management and repair of previous fractures. These hospitalisations equate to more than 579,000 bed days, and involved more than 206,300 procedures or interventions.

Hip fractures are common in Australia, although hospitalisation rates are declining

In 2015–16, there were an estimated 18,700 new hip fractures among Australians aged 45 and over—a crude (age-specific) rate of 199 fractures per 100,000 population.

Of these:

- 56% were neck-of-femur fractures
- 38% were pertrochanteric fractures
- 5.8% were subtrochanteric fractures.

The number of new hip fractures rose over time, in line with population ageing. But after accounting for differences in the age structure of the population over time, the rate of hospitalisations for new hip fractures fell by 9.5% between 2006–07 and 2015–16.

Hip fractures are commonly the result of falls, occur mostly at home, and are associated with other conditions

In 2015–16, of new hip fractures, 93% were the result of a fall-related injury, and 87% were minimal trauma (low-impact) falls.

Nearly half (48%) occurred in the person's private home, and about one-quarter (27%) occurred in an aged care facility.

Just under 95% of new hip fracture hospitalisations included at least 1 additional diagnosis (comorbid condition). The most commonly recorded conditions were:

- hypotension (22%)
- other disorders of fluid, electrolyte, and acid-base balance (20%)
- other anaemias (20%)
- delirium (20%)
- type 2 diabetes (19%).

Some population groups are at greater risk of hip fractures than others

In 2015–16, the hospitalisation rate for new hip fractures rose substantially with age. When the influence of age was adjusted for, new hip fractures were:

- 1.7 times as high for women as for men
- 5% higher for Indigenous Australians than for other Australians.

Some new hip fractures are not treated with surgery

In 2015–16, an estimated 1,200 hip fractures were not surgically managed—a rate of 12 per 100,000 people aged 45 and over.

Compared with other new hip fractures, those that were not surgically treated were:

- more likely to occur at younger ages
- more likely to occur in men
- less likely to be comorbid
- less likely to be the result of falls
- more likely to be a pertrochanteric fracture.

1 Introduction

1.1 Rationale

Hip fracture—a break occurring at the top of the thigh bone (femur)—greatly affects the health, wellbeing, productivity, and participation of individuals who have sustained it, and represents an increasing burden on the Australian health system (Boufous et al. 2004; Stephens et al. 2014).

The impact of hip fracture on the individual includes decreased mobility and quality of life, and increased likelihood of re-fracture, admission to residential aged care, and death (Dimitriou et al. 2012).

Hip fracture is an important population health issue. It is preventable—the majority are the result of low-impact (minimal trauma) falls in people with reduced bone density (osteopenia or osteoporosis)—and it is an indicator of health system integration and effectiveness, as well as the general health of an ageing population (Jaarsma et al. 2009).

In recent years, the importance of high-quality hip fracture care has led to the development of guidelines to improve care and optimise outcomes for people with hip fracture:

- The Australian and New Zealand Guideline for Hip Fracture Care assists in the provision of consistent, effective, and efficient care for hip fracture patients (ANZHFR 2014).
- The Hip Fracture Care Clinical Care Standard provides a national approach to improving the assessment and management of patients with a hip fracture, as well as optimising patient outcomes to reduce the risk of subsequent fractures (ACSQHC 2016).

Current national analysis on the incidence, treatment, management, and outcomes of hip fractures in Australia is based on single sources of data, such as the National Hospital Morbidity Database (NHMD).

Clinical data on neck-of-femur fractures among people aged 50 and over is collected by the Australian and New Zealand Hip Fracture Registry (ANZHFR), which provides information on the demographics, treatment, and outcomes for people admitted with a primary hip fracture to some of Australia's public hospitals.

The ANZHFR reports on many of the indicators specified in the Australian Commission on Safety and Quality in Health Care (ACSQHC) Clinical Care Standard.

This report takes a national population health monitoring approach to provide baseline findings on hip fracture incidence and hospital-based treatment, using data on all admitted episodes of patient care from the NHMD (Box 1). This report complements the clinical focus of the ANZHFR.

Box 1: National Hospital Morbidity Database

The National Hospital Morbidity Database (NHMD), maintained at the Australian Institute of Health and Welfare (AIHW), contains data from all public and private acute and psychiatric hospitals, free-standing day hospital facilities, and alcohol and drug treatment centres in Australia. State and territory health authorities supply data to the AIHW annually.

The data supplied are based on the Admitted Patient Care National Minimum Data Set, and include demographic, administrative, and length-of-stay data, as well as data on the diagnoses of the patients, the procedures they underwent in hospital, and external causes of injury and poisoning.

The information in the NHMD relates to discrete episodes of admitted patient care, also known as 'separations', and referred to as 'hospitalisations' in this report.

Analyses of NHMD data in this report are for 2015–16 only, except for trend data, which are presented for 2006–07 to 2015–16. Diagnosis, procedure, and external cause data for 2015–16 were reported to the NHMD by all states and territories using the International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian Modification (ICD-10-AM) 9th edition (ACCD 2015a), incorporating the Australian Classification of Health Interventions (ACCD 2015b).

More information and the data quality statement for the NHMD are available from Appendix A in *Admitted patient care 2015–16: Australian hospital statistics* <https://www.aihw.gov.au/reports/hospitals/ahs-2015-16-admitted-patient-care/contents/table-of-contents>.

1.2 Scope and structure

A single hip fracture can generate more than 1 discrete episode of hospital care. This means that an individual with a hip fracture can be represented by multiple records in the NHMD, because the individual received:

- treatment for the hip fracture in more than 1 hospital (a hospital transfer)
- more than 1 type of care—such as acute care and rehabilitation care—within the same hospital (a change in care type).

To measure the incidence (number of new cases) of hip fractures each year in the Australian population, it is necessary to be able to identify individuals in the hospital system. To do this effectively, linked data are needed to follow an individual's hospital separations over time.

At the time of analysis and drafting of this report, linked hospitals data were not available at the national level.

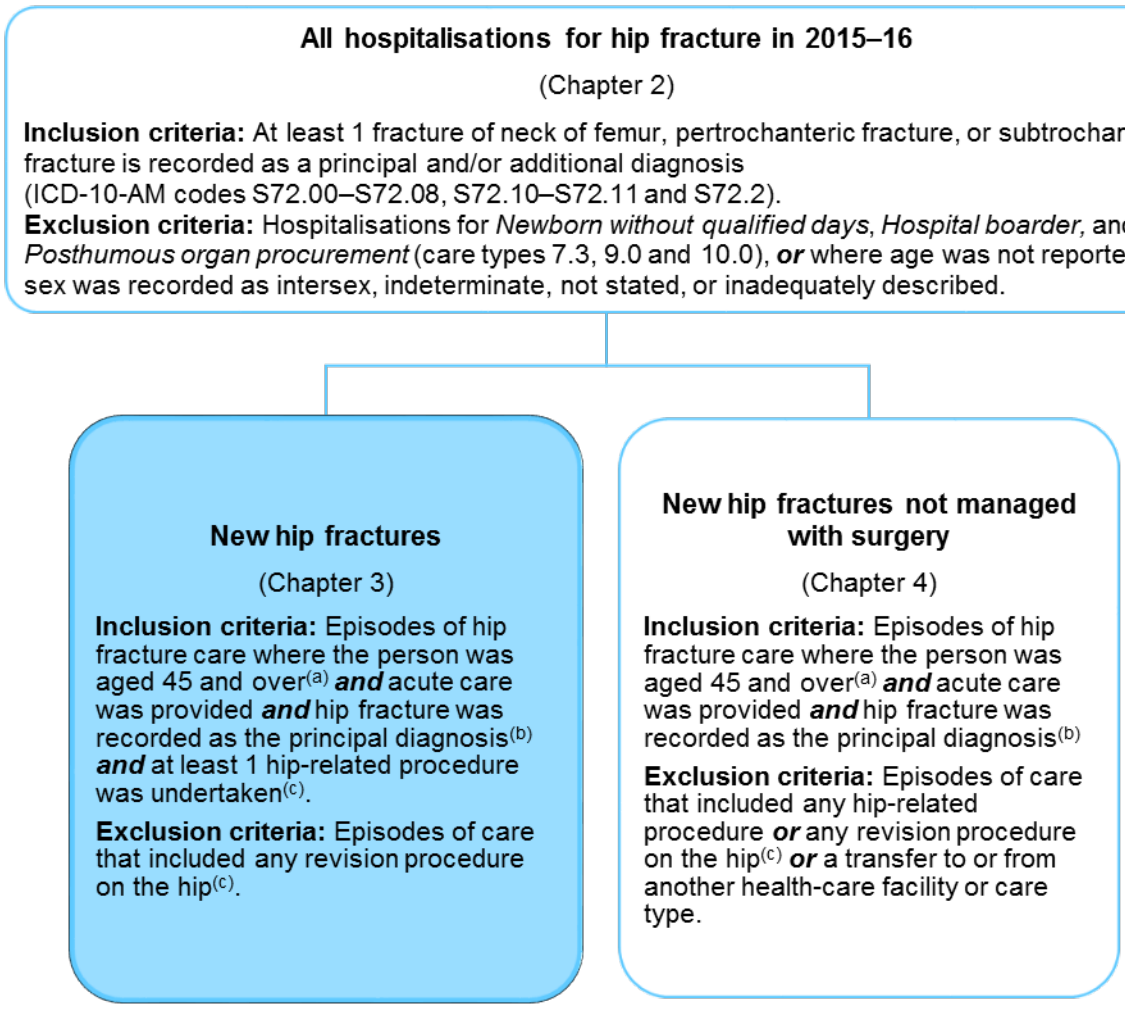
In the absence of person-level information, this report presents 3 measures of the impact of hip fractures in Australia, based on episode-level records from the NHMD. These are:

1. all episodes of care for hip fractures, as a measure of the magnitude and impact of hip fractures on hospital-based care in Australia (summarised in Chapter 2 'Hip fracture hospitalisations in Australia: an overview')
2. episodes of acute care for hip fracture as a principal diagnosis (main reason for hospitalisation) involving hip fracture-related surgical intervention, and without evidence of previous hip fracture, as a proxy measure of incident (new) hip fractures among people aged 45 and over (looked at in detail in Chapter 3 'Hospitalisations for new hip fracture')

3. episodes of acute care for hip fracture as a principal diagnosis that did not involve a hip fracture-related surgical intervention, and that were admitted from and separated to the community, as an estimate of the population with new hip fractures that are not managed with surgery (described in Chapter 4 'Non-operative management of hip fracture').

The different patient cohorts used in Chapters 2, 3, and 4, and the relationship between the incident hospitalisations and all hospitalisations is shown in Figure 1.1.

A discussion of key findings and proposed future work are in Chapter 5 'Discussion', methods and technical notes are provided in the Appendix, and supplementary tables are available for download from <https://www.aihw.gov.au/reports/injury/hip-fractures-in-australia-2015-16/data>.



(a) The age cohort was selected to maximise the capture of minimal trauma hip fractures, and ensure robustness of age-specific analysis.

(b) Includes hospitalisations where hip fracture was recorded as both principal and an additional diagnosis. Records where hip fracture was recorded as the additional diagnosis only are excluded.

(c) The complete list of procedures is provided in the Appendix (Table A5).

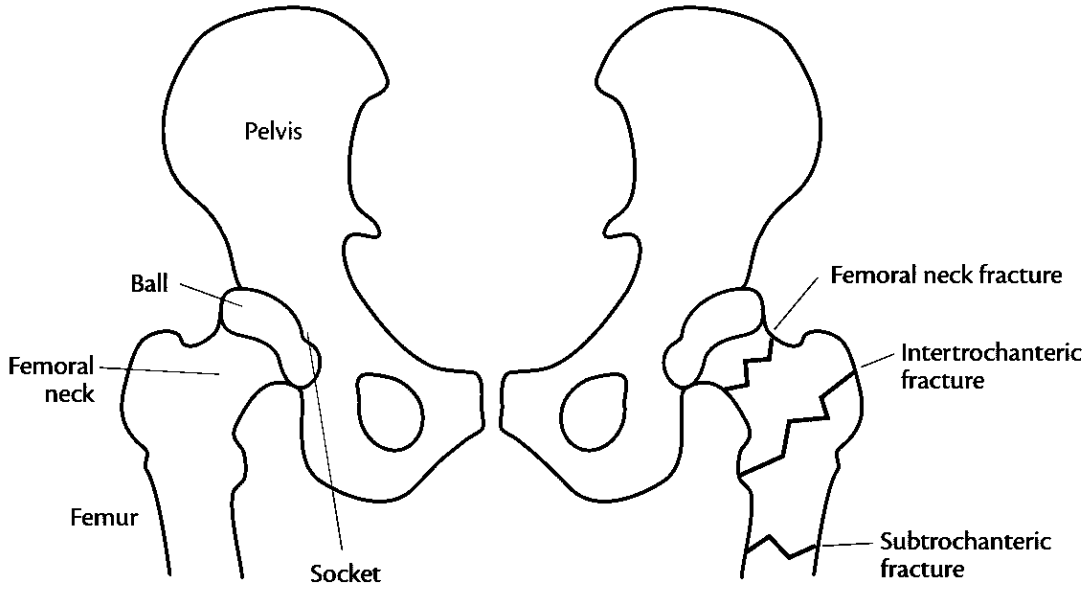
Figure 1.1: Defining hip fracture cohorts in the National Hospital Morbidity Database 2015–16

1.3 What are hip fractures?

A hip fracture is a break occurring at the top of the femur, close to the hip. Hip fractures are usually caused by force. In people with healthy bones, strong force is required to fracture the bone, but in people with conditions such as osteoporosis, a small amount of force can cause a hip fracture (known as 'minimal trauma fracture').

The 3 types of hip fractures are (Figure 1.2):

- femoral neck fracture, which occurs in the narrow section of bone between the main shaft of the femur and the ball of the hip joint
- intertrochanteric (pertrochanteric) fracture, where the shaft of the femur breaks just under the femoral neck
- subtrochanteric fracture, which occurs slightly further down the shaft of the femur.



Source: AIHW 2008.

Figure 1.2: Bones of the hip and sites of hip fracture

Risk factors

Broadly, risk factors for hip fractures are those that lead to decreased bone density and strength, and increased likelihood of falls.

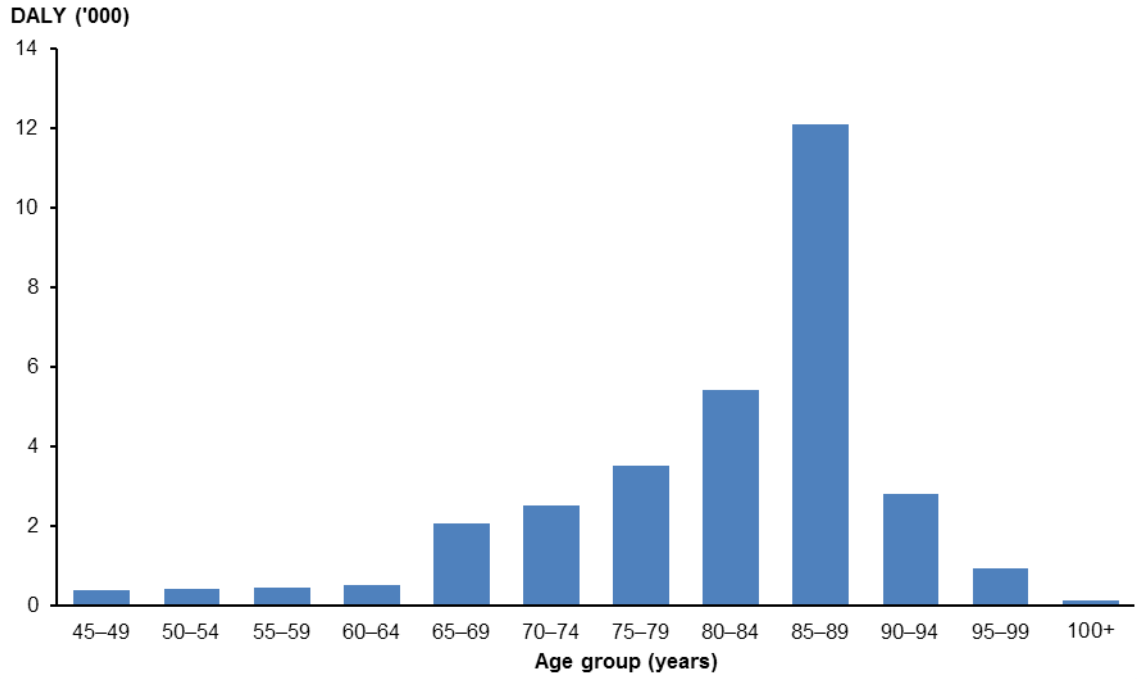
There are several modifiable and non-modifiable risk factors for hip fractures, including age, sex, being Aboriginal and/or Torres Strait Islander, having certain comorbid conditions, experiencing repeated minimal trauma, using some medications, and certain lifestyle factors.

Age and sex

Hip fractures are more common among older age groups and among women. Lower hormone levels—particularly lower levels of oestrogen in post-menopausal women—reduced physical activity, and changes in the absorption of dietary nutrients all contribute to reduced bone density and strength in older age. Ageing is also associated with reduced muscle strength and stability, increasing the likelihood of falls.

The 2011 Australian Burden of Disease Study reported that hip fracture burden generally increased with age—almost 30,000 disability-adjusted life years (DALYs) were attributable to hip fractures among those aged 65 and over, compared with more than 3,000 in those aged 45–64 (Figure 1.3). The DALY is a summary measure (in years) of healthy life lost through premature death or through living with ill health due to illness or injury.

A 2017 study by Lobo and others found that the incidence rate of hip fractures was 3 times as high for women as for men. Further, Holloway et al. (2018) reported that, of all hip fracture hospitalisations from the Victorian Admitted Episodes Dataset, women had a rate of 40 per 10,000 population compared with 19 per 10,000 population for men.



Sources: AIHW analysis of Australian Burden of Disease 2011 database; Table S1.1.

Figure 1.3: Disability-adjusted life year burden from hip fractures, by age, 2011

Indigenous status

Indigenous Australians have been shown to experience hip fractures at higher rates than non-Indigenous Australians. A study by Wong et al. (2013) found that in 1999–2009, the age-standardised hip fracture rate was 273 per 100,000 person-years for Indigenous Australians compared with 149 per 100,000 person-years for non-Indigenous Australians.

The underlying factors contributing to the higher risk of hip fracture among Indigenous Australians are not well described, and might include higher rates of comorbid conditions and lifestyle factors, as well as biomedical factors, such as inherited bone size and density (Brennan-Olsen et al. 2017).

Comorbid conditions

Several conditions, mostly degenerative, can increase the risk of hip fracture and of poor outcomes following a hip fracture, including osteoporosis, rheumatoid arthritis, and dementia.

Osteoporosis (meaning ‘porous bones’) is a condition in which the bones weaken and lose structural integrity, which greatly increases the risk of a fracture occurring (Osteoporosis Australia 2014).

Rheumatoid arthritis—an inflammatory condition causing joint weakness, stiffness, and deformation—has been shown to increase the likelihood of osteoporosis, and to increase the risk of hip fracture among people at a younger age (Lin et al. 2015; Xue et al. 2017).

Academic studies have also drawn a correlation between dementia and hip fracture—a study by Harvey et al. (2017) found that people with dementia (9.8%) were more likely to have a subsequent hip fracture than those without (6.6%), or to die within 30 days of the first fracture (12% compared with 6.4%).

Repeated minimal trauma

People who have had a minimal trauma fracture are at increased risk of subsequent fractures—an effect known as the 'fracture cascade' or 'cascade effect' (Osteoporosis Australia 2014). 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).

Medication use

Some medications have been shown to increase the risk of hip fractures. Corticosteroids are used in the management of many conditions, such as inflammatory conditions (including rheumatoid arthritis), asthma, and eczema. Many studies have drawn a connection between the use of corticosteroids and an increased risk of hip fracture, due to their effect on bone density (Hubbard et al. 2003; Kao et al. 2017; Vestergaard et al. 2003).

Lifestyle factors

Various studies have found associations between modifiable risk factors—including tobacco smoking, excessive alcohol consumption, and low vitamin D levels—and increased hip fracture risk (Høidrup et al. 2000; Ramason et al. 2014; Zhang et al. 2015).

Treatment

After a hip fracture diagnosis has been confirmed, it is crucial that treatment and management be both timely and effective (ACSQHC 2016; ANZHFR 2014). Hip fracture treatment may include both surgical and non-operative management.

Surgery

The majority of people with a hip fracture will elect surgery to repair the fracture. Most patients will be treated with surgery, either to repair and stabilise the fracture (usually for intertroachanteric and subtrochanteric fractures), or to replace the broken parts (usually for femoral neck fractures). Hip replacement surgery can either be partial, replacing the broken ball), or total (replacing the ball and the socket).

Rehabilitation

Rehabilitation after hip fracture surgery should focus on controlling pain, and maximising the patient's ability to restore movement to their pre-injury level (ANZHFR 2014). Successful post-fracture rehabilitation in hospital has been associated with lower mortality for up to 2 years (Ireland et al. 2016; Salpakoski et al. 2014).

Best practice indicates that patients should be offered a 'falls and bone health assessment' before being discharged from hospital, as part of a management plan to reduce the risk of subsequent fracture (ACSQHC 2016).

Malnutrition has been associated with poor functional recovery following a hip fracture (Mangano & Kenny 2016). So it is crucial that patients maintain a diet high in protein to prevent subsequent fractures—low protein intake has been associated with lower bone mineral density and poor physical performance (Bonjour et al. 1996).

Non-operative management

In some cases hip fractures are treated without surgery. This is known as conservative or non-operative management, and might include rest, restricted movement, and pain management. Non-operative management is indicated where the hip fracture is minor, and function, mobility, and pain can be managed with rest, strengthening exercises, and medication. It can also be indicated where the risk of poor outcomes (including death) from surgery is high, such as among people with poor general health or pre-existing comorbid conditions (ANZHFR 2014; Grigoryan et al. 2014).

Impact

Hip fractures cause considerable functional impairment and greatly affect the lives of individuals with a hip fracture, as well as the lives of their carers. A study by Dyer et al. (2017) found that between 10%–20% of survivors are institutionalised after their fracture, and those living in residential care before suffering a fracture have even poorer outcomes still.

Hip fractures are also associated with a decline in mental health, and cognitive impairment, particularly among those in older age groups (Lenze et al. 2004; Williams et al. 2014).

Mortality

Many studies have demonstrated a strong correlation between hip fractures and premature death. Patients who suffer a hip fracture after minimal trauma event are at a higher risk of premature death when compared with the general population (Abrahamsen et al. 2009; Dyer et al. 2017; Katelaris & Cumming 1996).

Further, a 2017 study found that people aged 65 and over who had suffered a hip fracture were more than 3.5 times as likely to die within a year of surgery as those who had not suffered a fracture (Lystad et al. 2017).

The 2011 Australian Burden of Disease Study reported that hip fractures contributed to 3.4% of the fatal burden in Australia.

Economic cost

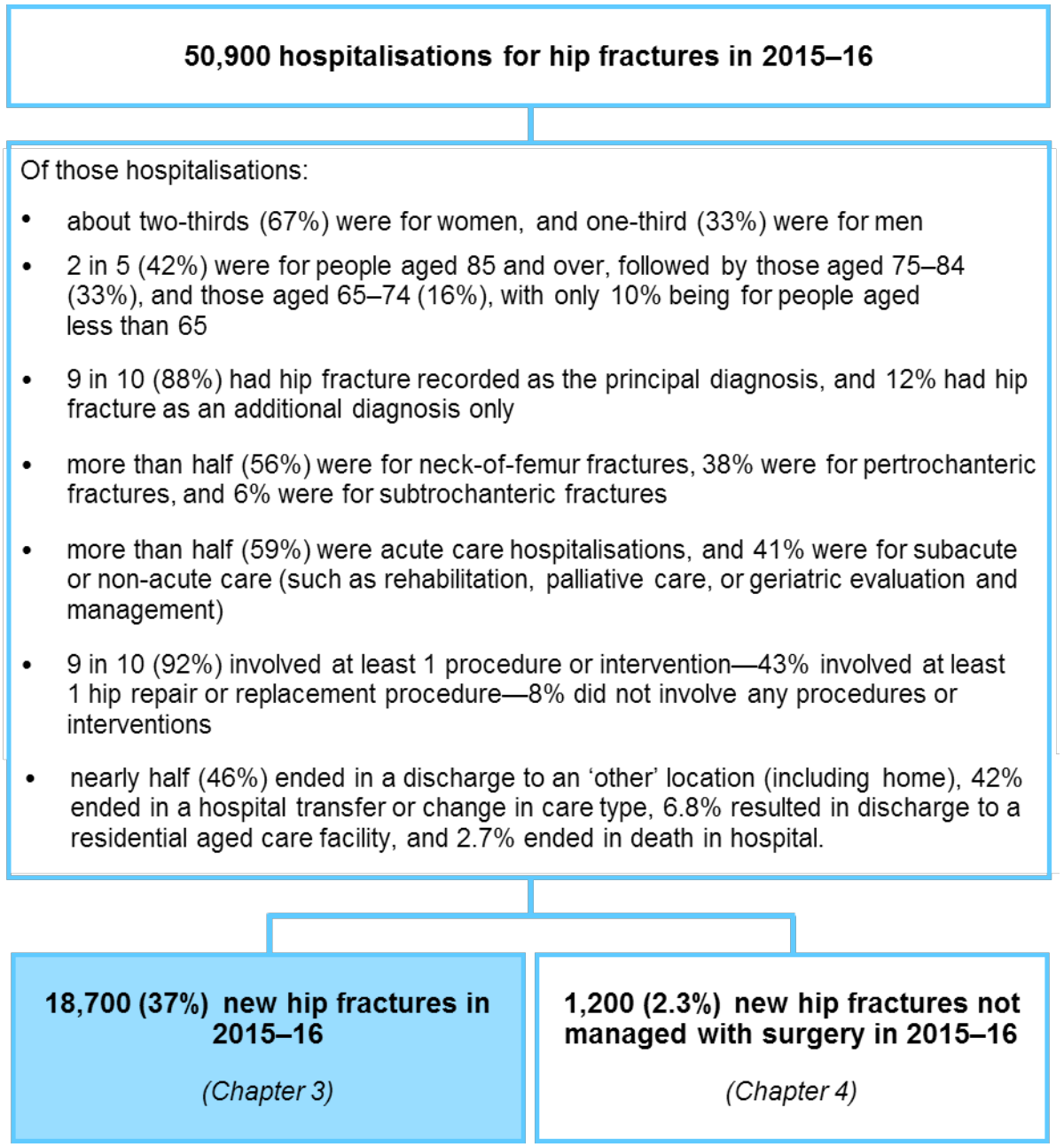
Hip fractures also place considerable financial burden on the Australian health-care system. In 2013, it was estimated that about 26,000 hip fractures would occur in 2016, costing close to $1 billion dollars, with treatment of hip fractures accounting for about 44% of all fracture-related hospital expenditure (Loefler & Close 2016).

A 2014 study predicted that the number of hip fractures will rise by 35% by 2036 (Stephens et al. 2014), while another study reported that the total annual cost of hip fractures attributable to osteoporosis and osteopenia would rise by 36% between 2013 and 2022—from $829 million to $1.27 billion (Watts et al. 2013).

In addition to direct health system costs, hip fractures also have indirect costs associated with lost productivity and participation, and with formal and informal care.

2 Hip fracture hospitalisations in Australia: an overview

In 2015–16, 50,900 episodes of care (hospitalisations) had at least 1 diagnosis of hip fracture. These accounted for 0.5% of all hospitalisations, resulted in more than 579,000 bed days (1.9% of the total), and involved more than 206,300 procedures and interventions (1.0% of the total).



Source: AIHW National Hospital Morbidity Database.

Figure 2.1: Hip fracture hospitalisations in Australia, 2015–16

3 Hospitalisations for new hip fracture

This chapter estimates the number of new cases of hip fractures (incidence), describes variation in hip fracture incidence by patient geography, demography, and over time, and explores comorbidity, treatment, and outcomes.

In 2015–16, among Australians aged 45 and over, 18,700 acute care hospitalisations had hip fracture as the principal diagnosis, and hip fracture-related surgery was performed. This equates to a crude (age-specific) incident rate of 199 hip fractures per 100,000 persons aged 45 and over, and represents 37% of all hip fracture hospitalisations in 2015–16.

In this chapter ‘hip fracture’ and ‘new hip fracture’ are used to refer to incident hip fractures.

3.1 Age and sex

In 2015–16, new hip fractures were most common among women and older people. More than two-thirds (70%, 13,000 hospitalisations) were for women—with about one-third (34%) for women aged 85 and over—and the median age for all people was 84.

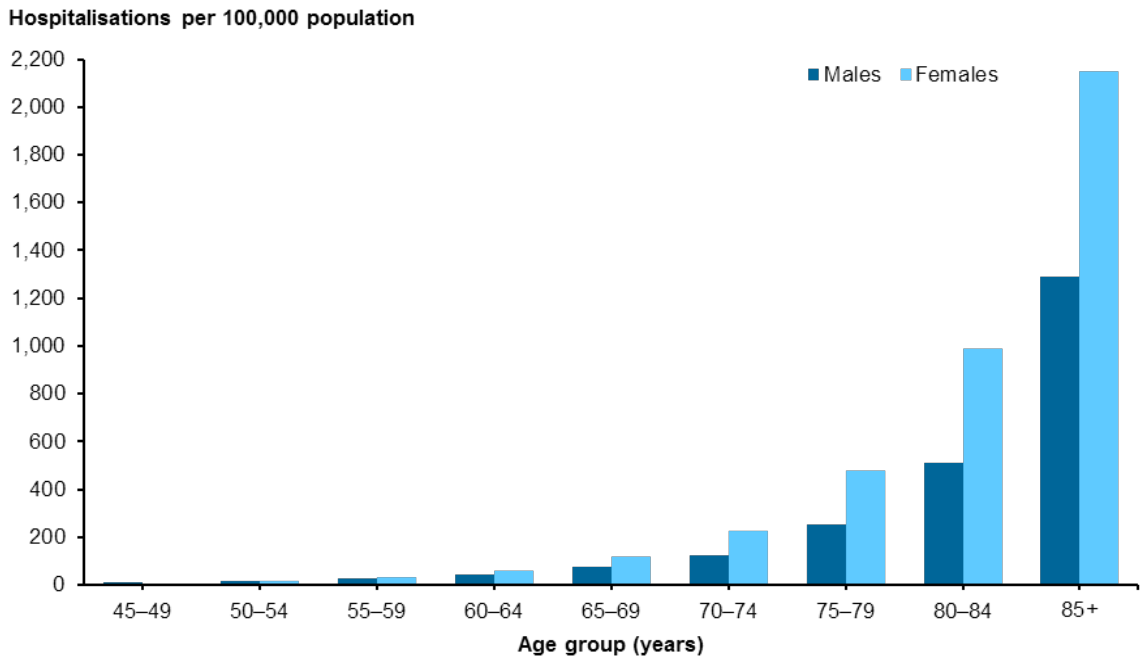
The new hip fracture hospitalisation rate increased with age—from 9 per 100,000 among people aged 45–49 to nearly 1,800 per 100,000 among those aged 85 and over (Figure 3.1).

People aged 85 and over were more than twice as likely as those aged 80–84 to be hospitalised with a new hip fracture, and nearly 5 times as likely as those aged 75–79.

Men with new hip fractures were younger than women, with a median age of 82 compared with 84.

Men aged 45–49 were nearly twice as likely to be hospitalised with new hip fractures as women of the same age. The rates were similar between the sexes for those aged 50–54, but women had increasingly higher rates than men across all age groups from age 55, and were twice as likely to be hospitalised as men from age 80 (Figure 3.1).

Overall, women were 1.7 times as likely as men to be hospitalised for a new hip fracture, with an age-standardised rate of 214 hospitalisations per 100,000 women compared with 126 per 100,000 men (Table S3.1).



Note: Age-specific rates are calculated using the estimated resident population for 31 December 2015.

Sources: AIHW National Hospital Morbidity Database; Table S3.1.

Figure 3.1: Rate of hospitalisation for new hip fractures, by age and sex, 2015–16

3.2 Type (location) of fracture

In 2015–16, the most common fracture site in hospitalisations for new hip fractures was the neck of femur (also known as intracapsular fracture), which was recorded as the principal diagnosis in almost 10,600 hospitalisations (56%). Pertrochanteric (or intertrochanteric) fractures were the next most common (nearly 7,100 hospitalisations, or 38%), while subtrochanteric fractures were the least common (almost 1,100 hospitalisations, or 5.8%) (Table 3.3).

There was no difference in the distribution of each type of fractures by sex, but there were differences by age, with:

- the proportion of new petrochanteric fractures generally rising with increasing age (from 31% in the 45–49 age group, to 42% in the 85 and over age group)
- new subtrochanteric fractures falling with increasing age (from 11% among those aged 45–49 to 5.8% among those aged 85 and over).

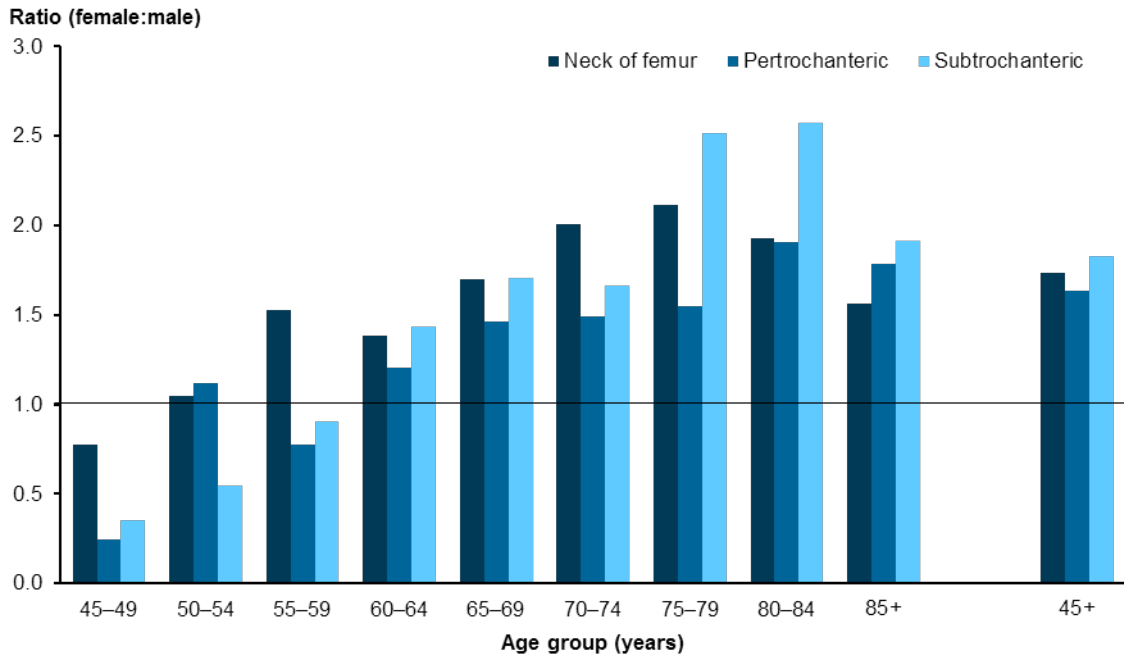
The proportion of new neck-of-femur fractures did not change substantially by age.

For each fracture type, and consistent with the finding for total hip fractures, the fracture rate rose with increasing age, and was about 1.6 to 1.8 times as high for women as for men overall. The rate of all types of fractures was higher among women than men aged 60 and over (Figure 3.2).

Men were more likely than women to have:

- a neck-of-femur fracture at ages 45–49
- a petrochanteric fracture at ages 45–49 and 55–59
- a subtrochanteric fracture at ages 45–54.

Figure 3.2 presents the female to male rate ratio—that is, the female fracture rate divided by the male rate in each age group.



Notes

1. The ratio is calculated by dividing the female age-specific rate by the male age-specific rate, at each age group. The age-specific rates are based on the estimated resident population at 31 December 2015.
2. The horizontal line at 1.0 indicates the male and female fracture rate is the same. A ratio above the line indicates women have a higher fracture rate than men of the same age. A ratio below the line indicates women have a lower rate than men of the same age.
3. See Table A1 for a full list of ICD-10-AM codes used in this analysis.

Sources: AIHW National Hospital Morbidity Database; Table S3.2.

Figure 3.2: Age-specific rate ratio of new hip fractures, by type of fracture, 2015–16

3.3 Comorbid conditions

Comorbid conditions are defined as those recorded as an additional diagnosis in new hip fracture hospitalisations. A single hospitalisation for hip fracture can include multiple additional diagnoses, so the sum of comorbid conditions exceeds the total number of new hip fractures. For each hospitalisation, only the first diagnosis in any specific condition group is counted.

In 2015–16, about 111,800 conditions were recorded as additional diagnoses in new hip fracture hospitalisations—or about 6 additional diagnoses per new hip fracture—with only 5.3% having no additional diagnoses recorded.

The condition most commonly recorded as an additional diagnosis were:

- hypotension (22%) of new hip fracture hospitalisations
- other disorders of fluid, electrolyte, and acid-base balance (20%)
- other anaemias (20%)
- delirium (20%)
- type 2 diabetes (19%).

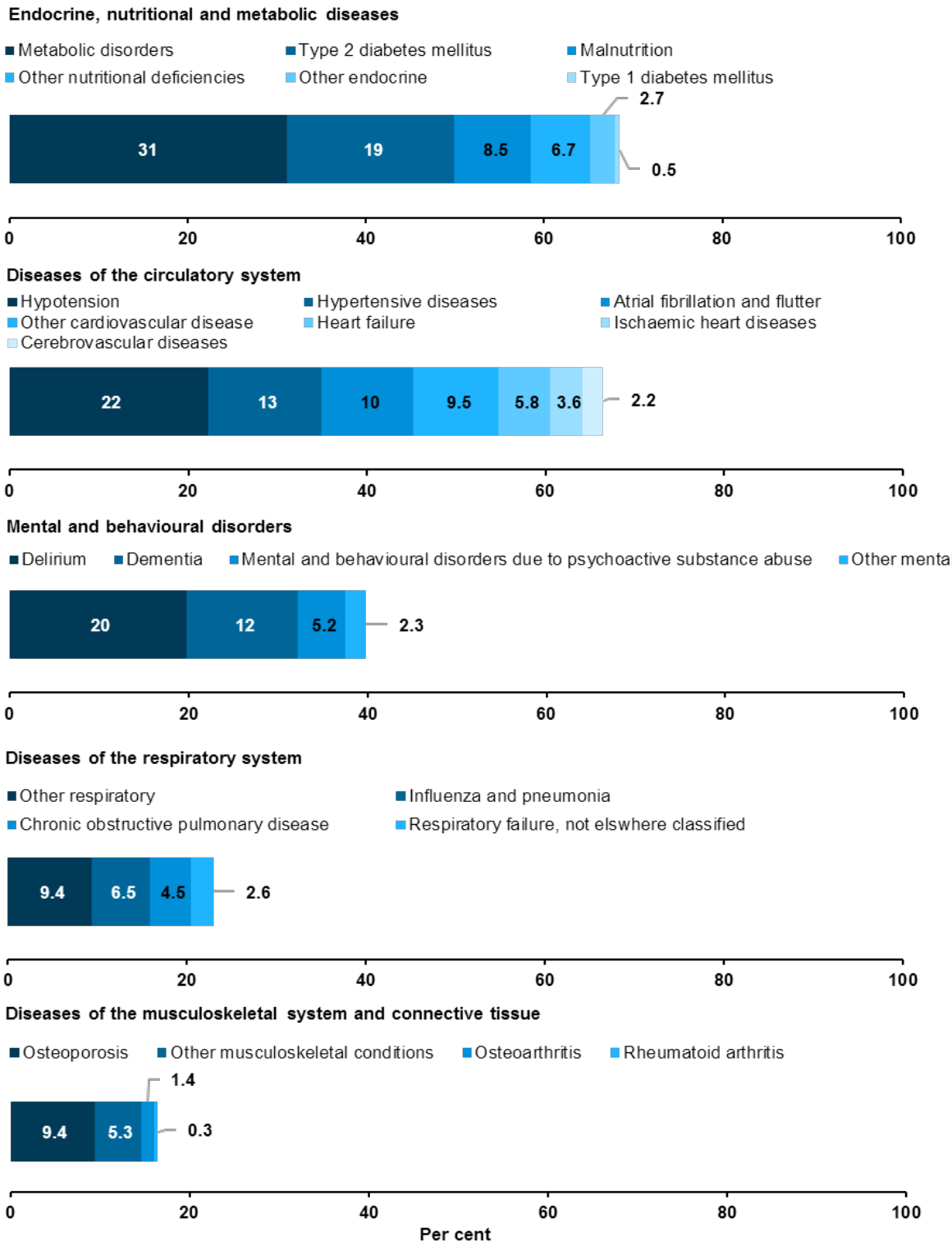
Selected chronic conditions and diseases as additional diagnoses

This section looks at the 5 chronic condition groups that commonly occur as comorbid conditions in new hip fracture hospitalisations. These are:

- *Endocrine nutritional and metabolic diseases*
- *Diseases of the circulatory system*
- *Mental and behavioural disorders*
- *Diseases of the respiratory system*
- *Diseases of the musculoskeletal system and connective tissue*.

In 2015–16, of new hip fracture hospitalisations:

- more than half (51%) had at least 1 recorded additional diagnosis of *Endocrine nutritional and metabolic diseases* (nearly 9,600 hospitalisations), with the most common condition being:
  - metabolic disorders (primarily dehydration) (31% of new hip fracture hospitalisations)
  - type 2 diabetes (19%)
  - malnutrition (8.5%)
- about 43% had at least 1 additional diagnosis of *Diseases of the circulatory system* (about 8,100 hospitalisations), with the most common condition being:
  - hypotension (22% of new hip fracture hospitalisations)
  - hypertension (13%)
  - atrial fibrillation and flutter (10%)
- one-third (34%) had at least 1 additional diagnosis of *Mental and behavioural disorders* (about 6,500 hospitalisations), with the most common condition being:
  - delirium (not induced by alcohol and other psychoactive substances) (20% of new hip fracture hospitalisations)
  - dementia (12%)
- almost 1 in 5 (18%) had at least 1 additional diagnosis of *Diseases of the respiratory system* (more than 3,400 hospitalisations), with the most common condition being:
  - other respiratory diseases (9.4% of new hip fracture hospitalisations)
  - influenza and pneumonia (6.5%)
  - chronic obstructive pulmonary disease (4.5%)
- about 15% had at least 1 additional diagnosis of *Diseases of the musculoskeletal system and connective tissue* (about 2,900 hospitalisations), with the most common condition being:
  - osteoporosis (9.4% of new hip fracture hospitalisations)
  - other musculoskeletal conditions (5.3%)
  - osteoarthritis (1.4%) (Figure 3.3).



Notes

1. A single hospitalisation for hip fracture can include multiple additional diagnoses. Only the first diagnosis in any specific condition group is counted.
2. See Table A2 for a full list of ICD-10-AM codes used in this analysis.

Sources: AIHW National Hospital Morbidity Database; Table S3.3.

Figure 3.3: Comorbid chronic conditions and diseases (additional diagnosis) for new hip fracture hospitalisations, 2015–16

3.4 Events causing hip fractures

In 2015–16, the vast majority (17,500, 93%) of new hip fractures were caused by fall-related injury events (Table 3.1). The most common were:

- falls on the same level from slipping, tripping, or stumbling (35%, 6,500)
- unspecified falls (23%, 4,300)
- other falls on the same level (22%, 4,200).

Other events causing new hip fractures included transport accidents (2.5%, or 467 hospitalisations), and accidental exposure to other and unspecified factors (1.5%, or 290).

In 2015–16, 87% (16,300) of new hip fractures were the result of minimal trauma falls (Table 3.1).

Table 3.1: External causes of new hip fractures, 2015–16

External cause of injury	Number	%
Falls	**17,493**	**93.3**
Fall on same level from slipping, tripping, and stumbling	6,465	34.5
Unspecified fall	4,332	23.1
Other fall on same level	4,184	22.3
Other falls	2,512	13.4
Minimal trauma fall	*16,300*	*87.0*
Transport accidents	467	2.5
Accidental exposure to other and unspecified factors	290	1.5
Other	250	1.3
Total[(a)]	**18,746**	**100.0**

(a) Total includes 246 records (1.3%) for new hip fracture hospitalisations that did not have an external cause of injury recorded.

Note: See Table A3 for a full list of ICD-10-AM codes used in this analysis.

Source: AIHW National Hospital Morbidity Database.

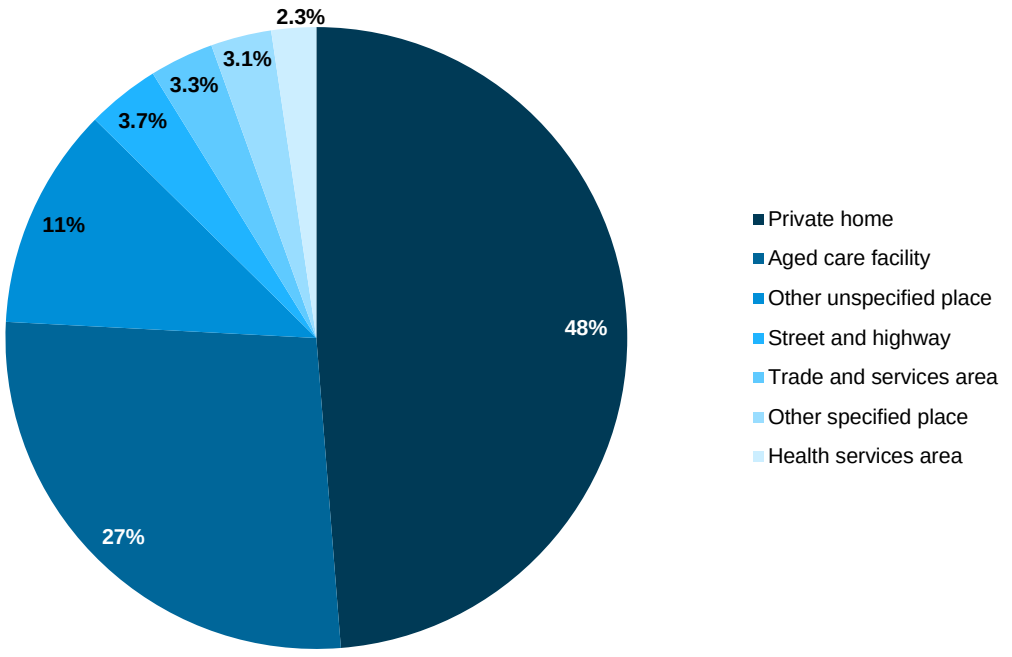
3.5 Place of occurrence

In 2015–16, the most commonly recorded place of occurrence for new hip fractures was:

- private home (48%, 9,000 of new hip fracture hospitalisations)
- aged care facilities (27%, 5,000)
- street and highway (3.7%, 700) (Figure 3.4).

The location for about 1 in 10 (11%, 2,100) new hip fracture hospitalisations was unspecified.

More than 400 (2.3%) new hip fractures were reported to have occurred in a health service area, and 5 of those occurred during an episode of care.



Notes

1. A place of occurrence was not recorded for 140 (0.7%) records. These are included in the total.
2. See Table A4 for a full list of ICD-10-AM codes used in this analysis.

Sources: AIHW National Hospital Morbidity Database; Table S3.4.

Figure 3.4: Place of occurrence of new hip fractures, 2015–16

3.6 Patient geography and demographics

Aboriginal and Torres Strait Islander status

In 2015–16, 191 (1.0%) new hip fractures occurred in people who identified as being Aboriginal and/or Torres Strait Islander—a hospitalisation rate of 129 per 100,000 population (Table 3.2).

While the age-specific hospitalisation rate for Indigenous Australians was lower than that for other Australians (198 per 100,000), when the younger age structure of the Indigenous population was accounted for, the new hip fracture hospitalisation rate for Indigenous Australians was 5% higher than that for other Australians (Table 3.2).

Remoteness area

In 2015–16, 12,700 (68%) of new hip fractures occurred among people living in *Major cities*. Consistent with the population distribution, the proportion fell with increasing remoteness.

Similarly, the age-specific rate of new hip fracture hospitalisations generally fell with increasing remoteness—it was highest among people living in *Inner regional* areas (201 per 100,000), and lowest among people living in *Remote and very remote* areas combined (149 per 100,000) (Table 3.2).

When the different age structures of those populations were accounted for, compared with people living in *Major cities*, the hospitalisation rate for new hip fractures was:

- 12% higher among people living in *Remote and very remote* areas
- 6% lower among people living in *Outer regional* areas
- 2% lower (similar) among people living in *Inner regional* areas (Table 3.2).

Socioeconomic status

In 2015–16, nearly one-quarter (22%) of new hip fractures occurred among people living in the areas of lowest socioeconomic status (SES), and the proportion fell with decreasing disadvantage (18% among those living in the highest SES areas).

There was a distinct gradient in the age-specific rate of new hip fracture hospitalisations, which was highest among people living in the lowest SES areas (212 per 100,000 population) and lowest among those in the highest SES areas (183 per 100,000) (Table 3.2).

When different age structures were taken into account, there were no substantial differences between SES, at 171–176 per 100,000.

Table 3.2: Hospitalisations for new hip fractures by Indigenous status, remoteness area, and socioeconomic status, 2015–16

Population group	Number	Age-specific rate (per 100,000 population)	Age-standardised rate (per 100,000 population)
Indigenous status			
Indigenous Australians	191	129	191
Other Australians[(a)]	18,555	198	183
Remoteness area[(b)]			
Major cities	12,723	198	176
Inner regional	3,987	201	173
Outer regional	1,633	175	165
Remote/Very remote	272	149	197
Socioeconomic status[(c)]			
1 (lowest)	4,163	212	176
2	4,101	206	176
3	3,627	190	171
4	3,314	184	174
5 (highest)	3,410	183	174

(a) Includes hospitalisations for which Indigenous status was not reported.

(b) Based on the Australian Standard Geographical Standard 2011 for remoteness classification. See the Appendix for more information.

(c) Based on the 2011 Socio-Economic Indexes For Areas Index of Relative Socioeconomic Disadvantage. See the Appendix for more information.

Notes

1. Remoteness area and socioeconomic status were not assigned for 131 records, which have been excluded from the analysis.
2. Data are directly age-standardised to the 2001 Australian Standard Population.

Source: AIHW National Hospital Morbidity Database.

3.7 Trends over time

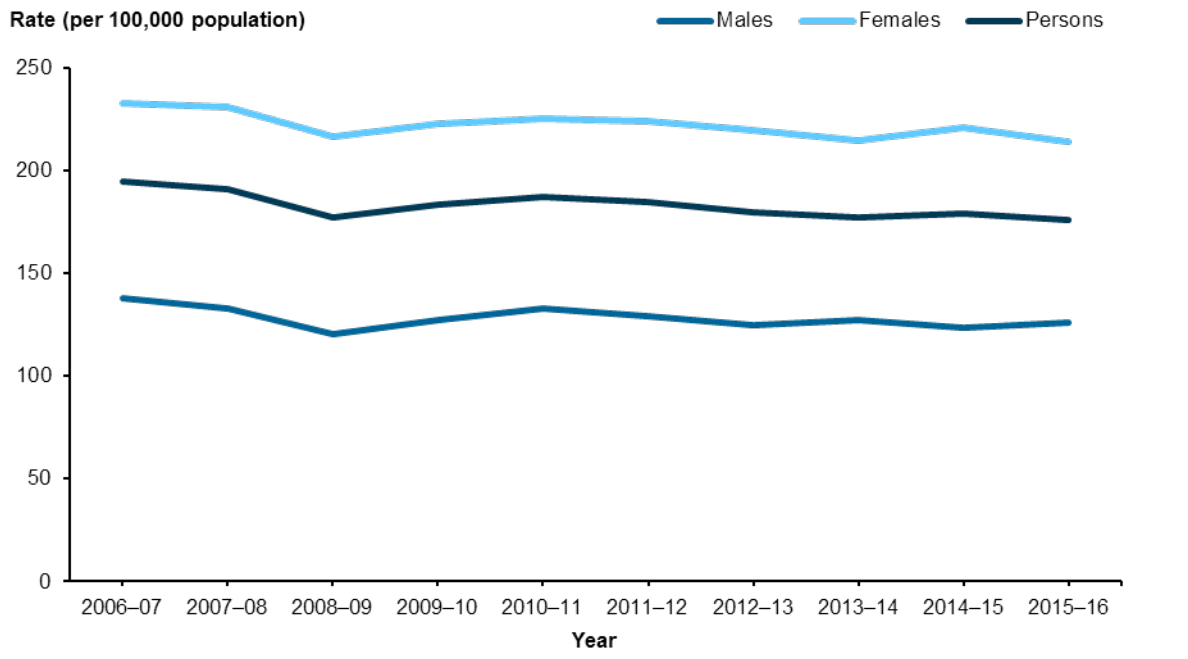
Between 2006–07 and 2015–16, the number of hospitalisations for new hip fractures rose by 18%—from 15,900 to 18,700 hospitalisations. The increase was greater for men (27%) than for women (14%).

Population growth is the most likely factor driving this increase—over the same time period, the size of the population aged 45 and over rose by 22%.

After accounting for differences in the age structure of the population over time, the rate of hospitalisations for new hip fractures fell by 9.5%—from 195 hospitalisations per 100,000 population in 2006–07 to 176 per 100,000 in 2015–16 (Figure 3.5).

Although the proportional increase in the number of hip fractures was greater for men than women, the proportional decrease in rates was similar, with an 8.6% decline for men, and an 8.0% decline for women (Figure 3.5).

The rate of hospitalisations for new hip fractures for women was consistently 70%–80% as high as for men over the 10 years from 2006–07 to 2015–16.



Note: Data have been age-standardised to the 2001 Australian Standard Population.

Sources: AIHW National Hospital Morbidity Database; Table S3.5.

Figure 3.5: Trends in new hip fracture hospitalisations, by sex, 2006–07 to 2015–16

Type of fracture

Between 2006–07 and 2015–16, the age-standardised rate of new hip fractures varied by type of fracture (Figure 3.6).

The number of hospitalisations generally rose, while the age-standardised rate fell for hospitalisations for new neck-of-femur and pertrochanteric fractures.

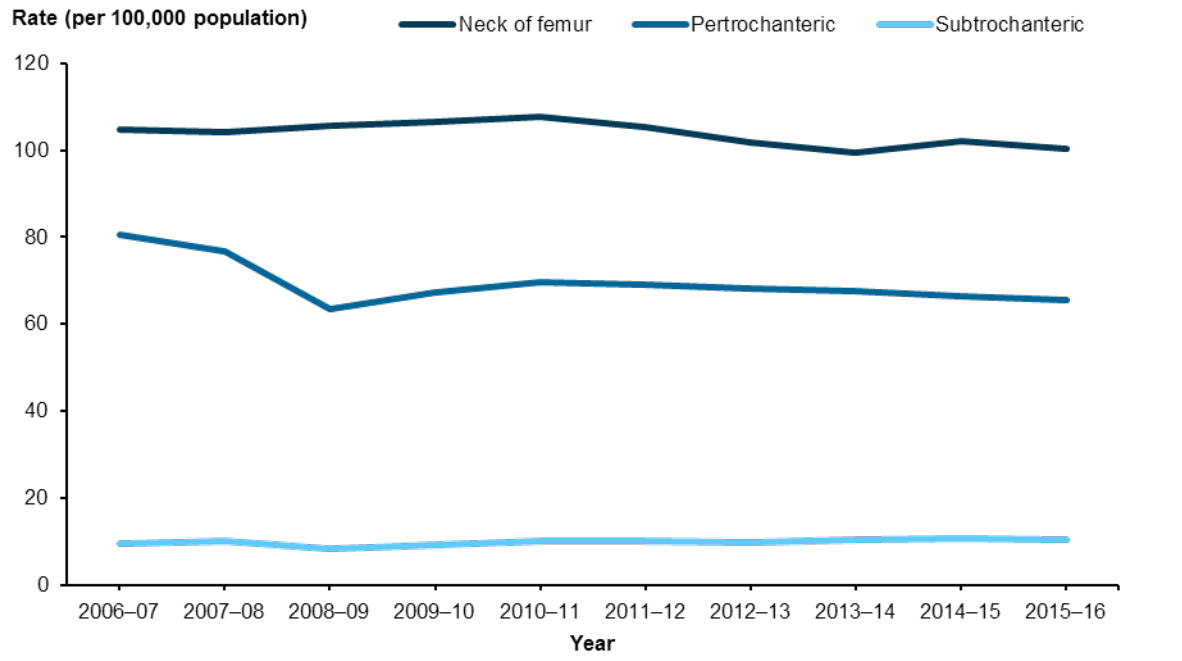
Between 2006–07 and 2015–16:

- the number of hospitalisations for neck-of-femur fractures rose by 24%, while the age-standardised rate fell by 4%—from 105 to 100 per 100,000 population—with some fluctuation over the period
- the number of hospitalisations for new pertrochanteric fractures rose by 7%, while the age-standardised rate fell by 18%—from 80 to 66 per 100,000 population (Figure 3.6).

The age-standardised hospitalisation rate for new pertrochanteric fractures fell by 21% between 2006–07 and 2008–09, then rose slightly by 3.4% between 2008–09 and 2015–16.

In contrast, the age-standardised rate of hospitalisations for new subtrochanteric fractures rose by 9.2%, with small peaks and troughs over the period—with rates ranging from 8.2 to 11 hospitalisations per 100,000 (Figure 3.6).

The age-standardised hospitalisation rate for neck-of-femur fractures was 1.3–1.7 times as high as for pertrochanteric fractures, and 9.5–11 times as high as for subtrochanteric fractures.



Note: Data have been age-standardised to the 2001 Australian Standard Population.

Sources: AIHW National Hospital Morbidity Database; Table S6.

Figure 3.6: Trends in new hip fracture hospitalisations, by type of fracture, 2006–07 to 2015–16

3.8 Treatment and outcomes

Selected surgical and allied health interventions

In 2015–16, 107,500 procedures or interventions were performed during new hip fracture hospitalisations, representing 573 unique procedure types, and equating to nearly 6 procedures or interventions for each hip fracture.

The most common of these were:

- physiotherapy (96% of new hip fracture hospitalisations)
- internal fixation of fracture of trochanteric or subcapital femur (61%)
- occupational therapy (49%) (Table 3.3).

The number of procedures per hospitalisation was higher among men (5.9) than women (5.7).

Occupational therapy, speech therapy, and social work were more commonly recorded in new hip fracture hospitalisations for men than for women, while total arthroplasty of the hip (unilateral) was more commonly recorded in hospitalisations for women.

Table 3.3: Selected interventions for new hip fractures, by type of fracture, 2015–16 (%)

Intervention	Neck-of-femur fracture	Pertrochanteric fracture	Subtrochanteric fracture	Total
Physiotherapy	96.2	96.5	97.5	96.4
Internal fixation of fracture of trochanteric or subcapital femur	31.8	98.0	97.5	60.6
Occupational therapy	49.1	48.1	52.7	49.0
Dietetics	30.0	31.8	32.3	30.8
Hemiarthroplasty of femur	51.8	1.3	1.3	29.8
Pharmacy	27.1	29.4	30.9	28.2
Social work	19.1	21.4	21.8	20.1
Speech pathology	16.4	17.3	14.9	16.6
Total arthroplasty of hip, unilateral	15.0	0.7	0.7	8.8
Prescribed/self-selected medication assessment	6.9	9.3	8.7	7.9
Total procedures per hospitalisation	**5.6**	**5.8**	**6.3**	**5.7**
Total new hip fracture hospitalisations (number)	**10,581**	**7,076**	**1,089**	**18,746**

Notes

1. Where a procedure type was coded more than once in a single hospitalisation, only the first was counted.
2. See Table A5 for a full list of ICD-10-AM codes used in this analysis.

Source: AIHW National Hospital Morbidity Database.

The use of generalised allied health interventions was similar by fracture type—the majority (96%–98%) involved physiotherapy, about half (49%–53%) involved occupational therapy, and one-third (30%–32%) involved dietetics. But there were differences in surgical procedures depending on the type of hip fracture.

The majority of pertrochanteric and subtrochanteric fractures were surgically repaired using internal fixation of fracture of trochanteric or subcapital femur procedures (98%).

For new neck-of-femur fractures:

- half (52%) involved hemiarthroplasty (partial hip replacement)
- one-third (32%) involved internal fixation of fracture of trochanteric or subcapital femur
- 1 in 6 (15%) involved total arthroplasty (total hip replacement) (Table 3.3).

Fewer procedures were performed for neck-of-femur fractures (5.6 per fracture) than for pertrochanteric fractures (5.8 per fracture) and subtrochanteric fractures (6.3 per fracture).

Outcomes

Length of stay

In 2015–16, the average duration—length of stay from admission to separation (discharge, transfer, care type change, or death)—of hospitalisations for new hip fractures was 9 days, with a maximum duration of 180 days.

Of new hip fracture hospitalisations:

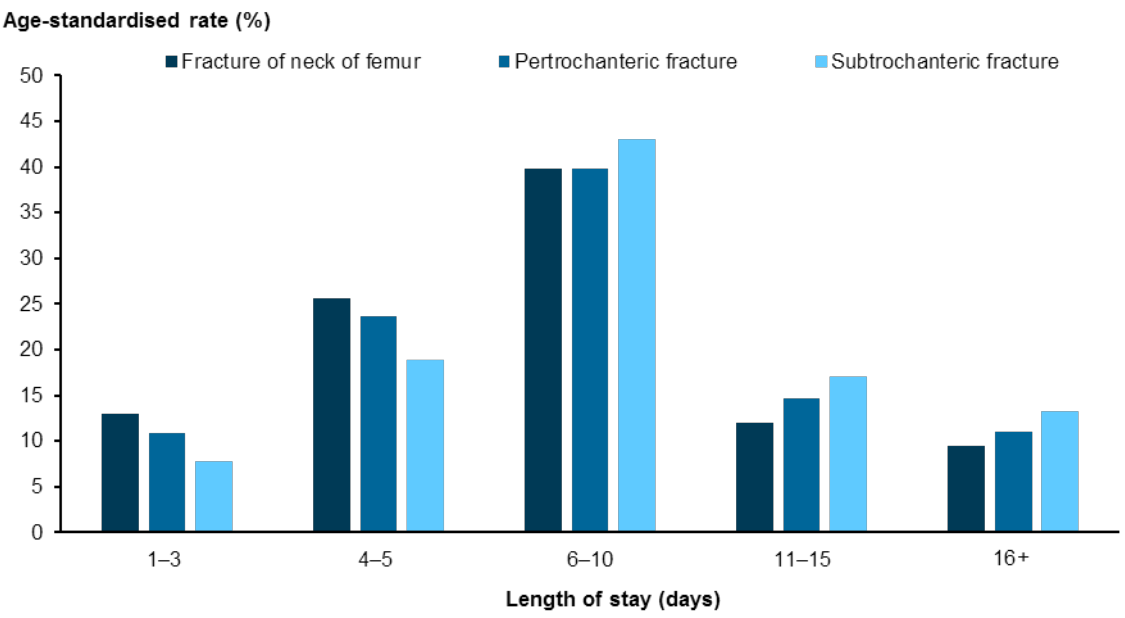
- 40% lasted 6–10 days
- 22% lasted 4–5 days
- 15% lasted 11–15 days
- 12% lasted 16 days or more
- 9.0% lasted 1–3 days.

Only 15 new hip fracture hospitalisations did not involve an overnight stay (same day separation).

The average length of stay for subtrochanteric hospitalisations was 10 days, slightly longer than for other fracture types (9 days).

Men (10 days) stayed slightly longer on average than women (9 days), and this was consistent for all fracture types.

Compared with other fracture types, hospitalisations for new subtrochanteric fractures were more likely to last 6–10, 11–15 or 16 or more days, and less likely to last 1–3 or 4–5 days (Figure 3.7).



Note: Directly age-standardised to the 2001 Australian Standard Population, and presented per 100 population.

Sources: AIHW National Hospital Morbidity Database; Table S3.7.

Figure 3.7: Length of stay in hospital for new hip fractures, by type of fracture, 2015–16

Compared with a similar cohort drawn from all hospitalisations—aged 45 and over, receiving acute care, and involving at least 1 procedure or intervention—new hip fracture hospitalisations:

- had a longer average length of stay (9 days compared with 3 days)
- were similarly likely to last 2–3 days or 16 days or more
- were 5–6 times as likely to be 4–15 days (Table S3.7).

These differences were greater for new subtrochanteric fractures, which were 7 times as likely to last 6–15 days as total hospitalisations.

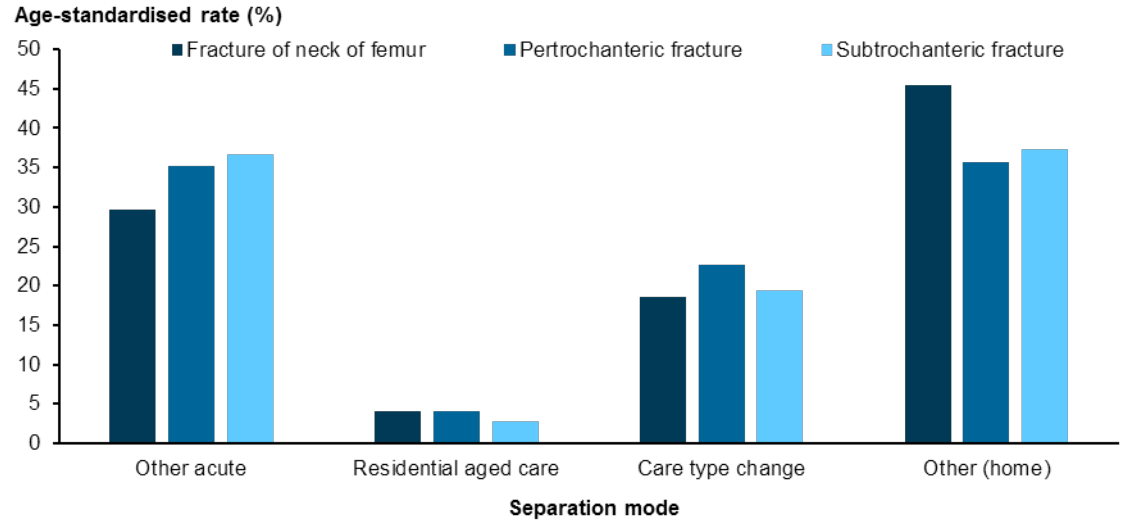
Discharge pathways

In 2015–16, of hospitalisations for new hip fractures:

- more than one-third (36%, 6,800) ended with a transfer to another acute hospital
- nearly one-third (29%) ended with discharge to another location, including the usual place of residence
- almost one-quarter (23%) ended with a change in care type within the same facility
- 1 in 12 (8.5%) resulted in a transfer to a residential aged care facility, where this was not the usual place of residence before hospitalisation
- about 500 (2.7%) hospitalisations for hip fractures ended in death.

There was little difference in the rate of separation mode by sex, but there were differences by fracture type.

Hospitalisations for new neck-of-femur fractures were more likely to end in a discharge to another location, and less likely to end in a change of care type. Subtrochanteric fractures were more likely to be end in a discharge to an(other) acute hospital, and less likely to end in a discharge to residential aged care (Figure 3.8).



Notes

1. A total of 4 records had a not reported/unknown separation mode.
2. Directly age-standardised to the 2001 Australian Standard Population, and presented per 100 population.

Sources: AIHW National Hospital Morbidity Database; Table S3.8.

Figure 3.8: Discharge pathways in hospitalisations for new hip fractures, selected separation modes, by type of fracture, 2015–16

Compared with a similar cohort drawn from all hospitalisations—aged 45 and over, receiving acute care, and involving at least 1 procedure or intervention—hospitalisations for new hip fractures were:

- about half as likely to end with discharge to another location (including usual place of residence)
- 4 times as likely to end with discharge to residential aged care (where this was not the usual place of residence)
- 10 times as likely to end with transfer to other acute care
- 11 times as likely to end with a change in care type (Table S3.8).

4 Non-operative management of hip fracture

This chapter presents an estimate of the number of new hip fractures in Australia that are managed without surgery (non-operative management), summarises the demographic and clinical characteristics, treatments, and outcomes, and makes comparisons with the surgically treated population (Chapter 3).

In 2015–16, 1,200 acute episodes of care with hip fracture as the principal diagnosis did not involve a hip fracture-related procedure or intervention, and did not begin or end with a transfer to another medical facility or care type.

This equates to a rate of 12 hospitalisations per 100,000 people aged 45 and over, and represents 2.3% of all hip fracture hospitalisations.

When combined with the incident hip fracture hospitalisation cohort presented in Chapter 3 (18,700 incident hip fractures), it is estimated that 5.8% of new hip fractures in 2015–16 were managed non-operatively.

4.1 Demographic characteristics

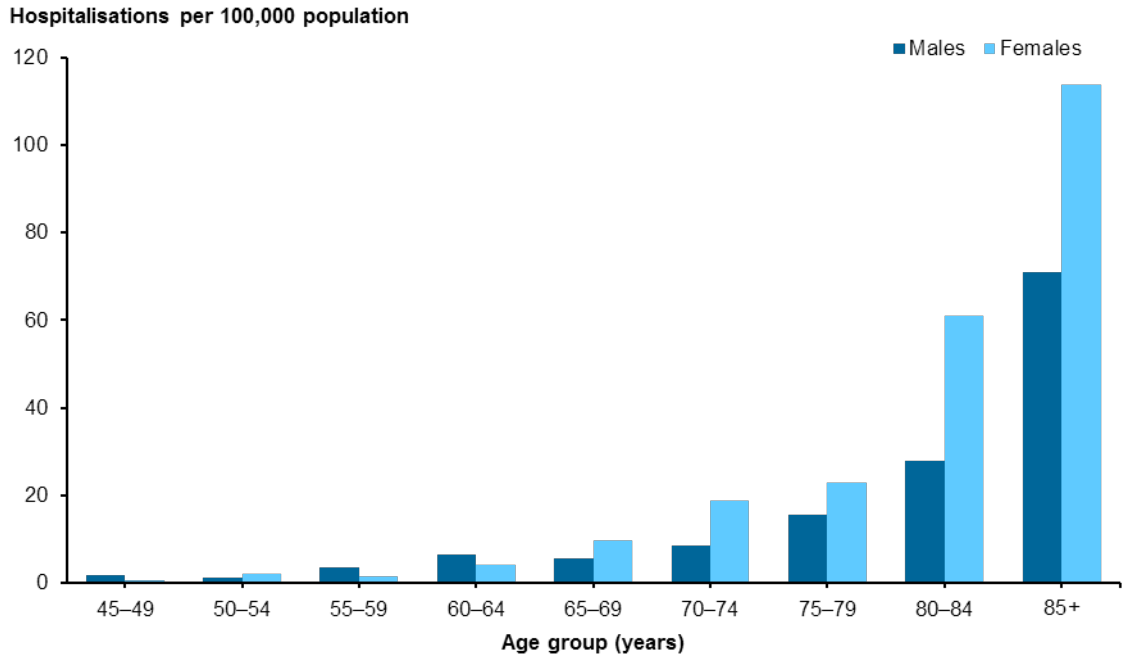
In 2015–16, two-thirds (66%) of non-operatively treated new hip fractures occurred among women, and nearly two-fifths (40%) occurred among people aged 85 and over.

The median age for non-operatively treated new hip fractures was 82, with men (78) being younger than women (83).

The rate of new hip fractures that were treated non-operatively rose with increasing age, and were more common among men than women at younger ages (45–49 to 60–64), but more common among women at older ages (65 and over), and overall (Figure 4.1).

In 2015–16, women were 1.5 times as likely as men to have a non-operatively treated hip fracture—with an age-standardised rate of 12.9 per 100,000 women compared with 8.4 per 100,000 men.

Compared with surgically treated new hip fractures, people hospitalised with non-operatively treated new hip fractures were more likely to be male and younger (see Chapter 3.1; Table S4.1).



Sources: AIHW National Hospital Morbidity Database; Table S4.1.

Figure 4.1: Hospitalisations for non-surgically treated new hip fractures, by age and sex, 2015–16

Of the 1,200 non-operatively treated new hip fractures:

- about 1.6% were in people who identified as being Aboriginal or Torres Strait Islander
- nearly three-quarters (74%) were in people living in *Major cities*
- nearly one-third (29%) were in people living in the highest SES areas of Australia (Table S4.2).

These were all observed to be higher than for the surgically treated hip fracture cohort (1.0% 68%, and 18%) (see Chapter 3.6).

In 2015–16, more than 3,400 additional diagnoses recorded in hospitalisations were for new hip fractures managed non-operatively—more than 3 additional condition diagnoses per hip fracture hospitalisation. About 15% had no additional diagnoses.

Comorbidity was less common in non-operatively managed hip fractures than in those treated with surgery (6 additional diagnoses per hip fracture, 5.3% with no additional diagnoses) (see Chapter 3.3).

Overall, endocrine disorders were recorded in 25% of non-operatively treated hip fracture hospitalisations, mental and behavioural disorders in 17%, circulatory in 14%, musculoskeletal in 6.4%, and respiratory disorders in 4.2%.

The most commonly recorded diagnoses (comorbid conditions) were:

- type 2 diabetes (14%)
- other disorders of the urinary system (6.8%)
- other disorders of fluid, electrolyte, and acid-base balance (6.5%) (Table S4.3).

4.2 Clinical characteristics

Unlike surgically treated hip fracture hospitalisations, the majority (57%) of non-operative hip fractures were pertrochanteric fractures, followed by neck-of-femur fractures (41%), and subtrochanteric fractures (2.6%) (Table S4.4). The proportion of pertrochanteric fractures was higher among men (62%) than women (54%).

In 2015–16, almost three-quarters (72%) of non-operatively treated new hip fractures were the result of falls, and two-thirds (67%) were the result of minimal trauma falls. About 15% did not have an external cause recorded (Table S4.5).

Compared with surgically treated new hip fractures, the proportion of non-operative hip fractures caused by falls was lower (72% compared with 93%), and the proportion caused by accidental exposure to other and unspecified factors was higher (8.0% compared with 1.5%) (see Chapter 3.4).

In 2015–16, one-third (32%) of hip fractures that were not managed with surgery occurred in private homes, nearly one-quarter (23%) occurred in aged care facilities, and another one-quarter (23%) occurred in other unspecified places (Table S4.6). About 13% did not have a place of occurrence listed.

Compared with new hip fractures managed with surgery, the observed proportion of non-operative hip fractures caused by falls occurring in:

- private homes was much lower (32% compared with 48%)
- aged care facilities slightly lower (23% compared with 27%)
- other unspecified place was much higher (23% compared with 11%) (see Chapter 3.5).

4.3 Treatment and outcomes

In 2015–16, three-quarters (75%, 900) of non-operative new hip fracture hospitalisations involved at least 1 generalised allied health intervention—the most common was physiotherapy (67%, 800), followed by occupational therapy (38%, 440) (Table S4.7). This was lower than for surgically treated hip fractures (see Chapter 3.8).

The average length of stay for non-operatively treated hip fracture hospitalisations was 5 days, with a maximum stay of 65 days.

Of non-operatively treated hip fracture hospitalisations:

- more than one-third (35%) lasted only 1 day—much greater than surgically treated new hip fracture hospitalisations (less than 0.1%)
- 29% lasted 1–3 days
- 13% lasted 4–5 days
- 10% lasted 6–10 days
- 6.4% lasted 11–15 days
- 6.9% lasted 16 days or more (see Chapter 3.8; Table S4.8).

5 Discussion

This report provides summary findings on hip fractures in Australia from a national population monitoring perspective, as a baseline for future work to explore treatment pathways and outcomes for people with hip fractures.

This work builds on and updates previously published work by the AIHW, and complements the clinical reporting done by the ANZHFR, and the work on health-care variation produced by the ACSQHC.

5.1 Summary of main findings

In 2015–16, 50,900 episodes of care (hospitalisations) had at least 1 diagnosis of hip fracture. Although accounting for only 0.5% of all hospitalisations, hip fracture hospitalisations represent a disproportionate percentage of bed days (1.9% of the total), and procedures and interventions (1.0% of the total).

Incident hip fracture

In 2015–16, 37% of all hip fracture-related episodes of care were estimated to represent a new hip fracture hospitalisation—an estimated 18,700 new hip fractures in Australia, at a crude (age-specific) rate of 199 hip fractures per 100,000 population aged 45 and over.

These were identified as acute episodes of care where hip fracture was the principal diagnosis, and where at least 1 hip fracture-related surgery was performed, excluding revision procedures that indicate a previous hip fracture.

The majority (93%) of these new hip fractures were fall-related, and the populations at higher risk for hip fractures were older people, particularly women, Aboriginal and/or Torres Strait Islander people, people living in more remote areas of Australia, and those living in lower SES areas.

The findings also highlight that, despite a rise in the number of hip fractures, and in the size of the at-risk population, after adjusting for the effect of age, the rate of new hip fracture hospitalisations in Australia over time has dropped. This suggests that measures to reduce risk factors and prevent falls among the ageing and at-risk population are having an effect.

The results of this report are consistent with those reported in other sources, including the ANZHFR annual reporting. The interpretation of any differences should take into account differences in scope, coverage, and method of collection and analysis between sources.

Chronic condition comorbidity

Many people hospitalised with new hip fractures have multiple comorbid conditions, including diabetes, cardiovascular diseases, and musculoskeletal conditions. These conditions can have implications for the treatment of and recovery from hip fractures, and the prevention of further injury.

Research has shown that pre-existing osteoporosis and rheumatoid arthritis both greatly increase the risk of a hip fracture (AIHW 2008; Lin et al. 2015).

The findings of this report show that in 2015–16, musculoskeletal conditions were comorbid in about 15% of new hip fracture hospitalisations, and osteoporosis was recorded in more than half of these (9.4%). But as most hip fractures occur among older age groups (more than 90% of fracture separations were for people aged 65 and over in 2015–16), and the vast majority (87%) of hip fractures were due to minimal trauma falls—strongly associated with osteoporotic

fracture—it was anticipated that there would be a stronger correlation between the incidence of hip fractures and the diagnosis of osteoporosis.

Osteoporosis is known to be underdiagnosed and under-recorded as a diagnosis in the hospital setting, and this factor is likely to account for the low rate of comorbid osteoporosis reported in this report (AIHW 2014; Nguyen et al. 2004). Further, osteoporosis might not require active management in the acute care setting, so might not meet the coding standard for a recorded diagnosis. This would account for the under-recording of osteoporosis in this report.

But as managing osteoporosis to improve bone health is an essential component of post-fracture care to prevent further fractures, best-practice guidelines show that investigations to diagnose osteoporosis, and a plan to manage osteoporosis if present should be done before discharge (ACSQHC 2016).

While these investigations and discharge planning might not be reflected in the assignment of an osteoporosis diagnosis, new codes introduced from 1 July 2015 as part of the ICD-10-AM 9th edition allow osteoporosis to be coded (U86.4), where it is part of the current health status of the person, but does not meet the requirements to be coded as a principal or additional diagnosis (ACCD 2015a).

The interpretation and use of these codes in chronic conditions monitoring is still to be assessed, and these codes were not included for analysis in this report.

The high level of comorbidity of circulatory diseases (such as cardiovascular disease) (43%) and endocrine, nutritional and metabolic diseases (such as diabetes) (51%) in new hip fracture hospitalisations in 2015–16 are supported by clinical and epidemiological research (Carbone et al. 2010; Janghorbani et al. 2006; Miao et al. 2005; Sennerby et al. 2007).

While some of the comorbidity might be due to common risk factors, including age, there is evidence that diabetes is an independent risk factor for hip fractures.

Diabetes-related severe hypoglycaemia, peripheral vascular disease, retinopathy, insulin deficiency in type 1 diabetes, and some medications used to treat type 2 diabetes have all been associated with an increased risk of falls and fractures (Brennan-Olsen et al. 2017; Khazai et al. 2009; Kurra & Siris 2011).

Similarly, those other most commonly reported conditions (hypotension, other disorders of fluid, electrolyte, and acid-base balance, other anaemias, and delirium) are also associated with increased risk of falls.

The implications of hip fractures among patients with 1 or more pre-existing comorbidities, and particularly among the elderly, are complex.

Harvey et al. (2017) reported that, among people aged 65 and over who sustained a fall-related hip fracture, existing comorbidities, such as osteoporosis, congestive heart failure, and acute myocardial infarction were linked to an increase risk of a subsequent hip fracture. The study also reported that the presence of dementia doubled the risk of mortality within 30 days of fracture.

A study by Roche et al. (2005) showed that people who reported multiple comorbid conditions had increased risk of complications and death following hip fracture surgery.

Surgical management

Surgery is a common treatment for new hip fractures. While hip fracture surgery was a defining criterion to identify incident hip fractures in the episode-based NHMD, when the population was combined with selected discrete non-surgical episodes of care (non-operative new hip fracture) it is estimated that 94% of new hip fractures in 2015–16 were surgically managed.

This, combined with the burden and associated risks of comorbidity, underscores the importance of pre-operative prevention and management of chronic conditions, in addition to post-fracture and post-operative care (Roche et al. 2005).

Continued emphasis on strategies to improve the early detection and management of conditions that might lead to increased risk of hip fracture—such as osteoporosis, arthritis, and dementia—might help reduce the risk of hip fractures and optimise post-surgery outcomes. Careful consideration of the differing health priorities and cultural beliefs of Aboriginal and Torres Strait Islander people when determining fall prevention strategies and management of hip fractures is also important (ANZHFR 2014; Lukaszyk et al. 2016).

Non-operative management of incident hip fracture

Not all hip fractures are managed and treated with surgery. While the method used in this report is the most accurate measure of national hip fracture incidence using the episode-based NHMD (in the absence of linked person-level data), that estimate excludes fractures not managed with hip fracture surgery, and so is an under-count.

Although not included in estimates of incidence in this report, an approximation of the number of new hip fractures that were treated non-operatively (without surgery) was developed based on discrete episodes of acute care that did not involve a transfer to or from other health-care facilities or care types.

This method estimates that 5.8% of new hip fractures were managed non-operatively, which is within the range of estimates in the international literature of 2.6%–6.2% (Hagino et al. 2017; Moulton et al. 2015; Neuman et al. 2010).

The non-operative population was distinct from the surgically treated population in demographic characteristics, clinical characteristics, and treatment and outcomes. Those patients were:

- younger
- more likely to be male
- more likely to be Aboriginal and/or Torres Strait Islander
- less likely to have a comorbid condition
- more likely to have a pertrochanteric fracture
- less likely to have a hip fracture caused by a fall occurring at home
- less likely to require a generalised allied health intervention
- more likely to have a shorter stay in hospital, including of only 1 day.

Some of these findings differ to those characteristics usually associated with non-operative management of a hip fracture, such as advanced age and poorer general health. So further examination of this cohort is warranted to better understand the nature, risk factor profile, and treatment pathways of these fractures.

5.2 Future work to address information gaps

While this report provides a comprehensive picture of hip fracture incidence, treatment and outcomes in Australia using the latest available hospitalisations data, a more complete picture of hip fracture pathways is required to adequately monitor adherence to clinical care guidelines, as well as changes in practice and outcomes.

A hip fracture usually requires a range of care, sometimes across different facilities, and care types within the same facility. As a result, the full treatment for a single individual might be recorded as several episodes of care in the NHMD. Care provided might also be recorded across different databases, such as the Medicare Benefits Scheme and the Pharmaceutical Benefits Scheme, representing continuity of care between primary and tertiary care teams.

AIHW is looking at the feasibility of using linked person-level data at the state level from various data sources—such as hospital admitted patient data, Medicare Benefits Scheme data, Pharmaceutical Benefits Schedule data, the National Death Index, and residential aged care data.

The linkage method, using patient identifiers, would enable population-level risk profiles for hip fractures to be developed, using analysis of hip fracture incidence, treatment, and outcomes throughout a patient's journey in the health-care system. This would include:

- admission and treatment information while in hospital
- the use of primary and allied health services and medication during recovery
- exploration of the short-, medium- and longer-term outcomes for patients, including long-term management of comorbid conditions, partial or full recovery, subsequent fracture, transition into aged care, or death.

Data linkage analysis would also help to refine the algorithm for estimating incident cases of hip fracture—particularly those managed without surgical intervention—from episode-level NHMD records. This might help assess the use of the new supplementary codes for chronic conditions, and would improve future national population monitoring of hip fracture incidence and hospital-based care using the (unlinked) NHMD.

Appendix: Method

Cohort creation

Cohort 1—all hip fracture hospitalisations

Inclusion criteria: All hip fracture hospitalisations (Chapter 2) were selected as any admitted patient episode of care in an Australian hospital with at least 1 diagnosis of hip fracture (ICD-10-AM codes S72.0, S72.1, S72.2; see Table A1).

Exclusion criteria: Episodes of care where the:

- care type was *Newborn with unqualified days only*, *Organ procurement—posthumous*, or *Hospital boarder* (care types 7.3, 9.0, 10.0)
- age was not reported, or sex was recorded as intersex, indeterminate, not stated, or inadequately described. The age and sex exclusions are for the purpose of demographic and rate calculations, and affected a total of 214 records in 2015–16.

Cohort 2—new (incident) hip fracture hospitalisations

Inclusion criteria: New hip fracture hospitalisations, a proxy for incident hip fractures (Chapter 3), were selected from Cohort 1 as episodes of care where:

- the person was aged 45 and over
- acute care was provided (care types 1.0, 99.0)
- hip fracture was recorded as the principal diagnosis—including where a hip fracture was also recorded as an additional diagnosis
- at least 1 hip fracture-related surgical procedure was performed (selected procedures from block numbers 1478, 1479, 1481, 1483, 1486, 1488, 1489, 1491; see Table A5).

Exclusion criteria: Episodes of care that included any revision to previous hip fracture repair (selected procedures from block numbers 1554, 1492; see Table A5).

Cohort 3—new (incident) hip fracture hospitalisations without surgical intervention

Inclusion criteria: New hip fracture hospitalisations without surgical intervention, a proxy for non-surgically treated incident hip fractures (Chapter 4), were selected from Cohort 1 as episodes of care where:

- the person was aged 45 and over
- acute care was provided (care types 1.0, 99.0)
- hip fracture was recorded as the principal diagnosis—including where a hip fracture was also recorded as an additional diagnosis.

Exclusion criteria: Episodes of care that included:

- hip fracture-related surgical procedures (see Table A5)
- any revision procedure on the hip (see Table A5)
- a transfer to or from another health-care facility or care type (admission modes 1, 2, 9; separation modes 0–8).

Diagnosis codes

A diagnosis of hip fracture (and associated comorbidities, causes, and place of occurrence) were classified using the ICD-10-AM 9th edition) (Table A1).

For trend analysis, ICD-10-AM codes for hip fractures (S72.0, S72.1, S72.2) have remained consistent over time. Tables A1–A4 present the ICD-10-AM diagnosis codes used for hip fractures, selected chronic conditions, external causes of injury, and place of occurrence of injury in this report.

Table A1: Diagnosis codes—hip (femoral) fracture

Description	ICD-10-AM code
Fracture of neck of femur	S72.0
Pertrochanteric fracture	S72.1
Subtrochanteric fracture	S72.2

Table A2: Diagnosis codes—selected chronic conditions

Description	ICD-10-AM code
Endocrine, nutritional, and metabolic diseases	**E00–E89**
Metabolic disorders	E70–E89
Type 2 diabetes mellitus	E11
Malnutrition	E40–E46
Type 1 diabetes mellitus	E10
Other nutritional deficiencies	E50–E64
Mental and behavioural disorders	**F00–F99**
Dementia	F00–F03
Delirium	F05
Mental and behavioural disorders due to psychoactive substance abuse	F10–F19
Cardiovascular diseases	**I00–I99**
Hypertensive diseases	I10–I15
Ischaemic heart diseases	I20–I25
Cerebrovascular diseases	I60–I69
Heart failure	I50
Hypotension	I95
Atrial fibrillation and flutter	I48
Diseases of the respiratory system	**J00–J99**
Influenza and pneumonia	J09–J18
Chronic obstructive pulmonary disease	J40–J44
Respiratory failure	J96
Diseases of the musculoskeletal system and connective tissue	**M00–M99**
Osteoporosis	M80–M81
Osteoarthritis	M15–M19
Rheumatoid arthritis	M05–M06

Table A3: Diagnosis codes—external cause of injury

Description	ICD-10-AM code
Fall-related injury	W00–W19
Minimal trauma falls	W00, W01, W03–W08, W18, W19
Falls on the same level from slipping, tripping and stumbling	W01
Unspecified fall	W19
Other fall on the same level	W18
Transport accidents	V00–V99
Overexertion and strenuous or repetitive movements	X50
Exposure to inanimate mechanical forces	W20–W49
Exposure to animate mechanical forces	W50–W64
Accidental exposure to other and unspecified factors	X58–X59
Assault	X85–Y09

Table A4: Diagnosis codes—place of occurrence of injury

Description	ICD-10-AM code
Private home	Y92.0
Aged care facility	Y92.14
School, other specified institution, and public administrative area	Y92.21, Y92.29
Health service area	Y92.22
Street and highway	Y92.4
Trade and services area	Y92.5
Other unspecified place	Y92.9
Other specified place	Y92.10–Y92.13, Y92.18–Y92.19, Y92.3, Y92.6, Y92.7, Y92.8

Procedure and intervention codes

A list of NHMD procedure codes relating to hip replacement/repair and allied health interventions used in this report are listed in Table A5. These codes are also used to identify the inclusion and exclusion criteria for cohorts 2 and 3.

Table A5: Australian Classification of Health Interventions procedure codes

Block name (number)	Procedure/intervention name	Procedure code
Hip fracture-related surgical procedure		
Osteotomy of pelvis, hip, or femur (1478)	Osteotomy of proximal femur	48424-01
	Osteotomy of proximal femur with internal fixation	48427-01
Fixation of fracture of pelvis or femur (1479)	Internal fixation of fracture of trochanteric or subcapital femur	47519-00
Other incision of hip (1481)	Arthroscopy of hip	49360-00
	Arthroscopic removal of loose body from hip	49366-00
	Arthrotomy of hip	49303-00
	Forage of neck and/or head of femur	47982-00
Ostectomy of femur or pelvis (1483)	Ostectomy of proximal femur	48424-04
	Ostectomy of proximal femur with internal fixation	48427-04
Reduction of fracture of pelvis or femur (1486)	Closed reduction of fracture of femur	47516-01
	Open reduction of fracture of femur	47528-00
Bone graft to pelvis or hip (1488)	Bone graft to femur	48200-00
	Bone graft to femur with internal fixation	48203-00
Arthroplasty of hip (1489)	Hemiarthroplasty of femur	47522-00
	Excision arthroplasty of hip	49312-00
	Partial arthroplasty of hip	49315-00
	Resurfacing of hip, unilateral	90607-00
	Resurfacing of hip, bilateral	90607-01
	Total arthroplasty of hip, unilateral	49318-00
	Total arthroplasty of hip, bilateral	49319-00
Other repair procedures on pelvis or hip (1491)	Arthroscopic repair of hip	96225-00
Hip fracture revision procedures		
Other application, insertion or removal procedures on other musculoskeletal sites (1554)	Removal of pin, screw, or wire from femur	47927-01
	Removal of plate, rod, or nail from femur	47930-01
Revision arthroplasty of hip (1492)	Revision of partial arthroplasty of hip	49346-00
	Revision of total arthroplasty of hip	49324-00
	Revision of total arthroplasty of hip with bone graft to acetabulum	49327-00
	Revision of total arthroplasty of hip with bone graft to femur	49330-00
	Revision of total arthroplasty of hip with bone graft to acetabulum and femur	49333-00
	Revision of total arthroplasty of hip with bone graft to femur	49330-00

(continued)

Table A5 (continued): Australian Classification of Health Interventions procedure codes

Block name (number)	Procedure/intervention name	Procedure code
Revision arthroplasty of hip (1492)	Revision of total arthroplasty of hip with anatomic specific allograft to acetabulum	49339-00
	Revision of total arthroplasty of hip with anatomic specific allograft to femur	49342-00
	Revision of total arthroplasty of hip with anatomic specific allograft to acetabulum and femur	49345-00
Other interventions		
Generalised allied health interventions (1916)	Dietetics	95550-00
	Social work	95550-01
	Occupational therapy	95550-02
	Physiotherapy	95550-03
	Podiatry	95550-04
	Speech pathology	95550-05
	Audiology	95550-06
	Orthoptics	95550-07
	Prosthetics and orthotics	95550-08
	Pharmacy	95550-09
	Psychology	95550-10
	Other allied health intervention	95550-11
	Spiritual care	95550-12
	Diabetes education	95550-14

Geographic classification

Data on geographical location of the person's usual residence are defined using the Australian Bureau of Statistics (ABS) Australian Statistical Geography Standard Remoteness Structure 2011, which categorises geographical areas in Australia into remoteness areas. In this report, hospitalisations have been classified into 4 remoteness areas: *Major cities*, *Inner regional* areas, *Outer regional* areas, and *Remote* and *Very remote* areas combined.

The classification is available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/17A7A350F48DE42ACA258251000C8CA0?opendocument>.

Socioeconomic status

Socioeconomic status in this report is defined using the ABS Socio-Economic Index for Areas Index of Relative Socio-economic Disadvantage, which is derived from 2011 Census information. The groups are broken down into fifths, from the lowest socioeconomic status areas to the highest.

The classification is available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/8C5F5BB699A0921CCA258259000BA619?opendocument>.

Glossary

additional diagnosis: A condition or complaint either coexisting with the principal diagnosis or arising during the episode of admitted patient care, episode of residential care, or attendance at a health-care establishment.

care type: The care type defines the overall nature of a clinical service provided to an admitted patient during an episode of care (admitted care), or the type of service provided by the hospital for boarders or posthumous organ procurement (care other than admitted care).

comorbidity: A situation where a person has two or more chronic conditions at the same time.

disability-adjusted life year (DALY): A year (1 year) of healthy life lost, either through premature death or equivalently through living with disability due to illness or injury. It is the basic unit used in burden of disease and injury estimates.

external cause: The environmental event, circumstance, or condition causing the injury, poisoning, and other adverse effect.

incident hip fracture: The occurrence of a new hip fracture.

neck-of-femur fracture: A type of hip fracture which occurs in the narrow section of bone between the main shaft of the femur and the ball of the hip joint.

pertrochanteric fracture: A type of hip fracture where the shaft of the femur breaks just under the femoral neck.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care, or an attendance at the health-care establishment.

procedure: A clinical intervention that is surgical in nature, carries a procedural risk, carries an anaesthetic risk, requires specialised training, and/or requires special facilities or equipment available only in an acute care setting.

separation: An episode of care for a patient who undergoes a hospital's admission process to receive treatment and/or care, which can be a total hospital stay (from admission to discharge, transfer, or death), or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute care to rehabilitation). Separation also means the process by which an admitted patient completes an episode of care either by being discharged, dying, transferring to another hospital, or changing type of care. Referred to as hospitalisation in this report.

subtrochanteric fracture: A type of hip fracture occurring slightly further down the shaft of the femur.

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List of tables

List of figures

In 2015–16, there were an estimated 18,746 new hip fractures in Australia, a crude rate of 199 hip fractures per 100,000 population aged 45 and over. This represents a decline in the rate of hip fractures over time, suggesting that measures to reduce risk factors and prevent falls are having an effect.

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