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Hip fracture care pathways in Australia

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Contents

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 analysis is unique in Australia due to its significant population coverage and use of multiple linked data sets, including linked hospitals and residential aged care data. Linked data were used to explore a more complete picture of hip fracture patient pathways such as the transition to aged care, readmission to hospital, second hip fracture and mortality.

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

Up to 17,100 Australians over 45 fracture their hip for the first time each year

A cohort of 69,900 people aged 45 and over had a hip fracture between 1 July 2013 and 30 June 2017, based on national hospital data (excluding Western Australia and the Northern Territory). The majority of these (67,200 people) were experiencing their first hip fracture, with around 16,300 to 17,100 people experiencing their first hip fracture each year. Most first hip fracture patients were managed with surgery (90%).

Overall, the rate of first hip fractures between 1 July 2013 and 30 June 2017 was 200 per 100,000 people aged 45 and over. The rate of first hip fractures ranged between 198 per 100,000 population in 2016–17 and 204 per 100,000 population in 2014–15.

First hip fractures were the focus of this report as patients who are experiencing a second hip fracture may have poorer outcomes, including a higher likelihood of dying or experiencing complications, and may follow a different treatment pathway to first hip fracture patients.

At least 43% of patients had osteoporosis medications dispensed following hip fracture

Of first hip fracture patients, 19% had at least one prescription dispensed for an osteoporosis-related medication in the year before their fracture.

Over the one year following fracture, 43% of patients who survived had at least one osteoporosis medication dispensed according to PBS data. Some long-lasting osteoporosis medications administered in hospital may not be captured in this estimate.

Hip fractures were more common among older women and people from residential aged care

The rate of first hip fracture among surgical patients aged 45 and over:

- increased with age, from 12 per 100,000 population aged 45–54 to 2,900 per 100,000 population aged 95 and over

- was 2.1 times as high in women (239 per 100,000 population) as in men (116 per 100,000 population).

Among people aged 65 and over, the incidence rate of first hip fractures treated with surgery for people from residential aged care (RAC) was 5.1 times as high as for people from the community, after adjusting for age.

Hip fractures involve substantial in-hospital care

Among surgical patients, the median length of a hip fracture hospital stay, including acute, rehabilitation or other care, was 20 days. The length of stay ranged between 13 and 29 days for the middle 50% of patients. Length of stay increased with increasing age, from 7 days in patients aged 45–54, to 22 days in those aged 75–94. Patients living in the community before their hip fracture stay had a longer length of stay (median 26 days) than patients from residential aged care (median 8 days).

In addition, 16% of surgical patients were readmitted to hospital within 30 days after the end of their hospital stay. Over the year following first hip fracture, 3.0% (1,800) were hospitalised with a second hip fracture.

Over 1 in 7 patients from the community were in RAC at 120 days

Among surgical patients who were living in the community before their hip fracture, at 120 days after the end of their hip fracture hospital stay:

- 73% were in the community
- 15% (over 1 in 7) were in RAC
- 12% had died.

Around 1 in 4 first hip fracture patients aged 45 and over died within a year

The mortality rate was 8.5% at 30 days, 15% at 90 days and 26% at one year among first hip fracture patients aged 45 and over. Non-surgical patients were more likely to die within one year (40%) than surgical patients (24%).

Having a hip fracture was associated with higher one-year mortality than matched non-hip fracture controls who were hospitalised, particularly among patients from the community.

Many factors associated with mortality in the general population were also associated with dying after a hip fracture. One-year mortality was higher among hip fracture patients who:

- were older
- were male
- were in RAC before their hip fracture
- had a hip fracture from a fall in hospital
- had comorbidities.

1 Introduction

About this report

This report takes a national population health monitoring approach to provide baseline findings on hip fracture treatment pathways. The associated *Technical notes* document outlines in detail the methods used, which will inform continued monitoring of hip fracture incidence, outcomes and care pathways. This report aims to address the following key questions, drawn from scoping work previously completed by the AIHW and the Australian Commission on Safety and Quality in Health Care's Hip Fracture Clinical Care Standard (2023):

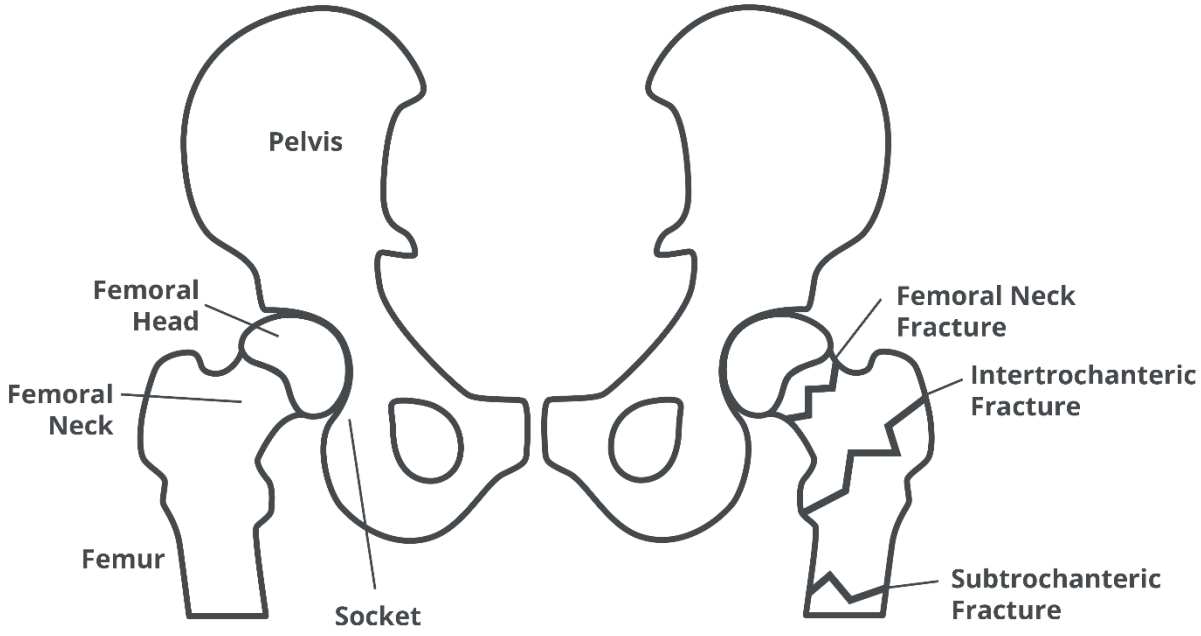
1. How many people were treated for a first hip fracture?
2. How many first hip fracture patients were discharged to their usual place of residence?
3. How many first hip fracture patients were readmitted to hospital within 30 days, 90 days and one year from the end of their stay?
4. How many first hip fracture patients had another hip fracture within one year?
5. What are the 30-day, 90-day and one year survival rates following first hip fracture?

What are hip fractures?

A hip fracture is a break occurring at the top of the femur, close to the hip. Three types of fractures are included in this report, based on where the thigh bone breaks:

- **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**, an important group of fractures which occur slightly further down the shaft of the femur, but are included in other reports monitoring and describing hip fractures (ANZHFR 2023a; BHI 2019) (Figure 1.1).

Figure 1.1: Bones of the hip and sites of fracture



Note: It was not possible to tell from the data how many subtrochanteric fractures were atypical femur fractures (a rare subtype of subtrochanteric fractures which are associated with bisphosphonate medication use, such as those used to treat osteoporosis).

Why report on hip fractures?

Hip fractures affect the wellbeing of the individual, their family and carers, and represent a substantial cost to the health care system in Australia. At the individual level, hip fractures are associated with decreased mobility and quality of life, and increased likelihood of refracture, admission to residential aged care and death (Dimitriou et al. 2012; Center 2017; Dyer et al. 2016).

Hip fracture is an important population health issue that can cause profound impacts, including healthy life lost due to injury or ill health (non-fatal burden) and years of lost life due to premature death (fatal burden). In 2019, hip fractures were associated with 2.9 million years lived with disability (YLD) globally. Years lived with disability represent the non-fatal burden of hip fractures, and the number of years of what could have been a healthy life that were instead spent in states of less than full health. This placed hip fractures as one of the 3 most burdensome fracture sites investigated (Wu et al. 2021).

According the 2022 Australian Burden of Disease Study (ABDS), hip fractures among Australians aged 45 and over were associated with around 5,500 YLD and a loss of 20,000 years of healthy life (total burden, DALY). Among people aged 45 and over:

- hip fracture accounted for 0.5% of the total disease burden
- hip fracture burden increased with increasing age, accounting for 0.05% of total disease burden among people aged 45–49 compared with 1.6% among people aged 95 and over
- the proportion of total burden from hip fracture was higher in women (0.6%) compared with men (0.4%)

- almost three-quarters (72%) of the total hip fracture disease burden was due to fatal burden, with the remaining 28% non-fatal burden (AIHW analysis of Australian Burden of Disease Database 2022).

Hip fractures generate a significant amount of health and hospital care associated costs. Previous reports, such as the 2018 AIHW report *Hip fracture incidence and hospitalisations in Australia 2015–16*, provided a comprehensive picture of hip fracture incidence in Australian hospitals. This report found that there were 50,900 hospitalisations with at least one diagnosis of hip fracture in 2015–16, accounting for 0.5% of all hospitalisations in that year. Hip fracture hospitalisations were associated with 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) (AIHW 2018).

The Australian Disease Expenditure Study estimated that health system expenditure on hip fractures in 2019–20 was $595 million (0.4% of all expenditure), which includes hospital services, primary health care and referred medical services (AIHW 2022a). In addition to direct health system costs, hip fractures have indirect costs associated with lost productivity and participation, and with formal and informal care. Other Australian research has estimated that hip fractures cost $1.01 billion in 2017 for direct health-related costs among peopled aged 50 and over (including ambulance, hospitalisation, emergency department, imaging, medical services, pharmaceuticals, rehabilitation, and community health) and non-health services (community support services including informal care and residential care). Hip fractures were estimated to cost over $39,000 per female patient aged 70 and over, and over $35,000 per male patients aged 70 and over (Tatangelo et al. 2019).

Reduced bone density, a characteristic of chronic diseases such as osteopenia or osteoporosis, is associated with an increased risk of hip fractures following low trauma falls (Healthy Bones Australia 2020). Indeed, the 2018 Australian Burden of Disease Study found that 34% of the total fall burden for females, and 23% of the total fall burden for males, was attributable to low bone mineral density. Overall, 0.9% of deaths in Australia were attributable to low bone mineral density (AIHW 2021a). Identifying and managing people at risk of hip fracture can prevent further bone loss and reduce future fracture risk (Ebeling et al. 2023; RACGP 2017).

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 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, 2023).

Gaps addressed by the data in this report

People with hip fractures require a range of services at the time of the acute event as well as following discharge. Linked data allow us to explore a more complete picture of hip fracture care and provides insight into hip fracture pathways and outcomes that is not possible with a single data set.

The care provided in hospital for a single fracture can generate more than one discrete episode of care ('separation'). The injured person may be transferred between hospitals, or from one type of care to another in the same hospital (for example, acute care to rehabilitation care). As a result, the treatment provided during a hospital stay for a single hip fracture event might be recorded as several episodes of care in admitted patient care data. Care provided might also be recorded across different databases, such as the Medicare Benefits Schedule and the Pharmaceutical Benefits Scheme, both during the initial hospital stay and after discharge.

Linked data provide a more complete picture of patient outcomes following a hip fracture, as well as enabling monitoring of adherence to clinical care guidelines and changes in practice and outcomes over time.

This report examined multiple linked data sources to provide extensive coverage of hip fracture care, including:

- admitted patient care data, for identifying a cohort of hip fracture patients, associated interventions, hospital readmission, selected comorbidities and second hip fractures
- emergency department (ED) data, for identifying patients who entered hospital via the ED
- residential aged care activity data, for permanent and respite residential aged care use
- National Death Index data, for the timing and cause of death following hip fracture
- Medicare Benefits Schedule (MBS) data, for services for hip fracture-related surgical care not captured in admitted patient care data
- Pharmaceutical Benefits Scheme (PBS) and Repatriation Schedule of Pharmaceutical Benefits (RPBS) data, for dispensing of osteoporosis-related medications.

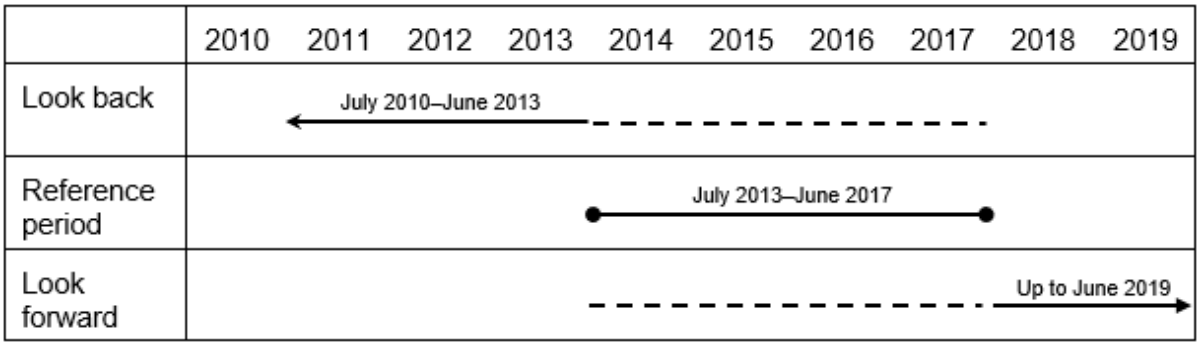
2 About the data and key methods

This section summarises the data and key variables used in this report. The *Technical notes* provide more information about the methods used throughout this report.

About the National Integrated Health Services Information data

This report used linked data from the National Integrated Health Services Information (NIHSI) version 1.0 data asset (NIHSI 2018-19). The NIHSI is a multi-source, enduring linked data asset that contains de-identified health care, residential aged care and mortality data. This report used data from July 2010 to June 2019, with July 2013 to June 2017 as the reference period. This reference period allows at least 3 years lookback to identify previous hip fractures, and generally at least one year follow up after the end of a hospital stay (Table 2.1). Admitted patient records are provided from all public hospitals in New South Wales, Victoria, Queensland, South Australia, Tasmania and the Australian Capital Territory from July 2010 to June 2019. Coverage of admitted patient private hospitals data in NIHSI data is limited with only Victoria, Queensland and the Australian Capital Territory having any private hospitals data included, and subject to identifiers available to states and territories as provided to the AIHW. As such, the scope of admitted patient private hospitals records is underrepresented and varies across participating states and territories.

Table 2.1: How data from July 2010 to June 2019 are used across this report



Project scope

The first hip fracture cohort included people aged 45 and over hospitalised with a first hip fracture between 1 July 2013 and 30 June 2017. The age threshold used when reporting the incidence or risk of hip fracture varies, with studies and registries selecting patients aged 45 and over (AIHW 2018; Lai et al. 2013), 50 and over (ANZHFR 2023b), 60 and over (Center 2017) or 65 and over (ACSQHC 2015). Osteoporosis and fracture caused by low trauma events, such as a fall from standing height or less, are more likely with increasing age. However, hip fracture in people aged between 45 and 60 can indicate poor bone health (Strøm Rönnquist et al. 2022). As such, people aged 45 and over were included in this report.

Patients with evidence of prior hip fracture care in the lookback period were excluded as this report focuses on patients who had their first hip fracture in the reference period. Patients who are experiencing a second hip fracture are more likely to die, experience surgical

complications, and less likely to live independently than first hip fracture patients (Sobolev et al. 2015; van der Steenhoven et al. 2015). As such, second hip fracture patients may follow a different treatment pathway from first hip fracture patients.

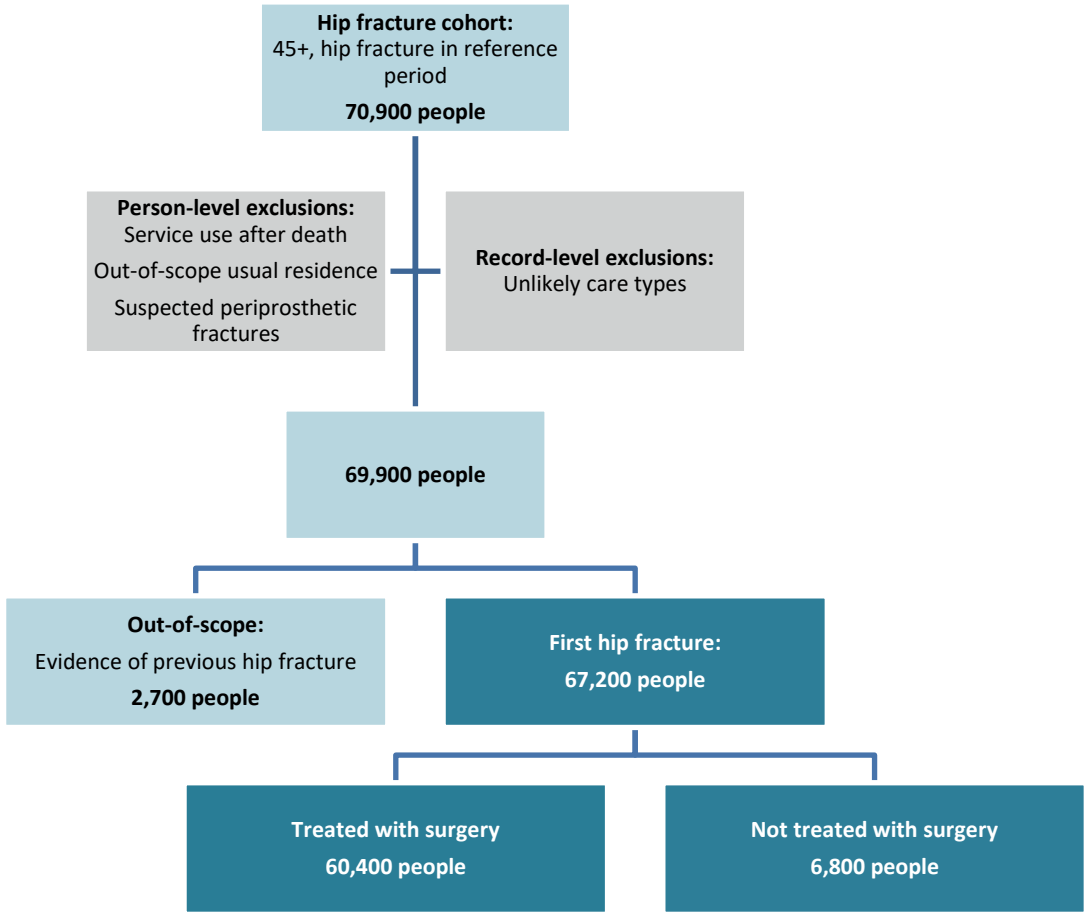
A set of rules was used to assess data quality and clean and process records. After data cleaning, there were 69,900 people aged 45 and over who were admitted for an acute, principal diagnosis of hip fracture or had a hip fracture in hospital between 1 July 2013 and 30 June 2017:

- 67,200 (96%) had their first hip fracture in the reference period
- 2,700 had previous hip fracture care before their hip fracture hospitalisation in the reference period and were out of scope (Figure 2.1).

The first hip fracture cohort is examined at 3 levels:

1. All first hip fracture patients, to measure of the overall incidence of first hip fractures and mortality associated with first hip fracture (summarised in Chapter 3 ‘First hip fractures: an overview’ and Chapter 10 ‘Mortality following a first hip fracture’).
2. Surgically treated first hip fracture patients, as the focus when describing the characteristics, treatments and outcomes of first hip fracture patients (chapters 4–8).
3. Non-surgical first hip fracture patients, as a separate cohort of patients. Chapter 9 ‘Non-surgical first hip fracture patients’ reports the number of first hip fractures in Australia that were managed without surgery; summarises the demographic and clinical characteristics, treatments and outcomes; and makes comparisons with the surgically treated population.

Figure 2.1: Cohort selection for hip fracture care pathways analysis



Notes

1. Hip fracture is indicated using ICD-10-AM codes S72.0, S72.1, S72.2.
2. Episodes with a care type of newborn care, organ procurement or hospital boarder were excluded.
3. People who had service use episodes that were inconsistent with date of death were taken to indicate poor linkage quality and were removed from the final analysis data set.
4. People with usual residence in Western Australia, the Northern Territory or overseas were excluded from analysis, as these areas are out-of-scope of NIHSI hospital data and any subsequent hospitalisations in these areas would not be captured.
5. Patients who had a hip fracture that was treated with a revision surgery were excluded from analysis, as they were assumed to represent a fracture associated with a previous hip replacement (periprosthetic fracture), and represent a separate sub-cohort of patients.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Defining hospital stays in linked data

A person may have several hospital episodes (or 'separations') between their admission and discharge from hospital. Indeed, many first hip fracture patients had multiple hip fracture-related hospital episodes, which may have been related to the same hip fracture or a second hip fracture. In the reference period, the 67,200 first hip fracture patients were associated with:

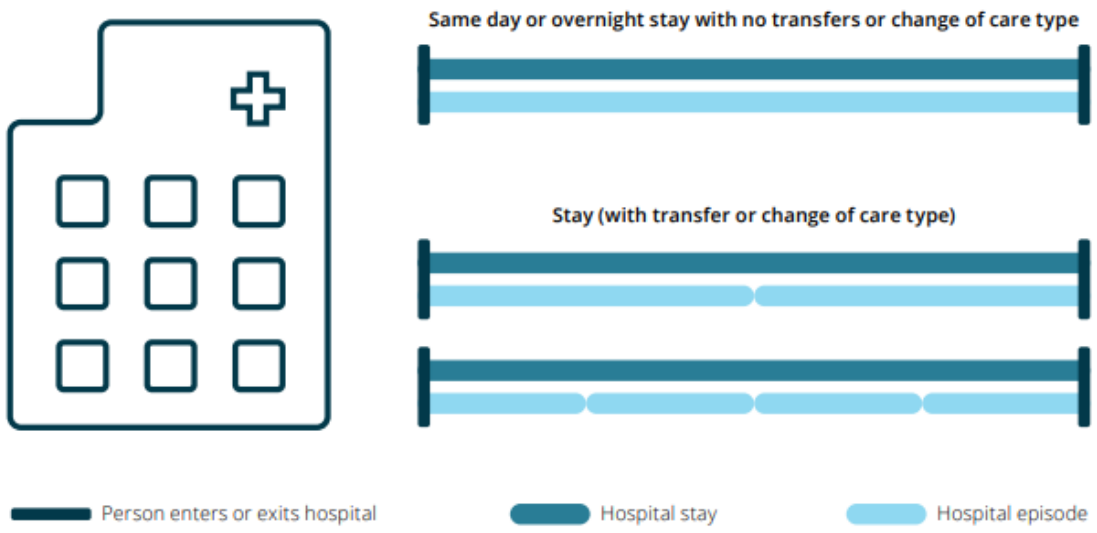
- 82,800 hospital episodes where the patient was treated for an acute, principal diagnosis of hip fracture or a hip fracture that occurred due to a fall in hospital
- 131,800 hospital episodes where hip fracture affected care (principal or additional diagnosis).

A hospital episode can be:

- a total hospital stay (from admission to discharge or death)
- a portion of a hospital stay beginning and/or ending in a change of care type (for example, from acute care to rehabilitation care)
- a portion of a hospital stay beginning and/or ending in a transfer from/to another hospital.

A hospital stay may be made up of one or more contiguous hospital episodes (Figure 2.2).

Figure 2.2: Conceptual diagram of relationships between hospital episodes and hospital stays



Note: Not all possible relationships are represented in this figure.

Source: AIHW 2021b.

Related hospital episodes were joined into a single 'hospital stay', using rules described in the *Technical notes*.

3 First hip fractures: an overview

This section describes the incidence of first hip fractures, dispensing of osteoporosis medications before and after hip fracture and surgical management among all first hip fracture patients.

Key findings:

There were around 16,300 to 17,100 first hip fracture patients each year, with a total of 67,200 first hip fracture patients between July 2013 and June 2017.

At least 43% of first hip fracture patients who were alive one year after their hip fracture had been dispensed osteoporosis medications in the year following fracture.

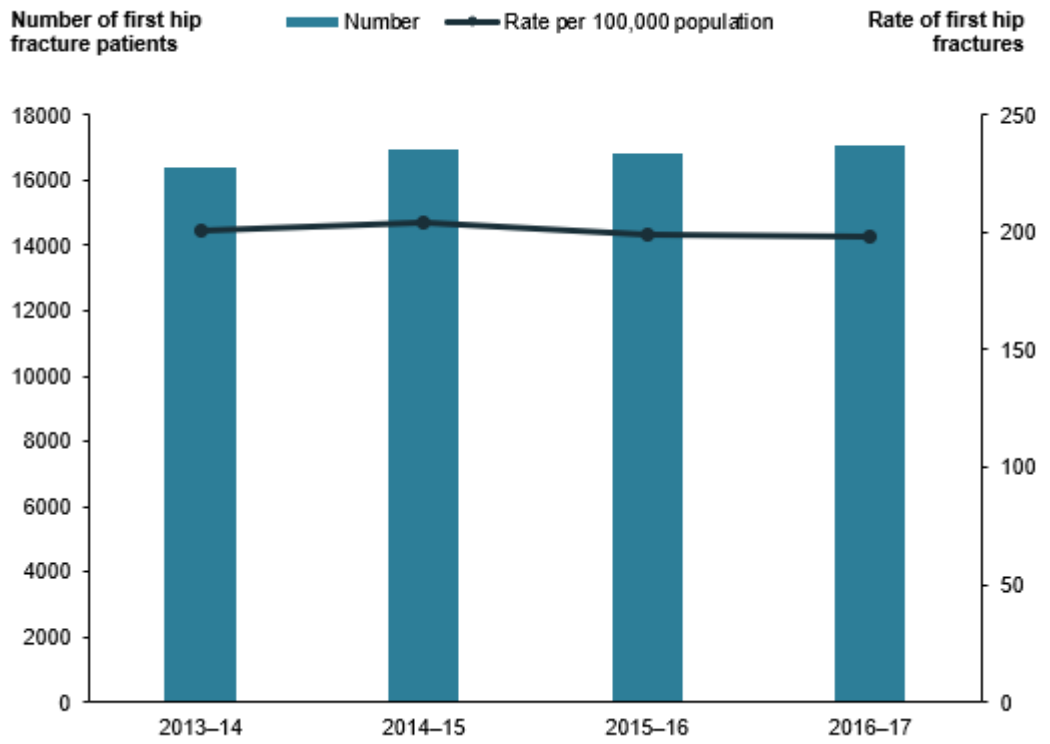
The majority of first hip fracture patients had hip fracture surgery (90%).

The rate of hip fractures decreased slightly across the reference period

The number of first hip fracture patients increased slightly in each year from 2013–14 to 2016–17, from around 16,300 to around 17,100 per year. Of these, around 400 (2.5–2.7%) first hip fractures occurred due to a fall in hospital each year. That is, the person was already in hospital for another diagnosis and fractured their hip in hospital.

The estimated crude rate of first hip fractures was 200 per 100,000 people aged 45 and over per year over the 4 years from 1 July 2013 to 30 June 2017 (Figure 3.1). The rate of first hip fractures ranged between 204 per 100,000 population in 2014–15 and 198 per 100,000 population in 2016–17. The rate of first hip fractures increased with age, and when age is taken into account the age-standardised rate of first hip fracture fell by 4.4% from the peak of 180 per 100,000 population in 2014–15 to 172 per 100,000 population in 2016–17.

Figure 3.1: Number and crude rate of first hip fractures in each year of the reference period, 2013–14 to 2016–17



Notes

1. Hip fracture is indicated using ICD-10-AM codes S72.0, S72.1, S72.2.

2. Rates were calculated using the estimated resident population (ERP) from the jurisdictions included in NIHSI admitted patient care data (NSW, Vic, Qld, SA, Tas, ACT) from 31 December 2013 to 31 December 2016.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

The rate of hip fractures by socioeconomic and remoteness area

The rate of first hip fractures was highest among people who lived in the areas with the greatest overall level of disadvantage (lowest socioeconomic areas, 229 per 100,000 population) compared with those living in areas with the least overall level of disadvantage (the highest socioeconomic areas, 179 per 100,000 population).

The overall rate of first hip fractures was higher in *Major cities* (200 per 100,000 population) than in *Remote* areas (173 per 100,000 population), and peaked in *Inner regional* areas (203 per 100,000 population). This overall pattern is affected by the age profile in each remoteness area and changes substantially when considered by age group.

The rate of first hip fractures varies by remoteness and age

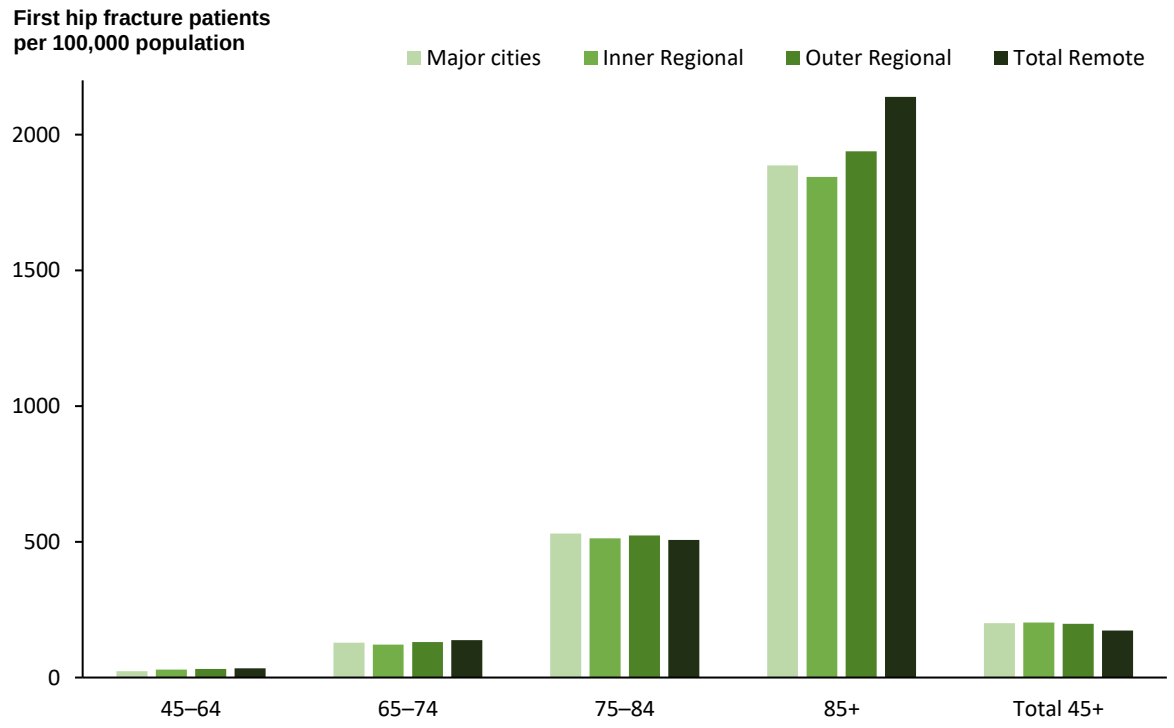
The rate of first hip fractures across remoteness areas varied by age group:

- Among people aged 45–64, the rate was lowest in *Major cities* and increased gradually across each of the remoteness areas: from 24 per 100,000 population in *Major cities* to 34 per 100,000 population in *Remote* areas.

- Among people aged 65–74, the rate was lower in *Major cities* compared with *Remote* areas.
- Among people aged 75–84, the rate was slightly higher in *Major cities* than in *Remote* areas, and was the opposite direction to other age groups.
- Among people aged 85 and over, the rate was 1,900 per 100,000 among those living in *Major cities*, lower than the rate of 2,100 per 100,000 among those living in *Remote* areas (Figure 3.2).

As such, the underlying age structure of the population in each remoteness area significantly affects the interpretation of the rate of first hip fractures by remoteness area.

Figure 3.2: Rate of first hip fractures by remoteness area and age group, 2013–14 to 2016–17



Notes

1. Rates were calculated using the ERP from the jurisdictions included in NIHSI admitted patient care data (NSW, Vic, Qld, SA, Tas, ACT). The December population for each year of the reference period (financial year) was estimated using the average of the ERP from 30 June at the start and end of each financial year.
2. Remoteness area is based on ASGS 2011 remoteness or ASGS 2016 remoteness depending on the year of separation of the patient's first hip fracture episode (records that separated after 30 June 2017 use ASGS 2016).
3. The proportion of the population living in each remoteness area within each SA2 was used to estimate the number of patients in each remoteness area.
4. Patients with a missing or invalid SA2 were excluded.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Use of osteoporosis medications

Once a patient has experienced a hip fracture, further investigation and treatment, which may include bone protection medicines, is recommended to prevent further fractures (Ebeling et al. 2023). Osteoporosis medications can slow bone loss, improve bone density and reduce fracture risk (Healthy Bones Australia 2021), and reduced bone loss is associated with reduced mortality (Bliuc et al. 2019). The importance of bone protection medication is reflected by quality indicator 6a ‘Proportion of admitted patients with a hip

fracture who received bone protection medicine while in hospital or a prescription prior to separation from hospital' in the Hip Fracture Clinical Care Standard (ACSQHC 2023).

Patients can be administered or prescribed bone protection medicines before discharge from hospital, where clinically appropriate. This report uses data on dispensed medication from the PBS, and does not include all possible use of osteoporosis-related medications. For example, 3 once-yearly infusions of the osteoporosis medication zoledronic acid (that is, one treatment each year for 3 years) are subsidised on the PBS. This long-lasting infusion may have been administered during the hospital stay of hip fracture patients, which may not be captured in PBS data (NPS Medicinewise 2009). As such, information about dispensing of osteoporosis medications is likely an underestimate of true use.

The osteoporosis-related medications measured include bisphosphonates (complemented with calcium and vitamin D if recommended), targeted monoclonal antibodies (Denosumab), selective estrogen receptor modulators, parathyroid hormone and vitamin D. Dispensing of at least one prescription for an osteoporosis-related medication was examined in the 90 days, 180 days and one year before and after admission for first hip fracture.

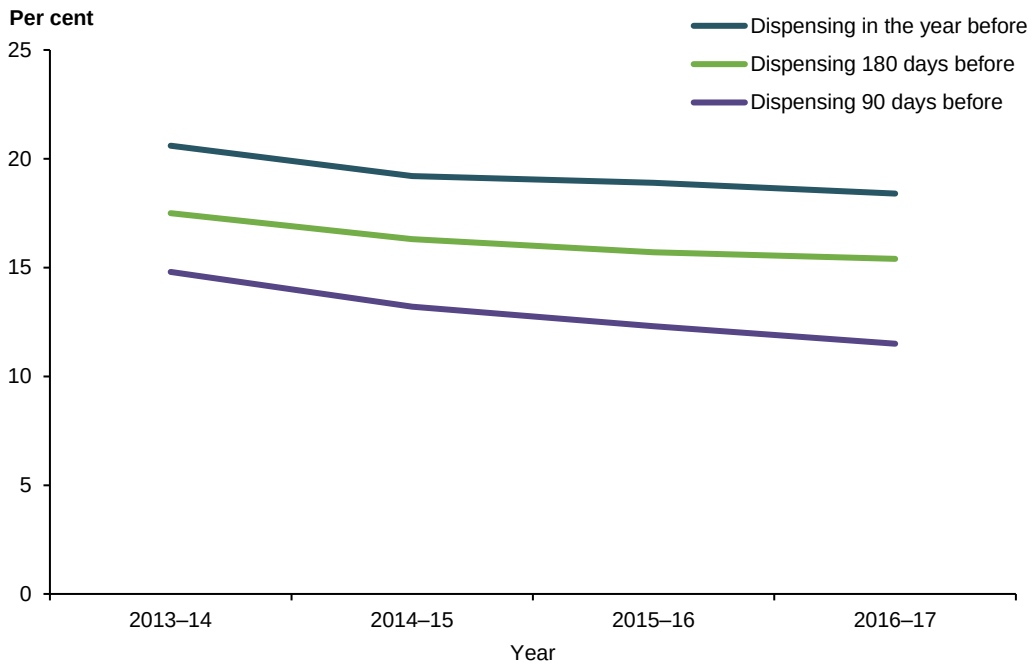
Osteoporosis medications before first hip fracture

There was a small decline in dispensing of osteoporosis medications in the 90 days, 180 days and one year before hip fracture admission in each year of the reference period. For example, 21% of first hip fracture patients had osteoporosis medications dispensed in the year before their fracture in 2013–14, which decreased to 18% in 2016–17 (Figure 3.3).

Overall, among first hip fracture patients:

- 13% had osteoporosis medications dispensed in the 90 days before their hip fracture admission
- 16% had osteoporosis medications dispensed in the 180 days before
- 19% had osteoporosis medications dispensed in the year before.

Figure 3.3: Dispensing of osteoporosis medications captured in the PBS in the 90 days, 180 days and one year before first hip fracture admission, by year



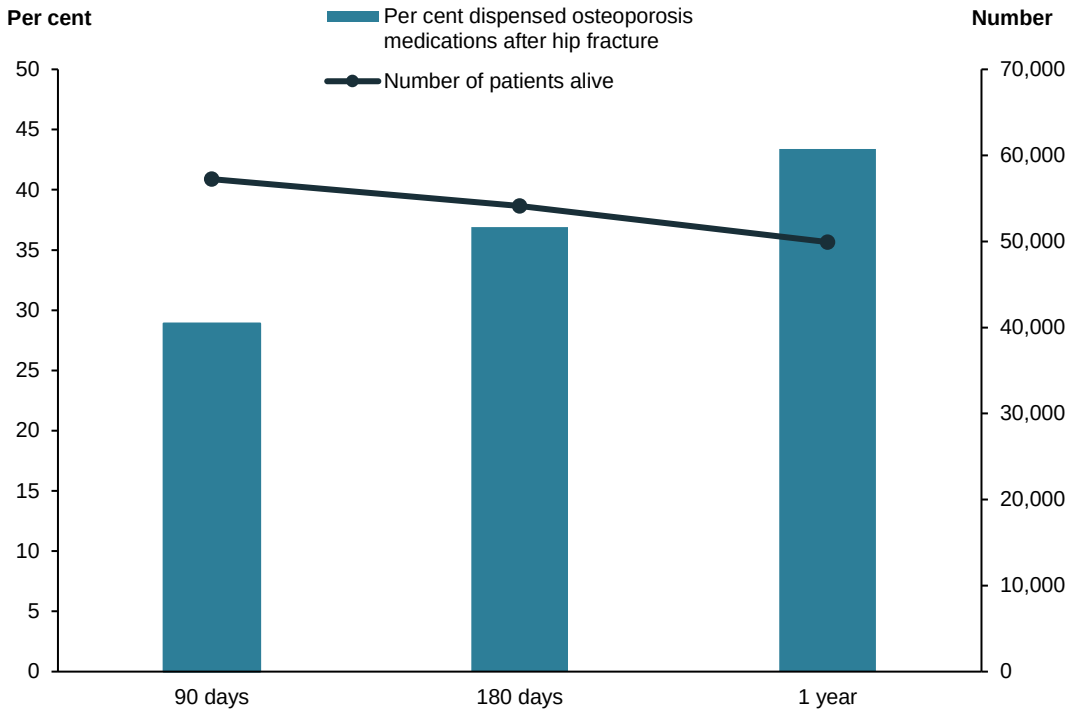
Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Patients with osteoporosis are at a higher risk of fractures, not just hip fractures (Healthy Bones Australia 2021). Among first hip fracture patients, 6.7% were admitted to hospital with another (non-hip) fracture in the year before their hip fracture. Dispensing of osteoporosis medications in the year before the hip fracture was higher among patients who had also been admitted to hospital with a fracture other than a hip fracture in the previous year (31%), compared with those who had not experienced other fractures (18%). This may reflect patients who have already experienced a fracture due to a low trauma fall, who are at increased risk of further fractures, taking osteoporosis medications.

Osteoporosis medications after first hip fracture

The proportion of patients with a dispensed prescription after hip fracture was reported only for those who were alive at the end of each follow-up period, as patients who die after their hip fracture may not have the opportunity to receive a prescription for osteoporosis medication. Among patients alive at each follow-up period, 29% were dispensed osteoporosis medication within the 90 days following hip fracture admission; this increased to 37% at 180 days and 43% at one year (Figure 3.4).

Figure 3.4: Dispensing of osteoporosis medications captured in the PBS after hip fracture admission, among patients alive at each follow-up period, 2013–14 to 2016–17



Notes

1. Number of patients alive at 90 days, 180 days and one year after admission for hip fracture.

2. Per cent dispensed at least one osteoporosis medication within 90 days, 180 days, and one year among patients who were alive at each of those times.

3. Osteoporosis medication dispensing uses PBS data, and does not include all possible use of osteoporosis-related medications,

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Among patients who were alive one year after their hip fracture, many of those with osteoporosis medication dispensed before their hip fracture also had osteoporosis medication dispensed after their hip fracture. Overall, 83% of patients with dispensing in the year before their fracture also had dispensing afterwards, compared with 34% of patients with no dispensing in the year before their hip fracture.

Dispensing of osteoporosis medications in the year following hip fracture admission was:

- higher among women (48%) than men (33%)
- higher with increasing age, peaking at 48% among people aged 75–84, before reducing to 32% among people aged 95 and over
- higher in people who did not have any residential aged care in the 120 days after their hip fracture (50%) compared with people who had at least one residential aged care episode in the 120 days after fracture (35%)
- higher among people who had been hospitalised with osteoporosis within the year before hip fracture (59%) than among those who had not been (42%).

Most patients had hip fracture surgery

The majority of first hip fracture patients had hip fracture surgery (60,400 patients, 90%). Hip fracture surgery includes procedures to repair and stabilise the fracture (such as via internal fixation) as well as replacement of the broken parts (such as hemiarthroplasty or total arthroplasty).

Around 10% of patients (6,800) did not have evidence of surgical management. Non-surgical management of hip fracture is indicated when the fracture is minor, or where the risk of poor outcomes (including death) from surgery is high. In the current report, the non-surgical group may also represent patients whose surgery was not captured in the NIHSI data (Box 3.1).

Box 3.1: Data caveats when defining hip fracture surgery

Most hip fracture patients in Australia have hip fracture surgery. Other studies using hospital data have found similar results, with 87% of hip fracture patients aged 50 and over in NSW receiving surgery (BHI 2019). Other sources have reported a higher rate of surgical management in Australia. For example, Australian and New Zealand Hip Fracture Registry (ANZHFR) data showed that 98% of hip fracture patients had surgical treatment in 2022. Of those patients, 76% were operated on within 48 hours of presentation to hospital in Australia (ANZHFR 2023a).

Hip fracture surgery in this report was identified using ACHI codes for procedures that were performed in a hospital episode within 7 days of admission for hip fracture or using an associated MBS item within 14 days. See *Technical notes* for further details.

NIHSI hospitals data do not cover all jurisdictions in Australia (excludes Western Australia and the Northern territory) and coverage of private hospitals data is limited. As a result, patients defined as 'non-surgical' may have transferred to an out-of-scope hospital and received surgery. The current data would not contain information about this surgery in admitted patient care data. Indeed, it was observed that non-surgical patients were more likely to:

- have their hip fracture stay end on a transfer or change in care type compared with surgical patients (11% compared with 9.2%)
- have a same-day first hip fracture stay (started and ended on the same day, 10% compared with 0.9%).

MBS services for the selected hip fracture-related procedures were used to fill the gaps in admitted patient care data and identify additional surgical patients, such as those whose hip fracture was captured in public hospital data but received hip fracture surgery in an out-of-scope private hospital. However, the current analysis may still underestimate the number of surgical patients in the cohort.

4 Demographic and fracture characteristics

This section explores the characteristics of hip fracture patients treated with surgery including age, sex, residential aged care status before fracture and cause of the fracture.

Key findings:

Among first hip fracture patients treated with surgery, first hip fractures were common among women, people aged 85 and over, people living in *Major cities* and people who were in residential aged care.

The majority of fractures were caused by a fall-related injury event and occurred at home.

Characteristics of first hip fracture patients

Age and sex

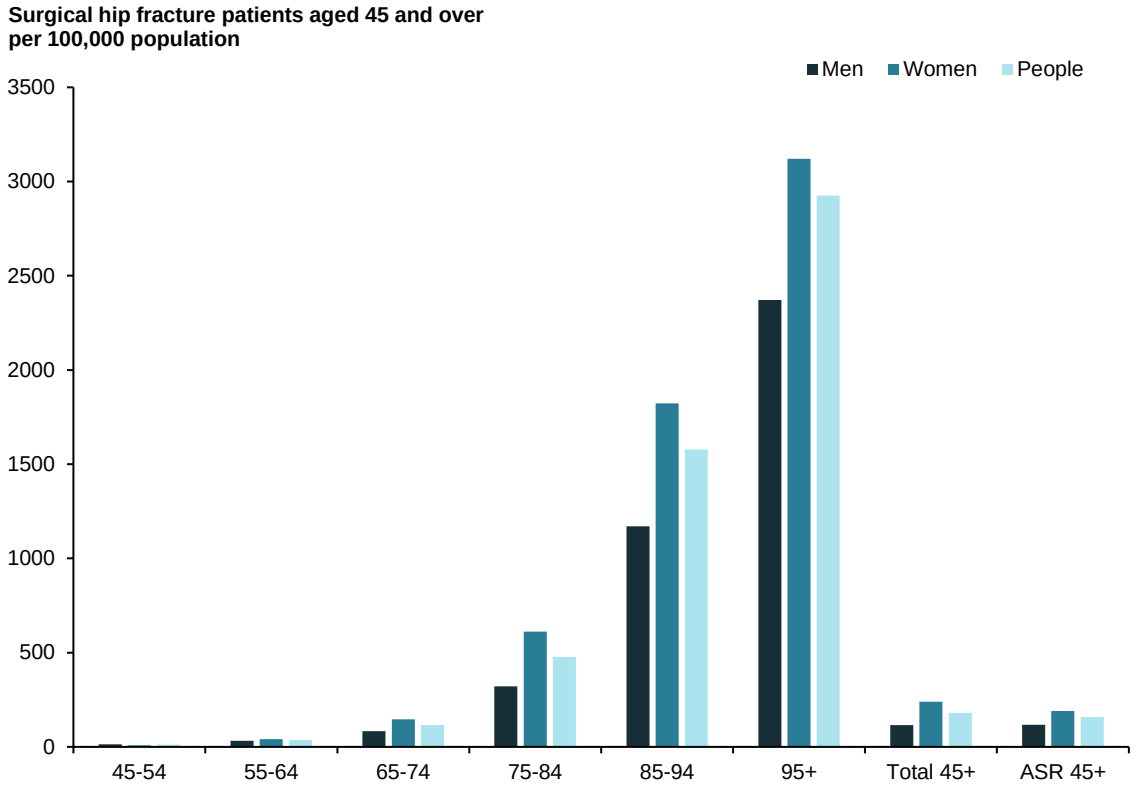
First hip fractures were most common among women and people aged 85 and over. Among patients aged 45 and over treated with surgery:

- over two-thirds (69%) were women, and just under half (47%) were over 85 years old at the time of first hip fracture
- men were younger than women, with a median age of 82 compared with 85 for women.

The rate of first hip fractures treated with surgery:

- increased with age, from 12 per 100,000 population aged 45–54 to 2,900 per 100,000 population aged 95 and over
- was 2.1 times as high in women (239 per 100,000 population) as in men (116 per 100,000 population)
- was 1.6 times as high in men aged 45–54 as in women the same age. However, in all other age groups the rate of hip fractures was higher in women than in men (Figure 4.1).

Figure 4.1: Rate of first hip fractures treated with surgery, by sex and age group, 2013–14 to 2016–17



Notes

1. Rates were calculated using the estimated resident population (ERP) from the jurisdictions included in NIHSI admitted patient care data (NSW, Vic, Qld, SA, Tas, ACT) from 31 December 2013 to 31 December 2016.

2. Age-standardised rates (ASRs) were calculated using the 2001 Australian standard population with the following age groups: 45–54, 55–64, 65–74, 75–84, 85–94, 95+.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Over 1 in 4 patients are in residential aged care before their hip fracture stay

Of first hip fracture patients aged 45 and over treated with surgery, 26% were in residential aged care (RAC) shortly before their hospital stay. RAC includes permanent and respite RAC services (Box 4.1).

Box 4.1: What is included in the definition of residential aged care?

NIHSI data includes data on permanent and respite RAC programs. Patients who were not in RAC before their hip fracture are described as 'patients from the community'. Patients from the community may include patients who were:

- receiving aged care programs that are not in scope of NIHSI version 1.0, including home support, home care and flexible care
- a permanent or respite residential aged care patient receiving care in an out-of-scope hospital more than 2 days before their hip fracture stay, which meant that RAC use was not captured.

The data included in this report therefore provide an underestimate of all aged care service use before and after hip fracture.

Proportion of patients from RAC increases sharply with age

The proportion of surgical first hip fracture patients in RAC before their hip fracture hospital stay increased with age, from 3.2% of those aged 45–64 to 51% of those aged 95 and over. The remaining analysis of age and sex by pre-fracture residence in this section is restricted to patients aged 65 and over. In most circumstances, the age criteria for aged care eligibility is 65 and over, or 50 and over for Aboriginal and Torres Strait Islander (First Nations) people, although younger people may be eligible in specific circumstances (Department of Health and Aged Care 2021).

Overall, 15,300 surgical patients (28%) aged 65 and over were in RAC before their hip fracture. In contrast, RAC patients make up only a small proportion of the general Australian population: at 30 June 2022 there were around 178,000 people aged 65 and over in permanent RAC and 7,400 in respite RAC (AIHW 2022b), representing around 4.2% of all people in Australia aged 65 and over.

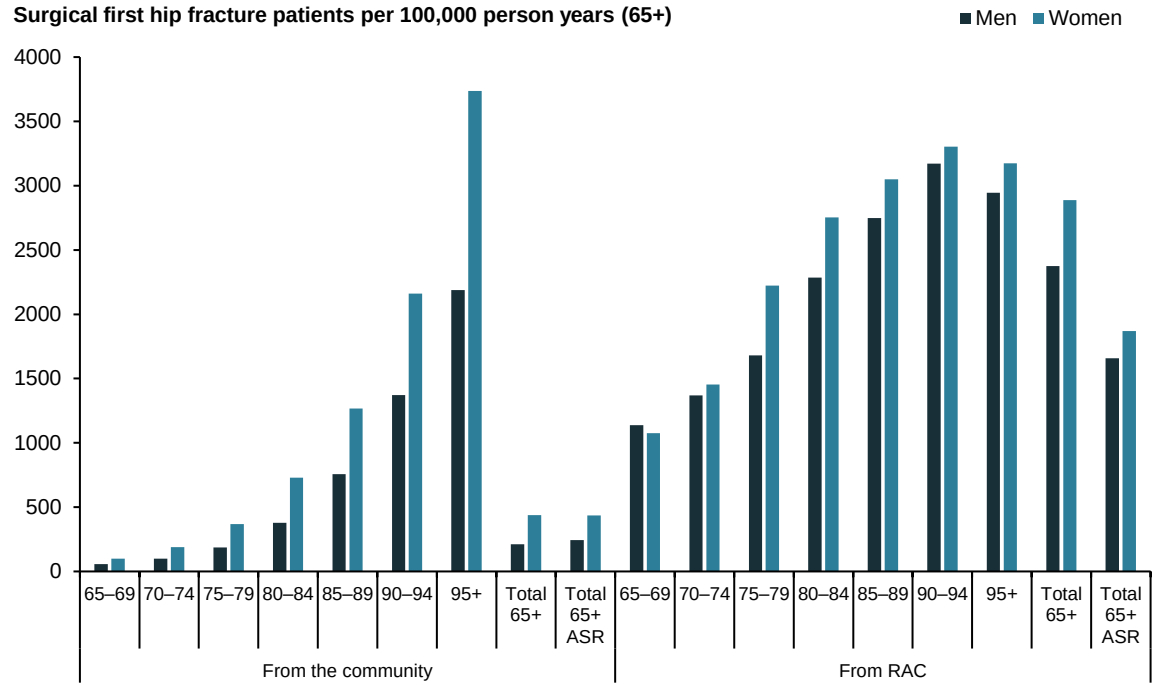
The incidence rate of first hip fractures is higher in patients from residential aged care

The crude incidence rate of first hip fractures treated with surgery among people aged 65 and over was 8.2 times as high in people from RAC (around 2,700 per 100,000 person years at risk) as in people from the community (around 330 per 100,000 person years). The incidence rate (specifically the person-time incidence rate) was used to account for time spent in RAC at risk of a first hip fracture (excludes time in RAC after a hip fracture).

The age-standardised incidence rate of first hip fractures among people aged 65 and over was 5.1 times as high in people from RAC as in people from the community (1,800 per 100,000 person years at risk in people from RAC compared with 350 per 100,000 person years in people from the community).

The difference in the incidence rate of hip fractures between women and men was larger in people from the community than among people from RAC. Among people from the community, the crude incidence rate of first hip fractures was 2.1 times as high in women as in men. Among people from RAC, the rate of hip fractures was only slightly higher (1.2 times) in women than in men (Figure 4.2).

Figure 4.2: The incidence rate of surgical first hip fractures, by whether in residential aged care, sex and age, 2013–14 to 2016–17



Notes

1. Incidence rates were calculated using person years (for people from the community) or person years at risk (for people from RAC) as the denominator.

2. Age-standardised rates (ASRs) were calculated using the 2001 Australian standard population with the following age groups: 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Comorbid conditions

Linked data allow us to connect hip fracture patients with hospital episodes before their hip fracture and identify other chronic conditions, or comorbidities, that the patient may have. Chronic conditions such as osteoporosis, rheumatoid arthritis and dementia can increase the risk of hip fracture and poor outcomes following a hip fracture (Xue et al. 2017; Harvey et al. 2017; Healthy Bones Australia 2020).

Selected comorbid conditions were identified in the first hip fracture hospital episode or any hospital episode that started or ended in the year before the hip fracture.

Of first hip fracture patients treated with surgery:

- Over half (56%) had at least one recorded diagnosis of *Endocrine, nutritional and metabolic disease*, with the most common being:
  - metabolic disorders (including dehydration) (37%)
  - type 2 diabetes (19%)
  - malnutrition (12%).
- Over half (52%) had at least one recorded diagnosis of *Diseases of the circulatory system*, with the most common being:
  - hypotension (25%)
  - hypertensive diseases (21%)

  - atrial fibrillation (14%).
- Over one-third (39%) had at least one recorded diagnosis of *Mental and behavioural disorders*, with the most common being delirium (21%) and dementia (16%).
- One-quarter (25%) had at least one recorded diagnosis of *Diseases of the respiratory system*, including:
  - influenza and pneumonia (11%)
  - chronic obstructive pulmonary disease (COPD) (6.9%).
- Almost one quarter (23%) had at least one recorded diagnosis of *Diseases of the musculoskeletal system*, including osteoporosis (9.5%).

How common are the selected comorbid conditions among matched hospitalised patients?

Many of the conditions that are comorbid in surgical hip fracture patients are also common among all patients aged 45 and over who are admitted to hospital. After matching for age, sex and residential aged care status before admission, surgical first hip fracture patients were particularly more likely to be hospitalised with conditions such as:

- osteoporosis (5.7 times as high in hip fracture patients as in matched controls)
- other nutritional deficiencies (2.9 times as high)
- mental and behavioural disorders due to psychoactive substance abuse (2.8 times as high)
- delirium (2.6 times as high) (Figure 4.3).

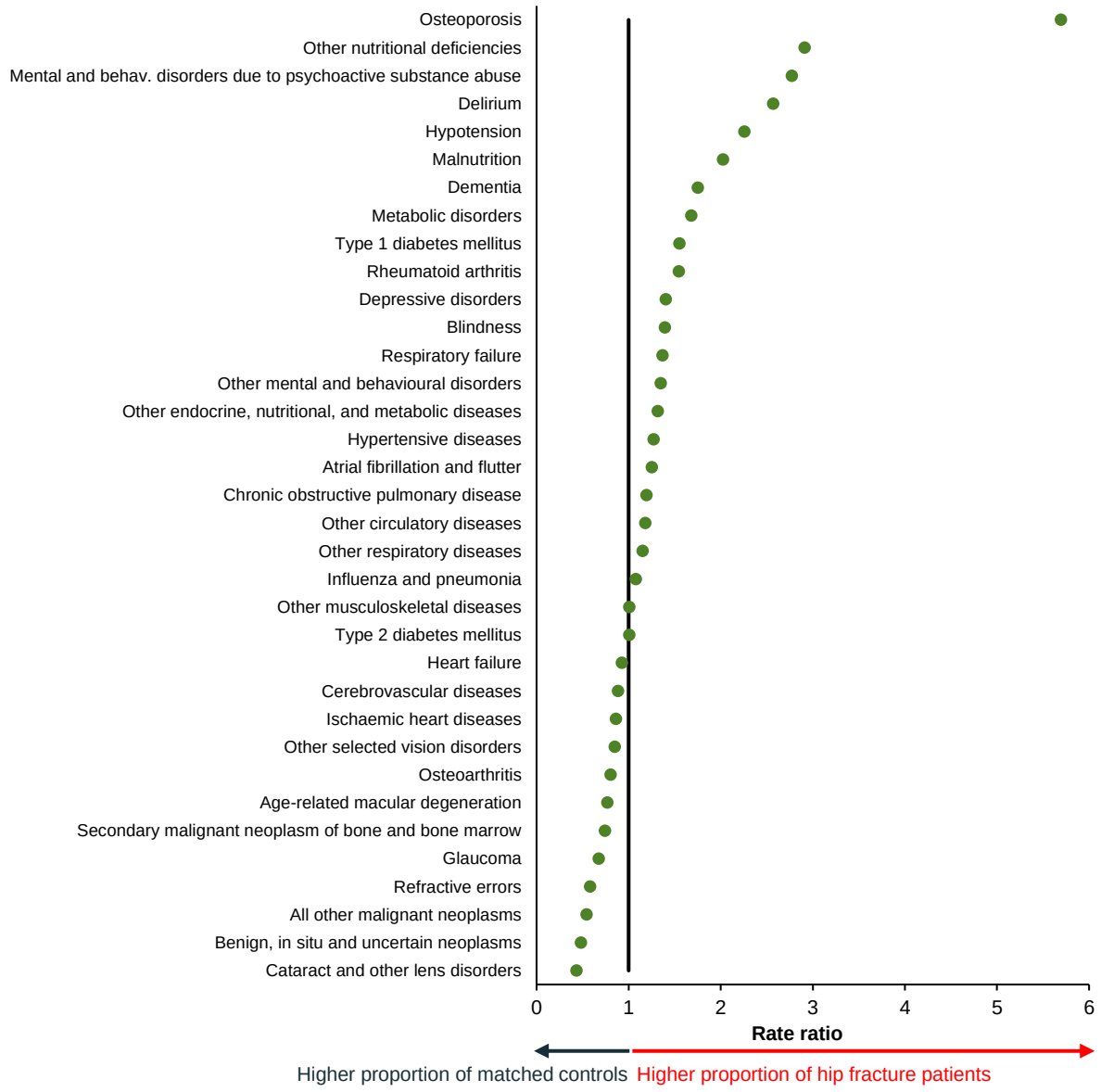
The hip fracture patients were less likely to have been hospitalised with conditions such as cataract and other lens disorders, and benign or malignant neoplasms than matched controls.

This analysis was done by comparing the pattern of comorbidity among hip fracture patients with a group of hospitalised patients who did not have a hip fracture in the reference period. The comparison population was created by using a systematic random sample of patients hospitalised during the reference period, with stratification (matching) on the following variables:

- age group
- sex
- residential aged care use before the start of the hospital stay.

After the comparison group was created, comorbid conditions were identified in any hospital episode that started or ended in the year before their randomly selected hospital episode.

Figure 4.3: The rate ratio of the proportion of selected chronic diseases among surgical first hip fracture patients compared with matched controls



Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Other (non-hip) fractures

First hip fracture patients treated with surgery were also more likely to have been admitted to hospital with another (non-hip) fracture in the year before their hip fracture (6.6%) compared with matched controls (4.0%).

Characteristics of first hip fractures

Information about the type of fracture (using diagnosis information), the external cause of injury and place of occurrence of injury recorded in the patient's first hip fracture hospital episode were used to explore the characteristics of first hip fractures.

Type of fracture

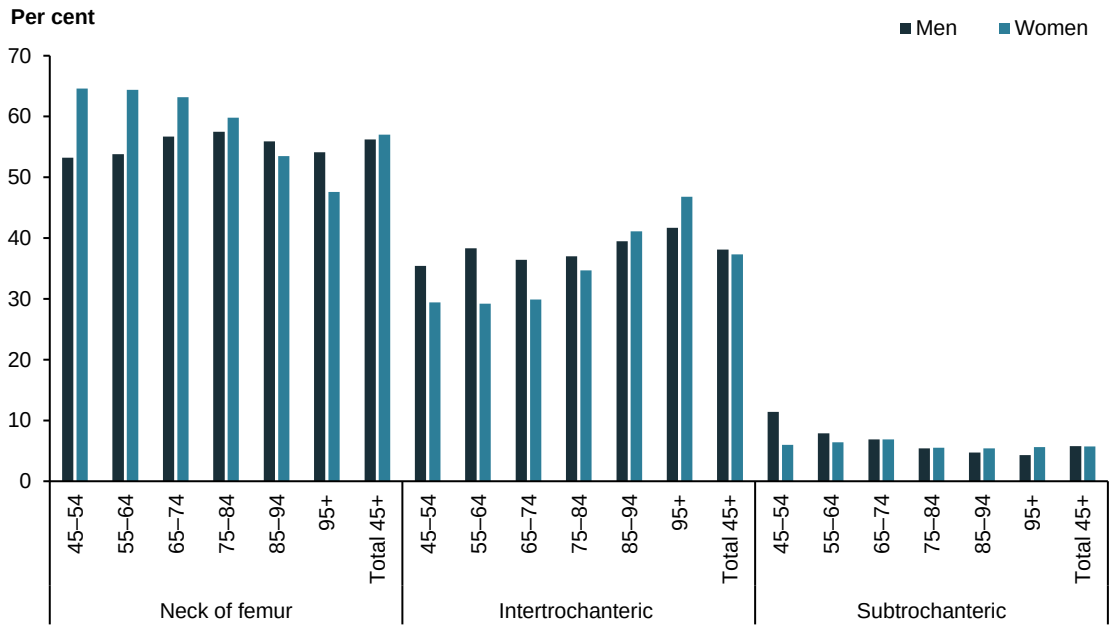
The most common fracture site for hip fracture patients treated with surgery was the neck of femur (57%), followed by intertrochanteric (38%) and subtrochanteric fractures (5.7%). This pattern was similar in each year of the reference period (see Supplementary data tables).

The type of fracture varied by age and sex

Among patients treated with surgery:

- The proportion of patients with an intertrochanteric fracture increased with increasing age (from 33% of those aged 45–54, to 46% aged 95 and over).
- The proportion of patients with a subtrochanteric fracture decreased with increasing age (from 9.2% aged 45–54, to 5.3% aged 95 and over).
- The proportion of patients with a neck of femur fracture was steady until 84 years old before decreasing (from 58%–61% aged 45–84, to 49% aged 95 and over).
- While the overall proportion of each fracture type was similar among men and women, younger men (aged 45–54) were more likely to have a subtrochanteric fracture than younger women (11% of men aged 45–54 compared with 6.0% of women of the same age; Figure 4.4).

Figure 4.4: The proportion of surgical first hip fractures, by fracture type, age and sex, 2013–14 to 2016–17



Note: Hip fracture is indicated using ICD-10-AM codes S72.0 (neck of femur fracture), S72.1 (intertrochanteric fracture), S72.2 (subtrochanteric fracture).

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Most hip fractures are caused by falls

The majority of first hip fractures were caused by a fall-related injury event (92% of surgery patients). Among hip fracture patients treated with surgery:

- The majority of fall-related injury events were due to low trauma falls (85% of all fractures). This is a fracture sustained in an event which would not be expected to fracture a healthy bone, such as a fall from standing height or less. These are also known as a ‘low-energy trauma’, ‘minimal trauma, ‘low-impact fracture’, ‘fragility fracture’ or ‘osteoporotic fracture’.
- The proportion of patients with a low trauma fall increased with increasing age (from 53% aged 45–54 to 91% aged 85 and over).
- Across all ages, low trauma falls were a more common cause of hip fracture among women than men (see Supplementary data tables).

Most hip fractures occur at home

Overall, most hip fractures treated with surgery occurred in a private home (49%) or an aged care facility (26%). The location for 10% of hip fractures was unspecified. The next most common place of occurrence was a street or highway (4.2%). Hip fractures were more likely to occur in residential aged care with increasing age: 3.5% of hip fractures among surgical patients aged 45–64 occurred in residential aged care, increasing to 38% among patients aged 85 and over.

5 Care received during the hip fracture hospitalisation

This section explores characteristics of hospital care for first hip fracture patients treated with surgery. Characteristics measured include admission via the emergency department, the length of the hip fracture hospital stay and procedures and interventions performed in hospital.

Key findings:

Most hip fracture patients (89%) were admitted via the emergency department.

The median length of finished stays in hospital was 20 days, and was shorter among patients who were from residential aged care.

Admission via the emergency department

Emergency departments (EDs) are an essential part of Australia's health care system. Many Australian public hospitals have purpose-built EDs, staffed 24 hours a day, providing care for patients who require urgent medical, surgical or other attention. Managing patients with hip fracture in the emergency department might include diagnostic imaging, pain control, rehydration and general medical and cognitive assessments.

The first hospital contact for hip fracture patients is likely to be the ED: 89% of surgical patients with a first hip fracture on admission to hospital had an ED stay directly before their hip fracture hospital stay. Hip fractures that occurred due to a fall in hospital or where the first episode in the stay was recorded as a hospital transfer or change in care type were excluded from this estimate.

Length of hospital stay

Hip fracture care is complex and may involve transfers between hospitals and within a hospital from acute care to rehabilitation care. Among surgical patients, 64% of patients with a hip fracture on admission to hospital and 75% of hip fractures that occurred due to a fall in hospital had at least one hospital episode directly following their 'index' hospitalisation (their first admission with an acute, principal diagnosis of hip fracture or hip fracture in hospital). As a result, unlinked data will often underestimate hospital length of stay (LOS) (Ireland and Kelly 2012). Linked data were used to join continuous hospital episodes within a single hospital stay to estimate the length of stay in hospital.

This analysis focuses on length of stay for finished stays among patients with a first hip fracture that was present on admission to hospital (see Box 5.1). Overall, the median length of a finished hospital stay was 20 days. The length of stay ranged between 13 and 29 days for the middle 50% of patients.

Box 5.1: Defining hospital length of stay

Hospital length of stay (LOS) was calculated from the start of the hip fracture until the separation date of the last episode of the stay. To obtain the most accurate estimate of LOS, the following types of episodes were excluded from this analysis:

- Hip fractures that occurred due to a fall in hospital, as it is impossible to tell from the data how much time in the patient's index episode is attributed to hip fracture care compared with unrelated care before the fracture. Indeed, the index episode for surgical hip fractures that occurred due to a fall in hospital was longer than for those that were not the result of a fall in hospital (median of 14 bed days compared with 7 bed days). As a result, LOS estimates for hip fractures that occurred in hospital might overestimate LOS.
- Patients whose stay was 'unfinished', or ended on a transfer to another hospital or care type. These patients may have transferred to an out-of-scope hospital (such as private hospitals in certain jurisdictions where not available in NIHSI version 1.0 data) resulting in missing information about how long they spent in hospital. Unfinished stays were shorter (median 7 days) than finished stays (median 20 days) for surgical patients and may not represent all the care received by the patient.

As a result, the current analysis focuses on 'finished stays'. That is, those where the final separation mode indicated the patient likely left hospital, and excludes patients with incomplete length of stay information.

How long is spent in each phase of care?

A hospital stay may involve acute care, rehabilitative care and care unrelated to the hip fracture. This analysis further explores the length of time spent in:

- **Acute care**: care with a principal, acute diagnosis of hip fracture continuous with the index hip fracture episode.
- **Rehabilitation care**: additional length of stay due to rehabilitation in hospital.
- **Other hip fracture care**: additional episodes where hip fracture affected care.
- **Non-hip fracture care**: without any diagnosis of hip fracture.

Acute phase

For all fractures that are present on admission to hospital, the start of the stay begins with the start of their acute phase of care. For finished stays treated with surgery, the median LOS for the acute continuous period of care was 8 days.

Rehabilitation care

Following the acute phase, 40% of finished stays for surgical patients had rehabilitation care at some point in their hospital stay. Of those who had rehabilitation care, the median number of days attributed to rehabilitation care was 20 days across the hospital stay.

Other hip fracture care

Other hip fracture care includes acute care that was not continuous with the index episode, or hospital care in which hip fracture was an additional diagnosis. For example, admission for another condition where hip fracture is recorded as an additional diagnosis, or where a patient has acute hip fracture care after a period of rehabilitative or other care. As such, other hip fracture care captures treatment for comorbidities or complications in which the hip fracture affects care. One in 5 surgical patients (21%) had additional hip fracture care in their hip fracture stay. Of these, the median number of days attributed to other hip fracture care was 16 days across their hip fracture stay.

Non-hip fracture care

Other care may include care for comorbidities or hospital time waiting for placement elsewhere, where the hip fracture does not affect care. One in 10 (10%) surgical patients had additional non-hip fracture-related care in their hip fracture stay. Of these patients, the median number of days attributed to non-hip fracture care was 13 days across the hip fracture stay.

Characteristics associated with length of stay

Patients who died in hospital had a shorter length of stay

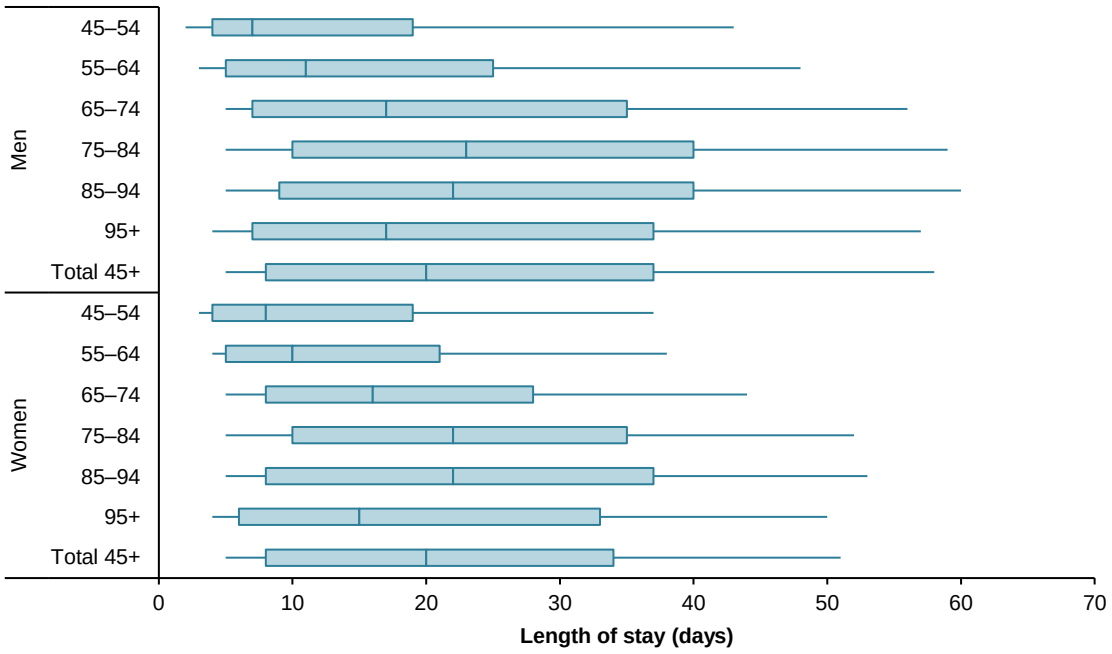
The overall length of stay for surgical patients who died in hospital was shorter (median 13 days) than for patients who finished their hospital stay alive (20 days). However, the length of time in acute care was similar (median 8 days). As such, the difference in length of stay may reflect patients dying during or at the end of acute care, without the opportunity to receive rehabilitative or other care in hospital. While patients who died in hospital had a shorter length of stay than patients who were alive at the end of the stay, both patients who died and those who were alive were included in estimates of length of stay, as this reflects true health service use for the episode of care associated with the hip fracture.

Patients aged 45 to 54 had a shorter length of stay

Among surgical patients, the median length of finished stays was similar in men and women. Median LOS generally increased with increasing age, from 7 days in patients aged 45–54, to 22 days in those aged 75–94. Median LOS in those aged 95 and over was 16 days. The shorter LOS in patients aged 95 and over may be due to other factors associated with age, such as living in residential aged care (RAC) and increased mortality (Figure 5.1, Box 5.2).

The median LOS for the acute continuous period of care increased only slightly with increasing age, from 6 days in patients aged 45–54, to 8 days in those aged 95 and over. As such, the increase in LOS with increasing age was largely driven by increased time spent outside the acute phase of care.

Figure 5.1: Length of overall stay, for surgical first hip fracture patients with a finished stay, by sex and age



Notes

1. Length of stay starts at the first admission with an acute, principal diagnosis of hip fracture or hip fracture in hospital ('index' hospitalisation).
2. Length of stay includes all care received from index hospitalisation to end of stay.
3. Same-day stays are counted as having length of stay of one day.
4. People with an unfinished stay are excluded from this analysis.
5. People with a hip fracture in hospital are excluded due to unknown timing of hip fracture.
6. See Box 5.2 for how to interpret this figure.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

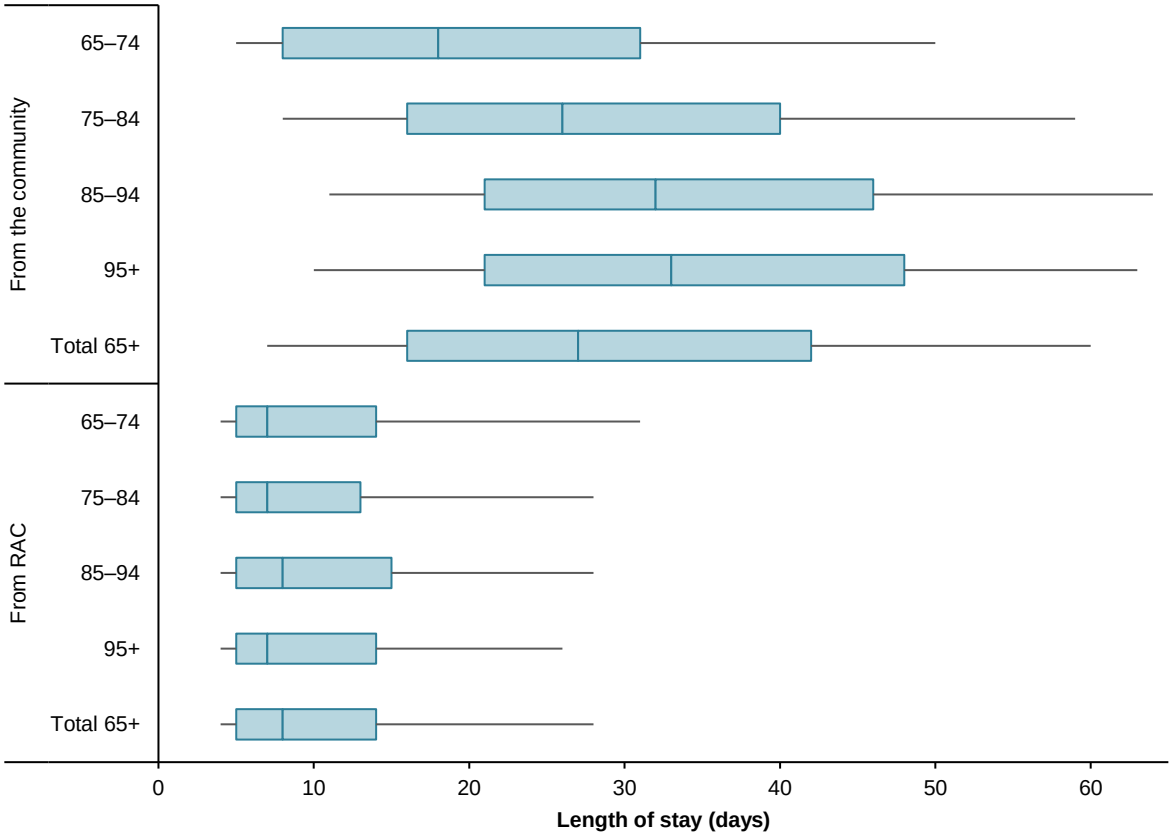
RAC origin was associated with a shorter hospital length of stay

Among surgical patients, those in the community before their hip fracture stay had a longer LOS (median 26 days) than patients from RAC (median 8 days).

While patients from both the community and RAC spent a similar length of time in acute care (median 8 days and 7 days respectively), patients from RAC were far less likely to have a rehabilitation phase in their stay (11% compared with 51%), which may contribute to the shorter LOS observed in patients from RAC.

LOS tended to increase by age in patients from the community but remained stable in patients from RAC across age groups. The median LOS for patients from the community aged 65–74 was 18 days, increasing to 33 days in patients aged 95 and over. The median LOS for patients from RAC was between 7 and 8 days across all age groups (Figure 5.2, Box 5.2).

Figure 5.2: Length of overall stay, for surgical first hip fracture patients with a finished stay, by pre-fracture residence and age, 2013–14 to 2016–17



Notes

1. Length of stay starts at the first admission with an acute, principal diagnosis of hip fracture or hip fracture in hospital ('index' hospitalisation).
2. Length of stay includes all care received from index hospitalisation to end of stay.
3. Same-day stays are counted as having length of stay of one day.
4. People with an unfinished stay are excluded from this analysis.
5. People with a hip fracture in hospital are excluded due to unknown timing of hip fracture.
6. See Box 5.2 for how to interpret this figure.

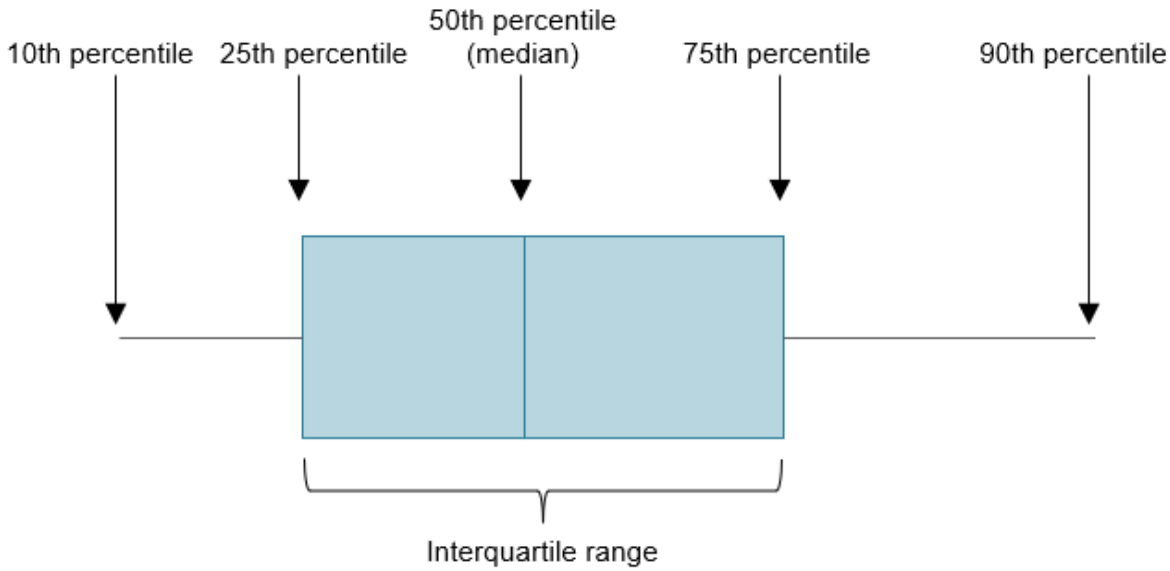
Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Box 5.2: How to read box plots

The values shown for LOS in the box plots in this section are the 10th percentile, 25th percentile, the median (or 50th percentile), 75th percentile and 90th percentile.

As an example of interpreting the percentiles, the 25th percentile shows at what value at least 25% of the population has a LOS equal to or lower than this. For example, if the 25th percentile is a length of stay of 10 days, then 25% of the population had a LOS equal to or less than 10 days, and 75% of the population had a LOS longer than 10 days.

The interquartile range is a measure of the variability or spread of the LOS values and is the difference between the 75th percentile (or 3rd quartile) and the 25th percentile (or 1st quartile) values.



Procedures in hospital

Types of hip fracture surgery

Different fracture types were managed with different types of surgical procedures. As expected, hip fracture surgery to repair and stabilise the fracture (such as via internal fixation) was most common for intertrochanteric and subtrochanteric fractures. Surgery to replace the broken parts (such as hemiarthroplasty or total arthroplasty) was more common for femoral neck fractures (Table 5.1).

Table 5.1. The proportion of patients who received each type of hip fracture-related surgery[(a)], by fracture type, 2013–14 to 2016–17

Procedure		Neck of femur	Intertrochanteric	Subtrochanteric	Total
Internal fixation of fracture of trochanteric or subcapital femur[(b)]	%	34.2	96.8	96.8	61.3
Hemiarthroplasty of femur[(c)]	%	50.2	1.7	1.4	29.2
Total arthroplasty of hip, unilateral[(d)]	%	14.0	1.1	0.7	8.4
All other surgery procedures[(e)]	%	11.5	7.6	21.0	10.6
Total patients with at least one procedure[(a)]	**N**	**34,267**	**22,697**	**3,454**	**60,418**

(a) Patients may have multiple different surgical procedures associated with their hip fracture.

(b) Includes ACHI code 47519-00 or MBS code 47519.

(c) Includes ACHI code 47522-00 or MBS code 47522.

(d) Includes ACHI code 49318-00 or MBS codes 49318 or 49321.

(e) 'All other surgery procedures' includes the following ACHI procedures that were also considered as surgery treatment for hip fractures: 47516-01, 47531-00, 47528-00, 47528-01, 48200-00, 48203-00, 49312-00, 49315-00. 90607-00, 90607-01, 49319-00, and the following MBS codes: 47516, 47531, 47528, 48200, 48203, 49312, 49309, 49315, 49319.

Note: MBS items reflect those that were current during the reference period.

Source: AIHW NIHSI 2018–19, analysis of NIHSI.

Hip fracture revision

Another type of surgical procedure received by hip fracture patients includes hip fracture revision procedures. Overall, 1.3% (800) first hip fracture patients received a revision procedure during the same period as they received a hip fracture surgery procedure. Hip fracture revision procedures:

- were more common among men than women (1.7% compared with 1.2%)
- decreased with increasing age (from 2.8% among people aged 45–54, to 0.9% among people aged 85 and over).

Hip fracture revision procedures in patients readmitted to hospital are also explored in Chapter 7 'Readmission to hospital'.

Allied health interventions in hospital

Other types of procedures in hospital were examined among hip fracture patients whose surgery was captured in hospital (rather than in MBS data). Hip fracture patients commonly receive allied health interventions during their hip fracture hospital stay. The most common of these were:

- physiotherapy (98%)
- occupational therapy (71%)
- dietetics (46%)
- social work (44%)
- pharmacy (37%).

6 Discharge pathways

This section describes the discharge pathway of surgically treated patients, and focuses on people aged 65 and over.

Key findings:

Among patients who had been in the community before their fracture, 15% were in RAC 120 days after their fracture and 12% had died.

Among patients who had been in RAC before their fracture, 66% continued to live in RAC 120 days after their fracture and 33% had died.

Why measure discharge to usual place of residence?

Hip fractures cause considerable functional impairment and greatly affect the lives of people with hip fractures, as well as the lives of their carers. Linked data help us understand a patient's movement across the hospital and aged care systems, before and after their hip fracture hospital stay.

Appropriate discharge from acute care reduces unplanned readmission and improves patient outcomes (ACSQHC 2020). Any services, equipment, medicine and assistance a patient may need when they leave hospital should be considered to ensure that the support required is in place (Healthdirect 2022).

In this section, post-hospital destination is provided:

- immediately following the hospital stay, to capture information about the end of the hospitalisation (Box 6.1)
- at 7 days after the end of the hospital stay, to capture the period shortly after hip fracture care
- at 120 days after the end of the hospital stay, to be consistent with the Hip Fracture Clinical Care Standard's indicators to support monitoring of hip fracture care (ACSQHC 2023).

Discharge to usual place of residence is an indicator of effective care in the hip fracture care pathway, reflecting patients leaving acute care without complex health or social care needs. Of particular interest are cases where the patient was previously living in the community and was discharged to a residential aged care (RAC) facility. Criteria for admission to RAC facilities in Australia include reduction in the ability to care for self, increased frailty and/or cognitive decline (Department of Health and Aged Care 2021). Factors such as functional capacity, cognitive status, current home suitability and availability of adequate formal or informal care and services are considered when determining the appropriate discharge location after hip fracture hospitalisation (Barberi and Mielli 2018). Due to the focus on a post-hospital destination of RAC, this analysis is restricted to patients aged 65 and over. Other Australian studies comparing hip fractures in community and residential aged care patients have also used 65 years and over as a threshold in analysis (Mitchell et al. 2019).

Box 6.1: What is included in the definition of usual residence immediately following the hospital stay?

Post-hospital discharge does not identify whether patients were discharged to a different example of the same accommodation type. For example, a patient who used to live alone but moved in with a carer after discharge would appear as a patient previously living in a private dwelling and being discharged to a private dwelling. Similarly, RAC patients who are transferred to alternative facilities that offer increased support are not captured.

Additionally, RAC is recorded as a discharge location only where a patient is beginning a new episode of RAC care. Otherwise, a patient returning to RAC will be recorded as returning to their usual accommodation. Linked RAC data were further used to identify those patients whose usual residence, and discharge location, was likely to be RAC.

Discharge pathway of patients aged 65 and over

Most patients returned to their usual place of residence following discharge from hospital for hip fracture. That is, most patients from the community returned to the community, and most patients from RAC returned to RAC. This section considers separately the discharge location for patients in the community or from RAC before their stay.

Discharge location of patients from the community

Among surgical patients who were in the community before their fracture, immediately following their hospital stay:

- 64% went to their usual or private accommodation
- 14% went to RAC (this can include respite or permanent RAC)
- 12% had a transfer or continuing care
- 5.5% died in hospital.

Location 7 days after hip fracture hospital stay

Among surgical patients who were in the community before their fracture, at 7 days after their hospital stay:

- 82% were in the community. Patients in the community are those who were not in RAC or had not died at 7 days. This is assumed to reflect patients living in their usual residence or private accommodation. As with patients in the community before hip fracture, patients in the community after hip fracture may have been receiving out-of-scope services, but this was assumed to be rare.
- 12% of patients were in RAC, a decrease from 14% immediately after their hospital stay. The slight reduction in the proportion of patients in RAC may reflect patients returning to the community, or dying. Returning to the community might be expected where patients were in respite RAC immediately following their hospital stay and returned to a private residence.
- 6% had died, a slight increase from 5.5% immediately after their hospital stay.

Discharge location of patients from RAC

Among surgical patients who were in RAC before their fracture, immediately following their hospital stay:

- 88% returned to RAC
- 6.5% died in hospital
- 4.1% had a transfer or continuing care
- 0.5% went to their usual or private accommodation. This could represent patients who are discharged into the community, or whose subsequent RAC episode was not linked to their record in the data.

At 7 days, patients from RAC were most likely to be in RAC (89%) or have died (10%).

Location 120 days after hip fracture hospital stay

This section explores a patient's location 120 days after the end of their hip fracture hospital stay, and provides information about the patient's transition from hospital care. Location was measured at 120 days to be consistent with the Hip Fracture Clinical Care Standard's indicators designed to support overall monitoring of hip fracture care (ACSQHC 2023).

Of surgical patients who were in the community before hospitalisation:

- 73% were in the community at 120 days, 15% were in RAC and 12% had died.
- The proportion of patients in RAC at 120 days increased with age (from 4.2% aged 65–69, to 32% aged 95 and over).
- A higher proportion of men (17%) than women (9.2%) died across all age groups. This affects the proportion of men and women in RAC at 120 days.
- The proportions of men and women in RAC 120 days after hip fracture were similar (both 15%).
- Men in younger age groups (aged 65–79) were more likely to be in RAC at 120 days than women, while women in older age groups (particularly those aged 90 and over) were more likely than men to be in RAC. The higher proportion of deaths among men in all age groups contributed to the higher proportion of women in RAC at older ages (Figure 6.1).

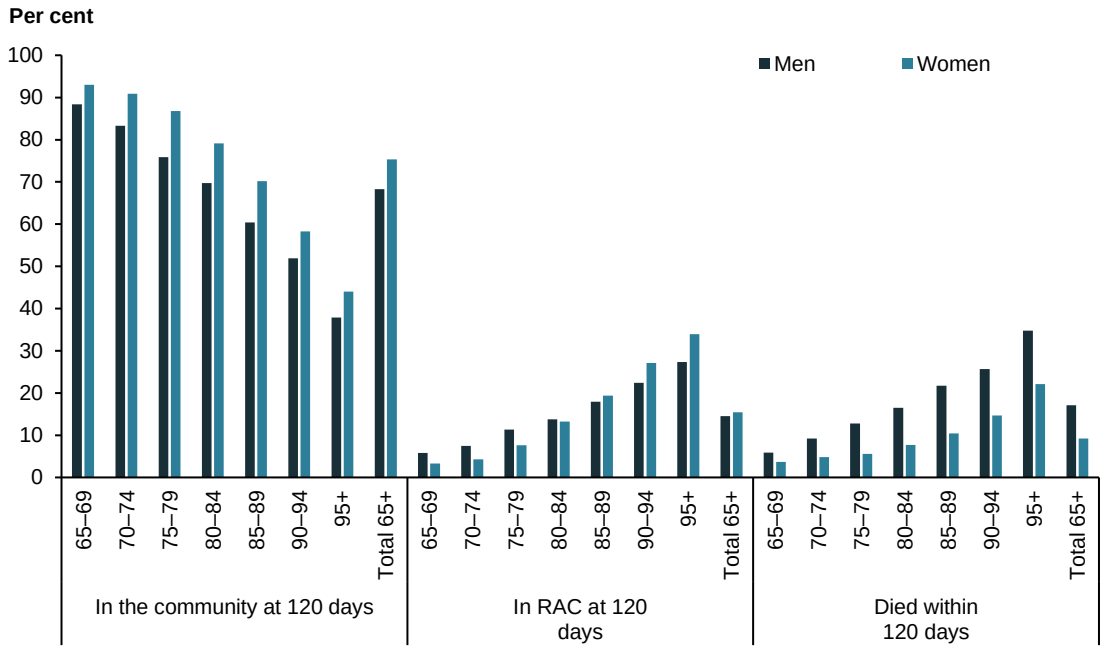
Another way to explore patient outcomes is to consider only those patients who are alive at 120 days. When patients who died were excluded from analysis, 83% of patients from the community were in the community and 17% were in RAC at 120 days.

Among surgical patients who were in RAC before their hip fracture:

- 66% continued to live in RAC at 120 days
- 33% had died.

For more information about the association between pre-fracture RAC residence and mortality, see 'Factors associated with one-year mortality'.

Figure 6.1: The location of surgical patients from the community aged 65 and over 120 days after the end of their hospital stay, 2013–14 to 2016–17



Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Patients who were in the community or had died at 120 days may have used RAC at some point following their hip fracture. The proportion of patients who ever used RAC within 120 days following their hip fracture provides an indicator of overall use of RAC in the period following hip fracture. Focusing on surgical patients from the community who were discharged from hospital alive:

- 3.3% of patients who were in the community at 120 days had ever used RAC within 120 days. This may represent patients who used respite RAC before returning to the community, or those moved from RAC to other services not captured in the data.
- 49% of patients who had died by 120 days had used RAC before their death.

Return to pre-hospital destination

Hip fracture patients may never fully recover from their hip fracture, with reduced mobility, fewer patients living in a private home and lower quality of life (Dyer et al. 2016). This section compares a patient's residence at 7 days and at 120 days post discharge. The proportion of patients who were discharged to the community shortly after their hospital stay (within 7 days), and were in the community at 120 days, demonstrates the patient's pathway between health care settings even after a patient has transitioned outside of hospital. These results exclude patients who died within 7 days after discharge.

Generally, there was little movement between a patient's residence at 7 days and at 120 days:

- Those who were in the community at 7 days generally remained in the community at 120 days (88%); 7.6% entered RAC and 4.4% died.

- Those who were in RAC at 7 days generally remained in RAC (74%); a small proportion were in the community (2.7%) and 23% had died within 120 days.

Patients who were in RAC 7 days post discharge, but in the community 120 days after discharge, could reflect patients who had been using temporary respite care returning to the community. Any patients classified as living in the community may also have accessed other aged care programs (such as home support, home care or flexible care) or other health care services out-of-scope of the NIHSI version 1.0 used in this analysis. While some patients in the community may have been in hospital, this was rare (see *Technical notes*).

7 Readmission to hospital

Hospital readmission is costly, not wanted by patients, and an indicator of the efficacy of discharge planning (BHI 2020). Understanding when readmissions occur, and why, could inform targeted interventions to reduce the risk of readmission.

In this section, readmission to hospital for any reason among hip fracture patients treated with surgery is explored at:

- 30 days after the end of the first hip fracture stay. Information about readmissions within 30 days of discharge and the reasons why can highlight potential areas for improvement (BHI 2020)
- 90 days, to indicate outcomes 3-months following fracture
- one year.

Key findings:

Of first hip fracture patients treated with surgery, 16% were readmitted to hospital for any reason within 30 days of the end of their hospital stay, 28% were readmitted within 90 days and 50% were readmitted within one year.

The most common reasons for a patient's first readmission within 30 days were hip fracture care, rehabilitation and complications of internal orthopaedic prosthetic devices, implants and grafts.

Defining readmission

Hospital readmissions are counted from the last day of the patient's hospital stay, to the admission date of their next hospital stay.

Only those patients who were discharged alive from hospital were included in analysis of readmission (57,100 surgical patients), and the 3,200 patients who died in hospital were excluded from analysis. Including patients who died during the hospital stay would underestimate the true rate of readmission in patients who are alive and able to be readmitted to hospital.

Episodes of dialysis were also excluded from this analysis, as patients receiving dialysis are likely to be readmitted to hospital multiple times and would appear as outliers when counting readmissions. Indeed, the 67,200 first hip fracture patients were associated with around 153,000 episodes of dialysis in the reference period (27% of all episodes captured for these patients). As such, episodes of dialysis are very common but reflect expected, effective care that is unlikely to be specifically related to the patient's hip fracture treatment pathway.

How many hip fracture patients are readmitted to hospital?

Among first hip fracture patients treated with surgery:

- around 9,000 (16%) were readmitted to hospital for any reason within 30 days of the end of their hospital stay
- 28% were readmitted to hospital within 90 days
- 50% were readmitted to hospital within one year.

Reason for readmission within 30 days

The most common principal diagnoses on readmission to hospital within 30 days were non-rehabilitation care for femur fracture (includes hip fracture, 7.2% of all readmitted surgical patients) or rehabilitation (including hip fracture rehabilitation, 6.4% of patients). Following this, the most common reasons for readmission were:

- complications of internal orthopaedic prosthetic devices, implants and grafts, 340 patients or 3.7%
- pneumonia (organism unspecified), 330 patients or 3.6%
- other disorders of the urinary system (includes urinary tract infection and incontinence), 280 people or 3.1%.

Types of complications causing readmission

Extra detail about readmissions due to complications of internal orthopaedic prosthetic devices, implants and grafts was explored using the 4th digit of the ICD-10-AM diagnosis code, which found that readmissions for complications of internal orthopaedic prosthetic devices, implants and grafts were most commonly due to:

- other complications of internal orthopaedic prosthetic devices, implants and grafts (26% of patients readmitted). These complications included haemorrhage, haematoma, embolism, pain, stenosis and metallosis
- mechanical complication of internal joint prosthesis (20%) or internal fixation device (14%)
- infection and inflammatory reaction due to internal joint prosthesis (20%) or internal fixation device (8%).

Readmission for complications of internal orthopaedic prosthetic devices, implants and grafts was associated with additional surgical or revision procedures. Surgical patients readmitted for such complications were much more likely to receive a hip fracture-related surgery or revision procedure in their readmission (42%) than patients readmitted for any other reason (5.0%).

Factors associated with 30-day readmission

Age and sex

The proportion of surgical patients readmitted to hospital (or rate of readmission) within 30 days varied by age and sex. Overall, men were more likely than women to be readmitted within 30 days (19% and 15%, respectively). Readmission increased with increasing age among men, and was fairly stable among women:

- 15% of men aged 45–54 were readmitted within 30 days, compared with 20% aged 95 and over
- around 13–15% of women were readmitted across each age group.

Discharge pathway

Readmission varies by a patient's discharge location after hospital. Patients were more likely to be readmitted within 30 days if they left hospital against advice, were discharged while on leave from hospital, or their discharge mode was unknown (23% of surgical patients readmitted within 30 days). On the other hand, patients were least likely to be readmitted if their stay ended on a transfer or continuing care (12% readmitted within 30 days). Patients who transferred may be receiving care in out-of-scope hospitals and therefore less likely to be admitted to an in-scope hospital within 30 days.

The relationship between mortality and readmission

There is a relationship between risk of readmission and mortality. In Australia, 51% of deaths in 2019 occurred in hospital (ABS 2021). Patients at risk of dying may be admitted to hospital for acute care or fatal events, resulting in high rates of readmission among patients who die in the period after their hip fracture. However, patients who die shortly after leaving hospital, without being readmitted, spend less time at risk of being readmitted than patients who are alive the entire period. This has the potential to produce an underestimate of the true risk of readmission.

There was a strong association between readmission within 30 days and dying within 30 days among surgical patients. Patients who were readmitted to hospital within 30 days were 2.2 times as likely to die within 30 days (9.2%) compared with patients who were not readmitted to hospital in the same period (4.2%).

The strength of the association between readmission and dying decreased at 90 days and one year among surgical patients:

- Patients who were readmitted within 90 days were 1.8 times as likely to die within 90 days (15%) as patients who were not readmitted in the same period (8.2%).
- Patients who were readmitted within one year were 1.3 times as likely to die within one year (23%) as patients who were not readmitted in the same period (18%).

As such, there was a strong association between readmission within 30 days and dying within 30 days among surgical patients, which persisted to a lesser degree at 90 days and one year.

Residential aged care origin

Overall, similar proportions of surgical patients from the community and from residential aged care (RAC) were readmitted within 30 days (16% and 17%, respectively).

There was a stronger association between readmission and death among patients from the community than among patients from RAC:

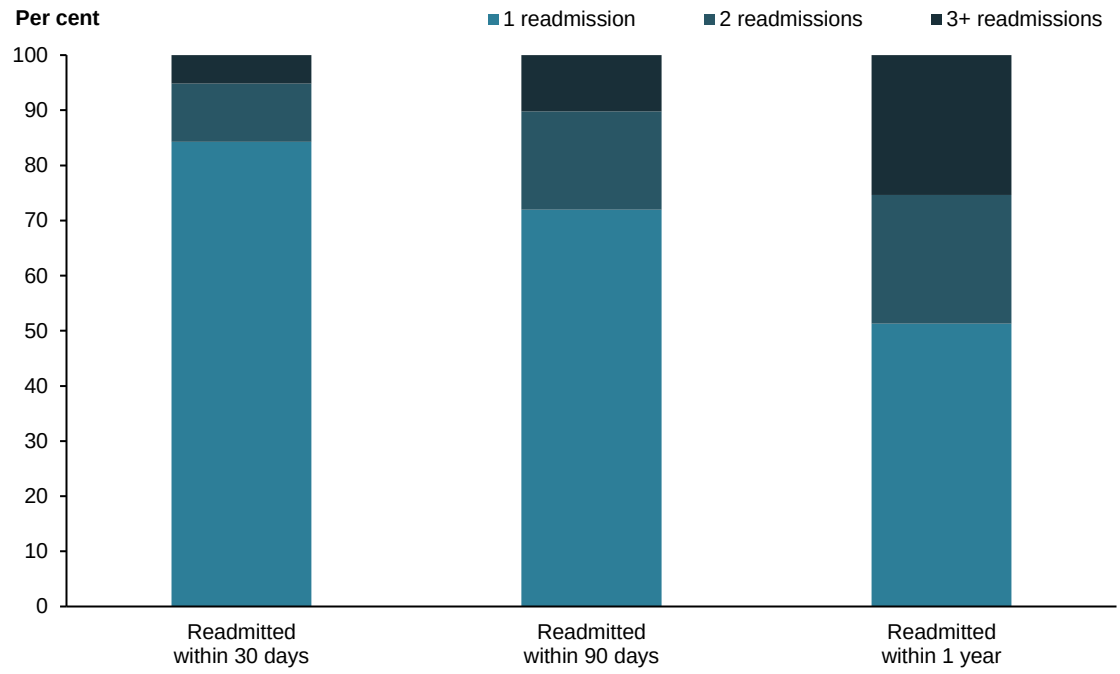
- Patients from the community who were readmitted within 30 days were 4 times as likely to die within 30 days of admission for their hip fracture as those who were not readmitted. That is, 6.0% of patients from the community who were readmitted died within 30 days, compared with 1.5% of patients who were not readmitted.
- Patients from RAC who were readmitted within 30 days were 1.5 times as likely to die within 30 days of admission for their hip fracture as those who were not readmitted (19% compared with 13%).

This may reflect patients from the community entering hospital for life-threatening events, while many aged care residents will die in RAC (AIHW 2021c).

How many times are hip fracture patients readmitted to hospital within 30 days, 90 days and one year?

Most people have only one readmission within 30 days, 90 days or one year. Of those surgical patients readmitted within 30 days, 84% were readmitted for one hospital stay, 11% were readmitted for 2 hospital stays and 5.2% were readmitted for 3 or more hospital stays (Figure 7.1).

Figure 7.1: The proportion of readmitted surgical patients with one, 2 or 3 or more hospital stays within 30 days, 90 days or one year, first hip fracture between 2013–14 and 2016–17



Note: this excludes patients who were not readmitted within each of the time periods.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

8 Second hip fracture within one year

People who have had a low trauma fracture are at increased risk of subsequent fractures. Data from the Dubbo Osteoporosis Epidemiology Study show that the increase in risk persists for up to 10 years, with the highest risk of refracture in the first few years after fracture (Center 2017). This section investigates how many hip fracture patients treated with surgery have a second hip fracture within one to 3 years of their first hip fracture.

Key findings:

Three per cent of first hip fracture patients treated with surgery had a second hip fracture within one year.

The proportion of patients with a second hip fracture was higher among women, people with dementia and patients discharged to RAC, and increased with increasing age.

Defining second hip fractures

Hip fractures involve complex care, which may include multiple hospital episodes for a single hip fracture event. A key challenge in defining second hip fractures is determining whether a hospital episode for hip fracture care following the first hip fracture hospital episode is for the same fracture or for a new hip fracture. Further, it is not possible to tell from the data whether the second hip fracture is in the same hip joint or the opposite joint.

A patient was considered as having a second hip fracture if they had:

1. An acute, principal diagnosis of hip fracture at least 42 days (6 weeks) after the first hip fracture episode and not part of the same hospital stay.
2. A hip fracture that occurred due to a fall in hospital, where the hospital episode was after the start of their hip fracture care.

A 6-week period was used to define second hip fractures as broken bones usually take 6 to 8 weeks to recover (Healthdirect 2020).

How many patients have a second hip fracture?

Overall, 3.0% of first hip fracture patients (1,800) treated with surgery had a second hip fracture within one year.

Overall, the proportion of surgical patients with a second hip fracture among those who were alive at one year (3.2%) was higher than the proportion of second fractures among those who died within one year of fracture (2.5%). This may be expected, as patients who die shortly after their hip fracture have less time at risk of a second hip fracture.

Second hip fractures within 2 and 3 years after the first hip fracture episode were also explored. Of all first hip fracture patients, 4.7% (2,800) had a second hip fracture within 2 years. Among those patients with at least 3 years of follow-up data, the risk of a second hip fracture decreased over time, from 3.0% in the first year, to 1.7% in the second year and to 1.3% in the third year after their first hip fracture (a total of 6.0% within 3 years).

Second hip fractures in hospital

Both hip fractures in hospital and second hip fractures were rare in the hip fracture cohort. Due to small numbers, surgical and non-surgical hip fracture cohorts were combined to briefly explore how many second hip fractures occurred due to a fall in hospital. Overall, around 1 in 8 (12%) of all second hip fractures occurred due to a fall in hospital. This was higher than the proportion of first hip fractures that occurred due to a fall in hospital (2.6%).

Patients whose second hip fracture occurred due to a fall in hospital were more likely to also have had their first hip fracture in hospital (15%) than patients whose second hip fracture did not occur in hospital (2.4%). Hospitalised patients who fell and had a second hip fracture in hospital may have been particularly frail or in hospital for other underlying health conditions, which may have increased their risk of falling.

Characteristics of patients who have a second hip fracture

Among surgical patients, the proportion of patients who had a second hip fracture was higher among patients who:

- were older (1.8% among patients aged 45–64 compared with a peak of 3.5% among patients aged 85–94)
- were women (3.1% compared with 2.8% among men)
- had dementia (3.6% compared with 2.9% without dementia)
- were in residential aged care (RAC) 7 days after their hip fracture (3.7% compared with 3.1% among patients in the community).

While the proportion of patients who had a second hip fracture varied based on a patient's residence shortly after their hip fracture, there was no difference when comparing the proportion of second hip fractures by pre-hospital residential aged care status. The proportion of surgical patients with a second hip fracture was similar among patients who were in the community and those in RAC (both 3.1%) before their initial fracture. However, this may reflect higher mortality rates among patients from RAC in the year following hip fracture, which means these patients have less time at risk of a second hip fracture than patients from the community. Indeed, after excluding patients who died within the year following hip fracture admission, 3.9% of patients from RAC had a second hip fracture, compared with 3.2% of patients from the community.

9 Non-surgical first hip fracture patients

This section presents an estimate of the number of first hip fractures in Australia that are managed without surgery, summarises their demographic and clinical characteristics and outcomes and makes comparisons with the surgically treated population.

Key findings:

First hip fracture patients living in *Major cities* were more likely to have had surgery (90%) than patients from *Remote* areas (85% received surgery).

The median length of stay in hospital was shorter among non-surgical patients (7 days) than among surgical patients (20 days).

Non-surgical patients were much more likely to die at the end of their hospital stay than surgical patients.

Characteristics of non-surgical patients

Surgical management varies by sex and age

Non-surgical management was more common in men and older people. Overall, men were more likely to be non-surgically managed than women (12% compared with 9.1%). The proportion of patients having hip surgery was highest among those aged 65–84 (91%) and lowest in those aged 95 and over (86%).

Remoteness and socioeconomic area

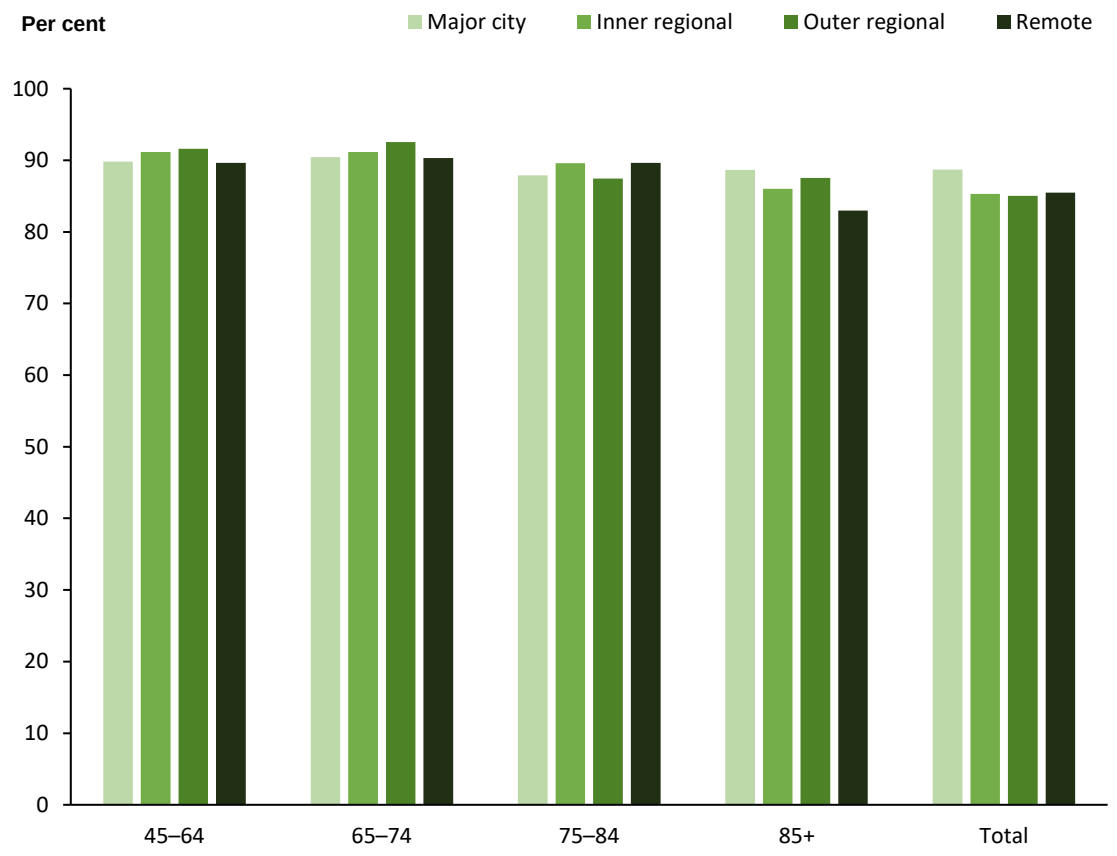
The proportion of patients receiving surgery varied by remoteness

Overall, most first hip fracture patients lived in *Major cities* among both surgical and non-surgical patients (67% of surgical patients and 63% of non-surgical patients).

First hip fracture patients living in *Major cities* were more likely to have had surgery (90%) than patients from *Remote* areas (85% received surgery). This pattern was true for both males and females.

Across age groups, those living in *Major cities* were more likely to have had surgery than patients from *Remote* areas, although the size of this effect varied by age and was lowest in patients aged 65–74 (Figure 9.1).

Figure 9.1: The proportion of surgically managed first hip fracture patients, by age and remoteness, 2013–14 to 2016–17



Notes

1. Remoteness area is based on ASGS 2011 remoteness or ASGS 2016 remoteness depending on the year of separation of the patient's first hip fracture episode (records that separated after 30 June 2017 use ASGS 2016).

2. The proportion of the population living in each remoteness area within each SA2 was used to estimate the number of patients in each remoteness area.

3. Patients with a missing or invalid SA2 are excluded.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Socioeconomic area

First hip fracture patients were more likely to live in the most disadvantaged socioeconomic areas than in the most advantaged areas. Among surgical patients, 45% lived in the 2 most disadvantaged socioeconomic areas, compared with 35% living in the 2 least disadvantaged socioeconomic areas. Similarly, non-surgical patients were also more likely to live in the 2 most disadvantaged socioeconomic areas (48%).

The rate of hip fractures was highest in the lowest socioeconomic areas for both surgical and non-surgical patients:

- There were 204 surgical first hip fracture patients per 100,000 population living in the lowest socioeconomic areas compared with 162 per 100,000 in the highest socioeconomic areas.
- There were 26 non-surgical first hip fractures patients per 100,000 population living in the lowest socioeconomic areas compared with 17 per 100,000 in the highest socioeconomic areas.

Generally, the proportion of first hip fracture patients who received hip surgery was similar across socioeconomic areas (between 89% and 91%).

Non-surgical patients more likely to come from residential aged care

Overall, 15,300 (28%) surgical patients and 2,000 (32%) non-surgical patients aged 65 and over were in residential aged care (RAC) before their hip fracture.

Similar to surgical patients, the incidence rate of non-surgical first hip fracture patients was higher in people from RAC than among people from the community.

Characteristics of non-surgical hip fractures

Compared with surgical patients, non-surgical patients were:

- more likely to have an intertrochanteric fracture (57% compared with 38% of surgical patients)
- less likely to have a neck of femur fracture (40% compared with 57%)
- less likely to have a subtrochanteric fracture (2.9% compared with 5.7%).

Overall, patients with intertrochanteric fractures were least likely to be surgically managed (85%) compared with neck of femur (93%) or subtrochanteric fractures (95%).

As in surgical patients, the majority of non-surgical fractures were caused by a fall-related injury event (92% of surgery patients and 88% of non-surgery patients).

Non-surgical patients were slightly less likely to have their fracture in a private home than surgical patients (43% compared with 49%), but were slightly more likely to have had their fracture in an aged care facility (29% compared with 26%).

Non-surgical patients had a shorter stay in hospital

Compared with surgical patients, non-surgical patients:

- had a shorter overall length of stay (median 7 days compared with 20 days among surgical patients)
- had a shorter acute continuous period (median 4 days compared with 8 days)
- were less likely to have rehabilitation care (18% compared with 40%), and spent slightly less time receiving rehabilitation care (median 17 days compared with 20 days)
- were slightly less likely to have other hip fracture care (18% compared with 21%), and spent less time receiving other hip fracture care (median 12 days compared with 16 days)
- were about as likely to have other care (9.2% compared with 10%), but spent less time in this care (median 9 days compared with 13 days).

As in surgical patients, the overall length of stay was shorter among non-surgical patients who died in hospital (median 4 days) than among those who finished their stay alive (median 9 days). The acute length of stay was also shorter among non-surgical patients who died (median 3 days) than among those who finished their stay alive (median 5 days).

Non-surgical patients were much more likely to die at the end of the hospital stay

Non-surgical patients may have a higher risk of death regardless of whether surgery is performed, possibly due to higher frailty or poor health contributing to risk of poor outcomes from surgery. Indeed, compared with surgical patients:

- Non-surgical patients who were in the community before their fracture were less likely to return to their usual or private accommodation (56% compared with 64% of surgical patients) and 2.9 times as likely to die at the end of their stay (16% compared with 5.5%).
- Non-surgical patients who were in RAC before their fracture were 4.4 times as likely to die at the end of their stay (29% compared with 6.5% of surgical patients from RAC).

Readmission among non-surgical patients

Compared with surgical patients, non-surgical patients were:

- about as likely to be readmitted to hospital for any reason within 30 days (17% compared with 16% of surgical patients)
- slightly more likely to be readmitted within 90 days (30% compared with 28%) and one year (53% compared with 50%)
- commonly readmitted for hip fracture care or rehabilitation care, pneumonia and disorders of the urinary system within 30 days. As expected, non-surgical patients were not commonly readmitted for complications of internal orthopaedic prosthetic devices, implants and grafts
- less likely to be readmitted within 30 days with increasing age, particularly among men (20% of men aged 95 and over treated with surgery were readmitted compared with 12% of non-surgical patients). Other factors associated with older age, such as mortality or RAC status, might affect the low readmission rate among older non-surgical patients.

There was not a strong relationship between mortality and readmission in non-surgical patients. Among non-surgical patients, a similar proportion died within 30 days for those who were readmitted within 30 days (8.3%) compared with patients who were not readmitted (9.5%). Further investigation would be required to determine if other factors, such as high mortality, receiving end-of-life or palliative care, older age, comorbidities or residential aged care status could affect the relationship between readmission and mortality among non-surgical patients.

Second hip fracture

The proportion of patients with a second hip fracture was the same for surgical and non-surgical patients (3.0%).

The rate of second hip fractures was particularly high among non-surgical patients who were alive at one year (4.1%) compared with those who had died (1.7% had a second hip fracture). This may be expected, as non-surgical patients are particularly likely to die in the period shortly after the hip fracture, thus having less opportunity to have a second hip fracture.

10 Mortality following a first hip fracture

An association between hip fractures and a substantially increased risk of mortality has been shown in several Australian studies among patients aged 60 or 65 and over (Frost et al. 2013; Lystad et al. 2017; Chen et al. 2018).

This section tracks hip fracture patients' survival at 30 days, 90 days and one year after they were first hospitalised with their first hip fracture. The proportion of hip fracture patients who die is compared with the proportion of matched hospitalised non-hip fracture patients who died in the same period. The matched controls, also described in Chapter 4 'Demographic and fracture characteristics', were matched on age, sex and RAC status before the start of the hospital stay separately for surgical and non-surgical patients.

Understanding when deaths occur, and why, could inform targeted interventions to reduce hip fracture mortality, in addition to prioritising hip fracture prevention. The data presented contribute to the monitoring of hip fracture mortality and in-depth analysis of factors associated with one-year mortality are explored.

Key findings:

Twenty-six per cent of first hip fracture patients and 25% of matched controls aged 45 and over died within one year of admission to hospital.

Accidental and other falls were the most common underlying causes of death for first hip fracture patients who died within 30 days.

Hip fracture patients from the community had higher one-year mortality than matched controls from the community after adjusting for age, selected comorbidities and other covariates. Among women from RAC, hip fracture patients had lower one-year mortality than matched controls.

More than 1 in 4 first hip fracture patients aged over 45 died within a year

Among first hip fracture patients aged 45 and over, the proportion who died was 8.5% at 30 days, 15% at 90 days and 26% at one year among first hip fracture patients aged 45 and over. This one-year mortality rate was only slightly higher than the proportion of matched non-hip fracture controls who died in the same period (25%).

Matched controls were selected from patients who were hospitalised during the reference period and represent a cohort of patients who are in poorer health than an ideal control group selected from a sample of all Australians aged 45 and over (Box 10.1). While the matched controls have higher mortality than the general population aged 45 and over, they are a valuable group for comparing first hip fracture patients with other hospitalised patients who did not have a hip fracture because we can adjust for characteristics related to mortality using NIHSI data (see 'Factors associated with one-year mortality').

Box 10.1: Hip fracture patients and matched, hospitalised controls have higher all-cause mortality than the general Australian population

Hip fractures have been shown to be associated with a substantially increased risk of mortality, and the risk of mortality is higher for men than women (Frost et al. 2013; Lystad et al. 2017; Chen et al 2018). For example, Lystad et al. 2017 found that among people aged 65 and over, men with a hip fracture were more than 4 times more likely to die within one year and women were more than 3 times more likely to die within one year, compared to matched individuals selected from the Australian electoral roll.

The mortality rate of first hip fracture patients and matched controls aged 65 and over from the reference period (2013–14 to 2016–17) was compared to the all-cause mortality rate for the Australian population aged 65 and over by age group and sex from 2014 to 2017 using national deaths data (AIHW 2023a).

This comparison showed that both hip fracture patients and matched controls had substantially higher all-cause mortality rates than the Australian population. Compared with the crude mortality rate among the Australian population aged 65 and over (3,600 deaths per 100,000 people):

- the crude mortality rate among hip fracture patients aged 65 and over was 7.6 times as high (27,000 deaths per 100,000 hip fracture patients)
- the crude mortality rate among matched controls aged 65 and over was 7.4 times as high (at 26,000 deaths per 100,000 matched controls).

After accounting for age, the age-standardised mortality rate among hip fracture patients aged 65 and over was 5.1 times as high as for the Australian population of the same age.

The mortality rate ratio of first hip fracture patients to the Australian population aged 65 and over was higher for men than women at the same age. Although the mortality rate increased with age among both populations, the mortality rate ratio decreased with age. Compared with the Australian population, the crude mortality rate among first hip fracture patients was:

- 11 times as high among men and women aged 65–74
- 7 times as high among men and 6 times as high among women aged 75–84
- 3.1 times as high among men and 2.5 times as high among women aged 85 and over.

Hip fracture patients are older on average than the general population within each of the age groups, and the crude mortality rates have not been adjusted to account for these differences. Matched, hospitalised controls had a more similar mortality rate to the hip fracture patients than the general Australian population.

Among first hip fracture patients, the proportion of patients treated with surgery who died was steady over each year of the reference period with around:

- 6.8% of patients dying within 30 days
- 13% dying within 90 days
- 24% dying within one year.

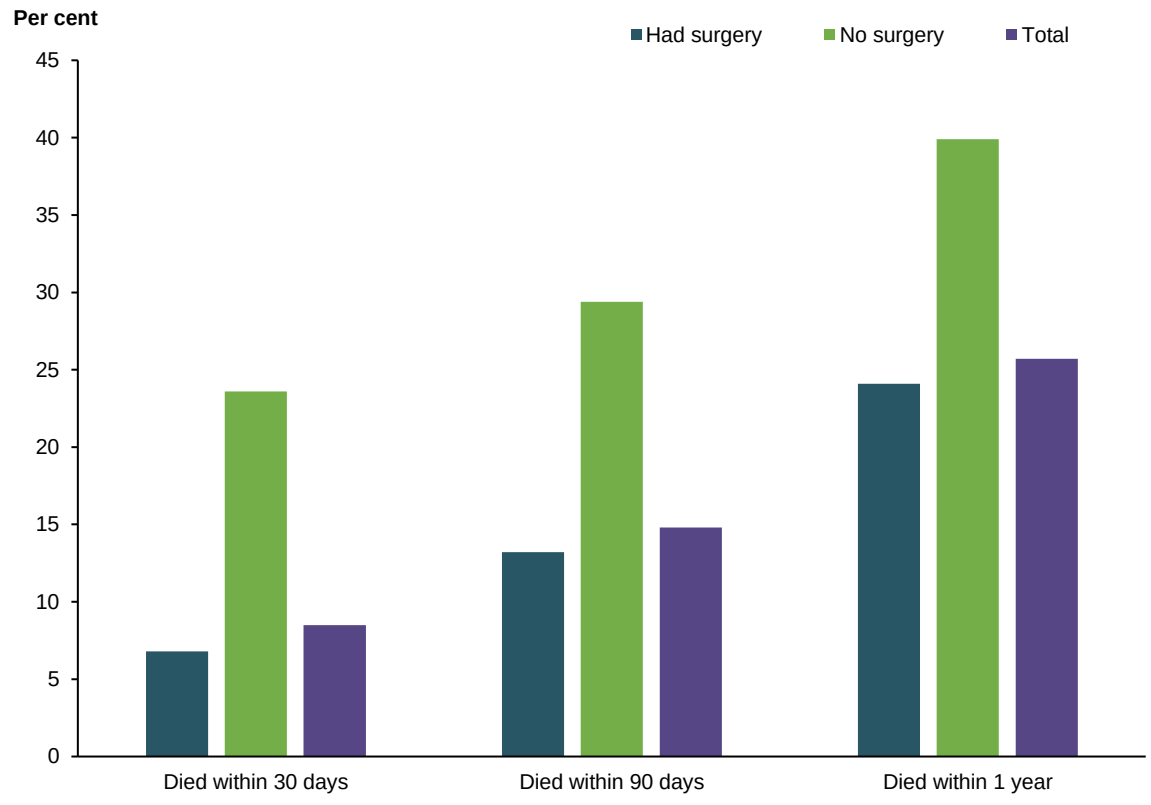
Non-surgical patients were consistently more likely to die than surgical patients. Compared with surgical patients, non-surgical patients were:

- 3.5 times as likely to die within 30 days (24%)
- 2.2 times as likely to die within 90 days (29%)
- 1.7 times as likely to die within a year (40%) (Figure 10.1).

The matched controls for non-surgical patients also had a higher one-year mortality (28%) than the matched controls for surgical patients (24%). This is expected because non-surgical patients are more likely to be older and male. Additionally, high mortality among non-surgical hip fracture patients may represent patients who die before they get a chance to receive surgery, or frail patients who had a high risk of death with or without receiving surgery.

Unless specified, results for surgical and non-surgical patients were combined in the remaining analysis in this section, to better represent the overall patterns in mortality among first hip fracture patients.

Figure 10.1: The proportion of first hip fracture patients who died within 30 days, 90 days and one year of admission, admitted between 2013–14 and 2016–17



Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Mortality among first hip fracture patients was higher at younger ages than in matched controls

Among first hip fracture patients, mortality was consistently higher in older first hip fracture patients than in younger patients, with patients aged 95 and over 6 times as likely to die within one year as patients aged 45–64 (49% compared with 7.8%).

Overall, men were more likely to die within one year than women (32% of men compared with 23% of women), with the difference between men and women higher at the older age groups, and little difference between men and women aged 45–64.

When comparing mortality between first hip fracture patients and matched non-hip fracture controls, the association between mortality and hip fracture decreased with age. Compared with matched controls, first hip fracture patients aged 45–64 were:

- 1.1 times as likely to die within 30 days
- 1.4 times as likely to die within 90 days
- 2.1 times as likely to die within one year.

This association was reversed among those aged 95 and older. Compared with matched controls, first hip fracture patients aged 95 and over were:

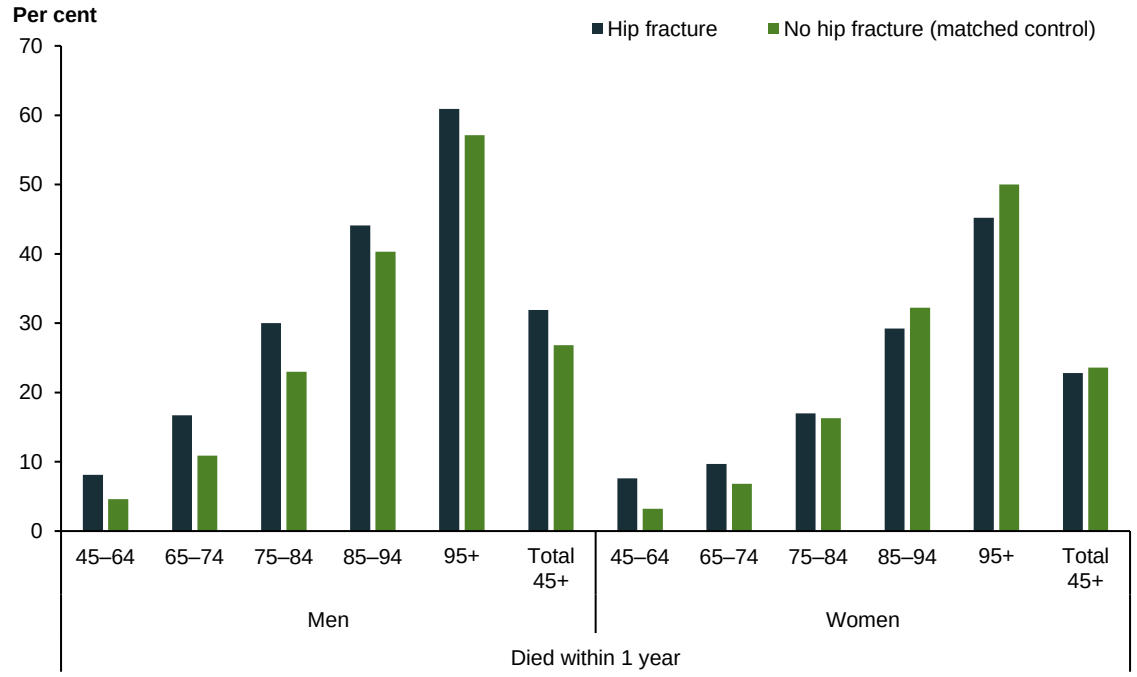
- 0.8 times as likely to die within 30 days
- 0.9 times as likely to die within 90 days
- 0.9 times as likely to die within one year.

Overall, the difference in mortality between first hip fracture patients and matched controls across age groups was highest at one year.

The association between mortality and hip fracture decreased with age even more among women than men. For men who had a hip fracture, the proportion who died within one year ranged from 1.8 times as likely for those aged 45–64 when compared with matched controls, down to 1.1 times as likely for those aged 95 and over (Figure 10.2). Overall, 32% of male first hip fracture patients and 27% of matched controls aged 45 and over died within one year.

For women who had a hip fracture, the proportion who died within one year ranged from 2.4 times as likely for those aged 45–64 when compared with matched controls, down to 0.9 times as likely for those aged 95 and over. Overall, one-year mortality was similar between female first hip fracture patients and matched controls: 23% of female first hip fracture patients and 24% of matched controls aged 45 and over died within one year.

Figure 10.2: The proportion of first hip fracture patients and matched non-hip fracture controls who died within one year of admission, by sex and age group, first hip fracture between 2013–14 and 2016–17



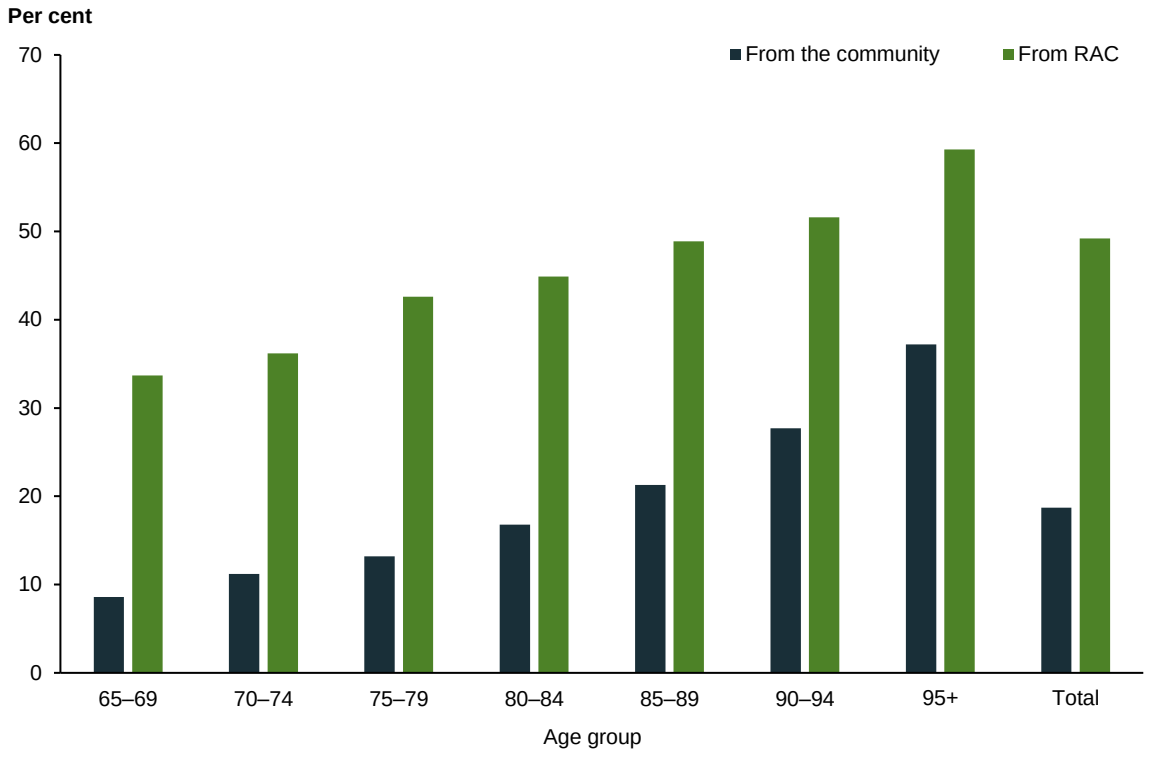
Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Patients from residential aged care were more likely to die within one year than patients from the community

Almost half (49%) of patients aged 65 and over in residential aged care (RAC) before their hip fracture died within one year; this was 2.6 times as likely as those who were in the community (19%) before their hip fracture.

The difference between patients from RAC and the community was bigger in the younger age groups (3.9 times as high in patients from RAC than in patients from the community in those aged 65–69, compared with 1.6 times in those aged 95 and over; Figure 10.3). This is consistent with patients from RAC having higher care needs and frailty then people in the community, which may be expected to be associated with higher mortality.

Figure 10.3: The proportion of first hip fracture patients who died within one year of admission, by age and pre-fracture residence, admitted between 2013–14 and 2016–17



Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

One-year mortality is higher in first hip fracture patients from the community than in matched controls

This section explores how one-year mortality among patients from RAC or the community differs between first hip fracture patients and matched controls. Among patients from the community, first hip fracture patients were slightly more likely to die within one year (19%) than matched controls (17%). The reverse was observed among patients from RAC: first hip fracture patients from RAC were slightly less likely to die within one year (49%) than matched controls (52%). The relationship between residential aged care and hip fracture on mortality is further explored in ‘Factors associated with one-year mortality’.

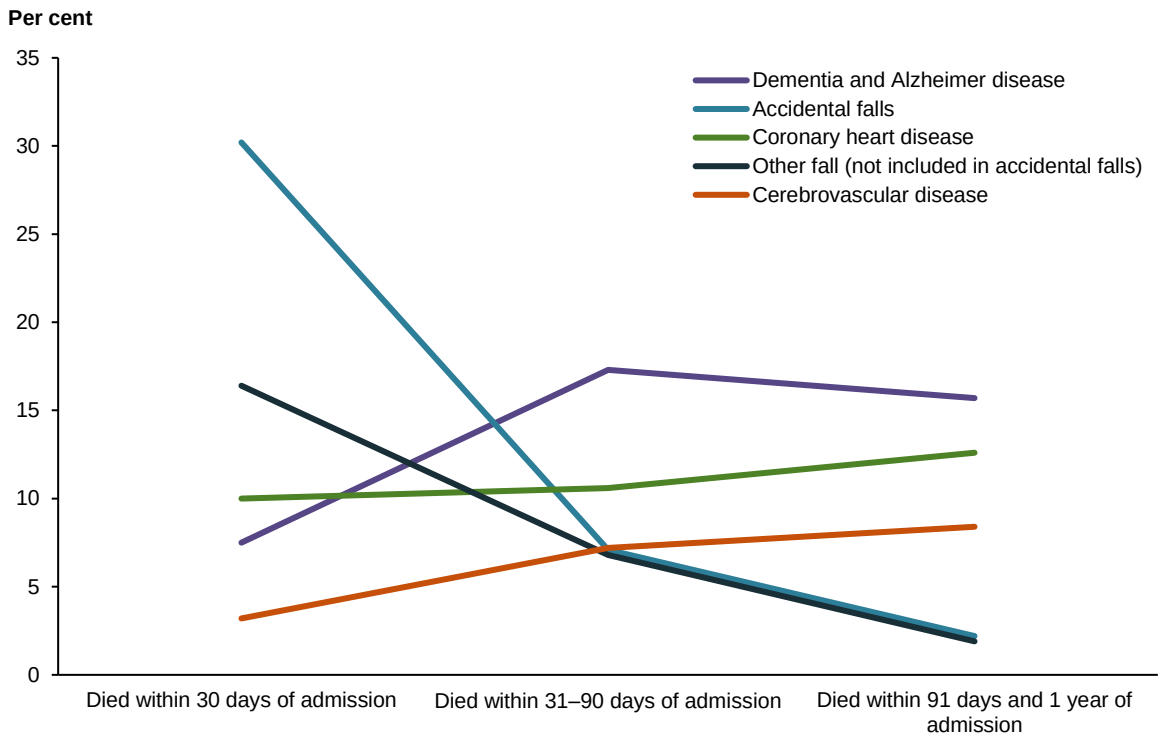
Cause of death following first hip fracture

Deaths data contain information on the underlying cause of death, which represents the disease or injury that initiated the train of morbid events leading to a person’s death, according to information available to the coder. If a death was due to an injury such as hip fracture, the ICD-10 requires that the external cause (such as a fall) is entered as the underlying cause of death. However, there is poor coverage of the fall type in the National Mortality Database, with deaths due to falls often classified as ‘other’ or ‘unspecified’ (AIHW 2022c).

The most common cause of death varied across each time point investigated. For first hip fracture patients who died within 30 days, accidental falls were the most common underlying cause of death (30%) followed by other falls (16%). These falls were likely associated with the hip fracture event, although it is possible that patients had a second, fatal fall after their

first hip fracture. For patients who died within 90 days and one year, dementia was the most common underlying cause of death (Figure 10.4).

Figure 10.4: The proportion of hip fracture patients who died within 30 days, 90 days and one year of admission, by the top 5 causes of death, admitted between 2013–14 and 2016–17



Notes

1. Dementia and Alzheimer disease are indicated using ICD-10-AM codes F00–F03, F05.1, F10.7, F13.7, F18.7, G30.
2. Accidental falls are indicated using ICD-10-AM codes W00–W19.
3. Coronary heart disease is indicated using ICD-10-AM codes I20–I25.
4. Other fall is indicated using ICD-10-AM code X59.
5. Cerebrovascular disease is indicated using ICD-10-AM codes I60–I69.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Does cause of death differ between hip fracture patients and matched controls?

Matched non-hip fracture control patients were much less likely to die from accidental falls or other falls. Compared with hip fracture patients, matched non-hip fracture patients were:

- 11 times less likely to die from accidental falls within 30 days (2.7%)
- 27 times less likely to die from other falls within 30 days (0.6%)

Among matched non-hip fracture controls the most common causes of death at each time point were coronary heart disease, dementia and cerebrovascular disease. As such, apart from death due to accidental or other falls, the common causes of death among matched non-hip fracture controls were also common among first hip fracture patients.

Remoteness and socioeconomic area

There was little variation in one-year mortality across remoteness, with mortality between 25% and 27% across all remoteness areas. However, this pattern may be due to demographic differences among patients living in these areas. After adjusting for known covariates, patients living outside *Major citie*s had higher one-year mortality than those in *Major cities* (see 'Factors associated with one-year mortality among first hip fracture patients').

There was also little variation in one-year mortality across socioeconomic areas, although one-year mortality was slightly higher among areas with the most disadvantage (26–27% in socioeconomic areas 1, 2 and 3) compared with socioeconomic areas with the least disadvantage (25% in socioeconomic area 4 and 24% in socioeconomic area 5). However, there was little difference between the most disadvantaged socioeconomic areas and all other areas after adjusting for covariates (see 'Factors associated with one-year mortality among first hip fracture patients').

Comorbidities

In this report, a comorbidity refers to any additional disease that is experienced by a hip fracture patient. In administrative data sets, such as hospital data, comorbidities are often defined using coding algorithms based on ICD diagnosis codes. The Charlson Comorbidity Index can be used to predict patient outcomes, particularly mortality, based on administrative data. The Charlson Comorbidity Index is composed of 17 chronic conditions, each with a set of weightings based on the ability to predict mortality. These weightings can be summed to provide a comorbidity score (with higher scores indicating a higher risk of death) (Charlson et al. 1987; Quan et al. 2005). However, the literature recommends using individual comorbidities to better predict death after hip fracture (Toson et al. 2015).

The Charlson comorbidities measured in the year before hip fracture were:

- Acute myocardial infarction
- Cancer (malignant)
- Metastatic solid tumour (cancer)
- Cerebrovascular disease
- Chronic pulmonary disease
- Congestive heart failure
- Dementia
- Diabetes (without complications)
- Diabetes (with complications)
- Hemiplegia or paraplegia
- Mild liver disease
- Moderate or severe liver disease
- Peptic ulcer disease
- Peripheral vascular disease
- Renal disease
- Rheumatic disease.

HIV/AIDS was excluded due to small numbers. The ICD-10 codes used to identify comorbidities were based on the algorithm described by Quan et al. (2005).

As expected, first hip fracture patients and matched controls with one of the selected Charlson comorbidities in the previous year were generally more likely to die within one year than those who did not have the condition. Rheumatic disease was the exception: a lower proportion of first hip fracture patients with the disease died within one year (23%) compared with those without the disease (26%). The relationship between first hip fracture and one-year mortality after controlling for these comorbidities is explored in 'Factors associated with one-year mortality among first hip fracture patients'.

Type of fracture

Among surgical first hip fracture patients, those with intertrochanteric fractures were most likely to die within one year (26%), compared with neck of femur (23%) or subtrochanteric (21%) fractures. However, non-surgical patients with neck of femur fractures had the highest one-year mortality (50%) compared with subtrochanteric (39%) or intertrochanteric (33%) fractures.

Other factors, such as age, are associated with both type of fracture and one-year mortality, and the association between fracture type and one-year mortality is further explored controlling for age and other factors in 'Factors associated with one-year mortality among first hip fracture patients'.

External cause

The cause of hip fractures that had the highest proportion of patients who died within one year were:

- hip fracture that occurred due to fall in hospital (42% of first hip fracture patients with onset in hospital died within one year)
- low trauma falls (27%)
- accident due to unspecified factors (25%).

Death in hospital

Overall, 5.4% of surgical patients and 19% of non-surgical patients aged 45 and over died in hospital, based on the separation mode of the last episode in their hip fracture hospital stay. As patients can have extended stays in hospitals, this could represent patients who died months, or even years, after the start of their hip fracture. However, this was rare, and of people who died in hospital, 90% of surgical patients with hip fracture on admission to hospital had died within 50 days.

Factors associated with one-year mortality

The modelling carried out in this section includes only a subset of known factors that may influence one-year mortality following hip fracture. Results from this analysis need to be interpreted with caution and within the context of the information provided. Not all factors associated with mortality are included in this modelling.

To further explore the factors associated with one-year mortality among first hip fracture patients, and whether hip fracture is associated with mortality, logistic regression analysis was conducted (Box 10.2).

Box 10.2: What is logistic regression?

Logistic regression analysis is a statistical method used to estimate the strength of association between several explanatory variables (characteristics of interest) and an outcome of interest (in this case, one-year mortality). The method adjusts for the potential confounding effect among variables in the model.

Odds ratio (OR)

The OR is a measure of the association between an exposure and an outcome in logistic regression, equal to the odds of an outcome in one group divided by the odds of the outcome in the reference group. Therefore:

- an OR = 1 means that the odds of the outcome is equal in both groups
- an OR < 1 means that the odds of the outcome in the specified group is lower than the odds of the outcome in the reference group
- an OR > 1 means that the odds of the outcome in the specified group is higher than the odds of the outcome in the reference group.

The ORs from logistic regression analysis are adjusted to account for the other explanatory variables included in the model.

Reference value

This is the comparison group against which other groups in an explanatory variable are compared. The reference values used in the regression analysis are specified as 'ref' in figures 10.5 and 10.7.

Hip fracture is associated with one-year mortality

Hip fractures are more likely to occur among people who are frail or in poor health, who may be at risk of mortality regardless of whether they had a hip fracture. This section explores whether hip fracture patients are more likely to die within one year than those in a similar, matched hospitalised non-hip fracture cohort. This comparison population has stratification (matching) on age group at admission to hospital, sex and whether in RAC before the start of the hospital stay.

Logistic regression analysis was performed to compare one-year mortality among hip fracture and matched controls. The analysis controlled for:

- age
- sex, by whether or not the person had a hip fracture (see Box 10.3)
- remoteness area
- socioeconomic area
- all Charlson comorbidities in the previous year up to and including the first admission
- whether the person had been dispensed an osteoporosis medication in the year before their hip fracture
- residential aged care before the start of the hospital stay, by whether or not the person had a hip fracture (see Box 10.3).

Box 10.3: How to interpret interaction terms in logistic regression

An interaction occurs in logistic regression when the effect of one of the variables in model on the outcome is different depending on the value of another variable. For example, this report hypothesised that:

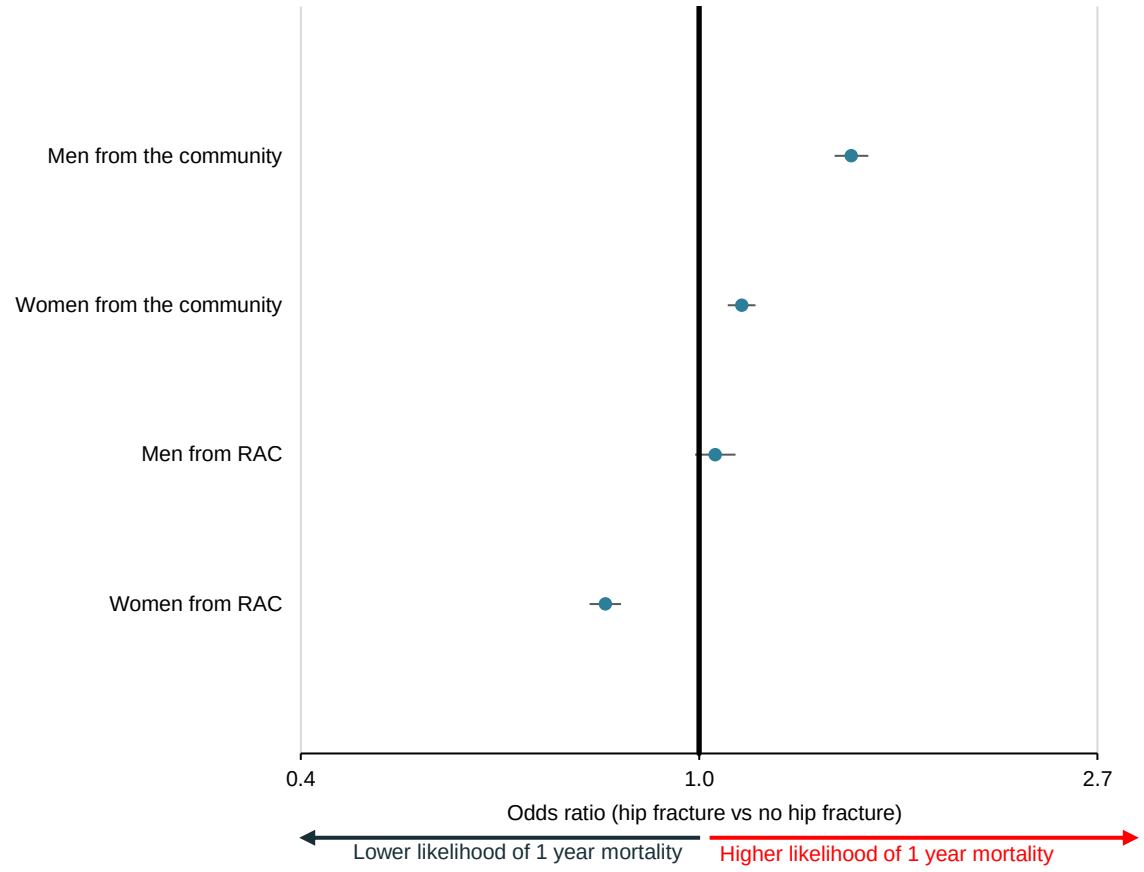
1. The association between whether someone had a hip fracture and one-year mortality was different for patients who had been in the community before their fracture compared with those from RAC.
2. The association between whether someone had a hip fracture and one-year mortality was different for men compared with women.

To explore these hypotheses, this report included the interaction between whether someone had a hip fracture and their RAC status, and whether they had a hip fracture and their sex in the analysis of one-year mortality.

Overall, hip fracture patients had higher one-year mortality than matched controls (OR 1.06, 95% CI: 1.04–1.09). Compared with matched controls, first hip fracture patients who were:

- men from the community had higher one-year mortality (OR 1.46, 95% CI: 1.40–1.53)
- women from the community had higher one-year mortality (OR 1.11, 95% CI: 1.07–1.15)
- men from RAC had similar one-year mortality (OR 1.04, 95% CI: 0.99–1.10)
- women from RAC had lower one-year mortality (OR 0.79, 95% CI: 0.76–0.82) (Figure 10.5).

Figure 10.5: Adjusted odds ratios from one-year mortality logistic regression among first hip fracture patients and matched non-hip fracture controls, admitted between 2013–14 and 2016–17



Notes

1. The model was adjusted for remoteness area, socioeconomic area, Charlson comorbidities and PBS dispensing in the year before fracture but these are not displayed in the figure.

2. Socioeconomic areas are classified according to population-based quintiles using the Index of Relative Socio-Economic Disadvantage (IRSD) based on Statistical Area Level 2 (SA2) of residence in the first hospital episode.

3. Patients with a missing or invalid SA2 are not shown.

4.Charlson comorbidities were identified in the first hospital episode or any hospital episode that started or ended in the year before admission.

5. 95% confidence intervals are shown.

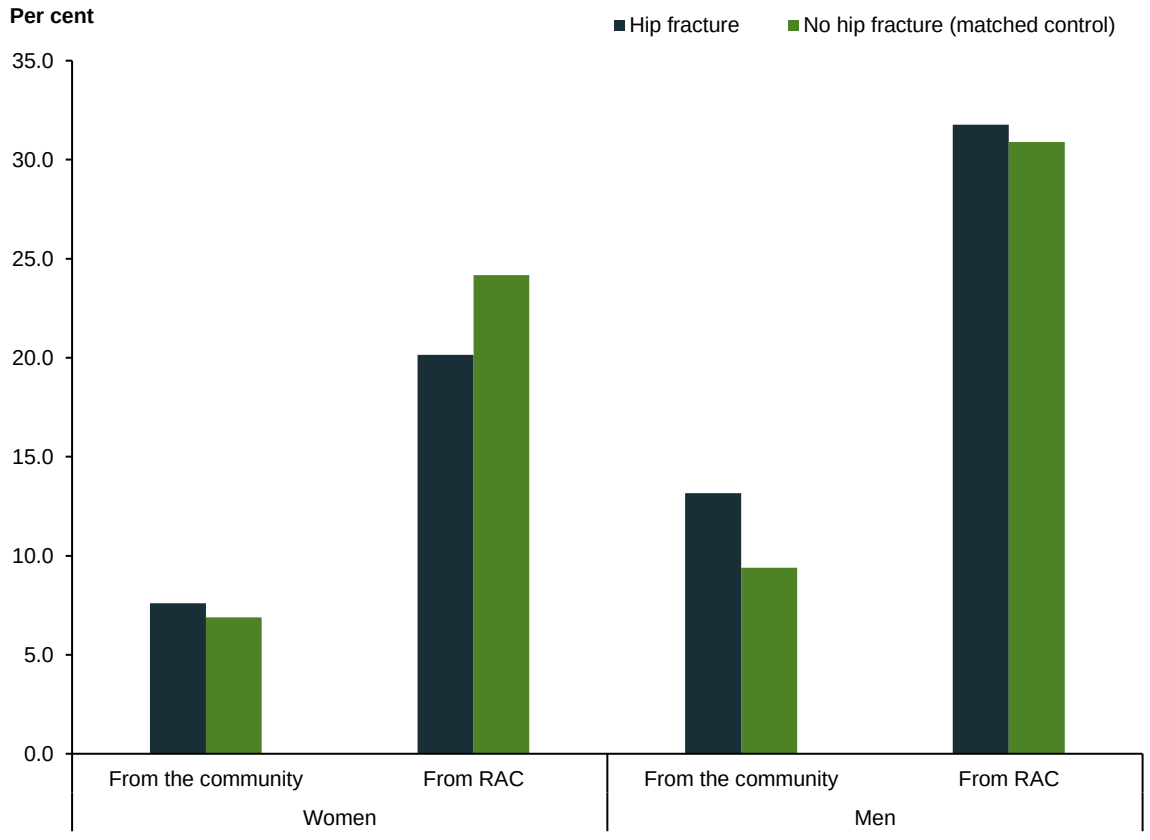
Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

An alternative way to show the difference in one-year mortality among first hip fracture patients and matched controls by sex and pre-fracture residence is using an example of the predicted probability of one-year mortality.

For example, if a person aged 82, living in a *Major cities* area and the middle 20% of socioeconomic areas, with no Charlson comorbidities in prior hospitalisations or dispensing of osteoporosis medications in the previous year was:

- male and from the community, the predicted probability of dying within one year was 13% if they had their first hip fracture, compared with 9.4% for matched controls
- female and from the community, the predicted probability of dying within one year was 7.6% if they had their first hip fracture, compared with 6.9% for matched controls
- male and from RAC, the predicted probability of dying within one year was 32% if they had their first hip fracture, compared with 31% for matched controls
- female and from RAC, the predicted probability of dying within one year was 20% if they had their first hip fracture, compared with 24% for matched controls (Figure 10.6).

Figure 10.6: The predicted probability of one-year mortality for a person aged 82, with selected characteristics, by whether had a hip fracture, pre-fracture residence and sex, admitted between 2013–14 and 2016–17



Note: The predicted probabilities are calculated for a hypothetical person aged 82, living in a *Major cities* area and the middle 20% of socioeconomic areas (area 3), with no prior Charlson comorbidity hospitalisations or dispensing of osteoporosis medications in the year before.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

Factors associated with one-year mortality among first hip fracture patients

This section explores one-year mortality among first hip fracture patients, and whether specific characteristics of the fracture or the patient are associated with one-year mortality after adjusting for other factors. Logistic regression analysis was performed to explore factors associated with one-year mortality for first hip fracture patients after controlling for:

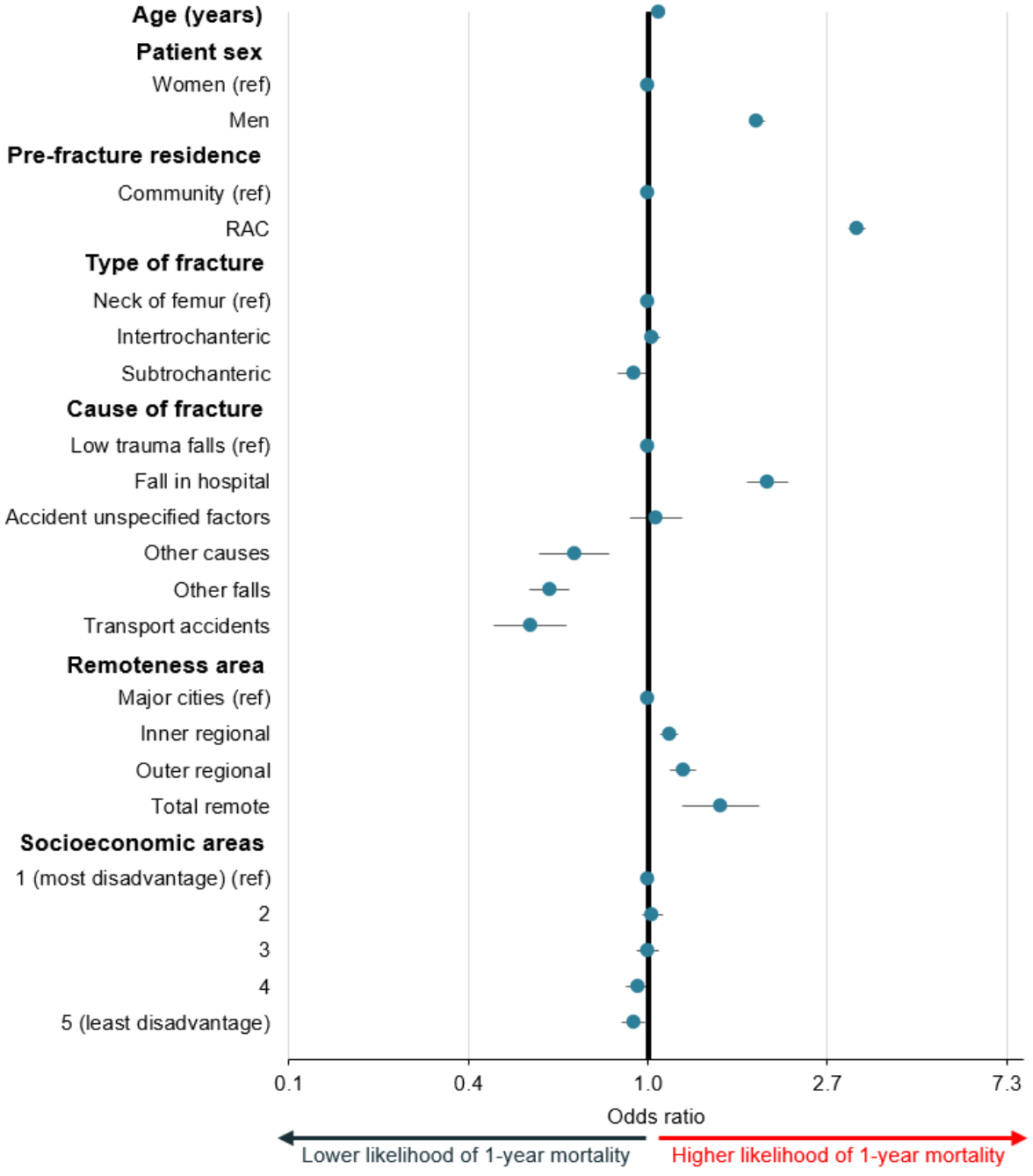
- age
- sex
- RAC before the start of the hospital stay
- the fracture subtype
- the cause of the fracture (such as low trauma falls)
- all Charlson comorbidities in the previous year up to and including the first hip fracture admission
- remoteness area
- socioeconomic area
- whether the person had been dispensed an osteoporosis medication in the year before their hip fracture.

Results of the logistic regression analysis show that, when adjusting for other factors in the model:

- Hip fracture patients who were hospitalised with comorbidities such as metastatic solid tumour, malignant cancer, liver disease, congestive heart failure, dementia, chronic pulmonary disease, acute myocardial infarction, renal disease, peripheral vascular disease, or cerebrovascular disease were more likely to die than hip fracture patients without these conditions.
- Hip fracture patients in RAC before their hip fracture hospital stay were more likely to die than patients from the community.
- Patients with a hip fracture due to a fall in hospital or low trauma fall were more likely to die than those with fractures due to other causes, such as other falls or transport accidents.
- Male first hip fracture patients were more likely to die than women.
- Older patients were more likely to die within one year.
- Hip fracture patients living outside of *Major cities* were more likely to die than patients living in *Major cities* (see Figure 10.7).

Fracture type, socioeconomic area and PBS dispensing in the year before fracture were not associated with one-year mortality after adjusting for other factors.

Figure 10.7: Adjusted odds ratios from one-year mortality logistic regression among first hip fracture patients, admitted between 2013–14 and 2016–17



Notes

1. Socioeconomic areas are classified according to population-based quintiles using the Index of Relative Socio-Economic Disadvantage (IRSD) based on Statistical Area Level 2 (SA2) of residence in the first hospital episode.

2. Patients with a missing or invalid SA2 are not shown.

3. The model was adjusted for Charlson comorbidities but these are not displayed in the figure. Charlson comorbidities were identified in the first hospital episode or any hospital episode that started or ended in the year before admission.

4. PBS dispensing in the year before fracture was not associated with one-year mortality after adjusting for other factors and is not displayed in the figure.

5. 95% confidence intervals are shown.

Source: AIHW NIHSI 2018–19, analysis of NIHSI. See Supplementary data tables.

11 Discussion

This section provides a discussion of the key findings. This report builds on and updates previously published work by the AIHW, and complements the clinical reporting done by the Australian and New Zealand Hip Fracture Registry (ANZHFR), and the work on health care variation produced by the Australian Commission on Safety and Quality in Health Care (ACSQHC). The linked data used in this report revealed new insights about patient journeys, and was used to describe:

- the characteristics of first hip fracture patients from a national population monitoring perspective
- patient discharge pathways and the transition from hospital care at the end of hip fracture care
- the rate of readmission following hip fracture care in Australian hospitals
- the proportion of patients who experience a second hip fracture
- mortality following first hip fracture and characteristics associated with increased likelihood of dying within one year of hip fracture.

The data presented for the reference period between 1 July 2013 and 30 June 2017 establish a baseline for future population monitoring work on hip fracture incidence, management and outcomes. The reference period for this data is before the COVID-19 pandemic, and the impact of COVID-19 on hip fracture pathways, such as possible excess mortality (Holleyman et al. 2022), may be explored in future work.

The rate of hip fractures decreased slightly

There were around 16,300 to 17,100 first hip fracture patients each year, with a total of 67,200 first hip fracture patients between July 2013 and June 2017. While the number of hip fractures increased in each year of the reference period, the rate of first hip fractures declined slightly. From the peak of 180 per 100,000 population in 2014–15 to 172 per 100,000 population in 2016–17, the age-standardised rate decreased by 4.4%.

The reduction in the rate of first hip fractures suggests measures to reduce risk factors and prevent falls among the ageing and at-risk population may be having an effect, although dispensing of osteoporosis medications captured in the data was low.

At least 43% of hip fracture patients who were alive one year after their hip fracture had at least one prescription dispensed for an osteoporosis-related medication in the year after their hip fracture. Low rates of osteoporosis medication use after hip fracture have also been reported elsewhere. For example, the data from the ANZHFR found that only 31% of patients in Australian hospitals had bone protection medication (a bisphosphonate, denosumab or teriparatide) on discharge from acute care in hospital, compared with 13% on admission (ANZHFR 2023a).

Despite the low rates of dispensing of osteoporosis medications after hip fracture, these medications, particularly nitrogen bisphosphonates such as zoledronic acid, may reduce second hip fractures and improve survival (Center et al. 2020; Lyles et al. 2007).

Additional fall prevention strategies (which may include addressing vision impairment, home modification, lifestyle changes and medicine review), as well as exercises to improve muscle strength and balance, are also recommended to reduce the risk of falls or another fracture (ACSQHC 2009; Healthdirect 2020).

Hip fractures due to a fall in hospital reported for the first time

In this report, hip fractures that occurred due to a fall in hospital were reported for the first time by the AIHW. Overall, 2.5% of first hip fractures and 12% of second hip fractures within one year occurred due to a fall in hospital. Patients who had a hip fracture due to a fall in hospital were at particularly high risk of mortality: 42% of patients died within one year.

Many hip fracture patients have comorbid conditions

Pre-existing chronic conditions and co-morbidities may increase the risk of hip fractures, as well as poor outcomes such as second fracture and mortality.

Endocrine, nutritional and metabolic diseases was the most common comorbidity disease group captured in patients admitted to hospital with a first hip fracture (56% of surgical patients). The high level of comorbidity of circulatory and endocrine, nutritional and metabolic diseases (such as diabetes) has been observed in other literature (Carbone et al. 2010; Barzilay et al. 2018; Hamilton et al. 2017; 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; Hyde et al. 2013; Khazai et al. 2009; Kurra and Siris 2011).

Around 4,000 surgical patients (9.5%) had osteoporosis reported as a comorbidity. 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 (Ebeling et al. 2023).

People aged 50 and over who sustain a hip fracture following a low trauma fall are considered to have a presumptive diagnosis of osteoporosis (RACGP 2017). As the majority of hip fractures were due to low trauma falls among older adults, a higher rate of recorded osteoporosis among first hip fracture patients would have been expected. This may be explained by the fact that osteoporosis is known to be underdiagnosed and undertreated in the Australian health care system (AIHW 2014; Naik-Panvelkar et al. 2020; Nguyen et al. 2004). Further, osteoporosis might not require active management in the hospital setting and therefore might not meet the coding standards for a recorded diagnosis.

Regardless of whether a patient is diagnosed with osteoporosis, managing bone health is an essential part of post-fracture care to prevent further fractures (Ebeling et al. 2023). Development of an individualised care plan, which may include prescribing medicines for osteoporosis if clinically indicated, should be done before discharge (ACSQHC 2023).

Academic studies have also drawn an association between dementia and hip fracture, with dementia patients at higher risk of hip fractures (Fisher et al. 2006; Seitz et al. 2011). A study by Harvey et al. (2017) found that people aged 65 and over with dementia were more likely to have a subsequent hip fracture than those without (9.8% compared with 6.6%), or to die within 30 days of the first fracture (13% compared with 6.4%). Around 401,300 people were estimated to have dementia in Australia in 2022 (AIHW 2023b). Based on AIHW estimates, this is equivalent to 15 people with dementia per 1,000 Australians, which increases to 84 people with dementia per 1,000 Australians aged 65 and over. This report found that 9,700 surgical patients (16%) had comorbid dementia.

In addition to dementia, Harvey et al. (2017) found that metastatic cancer and severe liver disease were strongly associated with death after hip fracture. In this report, cancers

(metastatic solid tumour and malignant cancer), liver disease (moderate/severe and mild), congestive heart failure and dementia were the comorbidities most strongly associated with one-year mortality.

Patients with comorbidity represent a vulnerable sub-cohort, with implications for the treatment of and recovery from hip fractures and the prevention of further injury.

The patient's pathway: entry via emergency department and discharge pathways

The emergency department (ED) was a common way for patients to enter the health system: 89% of surgical patients with a first hip fracture on admission to hospital had an ED stay directly before their hip fracture hospital stay.

Following this, patients spent a portion of time in hospital. For patients treated with surgery, the median length of finished stays was 20 days, compared with 7 days for non-surgical patients. Other Australian studies have reported a longer length of stay. For example, Ireland and Kelly (2012) estimated the mean hospital length of stay for hip fracture patients was around 31 days. Differences between estimates could be influenced by the different age profile used (45 and over compared with 75 and over) and population in the study (all Australians compared with Australian veterans).

After acute care, many surgical patients (40%) will also receive rehabilitation care in their hospital stay. The median amount of time spent in rehabilitation is longer than the time spent in acute care. Some patients may also receive additional care for their hip fracture, or other care in hospital, such as for treating comorbidities.

At the time of discharge from hospital, 64% of surgical patients from the community returned to their usual or private accommodation. At 120 days, 73% were living in the community and 15% were in RAC. The results of this analysis are broadly consistent with ANZHFR data, where 78% of patients in Australia were reported to have returned to their private residence 120 days after hip fracture in 2022 (ANZHFR 2023a).

Almost 1 in 6 first hip fracture patients treated with surgery were readmitted to hospital within 30 days

Among the 57,100 surgical patients who were alive at the end of their hip fracture hospital stay, 16% were readmitted for any reason with 30 days, 28% were readmitted within 90 days and 50% had been readmitted within one year. Most patients who were readmitted generally only had one readmission stay.

Overall, men were more likely to be readmitted within 30 days (19%) than women (15%). Readmission increased with increasing age among men, from 15% of men aged 45–54 readmitted within 30 days, to 20% among those aged 95 and over. Readmission was fairly stable across each age group among women.

An international meta-analysis showed that the median all-cause 30-day readmission rate to hospital following hip fracture was 10% (Ali and Gibbons 2017). The higher rate of readmission in this report could reflect gaps in NIHSI data which result in continuing hospital stays being counted as a readmission and is a limitation in the current data. Ali and Gibbons (2017) also found that the readmission rate increased with age. However, they found no clear association between sex and readmission with mixed findings reported from previous studies. In this report, the overall rate of readmission for any reason was not adjusted for

factors such as age or comorbidities which may influence readmission. Adjusting for these factors might affect the observed patterns of readmission.

Hip fracture care and rehabilitation were the most common reasons for readmission within 30 days among both surgical patients (14% of all those readmitted) and non-surgical patients (26% of all those readmitted). This was assumed to be additional care for the first hip fracture, but could also represent a new, second hip fracture event.

Among surgical patients, readmission for complications of internal orthopaedic prosthetic devices, implants and grafts was the most common reason for readmission following readmission for hip fracture care or rehabilitation, accounting for 3.7% of all readmissions.

Around 42% of patients readmitted for complications went on to have a hip revision procedure in hospital. A longer follow-up period may reveal further readmissions associated with revision procedures. The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) collects data on hip replacements and time to revision in Australia and includes extra detail about the details of the hip procedure which were not captured in this report. Overall, the AOANJRR found that the cumulative percentage of revision of total hip replacement for fractured neck of femur is 9.4% at 15 years, and was most commonly due to prosthesis dislocation/instability (34%) followed by fracture (28%) and infection (18%) (AOANJRR 2022).

Pneumonia, a type of lung infection, accounted for 3.6% of all readmissions among both surgical and non-surgical patients. Chest infections are a common postoperative complication, and have been associated with increased mortality among hip fracture patients (Roche et al. 2005). Pneumonia has also been reported as the most common reason for readmission for hip fracture patients in other studies (Ali and Gibbons 2017). As such, pneumonia represents an important and potentially preventable complication after hip fracture.

Three per cent of patients had a second hip fracture within one year

Three per cent of both surgical patients and non-surgical patients aged 45 and over had a second hip fracture within one year. A study using NSW hospitals by Harvey et al. (2018) reported a similar rate of second hip fracture (2.9%) among patients aged 65 and over with their first fall-related hip fracture.

Second hip fractures are associated with poor outcomes, including high mortality (Center 2017). Older people, women, people with dementia and patients discharged to RAC after their hip fracture had a higher proportion of second hip fractures. These population groups may represent groups that would benefit from targeted strategies to prevent second fractures. Future work could also use more advanced statistical techniques to control for mortality, age and other covariates to further explore factors associated with second hip fracture.

Almost 1 in 4 surgical first hip fracture patients died within a year

The mortality rate was 6.8% at 30 days, 13% at 90 days and 24% at one year among surgical first hip fracture patients aged 45 and over. The proportion of first hip fracture patients who die is consistent with estimates from other sources. The mortality rate was 7%

at 30 days and 25% at one year among surgical hip fracture patients aged 65 and over in NSW hospitals (Harvey et al. 2022), and 6% at 30 days among surgical hip fracture patients aged 50 and over (BHI 2019). The ANZHFR reported a 30-day mortality rate around 8% between 2016 and 2021 and a one-year mortality rate around 25% between 2016 and 2020, after adjusting for age, sex, premorbid level of function (mobility), fracture type, residence type and American Society of Anaesthesiologists (ASA) grade (ANZHFR 2022).

A higher rate of mortality was observed among non-surgical patients than surgical patients. However, high mortality in this group might reflect patients at high risk of death and not stable enough for surgical management.

Many factors associated with mortality in the general population were also associated with dying after a hip fracture. Overall, after adjusting for the selected covariates, first hip fracture patients were more likely to die within one year of their hip fracture if they:

- were older
- were male
- were in RAC before their hip fracture hospital stay
- had a hip fracture from a fall in hospital or low trauma fall
- lived outside *Major cities*
- had comorbidities such as metastatic solid tumour, malignant cancer, liver disease, congestive heart failure, dementia, chronic pulmonary disease, acute myocardial infarction, renal disease, peripheral vascular disease, or cerebrovascular disease.

First hip fracture patients were slightly more likely to die within one year than matched controls

Studies within Australia have shown that people aged 65 and over have a much higher one-year mortality following a hip fracture than the rest of the population, even more so for men than women (Frost et al. 2013; Lystad et al. 2017; Chen et al 2018). Similarly, this report found that crude estimates of mortality were substantially higher among hip fracture patients than the general Australian population.

Furthermore, first hip fracture patients were slightly more likely to die within one year than matched, hospitalised controls in the reference period. The relatively small difference between hip fracture patients and matched controls in this report reflects the similarly high mortality in the matched controls. A better comparison group would be comprised of matched controls from the general Australian population, and methods to identify controls that are more representative of the general Australian population could be explored in future work.

Overall, there was an association between hip fracture and one-year mortality but this varied by pre-fracture residence and sex. Living in the community was associated with higher mortality among first hip fracture patients than matched controls for both men and women. In contrast, men in RAC before their hip fracture had similar one-year mortality to matched controls, while women in RAC had lower one-year mortality than matched controls.

Residential aged care affects many parts of the care pathway

Overall, RAC patients make up only a small proportion of the Australian population: at 30 June 2022 around 4.2% of all people in Australia aged 65 and over were in permanent or

respite RAC. However, around 28% (17,300) of first hip fracture patients aged 65 and over were in RAC before their first hip fracture. This is broadly consistent with estimates from other sources, including 28% of hip fracture patients from RAC among Australian veterans (Ireland et al. 2015), 26% of patients captured in the ANZHFR (ANZHFR 2023a) and one-third of patients aged 65 and over in NSW (Mitchell et al. 2019).

Hip fracture patients from RAC were more likely to be older and female than patients from the community, and less likely to receive surgery. Patients from RAC had a higher rate of first hip fracture and were more likely to die within one year than patients from the community. This pattern was consistent across all age groups, especially younger age groups. Overall, among surgical patients the incidence rate of hip fracture was 5.1 times as high in patients from RAC as in patients from the community, after adjusting for age.

RAC was also a common destination for first hip fracture patients following discharge from hospital: 14% of surgical patients from the community and 88% of surgical patients from RAC were discharged to RAC.

Pre-hospital residence in RAC was associated with:

- a shorter length of hospital stay
- higher mortality at all time points, among both hip fracture patients and matched controls.

Post-hospital residence in RAC was associated with:

- lower readmission to hospital
- higher rates of second hip fracture.

Preventing falls in RAC, including falls that result in major injury such as fracture, is a crucial area of care. The National Aged Care Mandatory Quality Indicator Program (QI program), has required RAC providers to report on fall events and fall events that result in major injury (such as fracture or dislocation) every quarter since July 2021, which can be used to measure, monitor and improve quality of care provided (Department of Health and Aged Care 2023). From the first quarter of 2021–22 to the third quarter of 2022–23, the percentage of aged care recipients who had a fall has remained stable between 31% and 32%, while the proportion of aged care recipients who had a fall that resulted in major injury had a small, but statistically significant, downward trend between the first quarter of 2021–22 (2.1%) and the third quarter of 2022–23 (1.9%) (AIHW 2023c).

Length of stay varies by pre-hospital residence

Among surgical patients, length of stay was much shorter among patients in RAC before their hip fracture (median 8 days) than among those from the community (median 26 days). A shorter length of stay among patients from RAC, with lower rates of in-hospital rehabilitation, has been observed in other studies (Ireland and Kelly 2015). As such, this report supports other literature which shows that knowing a patient's pre-fracture RAC status is important to accurately describe patterns in length of stay.

Patients from RAC are likely to return to RAC after their stay, and may receive rehabilitation in RAC rather than in hospital, which may contribute to the shorter LOS observed in patients from RAC compared with patients from the community. However, the current data cannot confirm whether rehabilitation care has been received in RAC or not. Additionally, the report does not explore whether length of stay varied by the type of RAC received, such as permanent or respite care, but could be explored in future work.

Residential aged care is strongly associated with one-year mortality

A logistic regression model showed that being in RAC before fracture had one of the strongest associations with one-year mortality, after controlling for several patient and fracture characteristics. Other literature has shown that RAC residents are at higher risk of poor outcomes after hip fracture, particularly mortality (Mitchell et al. 2019). Pre-fracture residence in RAC was also associated with higher mortality in matched controls, and patients from RAC may have higher care needs and frailty than people in the community, which may contribute to higher mortality.

Patient characteristics were consistent with unlinked data

The estimated number of first hip fracture patients in each year is lower than estimates from unlinked administrative data. In 2015–16, there were an estimated 18,700 new hip fractures among Australians aged 45 and over using unlinked National Hospital Morbidity Database (NHMD) data (AIHW 2018). A number of factors influence the comparison of hip fracture estimates using linked and unlinked data.

Firstly, while most surgical patients will have multiple hospital separations as a part of their hip fracture event, estimates using unlinked NHMD data cannot assign hospital separations to an individual person. While attempts were made in analysis of unlinked NHMD data to avoid double-counting hip fracture events, it's expected that unlinked analysis of NHMD data could overestimate the number of first hip fracture patients associated with the observed hip fracture hospitalisations.

Secondly, NIHSI data used in this report includes data from 6 of the 8 jurisdictions and does not capture hip fractures in hospitals in Western Australia and the Northern Territory. Further, only Victoria, Queensland and the Australian Capital Territory had any private hospitals data included. As a result, the rate of hip fractures reported using linked data does not fully capture all those hip fractures which would have been captured in unlinked data.

However, many patterns in the characteristics of hip fracture patients were similar in linked and unlinked data, which both found that first hip fractures in Australia were more common among women, older people, people living in *Major cities* and people living in areas with the highest socioeconomic disadvantage. First hip fractures were most likely to occur at the neck of the femur, be related to a fall, be managed with surgery and occur at home.

Linked data also capture more instances of comorbid conditions in hip fracture patients, by using all hospitalisations in the year before the hip fracture. However, the types of common comorbid conditions were similar in both linked and unlinked data, including diabetes, cardiovascular diseases and musculoskeletal conditions (AIHW 2018). As such, many of these comorbid conditions may be reported in the first hip fracture admission and therefore captured in both linked and unlinked data.

As such, while linked data offer the chance to more accurately count first hip fracture patients and explore the pathways of hip fracture patients, unlinked data may be sufficient for monitoring some trends in the pattern of hip fracture characteristics.

Limitations and future directions

It is important to note that there are several limitations to the results presented in this report; these have been described, where possible, alongside the relevant results.

NIHSI data used in this report do not have full coverage across all states and territories and all private and public hospitals. As a result, the incidence of hip fractures and associated comorbidities, proportion of patients receiving surgery and the rate of readmission may be underestimated. Further, comorbidity information is drawn from the admitted patient care data only. The identification of comorbidities is likely to be an underestimate, as not all chronic conditions will be captured in hospital record data. From 1 July 2015, as part of the ICD-10-AM 9th edition, certain comorbidities, including arthritis and osteoporosis, are captured as a supplementary code where the condition 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. The supplementary codes were not available in the current data but may increase the capture of patients with osteoporosis in hospital (AIHW 2023d) and would be considered for inclusion in future work if available. Further, multimorbidity, which may be an indicator of more complex health conditions and service needs, is not captured in the analysis. Additional work is needed to explore the impact of multimorbidity on the hip fracture care pathway.

The rate of hip fracture may differ between First Nations people and non-Indigenous people. In studies where non-Indigenous Australians and those who have not reported their Indigenous status are grouped, outcomes for First Nations people are compared with 'other Australians'. Some studies have found higher rates of age-standardised hip fracture among First Nations people compared with other Australians (Wong et al. 2013; Brennan-Olsen et al. 2017; AIHW 2018). However, other studies have found similar or lower rates of hip fracture in First Nations people compared with non-Indigenous people or other Australians (Lukaszyk et al. 2017, Pit et al. 2022). Low trauma hip fractures occur at a younger age among First Nations people than among non-Indigenous people, and are more common among rural First Nations people than rural non-Indigenous people (Pit et al. 2022). As such, the proportion of younger patients or patients living rurally can influence estimates of the rate of hip fracture. Factors which may contribute to a higher risk of hip fracture among both First Nations and non-Indigenous people are varied, including rates of comorbid conditions and lifestyle factors, as well as biomedical factors, such as inherited bone size and density (Brennan-Olsen et al. 2017). In the NIHSI data used in this report, availability of information on First Nations status was limited and would likely result in an undercount of the number of First Nations people who suffered a hip fracture. As such, the rate of first hip fracture was not reported separately for First Nations people in this report.

This report relied on administrative data to explore the characteristics of first hip fracture patients and their care pathway, such as readmission and mortality. Other factors which may be associated with a patient's mortality or readmission after hip fracture were not available in the data. For example, time to surgery, bone mineral density, frailty and multimorbidity may be important predictors of mortality and readmission, as well as potentially important patient outcomes, and were not examined in this report. The proportion of patients receiving hip fracture surgery within 48 hours of presentation is a quality indicator from the ACSQHC 2016 Hip Fracture Care Clinical Care Standard that could not be assessed in the NIHSI data used in this report but is well reported elsewhere (ANZHFR 2023a; ACSQHC 2016). From 2023 onwards, the recommended time to surgery has decreased from 48 hours to 36 hours (ACSQHC 2023).

From the current data, the type of rehabilitation, or whether patients receive rehabilitation outside hospital (including in residential aged care facilities), is not known. As such, this report does not explore whether patients are receiving appropriate rehabilitation after their

hip fracture, or whether the type of rehabilitation affects patient outcomes. However, there is some evidence that in-hospital multidisciplinary rehabilitation following hip fracture surgery reduces poor outcomes (Handoll et al. 2021) and interventions targeting improvement in mobility (including training of gait, balance and functional training) in both in-hospital and post-hospital settings may improve mobility and walking speed compared with conventional care (Fairhall et al. 2022). Rehabilitation tailored to physical and mental ability is recommended for patients with cognitive impairment and/or living in RAC (Mitchell et al. 2021).

Future directions include:

- continued monitoring of hip fracture care incidence, outcomes and care pathways to explore changes over time
- monitoring hip fracture incidence and treatment in specific population groups, such as First Nations people or people living in regional or remote areas
- using more advanced statistical techniques to examine factors associated with the outcomes explored in this report. For example, controlling for mortality, age, sex and other covariates when exploring factors associated with second hip fracture
- using new data sources as they become available and using existing data in new ways, which may enable analysis that addresses the limitations described in this report, such as reporting on additional patient outcomes or using a control group that is more representative of the general Australian population.

Conclusions

This report examined health care pathways in a large cohort of patients following their first hip fracture. This analysis is unique in Australia due to its significant population coverage and use of multiple linked data sets. Hospitals data from 6 jurisdictions are used, as well as linked administrative data sets such as residential aged care and deaths data.

This work establishes a baseline that will allow future monitoring of the incidence of hip fracture and outcomes of hip fracture patients over time and supports the monitoring of key quality indicators outlined in the Hip Fracture Clinical Care Standard (ACSQHC 2023).

The hip fracture care pathway involves multiple aspects of the health care system, including emergency department care, in-hospital acute and rehabilitation care, readmission to hospital, medication use and transition to aged care. Hip fractures were associated with comorbid conditions and high mortality. Continued emphasis on measures to reduce risk factors and prevent falls among the ageing and at-risk population remains an important strategy to reducing the risk of hip fracture and improving post-fracture outcomes. Patients from residential aged care are at higher risk of poor outcomes than patients from the community, which may reflect higher care needs, underlying frailty or poor health.

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Abbreviations

ABS	Australian Bureau of Statistics
ACHI	Australian Classification of Health Interventions
ACSQHC	Australian Commission on Safety and Quality in Health Care
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ANZHFR	Australian and New Zealand Hip Fracture Registry
ASA	American Society of Anaesthesiologists
ASGS	Australian Statistical Geographical Standard
ASR	age-standardised rate
CI	confidence interval
ED	emergency department
ERP	estimated resident population
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification
IRSD	Index of Relative Socio-Economic Disadvantage
LOS	length of stay
MBS	Medicare Benefits Schedule
NIHSI	National Integrated Health Services Information
NDI	National Death Index
NHMD	National Hospital Morbidity Database
NSW	New South Wales
OR	odds ratio
PBS	Pharmaceutical Benefits Scheme
Qld	Queensland
RAC	residential aged care
RPBS	Repatriation Pharmaceutical Benefits Scheme
SA	South Australia
SA2	Statistical Area Level 2 (SA2)
Tas	Tasmania
VIC	Victoria
YLD	years lived with disability

Symbols

%	per cent
$	Australian dollars, unless otherwise specified
<	less than
>	greater than

Glossary

acute care: Care in which the intent is to perform surgery, diagnostic or therapeutic procedures in the treatment of illness or injury.

additional diagnosis: Conditions or complaints, either coexisting with the principal diagnosis or arising during the episode of admitted patient care (hospitalisation), episode of residential care or attendance at a health care establishment that require the provision of care. Multiple diagnoses may be recorded.

admitted patient: A patient who undergoes a hospital's formal admission process.

age-standardisation: Method to remove the influence of age when comparing rates between population groups with different **age structures**. This is used as the rate of many diseases vary strongly (usually increasing) with age, and so too can service use, for example, hospitalisations – a population group with an older **age structure** will likely have more hospitalisations. The **age structures** of different populations are converted to the same 'standard' structure, and then the relevant rates, such as hospitalisations, that would have occurred within that structure are calculated and compared.

age-standardised rates: are **incidence**, or **prevalence** rates that enable comparisons to be made between populations that have different age structures. The age structures of the different populations are converted to the same 'standard' structure, and then the rates that would have occurred with that structure are calculated and compared. Rates can be expressed in many ways, examples, per 100,000 per population years, per 100,000 population and per 1,000 population.

age structure: The relative number and percentage of people in each age group in a population.

allied health: A range of services provided by university qualified health practitioners with specialised expertise in preventing, diagnosing and treating a range of conditions and illnesses. The practitioners have autonomy of practice, a defined scope of practice, a regulatory mechanism and a national organisation with clearly defined entrance criteria. Examples include psychologists, optometrists and physiotherapists.

arthritis: A group of disorders for which there is inflammation of the joints – which can then become stiff, painful, swollen or deformed. The 2 main types of arthritis are osteoarthritis and rheumatoid arthritis.

associated cause(s) of death: All causes listed on the Medical Certificate of Cause of Death, other than the underlying cause of death. They include the immediate cause, any intervening causes, and conditions which contributed to the death but were not related to the disease or condition causing the death. See also cause of death.

atypical femoral fractures: A specific form of subtrochanteric fracture with distinct clinical characteristics, which by definition are caused by a low-energy trauma (such as a fall from standing height). There is evidence that the risk of atypical femoral fractures is higher among people taking bisphosphonate medications, such as those used in the treatment for osteoporosis and prevention of typical osteoporotic fractures. Although there is an association between atypical femoral fractures and bisphosphonate medications, these fractures are rare and can also occur in people with osteoporosis who have not been taking these medications.

Australian Standard Geographical Classification (ASGC): Common framework defined by the Australian Bureau of Statistics for collecting and disseminating geographically

classified statistics. The framework was implemented in 1984 and its final release was in 2011. It has been replaced by the Australian Statistical Geography Standard (ASGS).

Australian Statistical Geography Standard (ASGS): Common framework defined by the Australian Bureau of Statistics for collecting and disseminating geographically classified statistics. It replaced the Australian Standard Geographical Classification (ASGC) in July 2011.

burden of disease (and injury): The quantified impact of a disease or injury on a population, using the disability-adjusted life years (DALYs) measure. Referred to as the 'burden' of the disease or injury in this report.

cancer (malignant neoplasm): Cancer, also called malignancy, is a term for diseases in which abnormal cells divide without control and can invade nearby tissues. Cancer cells can also spread to other parts of the body through the blood and lymph systems.

cause(s) of death: All diseases, morbid conditions or injuries that either resulted in or contributed to death—and the circumstances of the accident or violence that produced any such injuries—that are entered on the Medical Certificate of Cause of Death. Causes of death are commonly reported by the underlying cause of death. See also **associated cause(s) of death** and **underlying cause of death**.

chronic obstructive pulmonary disease (COPD): Serious, progressive and disabling long-term lung disease where damage to the lungs, usually because of both emphysema and chronic bronchitis, obstructs oxygen intake and causes increasing shortness of breath. By far the greatest cause is cigarette smoking.

comorbidity: Defined in relation to an index disease/condition, comorbidity describes any additional disease that is experienced by a person while they have the index disease. The index and comorbid disease/condition will change depending on the focus of the study. Compare with multimorbidity.

condition onset flag (COF): A means of differentiating those conditions which arise during, or arose before, an admitted patient episode of care.

crude rate: A rate derived from the number of events recorded in a population during a specified time period, without adjustments for other factors such as age (see **age-standardisation**).

data linkage/linked data: Bringing together (linking) information from 2 or more data sources believed to relate to the same entity, such as the same individual or the same institution. The resulting data set is called linked data. In this report, data linkage is used to bring together information from data sets that indicate a population of interest (such as people with a hip fracture) with other data sets that include information on other characteristics or service usage.

dementia: A term used to describe a group of similar conditions characterised by the gradual impairment of brain function. It is commonly associated with memory loss, but can affect speech, cognition (thought), behaviour and mobility. An individual's personality may also change, and health and functional ability decline as the condition progresses.

diabetes (diabetes mellitus): A chronic condition in which the body cannot properly use its main energy source, the sugar glucose. This is due to a relative or absolute deficiency in insulin, a hormone that is produced by the pancreas and helps glucose enter the body's cells from the bloodstream and then be processed by them. Diabetes is marked by an abnormal build-up of glucose in the blood, and it can have serious short- and long-term effects. See also **type 1 diabetes** and **type 2 diabetes**.

dialysis: An artificial method of removing waste substances from the blood and regulating levels of circulating chemicals – functions usually performed by the kidneys.

disability-adjusted life year (DALY): A year (one 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.

hip fracture stay: The hospital stay containing the index episode and all episodes following the index episode.

hospital episode or **separation**: An episode of care for an admitted patient, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute 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.

hospital stay: A complete episode of care (from admission to discharge or death), created by joining hospital episodes including transfers and change in care type.

incidence: The number of new cases (of an illness or event, and so on) occurring during a given period. Compare with **prevalence**.

incidence rate: The number of new cases occurring during a given period divided by the population. The population can be calculated in two different ways, either the average population over the time period (described as per 100,000 people per year), or the person-time spent at risk of the event (described as per 100,000 person-years).

index episode: Also referred to as 'first hip fracture episode', the index episode is the first hospital episode in the reference period where acute care was provided for a principal diagnosis of hip fracture or a hip fracture that occurred due to a fall in hospital. The index episode is used for information about the hip fracture, such as its location or cause.

Index of Relative Socio-Economic Disadvantage (IRSD): One of the sets of Socio-Economic Indexes for Areas for ranking the average socioeconomic conditions of the population in an area. It summarises attributes of the population such as low income, low educational attainment, high unemployment and jobs in relatively unskilled occupations.

mortality: Number or rate of deaths in a population during a given time period.

multimorbidity: The presence of 2 or more chronic diseases/conditions in a person at the same time. Compare with comorbidity.

non-fatal burden: The quantified impact on a population of ill health due to disease or injury. Measured as years lived with disability (YLD), which is also sometimes referred to as years of healthy life lost due to disability.

osteoarthritis: A chronic and common form of arthritis, affecting mostly the spine, hips, knees and hands. It first appears from the age of about 30 and is more common and severe with increasing age.

osteopenia: A condition when bone mineral density is lower than normal but not low enough to be classified as osteoporosis.

osteoporosis: A condition that causes bones to become thin, weak and fragile, such that even a minor bump or accident can break a bone.

overnight hospitalisation: An admitted patient who received hospital treatment for a minimum of one night (that is, admitted to, and has a separation from, hospital on different dates).

pneumonia: Inflammation of the lungs as a response to infection by bacteria or viruses. The air sacs become flooded with fluid, and inflammatory cells and affected areas of the lung become solid. Pneumonia is often quite rapid in onset and marked by a high fever, headache, cough, chest pain and shortness of breath.

prevalence: The number or proportion (of cases, instances, and so forth) in a population at a given time. For example, this refers to the number of people alive who had been diagnosed with a condition in a prescribed period (usually 1, 5, 10 or 26 years). Compare with **incidence**.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning the patient's episode of care in hospital. In some cases, the principal diagnosis is described in terms of a treatment for an ongoing condition (for example, same-day care for dialysis).

private hospital: A privately (non-government) owned and operated institution catering for patients who are treated by a doctor of their own choice. Patients are charged fees for accommodation and other services provided by the hospital and relevant medical and paramedical practitioners. Acute care and psychiatric hospitals are included in this category as are private free-standing day facilities.

private patient: Person admitted to a private hospital, or person admitted to a public hospital who decides to choose the doctor(s) who will treat them or to have private ward accommodation. This means they will be charged for medical services, food and accommodation.

public hospital: A hospital controlled by a state or territory health authority. Public hospitals offer free diagnostic services, treatment, care and accommodation to all eligible patients.

public patient: A patient treated at no charge in a public hospital (or provided with care by a private hospital on behalf of a public hospital).

rate: One number (numerator) divided by another number (denominator). The numerator is commonly the number of events in a specified time. The denominator is the total number of people in the cohort or population (prevalence rate). Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers. In some instances, a multiplier of 100 is used to aid comprehension. See also **incidence rate**.

rate ratio: Shows the relative difference between two rates. May be calculated as the rate for population A divided by the rate for population B. Commonly used to compare rates between:

i. two points in time for the same population

ii. different populations at the same point in time.

A rate ratio of 1 indicates no difference between the rates. A rate ratio less than 1 indicates that rates have decreased over time (use i), or that the rate for Population A is lower than that for Population B (use ii). A rate more than 1 indicates an increase over time or that the rate for Population A is higher than that for Population B.

rheumatoid arthritis: A chronic, multisystem disease whose most prominent feature is joint inflammation and resulting damage, most often affecting the hand joints in symmetrical fashion. It can occur in all age groups but most commonly appears between ages 20 and 40. Its causes are not certain but involve auto-immune processes.

same-day hospitalisation: A patient who is admitted to, and has a separation from, hospital on the same date.

Socio-Economic Indexes for Areas (SEIFA): A set of indexes, created from Census data, that aim to represent the socioeconomic position of Australian communities and identify areas of advantage and disadvantage. The index value reflects the overall or average level of disadvantage of the population of an area; it does not show how individuals living in the same area differ from each other in their socioeconomic group.

type 1 diabetes: A form of diabetes mostly arising among children or younger adults (but can be diagnosed at any age) and marked by a complete lack of insulin. Insulin replacement is needed for survival. It is a lifelong disease, for which the exact cause is unknown, but believed to be the result of an interaction of genetic and environmental factors.
See diabetes (diabetes mellitus).

type 2 diabetes: The most common form of diabetes, it is a condition in which the body becomes resistant to the normal effects of insulin and gradually loses the capacity to produce enough insulin in the pancreas. The condition has strong genetic and family-related (non-modifiable) risk factors and is also often associated with modifiable risk factors.
See **diabetes (diabetes mellitus)**.

underlying cause of death: The primary or main cause of death: the condition, disease or injury that initiated the sequence of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury. See also **cause(s) of death** and **associated cause(s) of death**.

years lived with disability (YLD): A measure calculated as the prevalence of a condition, multiplied by a disability weight for that condition. YLD represent non-fatal burden. Sometimes referred to as years of healthy life lost due to disability (YLD).

years of healthy life lost due to disability: See **years lived with disability (YLD)**.

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