Readmission and returns to acute care following hospitalisation for eight clinical conditions

July 2015 – June 2018

bureau of health information

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Setting the scene

Overview of key findings

Measures that assess how healthcare affects health outcomes make an important contribution to efforts to support transparency, strengthen accountability and inform local efforts to improve care for patients in NSW.

This report provides the community and health professionals with information about the performance of 74 public hospitals for eight clinical conditions, including three surgical procedures. The patient journey from an acute care admission to readmission is tracked in two ways:

1. **Readmissions following discharge**: discharge from hospital following an acute care admission, then readmission to the same hospital, or a different hospital, within 30 days (60 days for specified surgical procedures).
2. **Returns to acute care**: a change in care type or transfer to non-acute care within the same or different hospital, then a return to acute care within 30 days (60 days for specified surgical procedures).

Indicators of readmission often only include patients who return to hospital following discharge. However, the value of including readmission following discharge (patients returning to hospital) and returns to acute care (patients returning to acute care from non-acute care, such as rehabilitation) is that both provide insights into the quality and effectiveness of transitions of care. **Therefore, the readmission indicators used throughout this report include both readmissions following discharge and returns to acute care.**

The readmission indicators used are readmission rates at NSW level and risk-standardised readmission ratios (RSRRs) at hospital-level.

The RSRR calculation takes into account the volume and characteristics of adults treated in each hospital, as different hospitals provide care to patients who may be more or less likely to require readmission. It differs from other readmission indicators principally because it is risk-adjusted and takes into account readmission to any, rather than just the same, hospital. This includes readmission to all hospitals, public and private, and provides a more meaningful and accurate reflection of readmissions, which are attributed to the last discharging hospital.

Eight clinical conditions covered

- acute myocardial infarction (AMI)
- ischaemic stroke
- congestive heart failure (CHF)
- pneumonia
- chronic obstructive pulmonary disease (COPD)
- hip fracture surgery
- total hip replacement
- total knee replacement.

Figure 1 Age-sex standardised readmission rate per 100 hospitalisations, by condition, NSW, July 2012 – June 2018

Condition	No. of index hospitalisations July 2015 – June 2018	Readmission rate		
		July 2015 – June 2018	July 2012 – June 2015	Percentage change
AMI	28,583	15.0	15.2	-1.1%
Ischaemic stroke	16,435	10.0	10.1	-1.0%
CHF	33,686	22.2	22.1	0.0%
Pneumonia	48,855	13.3	13.2	1.2%
COPD	48,336	21.2	21.1	0.6%
Hip fracture surgery	14,895	10.8	9.8	10.1%
Total hip replacement	8,985	10.6	9.4	13.1%
Total knee replacement	15,940	11.9	11.3	4.9%

Results are presented in terms of adult patient readmissions within 30 days of discharge for six of the conditions and within 60 days for two of the surgical procedures (total hip replacement and total knee replacement), during the period July 2015 to June 2018. Altogether, this report focuses on almost 216,000 acute admissions to hospital and about 35,000 readmissions following discharge.

Three years of data are used to create stable, reliable estimates of performance. However, as with any measure, care is needed in interpretation. Each hospital's ratio is based on its particular patient cohort so it cannot be used in direct hospital comparisons. While the statistical models used to risk-standardise perform well, some risk factors are not captured in the available data, so standardisation is not perfect. RSRRs are best used as screening tools to indicate where further, locally-driven, assessment is needed. They should be looked at alongside other measures and used by clinicians as a tool to prompt discussion and inform the development of quality improvement initiatives.

Readmission rates for NSW

Rates in NSW for 2015–2018 varied by condition. Rates were lowest for ischaemic stroke (10%), total hip replacement (10.6%) and hip fracture surgery (10.8%), and highest for congestive heart failure (CHF) (22.2%), followed by chronic obstructive pulmonary disease (COPD) (21.2%) (Figure 1).

Rates were relatively stable for five of the eight conditions in 2015–2018, when compared with results from the 2012–2015 period. There were increases in the rates of readmission for the three surgical procedures, ranging from 4.9% to 13.1%. However, these increases were relative to the smaller size of their respective patient cohorts (Figure 1).

Readmission ratios for hospitals

A majority of public hospitals in NSW had RSRRs that were within the expected range across all eight conditions. The number of hospitals with lower than expected readmission ranged from no hospitals for ischaemic stroke to six hospitals for COPD.

The number of hospitals with higher than expected readmission ranged from no hospitals for total knee replacement to six hospitals for COPD.

Five hospitals had lower than expected readmission for at least two conditions:

- **Hornsby:** acute myocardial infarction (AMI) and CHF
- **Lismore:** COPD and hip fracture surgery
- **Manning**: total knee replacement and hip fracture surgery
- **Orange:** CHF and COPD
- **Wagga Wagga:** AMI, CHF, pneumonia and COPD.

Eight hospitals had higher than expected readmission for at least two conditions:

- **Canterbury**: CHF and COPD
- **Gosford:** AMI and COPD
- **Nepean:** ischaemic stroke and hip fracture surgery
- **St George:** AMI and pneumonia
- **The Tweed**: AMI and total hip replacement
- **Wyong:** pneumonia and COPD
- **Campbelltown:** CHF, COPD and hip fracture surgery
- **Royal Prince Alfred:** ischaemic stroke, COPD and total hip replacement.

Readmission ratios for local health districts

Illawarra Shoalhaven, Murrumbidgee, Northern Sydney, Southern NSW, St Vincent's Health Network and Western NSW local health districts (LHDs) had one or more hospitals where RSRRs were lower than expected. These LHDs also had no hospitals where RSRRs were higher than expected.

Central Coast, Nepean Blue Mountains and South Western Sydney LHDs had two or more hospitals where RSRRs were higher than expected. These LHDs also had no hospitals where RSRRs were lower than expected.

Eight clinical conditions

The eight clinical conditions in this report include acute and chronic, surgical and medical, general and specialised hospital services, delivered in both public and private hospitals.

Each condition has evidence-based clinical guidelines and well-defined best practice models of care.[1] Consequently, the conditions differ in terms of the overall rate and patterns of readmission.

Acute myocardial infarction (AMI)

- Occurs when blood supply to part of the heart is interrupted.
- In July 2015 – June 2018, 27,868 patients had 29,506 hospitalisations for AMI.
- After excluding 923 hospitalisations without 30-day follow-up, there were 28,583 index hospitalisations and 4,250 (15%) readmissions within 30 days of discharge.
- 4% of these were returns to acute care from an inpatient non-acute setting.
- 66% of hospitalised patients were male.
- Average patient age was 69 years (37% were aged 75+ years).

Ischaemic stroke

- Is a blockage of a blood vessel in the brain, depriving brain cells of oxygen.
- In July 2015 – June 2018, 16,342 patients had 16,995 hospitalisations for ischaemic stroke.
- After excluding 560 hospitalisations without 30-day follow-up, there were 16,435 index hospitalisations and 1638 (10%) readmissions within 30 days of discharge.
- 31% of these were returns to acute care from an inpatient non-acute setting.
- 56% of hospitalised patients were male.
- Average patient age was 74 years (53% were aged 75+ years).

Congestive heart failure (CHF)

- Occurs when the heart is unable to pump adequately.
- In July 2015 – June 2018, 26,478 patients had 34,789 hospitalisations for CHF.
- After excluding 1,103 hospitalisations without 30-day follow-up, there were 33,686 index hospitalisations and 7,465 (22%) readmissions within 30 days of discharge.
- 4% of these were returns to acute care from an inpatient non-acute setting.
- 53% of hospitalised patients were male.
- Average patient age was 79 years (69% were aged 75+ years).

Pneumonia

- Is an infection in one or both lungs, causing inflammation and breathing difficulty.
- In July 2015 – June 2018, 46,217 patients had 50,305 hospitalisations for pneumonia.
- After excluding 1,450 hospitalisations without 30-day follow-up, there were 48,855 index hospitalisations and 6,704 (14%) readmissions within 30 days of discharge.
- 5% of these were returns to acute care from an inpatient non-acute setting.
- 53% of hospitalised patients were male.
- Average patient age was 71 years (49% were aged 75+ years).

Collectively, these conditions account for about 12% of acute emergency hospitalisations for people aged 15+ years.

The conditions differ in terms of the overall rate and patterns of readmission over the 30- or 60-day period following hospitalisation.

Chronic obstructive pulmonary disease (COPD)

- Is a progressive lung disease, where airflow is blocked making breathing difficult.
- In July 2015 – June 2018, 31,595 patients had 49,828 hospitalisations for COPD.
- After excluding 1,492 hospitalisations without 30-day follow-up, there were 48,336 index hospitalisations and 10,241 (21%) readmissions within 30 days of discharge.
- 2% of these were returns to acute care from an inpatient non-acute setting.
- 49% of hospitalised patients were male.
- Average patient age was 74 years (47% were aged 75+ years).

Hip fracture surgery

- A fracture in the upper quarter of the thigh bone (femur), treated with surgery.
- In July 2015 – June 2018, 15,005 patients had 15,388 hospitalisations for hip fracture surgery.
- After excluding 493 hospitalisations without 30-day follow-up, there were 14,895 index hospitalisations and 1,617 (11%) readmissions within 30 days of discharge.
- 42% of these were returns to acute care from an inpatient non-acute setting.
- 30% of hospitalised patients were male.
- Average patient age was 83 years (79% were aged 75+ years).

Total hip replacement

- Elective surgery to remove a damaged hip joint and replace it with an artificial joint.
- In July 2015 – June 2018, 9,018 patients had 9,566 hospitalisations for total hip replacement (2% had bilateral procedures).
- After excluding 581 hospitalisations without 60-day follow-up, there were 8,985 index hospitalisations and 949 (11%) readmissions within 60 days of discharge.
- 11% of these were returns to acute care from an inpatient non-acute setting.
- 48% of hospitalised patients were male.
- Average patient age was 67 years (27% were aged 75+ years).

Total knee replacement

- Elective surgery to remove a damaged knee joint and replace it with an artificial joint.
- In July 2015 – June 2018, 15,789 patients had 16,984 hospitalisations for total knee replacement surgery (7% had bilateral procedures).
- After excluding 1,044 hospitalisations without 60-day follow-up, there were 15,940 index hospitalisations and 1,892 (12%) readmissions within 60 days of discharge.
- 8% of these were returns to acute care from an inpatient non-acute setting.
- 42% of hospitalised patients were male.
- Average patient age was 69 years (28% were aged 75+ years).

About this report

Introduction

This report looks at readmissions across 74 NSW public hospitals for eight clinical conditions, including three surgical procedures. The patient journey from an acute care admission to readmission is tracked in two ways:

1. **Readmissions following discharge**: discharge from hospital following an acute care admission, then readmission to the same hospital, or a different hospital, within 30 days (60 days for specified surgical procedures).
2. **Returns to acute care**: a change in care type or transfer to non-acute care within the same or different hospital, then a return to acute care within 30 days (60 days for specified surgical procedures).

Indicators of readmission often only include patients who return to hospital following discharge. However, the value of including readmission following discharge (patients returning to hospital) and returns to acute care (patients returning to acute care from non-acute care, such as rehabilitation) is that both provide insights into the quality and effectiveness of transitions of care. **Therefore, the readmission indicators used throughout this report include both readmissions following discharge and returns to acute care.**

The readmission indicators used are readmission rates at NSW level and risk-standardised readmission ratios (RSRRs) at hospital-level. The proportion of returns to acute care included as part of these readmission indicators for each condition in this report were relatively small for most conditions, and are detailed on pages 4 and 5.

Measures of unplanned or potentially avoidable readmissions are used to inform assessments of healthcare performance and highlight potential areas for improvement.[2–8] However, not all readmissions can be avoided, even with optimal care. Some occur when patients develop new health problems, and others are prompted by an acute deterioration in a longstanding chronic condition, despite appropriate management.

High rates of hospital readmission can indicate low quality care during previous hospitalisations, or poor care surrounding discharge. However, readmission is influenced by numerous patient, clinician and system-level factors. These include age and comorbidities, complications of hospital care or lack of adherence to recommended care, inadequate discharge planning, or problems with coordination and integration of care across hospital, primary care and community settings. Readmission measures are best used as screening tools to indicate where further locally-driven assessment is needed.[2–8]

This report assesses about 35,000 readmissions following almost 216,000 discharges from NSW public hospitals. Readmissions were following an acute hospitalisation for any of the eight conditions during the period July 2015 – June 2018. This report sits within a suite of reporting products which aim to provide helpful information for health professionals, and aid their understanding of patterns of readmission for select conditions in their hospitals. This information can assist local efforts to improve care in NSW public hospitals.

The suite of products includes this report and a technical supplement that builds on the previously published *Spotlight on Measurement: Measuring return to acute care following discharge from hospital, 2nd edition*, which describes the development and validation processes that underpin the RSRRs. The technical supplement addresses new issues and sensitivity analyses relevant to the July 2015 to June 2018 results.

Hospital profiles

Individual profiles for 74 public hospitals outline key characteristics of patients readmitted following hospitalisation for the eight clinical conditions of interest. The profiles feature demographic details of patients, hospital case mix and how it differs from the NSW patient population, time series results, and the distribution of higher than expected and lower than expected results across similar peer group hospitals.

All reports and profiles are available at **bhi.nsw.gov.au**

Measuring readmission

The main readmission indicator used in this report is the risk-standardised readmission ratio (RSRR). At NSW level, this report looks at age-sex standardised readmission rates, while at hospital level it uses the RSRR.

The RSRR calculation takes into account the volume and characteristics of adults treated in each hospital (known as the case mix), as different hospitals provide care to patients who may be more or less likely to require readmission following discharge.

Assessments of readmission at hospital level must take into account differences in pre-existing patient characteristics. A hospital that treats older or sicker patients should not be expected to have the same rates of readmission as a hospital that treats younger patients or less complex cases. Assessments should also avoid over-interpretation of small fluctuations in the number of readmissions, particularly in smaller hospitals.

The RSRR uses a statistical model[9], based on a condition-specific NSW patient population, to calculate an 'expected' number of readmissions for each hospital, given the characteristics of their patients (such as age and comorbidity). It then compares that 'expected' number to the 'observed' number of readmissions. Results are reported as higher than expected, lower than expected or no different than expected. The RSRR does not identify specific, potentially avoidable readmissions.

The RSRR differs from other readmission indicators principally because it is risk-adjusted and it takes into account readmission to any, rather than just the same, hospital. This includes readmission to all hospitals, public and private, and provides a more meaningful and accurate reflection of readmissions, which are attributed to the last discharging hospital.

As with any measure, care is needed in interpretation. Each hospital's ratio is based on its particular patient cohort and so cannot be used in direct hospital comparisons. Some risk factors are not recorded in the available data, and so risk-standardisation is not perfect. RSRRs are best used as screening tools to indicate where further, locally driven, assessment is needed.

Care type is a classification used in the NSW Admitted Patient Data Collection to define the type of clinical service being delivered during an admission. Non-acute defines a collection of services that do not meet the criteria for acute care. These include services such as rehabilitation, palliative, geriatric evaluation and management, psychogeriatric or maintenance care.

Report on mortality rates for seven clinical conditions

In November 2019, the Bureau of Health Information (BHI) published a report presenting mortality rates for seven clinical conditions in NSW in the 30 days following admission to hospital, including the release of detailed results for 73 public hospitals.

Mortality following hospitalisation for seven clinical conditions, July 2015 – June 2018 provides information that is useful for health professionals in understanding patterns of mortality across the seven conditions in their hospitals and informing local efforts to improve care.

The seven conditions included in the report are: acute myocardial infarction, ischaemic stroke, haemorrhagic stroke, congestive heart failure, pneumonia, chronic obstructive pulmonary disease and hip fracture surgery.

To access the report, including individual profiles for 73 public hospitals, visit **bhi.nsw.gov.au/BHI_reports/mortality**

Data and methods

The measure

The principal hospital-level indicator used in this report is a risk-standardised readmission ratio (RSRR) (Figure 2). The RSRR describes, for each hospital, the number of 'observed' readmissions in the 30 days (60 days for specified surgical procedures), compared with the 'expected' number of readmissions to public and private hospitals. The 'expected' number of readmissions is generated by a statistical model that takes into account patient characteristics that could affect the likelihood of requiring readmission.

For each condition, principal diagnosis codes were used to identify patients discharged from acute care during July 2015 – June 2018. For hip fracture and joint replacement surgery, procedure codes and diagnosis-related group codes were also used.

Calculation of unadjusted readmission rates and hospital RSRRs excluded index cases that occurred fewer than 30 days (60 days for specified surgical procedures) from the end of the study period to avoid bias with incomplete follow-up. However, as competing risk regression models take into account different follow-up periods, index hospitalisations without complete follow-up information were included when building the NSW prediction models.

Readmissions to any NSW public or private hospital occurring within 30 days of discharge from hospital (60 days for specified surgical procedures), were included regardless of the principal diagnosis for the readmission. Following clinician advice and sensitivity testing, the follow-up period for joint replacements was set to 60 days and readmissions for these two conditions also included non-emergency admissions. This captured hospitalisations for procedures related to orthopaedic complications such as joint manipulation and wound debridement, which are often categorised as non-emergency (i.e. they do not require treatment within 24 hours). Non-emergency hospitalisations for routinely scheduled procedures such as haemodialysis or chemotherapy were excluded.

Multiple acute, contiguous hospitalisations were considered as a single, acute period of care. Acute admissions on the same day of separation from another acute hospitalisation were included in the index period of care, regardless of the mode of separation recorded in the initial hospital admission. If an acute admission ended in a transfer (not a discharge), followed by another acute admission within one day, the second admission was concatenated into the same period of care. Returns to acute care following a change in care type were considered a readmission unless documented as planned.

Prediction models

Competing risk models[9] developed for each condition draw on NSW public hospital patient population characteristics and outcomes. They estimate the expected number of readmissions for each hospital, given its case mix. The patient factors and comorbidities included in the model are shown in Appendix 2. SAS[10] and StataSE v12[11] were used for the analyses.

Interpretation

Funnel plots are used to determine whether RSRRs reach statistical significance (see Appendix 3 – How to interpret a funnel plot). Control limit calculations use a Poisson distribution. Hospital results that fall outside the 95% control limits are considered to be 'special cause' outliers and flagged. The probability that an RSRR inside the 95% control limits would fall outside these limits by chance alone is, at most, one in 40.[12]

Attribution and reporting

Index hospitalisations and readmissions were attributed to the hospital that discharged the patient. For some analyses, results are stratified by peer group: principal referral hospitals (peer group A), major hospitals (peer group B) and district hospitals (peer group C). Results for hospitals in peer groups A–C with at least 50 hospitalisations for the conditions of interest in the three-year study period are reported publicly. Results for hospitals with less than 1.0 expected readmissions are suppressed. Not all hospitals have results for all conditions.

Depth of coding

The RSRR relies on accurate coding of secondary diagnoses in patients' hospital records. Comorbidities are identified by a one-year lookback to capture those listed in any hospitalisation in the previous year. Depth of coding is monitored to assess differences over time and between hospitals. See the technical supplement for further information.

Characterising reasons for readmission

Reasons for readmission were categorised based on the recorded principal diagnosis at the time of readmission. These categories are stratified based on their potential relationship to the initial admission, hospital care and the time between initial hospitalisation and readmission.

Reasons for readmission were either for the same or a related condition, for a condition potentially related to hospital care in the index admission (with different levels of certainty), or for another condition.

Please refer to the previously published *Spotlight on Measurement: Measuring return to acute care following discharge from hospital, 2nd edition*, along with the technical supplement to this report, which outline the specifications used to describe reasons for readmission.

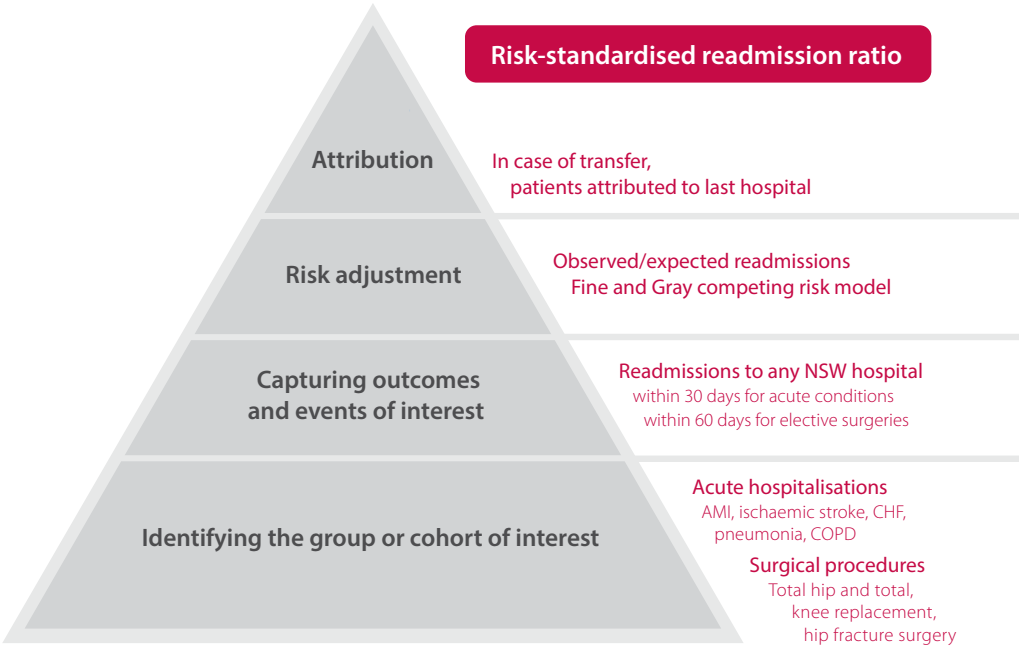
Data sources

Data used by BHI to calculate results were drawn from the Hospital Performance Dataset, NSW Ministry of Health Secure Analytics for Population Health Research and Intelligence.

Record linkage was carried out by the Centre for Health Record Linkage. Linked data were used to follow the patient journey and to measure readmissions to any hospital, public or private, and the competing risk of death.

Details about cohort definitions, outcomes, risk adjustment models and attribution are described in the technical supplement to this report and *Spotlight on Measurement: Measuring return to acute care following discharge from hospital, 2nd edition*.

Figure 2 Risk-standardised ratios for assessing performance in readmission



Exploring readmission results

NSW results

Between 2009 and 2018, the age-sex standardised readmission rates remained relatively stable at NSW level for five of the eight conditions: congestive heart failure (CHF), acute myocardial infarction (AMI), ischaemic stroke, total knee replacement and chronic obstructive pulmonary disease (COPD). Readmission rates for pneumonia, hip fracture surgery and total hip replacement were higher in 2015–2018 than 2009–2012 (Figures 3 and 4).

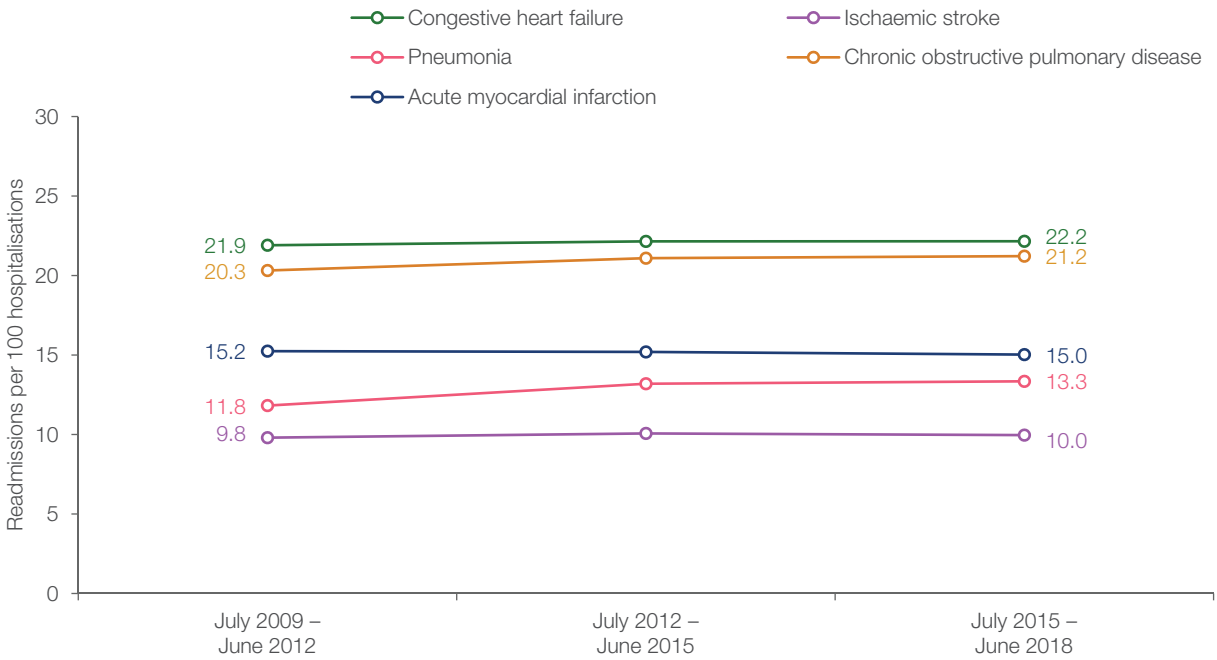
Figure 4 shows the proportion of readmissions within 30 days (60 days for specified surgical procedures), per condition that were to the same hospital following discharge; to another hospital following discharge; or returns to acute care from a non-acute care setting within the same or a different hospital.

The proportion of readmissions following discharge returning to the same hospital varied for each condition – ranging from 43% for hip fracture surgery to 83% for COPD. The proportion of returns to acute care from a non-acute hospitalisation ranged from 2% for COPD to 42% for hip fracture surgery (Figure 5).

The conditions also differed in terms of patients' average length of stay for the index hospitalisation – ranging from 4.6 days for total hip replacement to 9.7 days for hip fracture surgery. Across the conditions, there were generally higher unadjusted readmission rates seen for patients with longer lengths of stay in the index hospitalisation. This was particularly marked for pneumonia and total knee replacement patients (see pages 25–53).

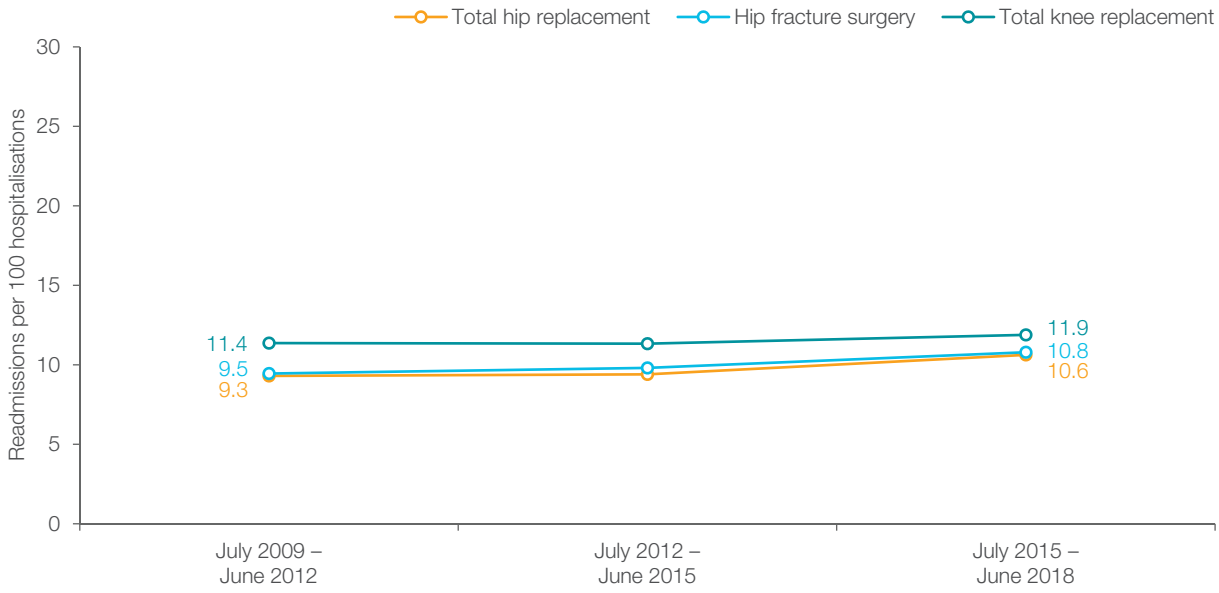
In terms of international comparisons, there are limited data for benchmarking NSW results. Available information suggests that NSW readmission rates are similar to those in other systems for most conditions.[13–17]

Figure 3 **Age-sex standardised readmission rate, per 100 hospitalisations, by condition, NSW, July 2009 – June 2018**



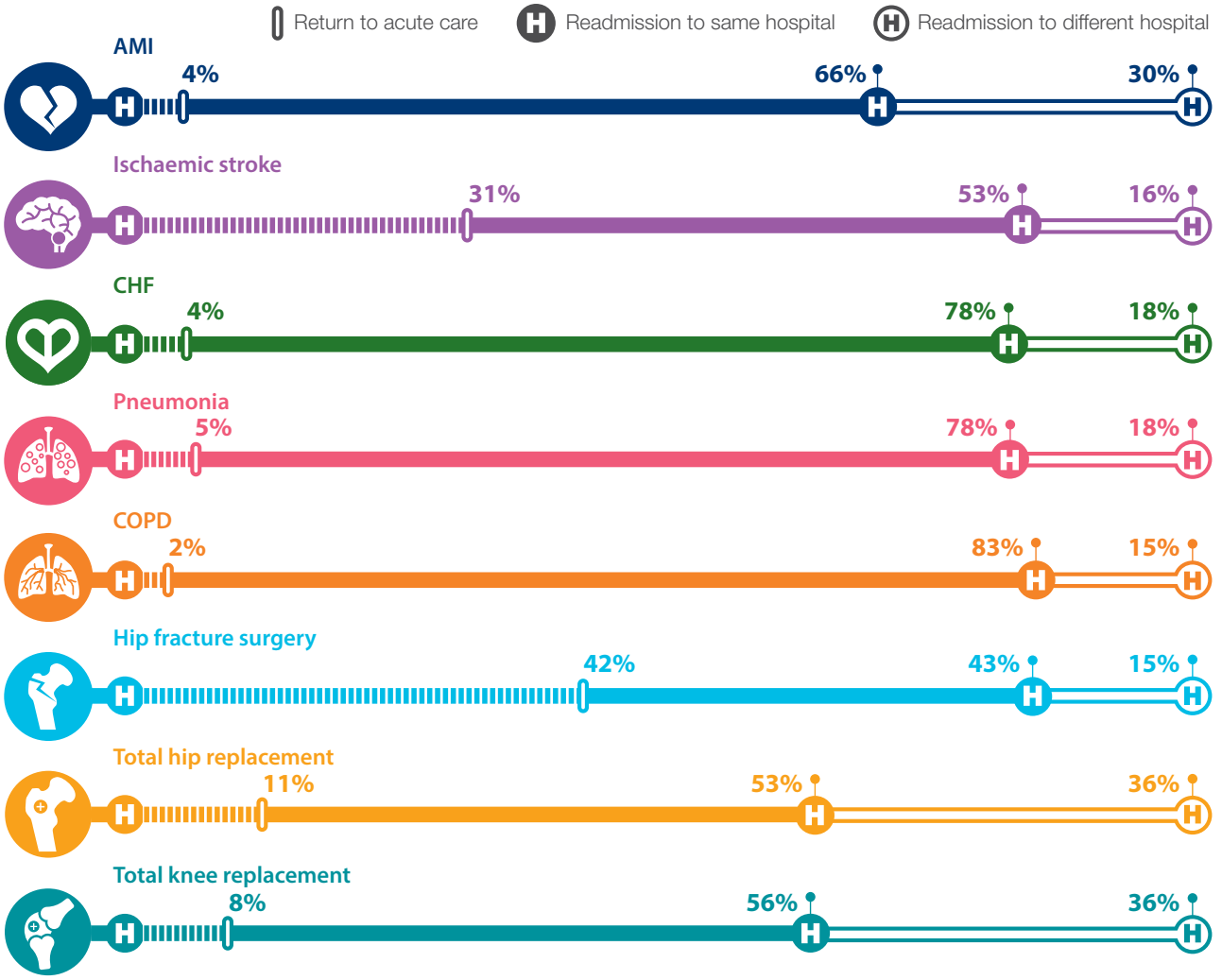
Notes: Directly standardised using July 2009 – June 2012 NSW condition-specific hospitalisation cohorts as the standard population. Excludes patients who were treated in, and discharged from, an emergency department only.

Figure 4 Age-sex standardised readmission rate per 100 hospitalisations, by surgical procedure, NSW, July 2009 – June 2018



Notes: Directly standardised using July 2009 – June 2012 NSW condition-specific hospitalisation cohorts as the standard population. Excludes patients who were treated in, and discharged from, an emergency department only.

Figure 5 Proportion of readmissions that were readmitted, following discharge, to the same or a different hospital, or returns to acute care, by clinical condition, NSW, July 2015 – June 2018



Hospital-level results

A large majority of public hospitals* in NSW had risk-standardised readmission ratios (RSRRs) that were within the expected range across all eight conditions during July 2015 – June 2018 (Figure 7).

The number of hospitals with lower than expected readmission across the eight clinical conditions ranged from zero for ischaemic stroke to six for chronic obstructive pulmonary disease (COPD). The number of hospitals with higher than expected readmission ranged from zero for total knee replacement to six for COPD (Figure 7).

Four hospitals had lower than expected readmission for two conditions each (Hornsby, Orange, Lismore and Manning) and one hospital had lower than expected readmission for four conditions (Wagga Wagga) (Figure 6).

A total of 56 hospitals had readmission that was within the expected range or lower than expected across all of the eight conditions (Appendix 1).

Six hospitals had higher than expected readmission for two conditions (Gosford, Canterbury, St George, The Tweed, Nepean and Wyong) and two hospitals had higher than expected readmission for three conditions (Royal Prince Alfred and Campbelltown) (Figure 8).

Figure 6 NSW public hospitals with readmission results that were higher or lower than expected, by condition, July 2015 – June 2018

	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Higher than expected readmission	Calvary Mater Gosford St George The Tweed	Murwillumbah Nepean Royal Prince Alfred	Auburn Blue Mountains Campbelltown Canterbury Westmead	Coffs Harbour Liverpool St George Tamworth Wyong	Campbelltown Canterbury Gosford Prince of Wales Royal Prince Alfred Wyong	Bankstown-Lidcombe Campbelltown Nepean	Royal Prince Alfred The Tweed	
Lower than expected readmission	Hornsby Sutherland Wagga Wagga Wollongong		Concord Hornsby Orange Shellharbour Wagga Wagga	Blacktown Deniliquin Wagga Wagga	Lismore Orange Queanbeyan Shoalhaven St Vincent's Wagga Wagga	John Hunter Lismore Port Macquarie	Manning Mount Druitt	Manning

*Hospital results are shown for principal referral, major and district hospitals only (peer groups A–C), with at least 50 index hospitalisations for the condition of interest.

Figure 7 Number of NSW public hospitals with readmission results that were higher, lower or no different from expected, by condition, July 2015 – June 2018

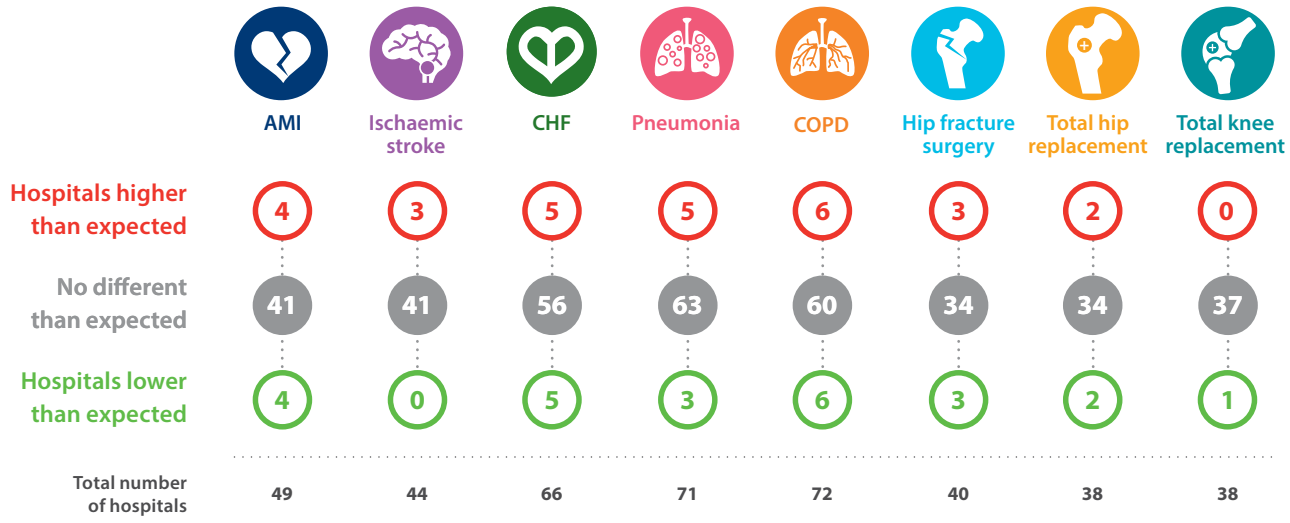
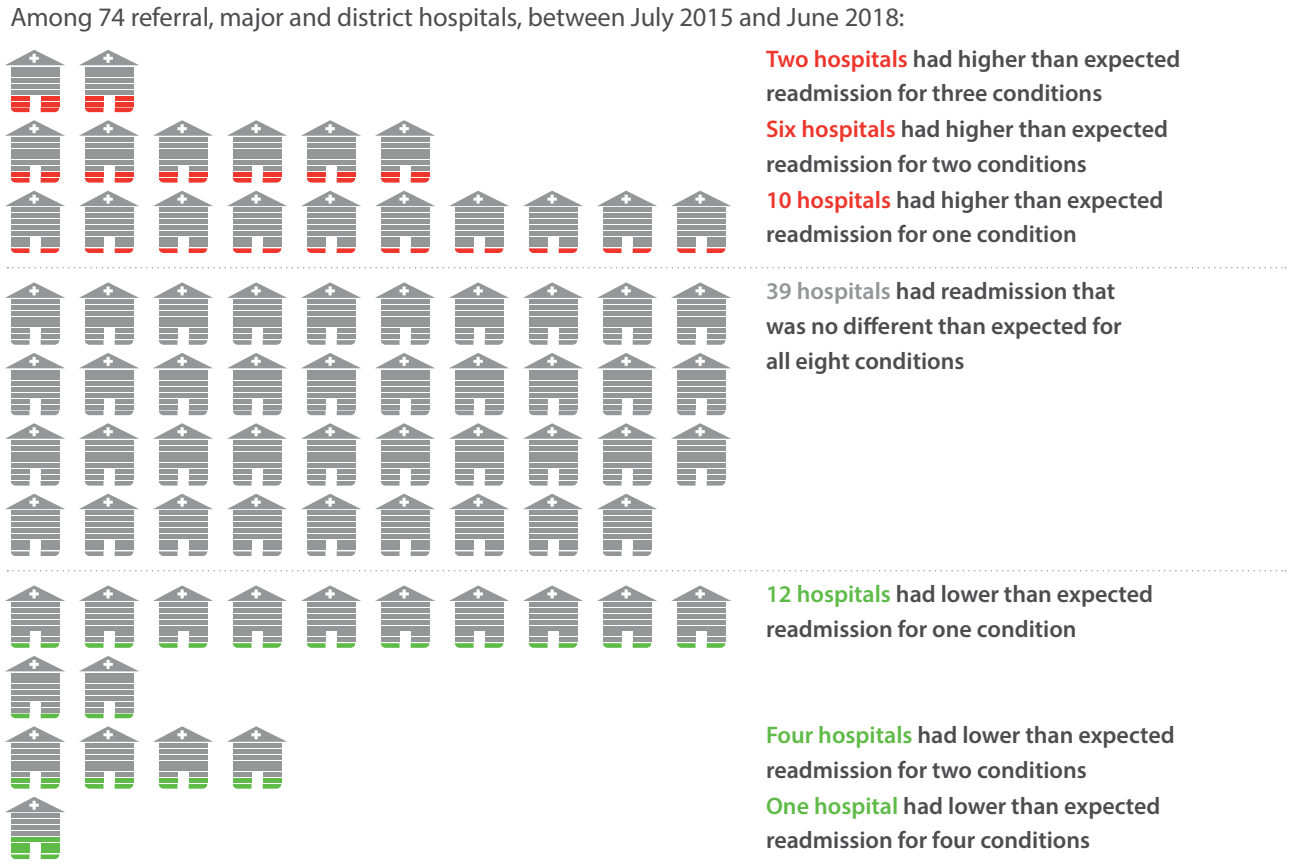


Figure 8 Concentration of readmission results that were higher, lower or no different than expected across 74 NSW public hospitals, July 2015 – June 2018*



* Not all hospitals have results for all eight conditions.

Readmission by local health district

Local health districts

In NSW there are 16 local health districts (LHDs) responsible for the 74 public hospitals included in this report.

Across the eight clinical conditions, public hospitals with 30-day readmission (60 days for specified surgical procedures) results that were lower or higher than expected are summarised by LHD in Figure 9.

There were instances of both lower and higher than expected RSRRs across metropolitan, regional and rural LHDs.

There were some LHDs where one or more hospitals had RSRRs lower than expected: Illawarra Shoalhaven, Murrumbidgee, Northern Sydney, Southern NSW, St Vincent's Health Network and Western NSW. These LHDs also had no hospitals where RSRRs were higher than expected (Figure 9).

There were some LHDs where two or more hospitals had RSRRs higher than expected: Central Coast, Nepean Blue Mountains and South Western Sydney. These LHDs also had no hospitals where RSRRs were lower than expected (Figure 9).

Figure 9 LHDs with at least one public hospital with a readmission result that was higher or lower than expected, by condition, July 2015 – June 2018

● Higher than expected ● Lower than expected

	LHD	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Metropolitan	Central Coast	Gosford			Wyong	Gosford Wyong			
	Illawarra Shoalhaven	Wollongong		Shellharbour		Shoalhaven			
	Nepean Blue Mountains		Nepean	Blue Mountains			Nepean		
	Northern Sydney	Hornsby		Hornsby					
	South Eastern Sydney	St George Sutherland			St George	Prince of Wales			
	South Western Sydney			Campbelltown	Liverpool	Campbelltown	Bankstown-Lidcombe Campbelltown		
	Sydney		Royal Prince Alfred	Canterbury Concord		Canterbury Royal Prince Alfred		Royal Prince Alfred	
	Western Sydney			Auburn Westmead	Blacktown			Mount Druitt	
	St Vincent's Health Network					St Vincent's			
Rural and regional	Far West	Far West LHD did not have any hospitals that were outliers in 2015–2018							
	Hunter New England	Calvary Mater			Tamworth		John Hunter	Manning	Manning
	Mid North Coast				Coffs Harbour		Port Macquarie		
	Murrumbidgee	Wagga Wagga		Wagga Wagga	Deniliquin Wagga Wagga	Wagga Wagga			
	Northern NSW	The Tweed	Murwillumbah			Lismore	Lismore	The Tweed	
	Southern NSW					Queanbeyan			
	Western NSW			Orange		Orange			

Reasons for readmission

Variation in timing and reasons for readmission

Reasons for hospital readmission are multifaceted. Understanding the factors influencing a patient journey from the initial hospitalisation to readmission may help inform local efforts to avoid or reduce readmissions.

This report compares the principal diagnosis at the initial hospitalisation with the principal diagnosis at the readmission, as well as the length of time between the initial hospitalisation and readmission.

Reasons for readmission were assigned to a selection of categories based on the recorded principal diagnosis at the time of readmission. These categories are stratified based on their potential relationship to the initial admission, hospital care and the time between initial hospitalisation and readmission.

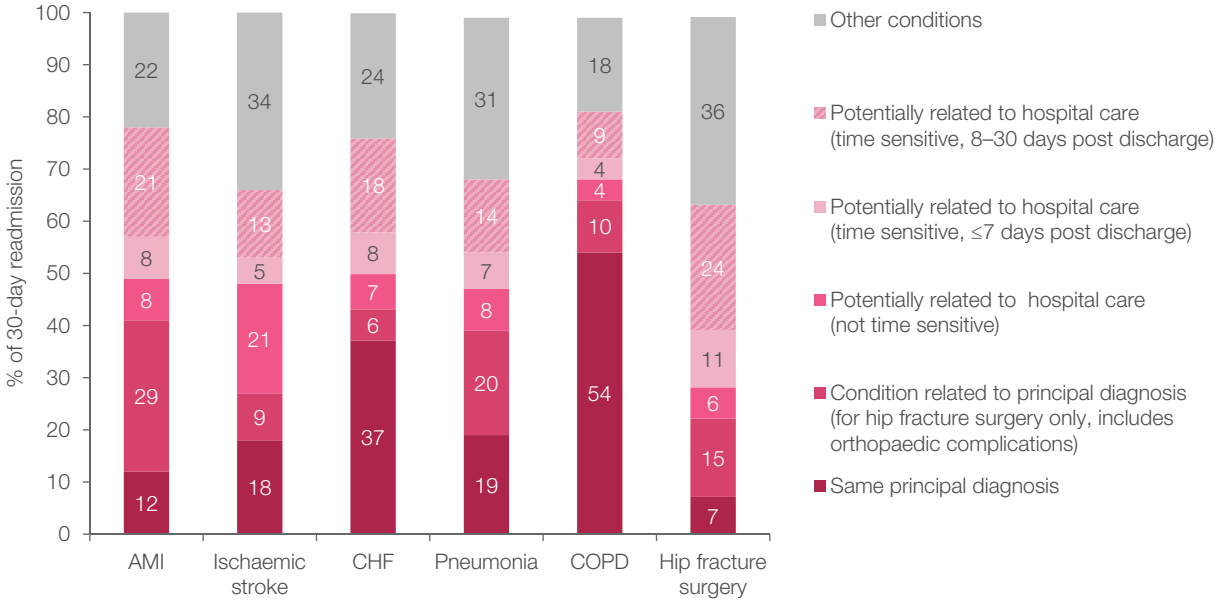
When examining reasons for readmission that are time sensitive, the length of time between discharge and readmission was measured to determine if it occurred within a time interval specified by clinical advisors in NSW. If a readmission occurred within the time specified the readmission was more likely to be related to hospital care.

Reasons for readmission within 30-days varied across the six conditions. The proportion of reasons for readmission that were the same as or related to the principal diagnosis of the initial hospitalisation ranged from 22% for hip fracture surgery to 64% for chronic obstructive pulmonary disease (COPD) (Figure 10).

Readmissions within 60 days of discharge related to orthopaedic complications or potentially related to hospital care were 55% for total hip replacement and 59% for total knee replacement surgeries (Figure 11).

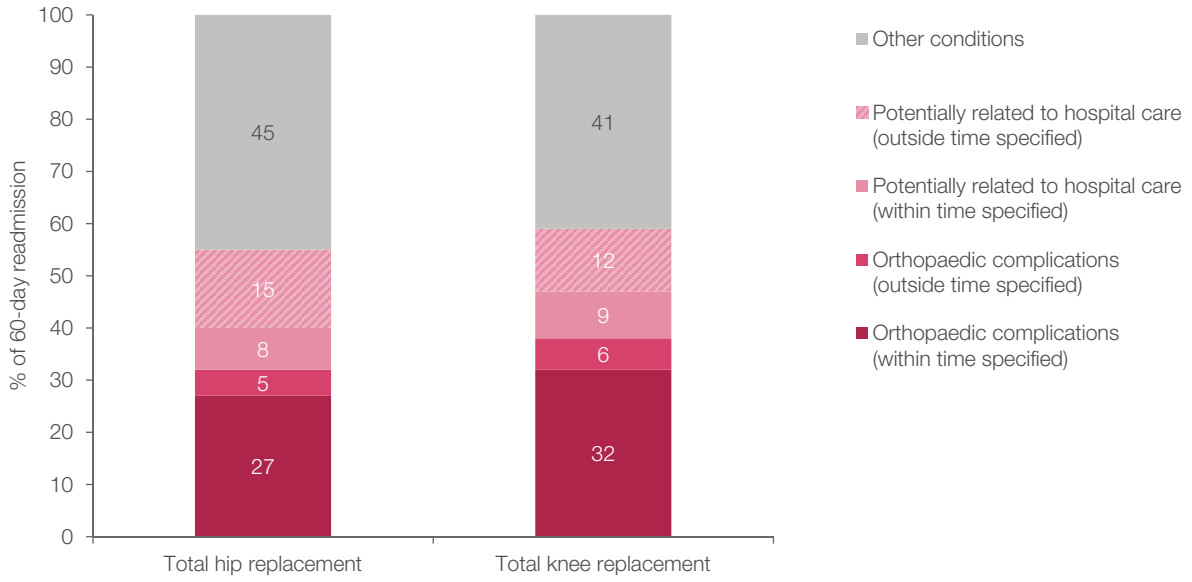
Figure 12 outlines the most frequently occurring principal diagnoses at the time of readmission, by condition, for the period July 2015 – June 2018.

Figure 10 Distribution of reasons for readmission by category, by clinical condition and type of readmission, NSW, July 2015 – June 2018



Note: For reasons for readmission that are time sensitive, the length of time between discharge and readmission was measured to determine if it occurred within a time interval specified by clinical advisors in NSW. If a readmission occurred shortly after discharge, the readmission was more likely to be related to hospital care. If the readmission occurred outside the time interval specified, it was less likely to be related to hospital care. See *Spotlight on Measurement: Measuring return to acute care following discharge from hospital, 2nd edition* for further information on reasons for readmission.

Figure 11 Distribution of reasons for readmission by category for two surgical procedures and type of admission, NSW, July 2015 – June 2018



Note: For reasons for readmission that are time sensitive, the length of time between discharge and readmission was measured to determine if it occurred within a time interval specified by clinical advisors in NSW. If a readmission occurred within the time specified (7, 15 or 30 days after discharge, depending on the principal diagnosis), the readmission was more likely to be related to surgery or hospital care. If the readmission occurred outside the time specified, it was less likely to be related to surgery or hospital care. See Spotlight on Measurement: Measuring return to acute care following discharge from hospital, 2nd edition for further information on reasons for readmission.

Figure 12 Most frequently recorded principal diagnoses for readmissions under categories 'same or related to index admission' and 'potentially related to hospital care', by condition, July 2015 – June 2018

	Reason for readmission was same as or related to index admission	Reason for readmission was potentially related to hospital care
Condition	Principal diagnosis (n)	Principal diagnosis (n)
AMI	Acute subendocardial myocardial infarction (377) Congestive heart failure (312)	Pneumonia (62) Gastrointestinal haemorrhage (48)
Ischaemic stroke	Cerebral infarction (129) Transient cerebral ischaemic attack (55)	Pneumonitis due to food or vomit (71) Pneumonia (38)
CHF	Congestive heart failure (2,532) Left ventricular failure (176)	Acute kidney failure (137) Pneumonia (73)
Pneumonia	Pneumonia (1067) COPD with acute lower respiratory infection (395)	Congestive heart failure (113) Pulmonary embolism (without cor pulmonale) (82)
COPD	COPD with acute lower respiratory infection (3,197) COPD with acute exacerbation (1,965)	Congestive heart failure (92) Constipation (64)
Hip fracture surgery	Fracture of intertrochanteric section of femur (43)* Pain in a joint, pelvic region and thigh (30)*	Urinary tract infection (52) Pneumonia (31)
Total hip replacement	Infection/inflammatory reaction to joint prosthesis (48)* Wound infection following a procedure (36)*	Constipation (6) Phlebitis and thrombophlebitis of deep vessels (6)
Total knee replacement	Wound infection following a procedure (122)* Infection/inflammatory reaction to joint prosthesis (95)*	Phlebitis and thrombophlebitis of deep vessels (19) Constipation (11)

*orthopaedic complication

Condition-specific results

Acute myocardial infarction

An acute myocardial infarction (AMI), or heart attack, occurs when the blood supply to part of the heart is interrupted, resulting in death of heart muscle cells. The heart muscle suffers permanent damage if blood supply is not restored rapidly.

The NSW 30-day readmission rate was 15 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for AMI between July 2015 and June 2018, the readmission rate ranged from nine to 23 per 100 hospitalisations.

Statistics such as risk-standardised readmission ratios (RSRRs) take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 41 hospitals (84%) with AMI readmissions that were no different than expected. Four hospitals (Calvary Mater, Gosford, St George and The Tweed) had higher than expected readmission and four hospitals (Hornsby, Sutherland, Wagga Wagga and Wollongong) had lower than expected readmission (Figure 13).

Figure 13 Acute myocardial infarction 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018

Acute myocardial infarction 30-day readmission

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 29,506 index hospitalisations that met the inclusion criteria – with a principal diagnosis of AMI (ICD-10-AM code I21, I22). Some patients had multiple discharges. There were 27,868 patients included in the analyses.
- There were 530 people (2%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 4,301 acute, emergency readmissions (all causes). After excluding 923 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 15 per 100 hospitalisations.

Among the 4,301 readmissions:

- 495 (12%) were for the same condition (i.e. principal diagnosis of AMI).
- 1,254 (29%) were for a condition related to AMI*.
- 348 (8%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 364 (8%) were potentially related to hospital care as they occurred within seven days of discharge.
- 898 (21%) were potentially related to hospital care but occurred outside the seven-day window.
- 942 (22%) were for other reasons.
- 2,990 (70%) patients were readmitted to the same hospital.

Age, sex and comorbidity

- Almost twice the number of males (19,350) to females (10,155) were admitted for a principal diagnosis of AMI.
- There were more females (17%) than males (13%) with a readmission within 30 days of discharge.
- After adjusting for age and comorbidity, sex was associated with readmission and males were at lower risk of readmission.

* Same ICD-10-AM chapter.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 41% of readmissions occurred in the first seven days following discharge and about half of these were for AMI or related conditions (Figure 14). Among readmissions that were potentially related to hospital care, pneumonia was identified as the most frequently occurring reason (Table 1).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for AMI increased with the length of stay, up to 20% following stays of 15+ days (Figure 15).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that as length of stay increased, there was a greater proportion of readmissions that were potentially related to hospital care (Figure 16).

Table 1 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Potentially related to hospital care (not time sensitive)	Gastrointestinal haemorrhage (48)
	Acute kidney failure (35)
	Constipation (30)
Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	Pneumonia (62)
	COPD with acute lower respiratory infection (17)
	Syncope and collapse (17)
	Dizziness and giddiness (15)
	Wound infection (15)
	Pleural effusion (15)

Figure 14 Acute myocardial infarction, number of, and reasons for readmission, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

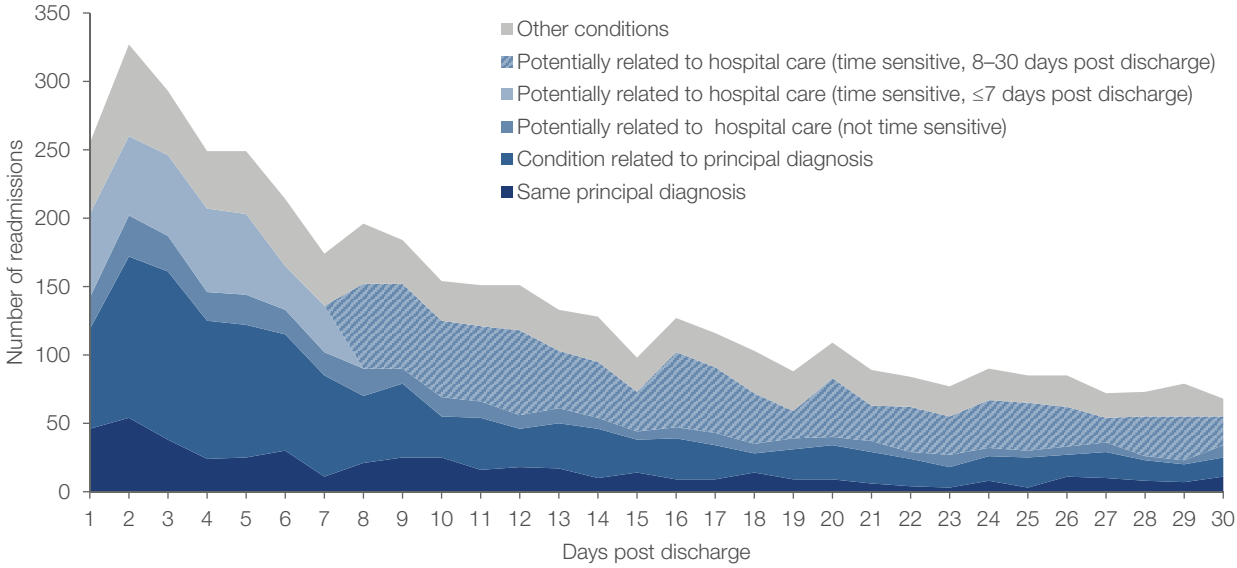


Figure 15 Acute myocardial infarction, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

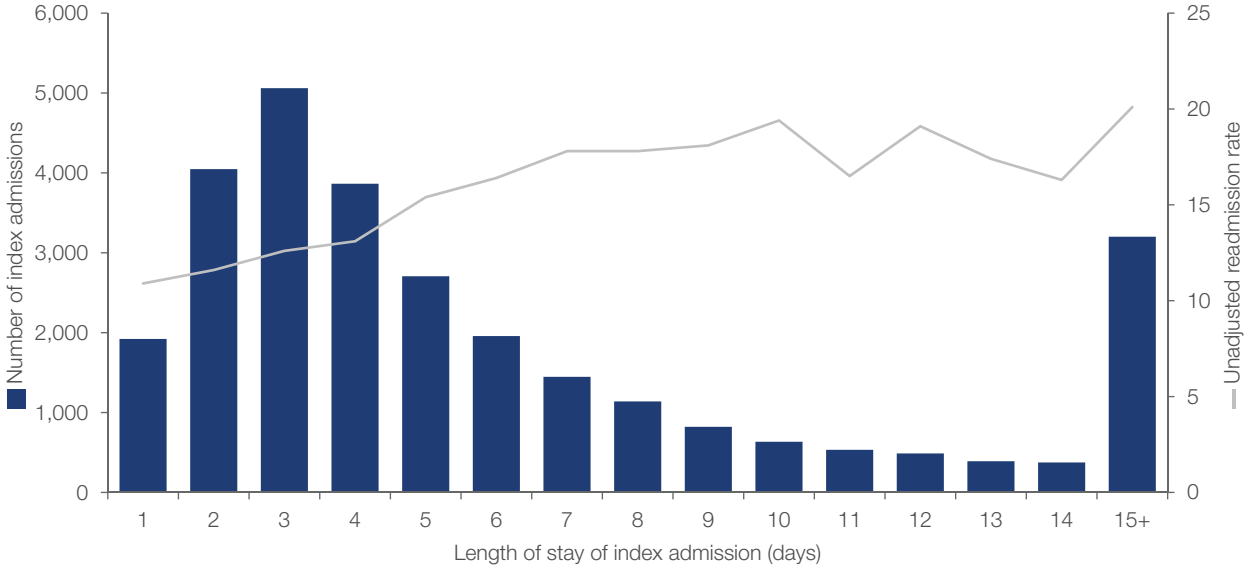
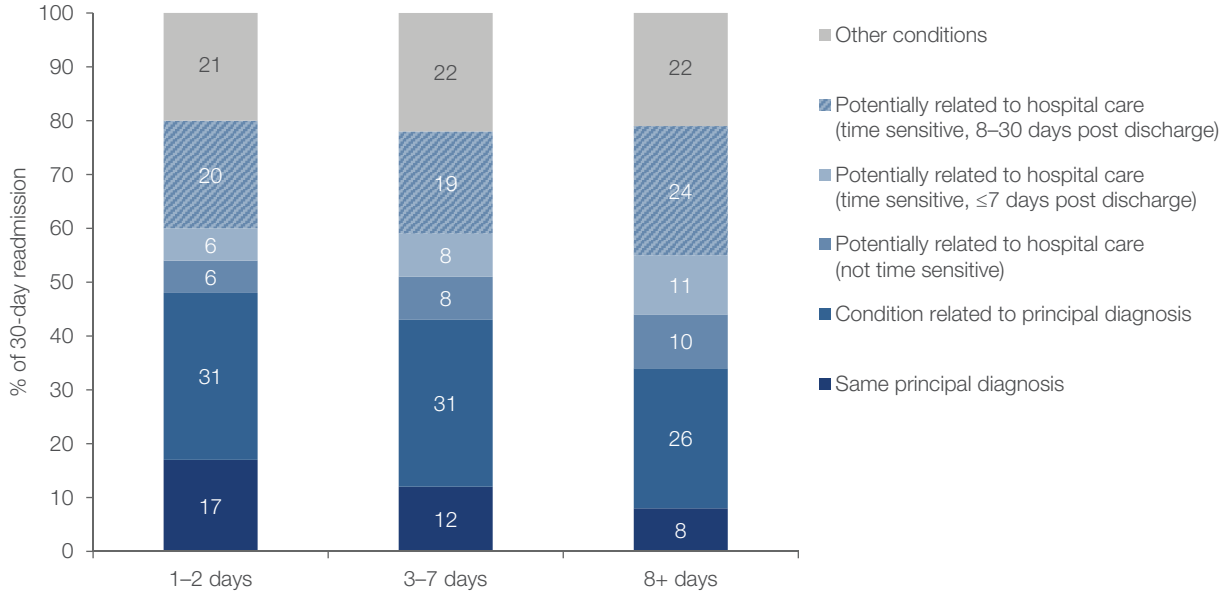


Figure 16 Acute myocardial infarction, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



Ischaemic stroke

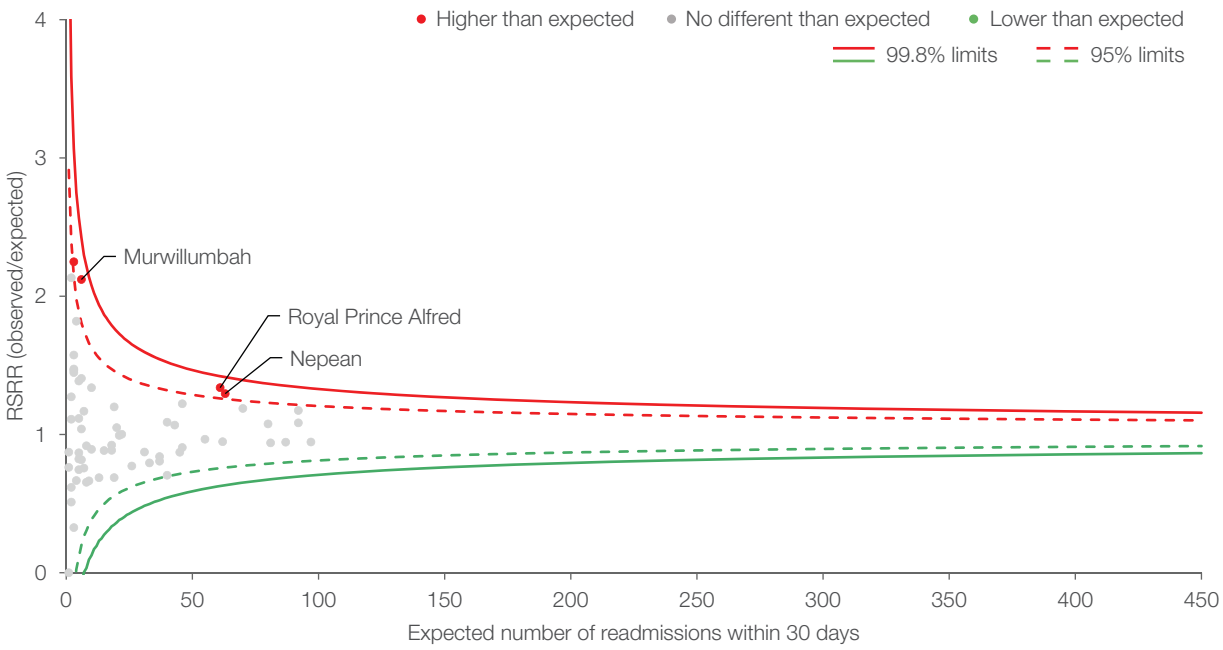
Ischaemic stroke occurs when a blood vessel is blocked, depriving the brain of oxygen and nutrients. As a result, the area of the brain supplied or drained by the blood vessel suffers damage.

The NSW 30-day readmission rate was 10 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for ischaemic stroke between July 2015 and June 2018, readmission rates ranged from five to 23 per 100 hospitalisations.

Statistics such as risk-standardised readmission ratios (RSRRs) take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 41 hospitals (93%) with ischaemic stroke readmission results that were no different than expected.

Three hospitals (Murwillumbah, Nepean and Royal Prince Alfred) had higher than expected readmission and no hospitals had lower than expected readmission (Figure 17).

Figure 17 Ischaemic stroke 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018



Ischaemic stroke 30-day readmission

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 16,995 index hospitalisations that met the inclusion criteria – with a principal diagnosis of ischaemic stroke (ICD-10-AM code I63). Some patients had multiple discharges. There were 16,342 patients included in the analyses.
- There were 1029 people (6%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 1,660 acute, emergency readmissions (all causes). After excluding 560 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 10 per 100 hospitalisations.

Among the 1,660 readmissions:

- 302 (18%) were for the same condition (i.e. principal diagnosis of ischaemic stroke).
- 146 (9%) were for a condition related to ischaemic stroke*.
- 341 (21%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 89 (5%) were considered potentially related to hospital care as they occurred within seven days of discharge.
- 212 (13%) were for a condition considered potentially related to hospital care (but occurred outside the seven-day window).
- 570 (34%) were for other reasons.
- 1,317 (79%) were to the same hospital.

Age, sex and comorbidity

- More males (9553) than female patients (7442) had index hospitalisations for ischaemic stroke.
- Index hospitalisations followed by a readmission within 30 days were equal among males (10%) and females (10%).
- After adjusting for age and comorbidity, sex was not associated with readmission.

* Same ICD-10-AM chapter.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 36% of readmissions occurred in the seven days following discharge and 33% of these were for the same or a related condition (Figure 18). Among readmissions that were potentially related to hospital care, pneumonitis was the most frequent cause (Table 2).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for ischaemic stroke rose in line with increasing lengths of stay, up to a rate of 13% for stays of 15+ days (Figure 19).

Reasons for readmission which occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that as length of stay increased, there was a greater proportion of readmissions that were potentially related to hospital care (Figure 20).

Table 2 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Potentially related to hospital care (not time sensitive)	Pneumonitis due to food and vomit (71)
	Pneumonia (38)
	Septicaemia (29)
Potentially related to hospital care (time sensitive, ≤7 days post discharge)	Syncope and collapse (13)
	Dizzyness/giddiness (10)
	Urinary tract infection (8)

Figure 18 Ischaemic stroke, number of, and reasons for readmission, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

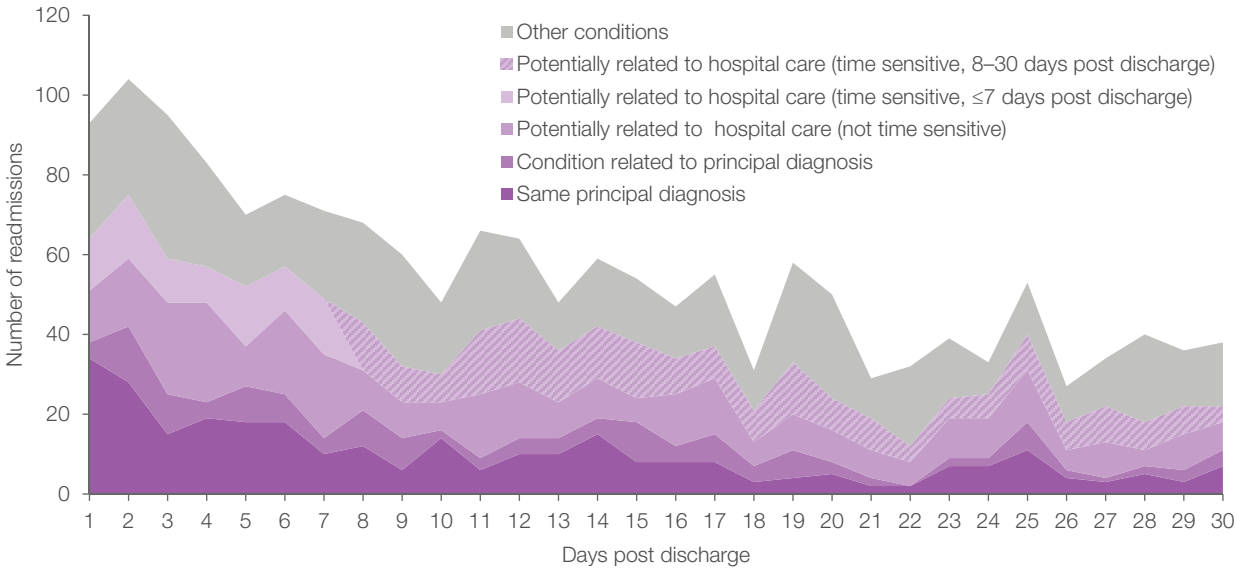


Figure 19 Ischaemic stroke, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

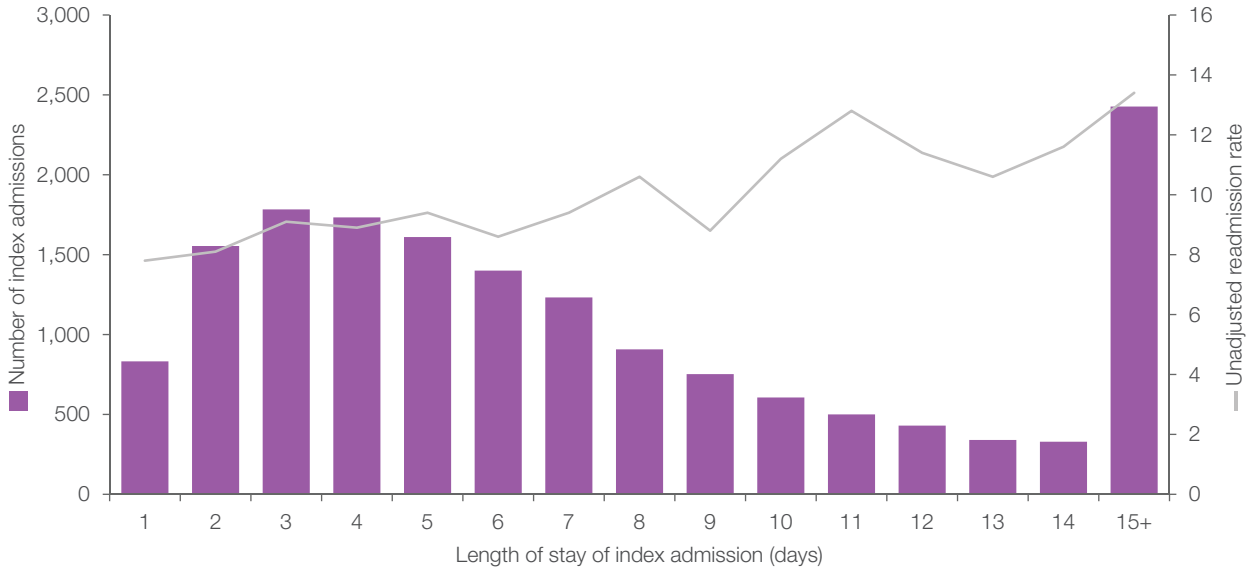
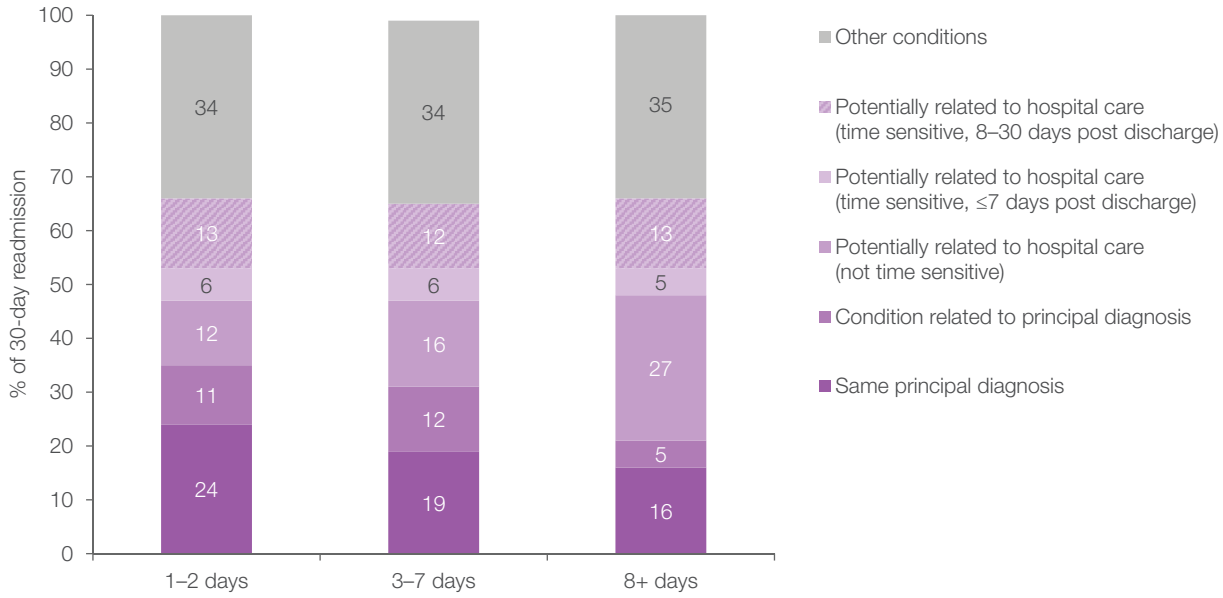


Figure 20 Ischaemic stroke, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



Congestive heart failure

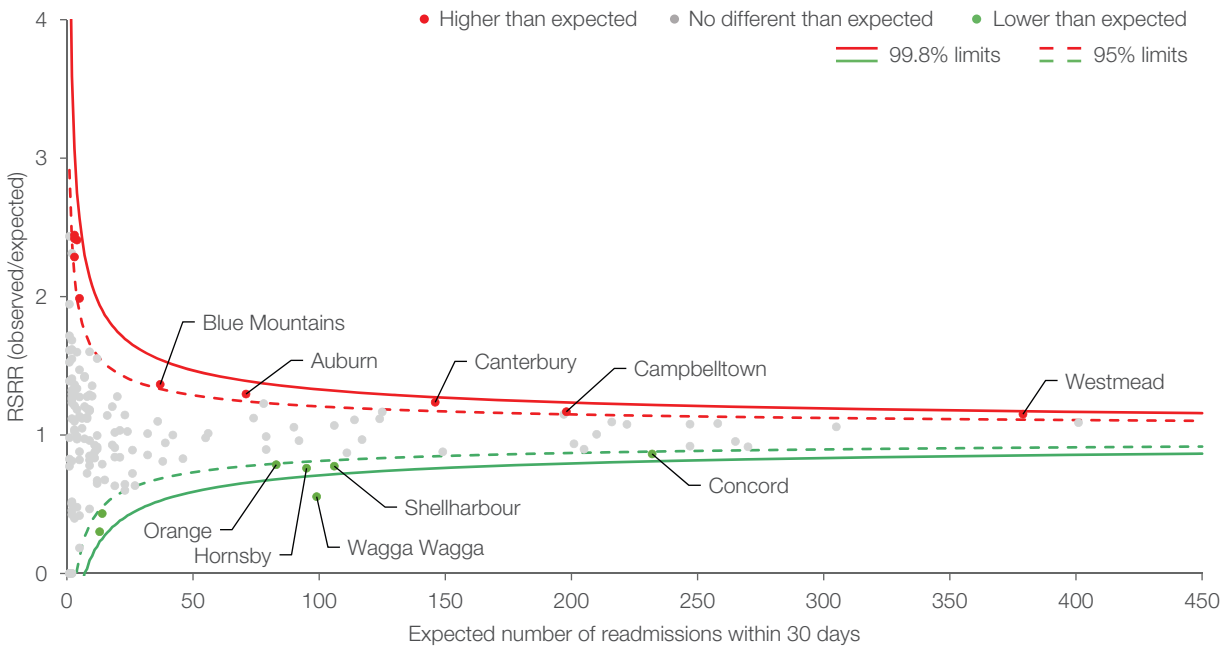
Congestive (or chronic) heart failure (CHF) is a condition that occurs when the heart is unable to keep up with the demands of, or provide adequate blood flow to other organs. It often develops as a result of hypertension, diabetes or other coronary diseases.

The NSW 30-day readmission rate was 22 per 100 hospitalisations. For hospitals with at least 50 index hospitalisations for CHF between July 2015 and June 2018, readmission rates ranged from 12 to 33 per 100 hospitalisations.

Statistics such as risk-standardised readmission ratios (RSRRs), take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly

Among principal referral, major and district hospitals (peer groups A–C), there were 56 hospitals (85%) with CHF readmissions that were no different than expected. Five hospitals (Orange, Hornsby, Wagga Wagga, Shellharbour and Concord) had lower than expected readmission and five (Blue Mountains, Auburn, Canterbury, Campbelltown and Westmead) had higher than expected readmission (Figure 21).

Figure 21 **Congestive heart failure 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018**



Congestive heart failure 30-day readmissions

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 34,789 index hospitalisations that met the inclusion criteria – with a principal diagnosis of CHF (ICD-10-AM codes I11.0, I13.0, I13.2, I50.0, I50.1, I50.9). Some patients had multiple discharges. There were 26,478 patients included in the analyses.
- There were 1,423 people (5%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 7,553 acute, emergency readmissions (all causes). After excluding 1,103 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 22 per 100 hospitalisations.

Among the 7,553 readmissions:

- 2,759 (37%) were for the same condition (i.e. principal diagnosis of CHF).
- 484 (6%) were for a condition related to CHF*.
- 557 (7%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 605 (8%) were potentially related to hospital care as they occurred within seven days of discharge.
- 1,353 (18%) were potentially related to hospital care but occurred outside the seven-day window.
- 1,795 (24%) were for other reasons.
- 6,178 (82%) were to the same hospital.

Age, sex and comorbidity

- Of the CHF index hospitalisations, there were more male patients (18,456) than female patients (16,333).
- Among males, 22% of index hospitalisations were followed by a readmission within 30 days, compared with 21% among females.
- After adjusting for age and comorbidities, sex was not associated with readmission.

* Same ICD-10-AM chapter

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

Around one-third of readmissions occurred within seven days of hospital discharge (34%). Throughout the 30-day period, 43% of the readmissions were for CHF or related conditions and about a third of all readmissions (33%) were potentially related to hospital care (Figure 22). Among these, acute kidney failure was the most frequent cause (Table 3).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for CHF rose slightly in step with increasing lengths of stay in the index hospitalisation (Figure 23).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show similar profiles regardless of the length of stay (Figure 24).

Table 3 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reasons for readmission (n)
Potentially related to hospital care (not time sensitive)	Acute kidney failure (137)
	Gastrointestinal haemorrhage (64)
	Constipation (47)
Potentially related to hospital care (time sensitive, ≤7 days post discharge)	Pneumonia (73)
	COPD with acute lower respiratory infection (70)
	COPD with acute exacerbation (35)

Figure 22 Congestive heart failure, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

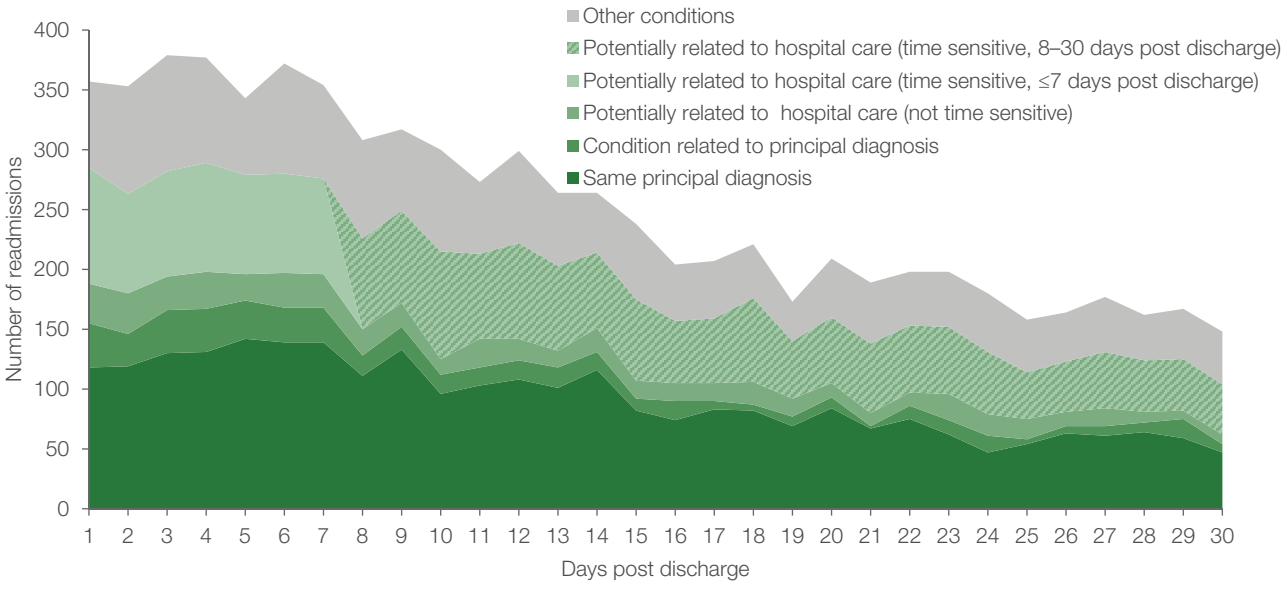


Figure 23 Congestive heart failure, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

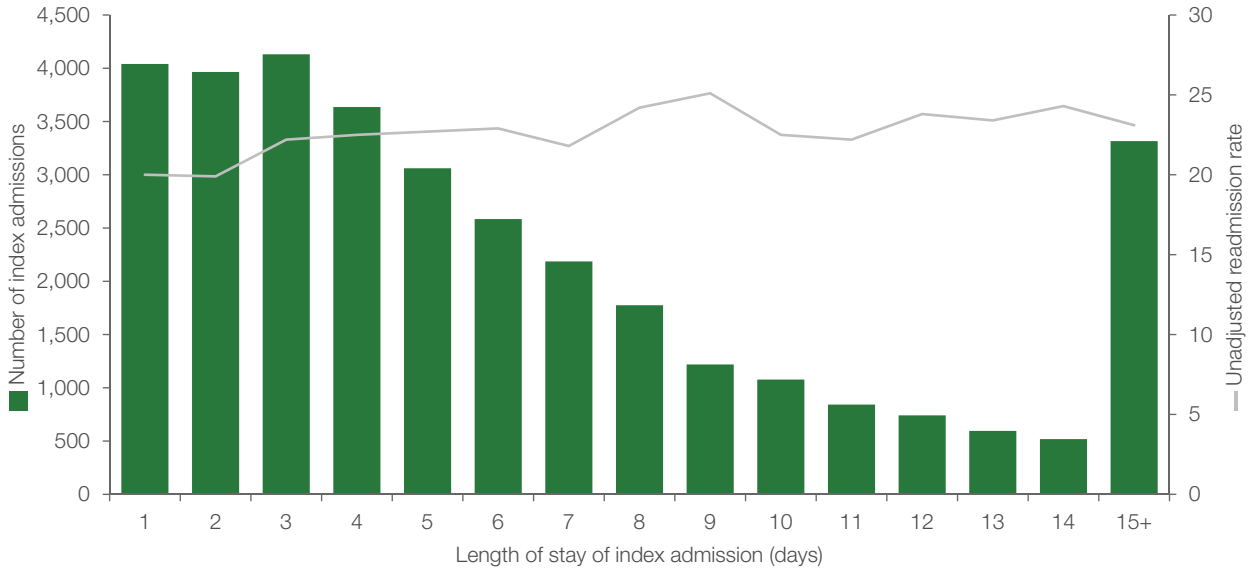
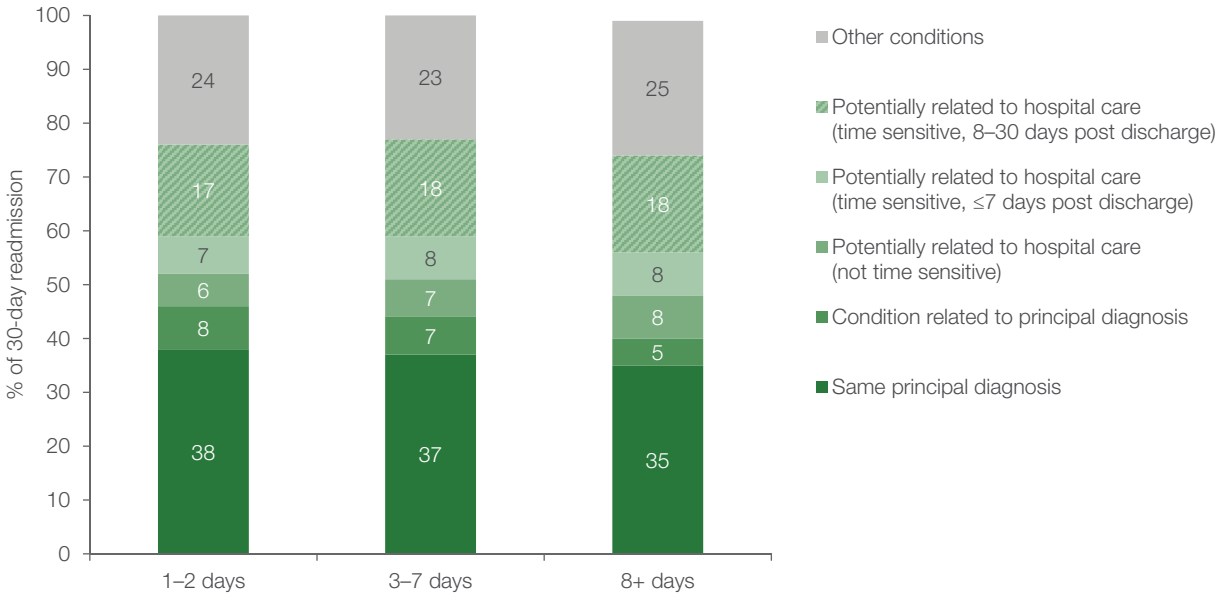


Figure 24 Congestive heart failure, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



Pneumonia

Pneumonia is an infection in one or both lungs, causing inflammation and breathing difficulty. Symptoms may include fever, chills, cough with sputum production, chest pain and shortness of breath.

The NSW 30-day unadjusted readmission rate was 14 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for pneumonia between July 2015 and June 2018, unadjusted readmission rates ranged from five to 17 per 100 hospitalisations.

Statistics such as risk-standardised readmission ratios (RSRRs) take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 63 hospitals (89%) with results that were no different than expected. Three hospitals (Deniliquin, Wagga Wagga and Blacktown) had lower than expected readmission and five hospitals (Tamworth, Coffs Harbour, Wyong, Liverpool and St George) had higher than expected readmission (Figure 25).

Figure 25 Pneumonia 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018

Pneumonia 30-day readmissions

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 50,305 index hospitalisations that met the inclusion criteria – with a principal diagnosis of pneumonia (ICD-10-AM codes J13–J16, J18). Some patients had multiple discharges – 46,217 patients were included in the analyses.
- There were 1,833 people (4%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 6,789 acute, emergency readmissions (all causes). After excluding 1,450 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 14 per 100 hospitalisations.

Among the 6,789 readmissions:

- 1,321 (19%) were for the same condition (i.e. principal diagnosis of pneumonia).
- 1,359 (20%) were for a condition related to pneumonia*.
- 531 (8%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 508 (7%) were potentially related to hospital care as they occurred within seven days of discharge.
- 962 (14%) were potentially related to hospital care but occurred outside the seven-day window.
- 2,108 (31%) were for other reasons.
- 5,553 (82%) were to the same hospital.

Age, sex and comorbidity

- Among the pneumonia index hospitalisations, there were more male patients (26,733) than female patients (23,572).
- Among males, 14% of index hospitalisations were followed by a readmission within 30 days, compared with 13% among females.
- After adjusting for age and comorbidities, sex was significantly associated with readmission and males were at higher risk of readmission.

* Same ICD-10-AM chapter.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 38% of readmissions occurred in the seven days following discharge and 27% of these were potentially related to hospital care (Figure 26). Among the readmissions that were potentially related to hospital care, CHF was the most frequent cause (Table 4).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections.. The unadjusted readmission rate following hospitalisation for pneumonia increased in line with length of stay, up to about 21% for stays of 12 days. It then decreased to around 19% (Figure 27).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that as length of stay increased, there was a lower proportion of readmissions for pneumonia (Figure 28).

Table 4 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Potentially related to hospital care (not time sensitive)	Pulmonary embolism without mention of acute cor pulmonale (82)
	Constipation (70)
	Acute kidney failure (62)
Potentially related to hospital care (time sensitive, ≤7 days post discharge)	CHF (113)
	Chest pain (29)
	Gastroenteritis and colitis (24)

Figure 26 Pneumonia, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

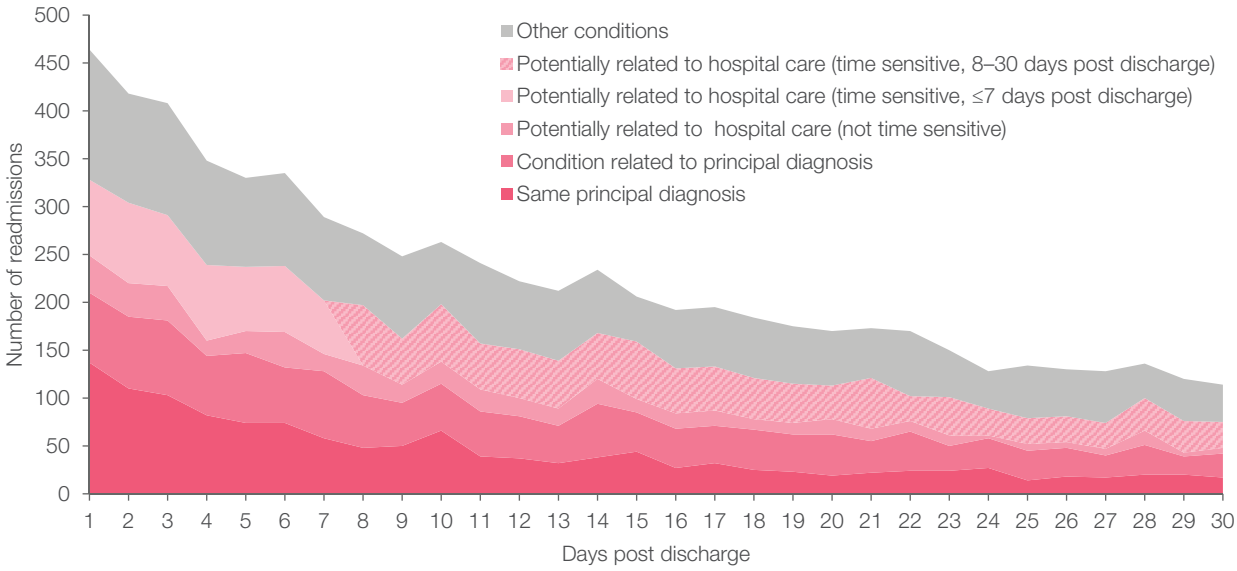


Figure 27 Pneumonia, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

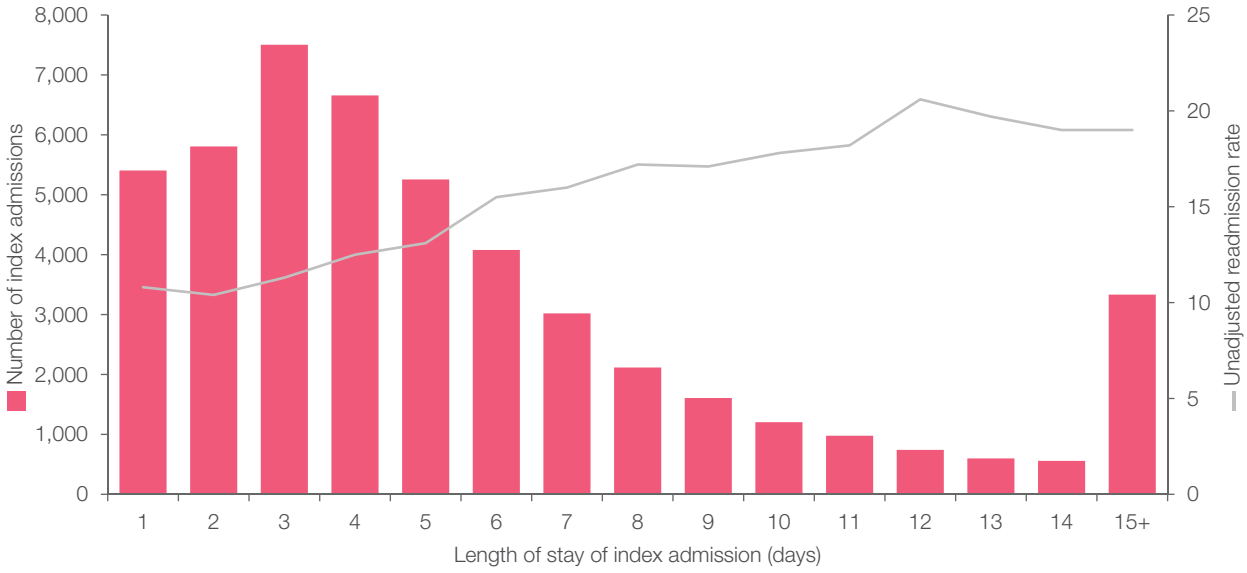
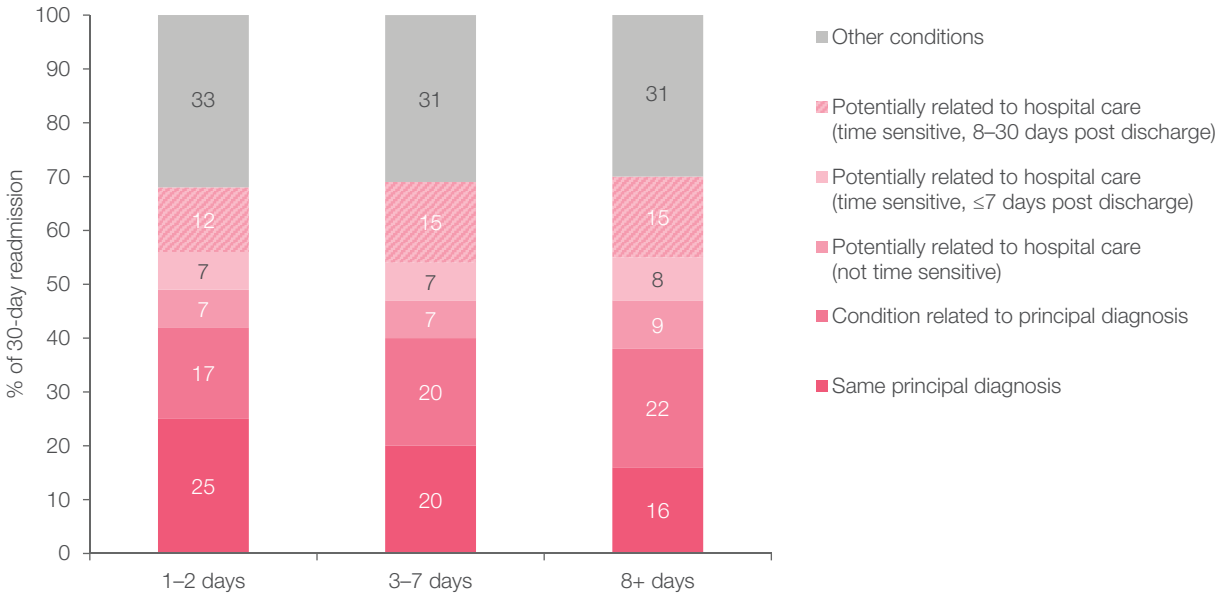


Figure 28 Pneumonia, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



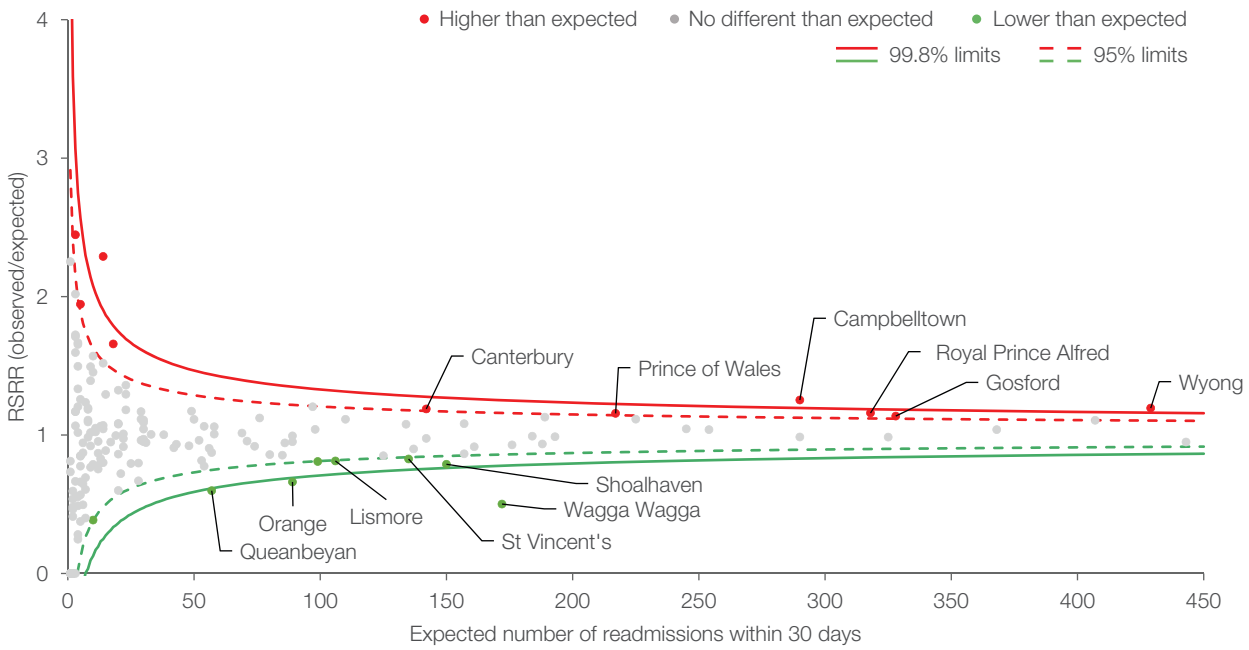
Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) is a long-term lung disease, associated with prolonged exposure to tobacco smoke. While no existing treatment can cure COPD, it can be effectively managed.

The NSW 30-day readmission rate was 21 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for COPD between July 2015 and June 2018, unadjusted readmission rates ranged from 10 to 27 per 100 hospitalisations.

Statistics such as risk-standardised readmission ratios (RSRRs), take account of different patient-level factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 60 hospitals (83%) with readmission results that were no different than expected. Six hospitals (Queanbeyan, Orange, Lismore, Wagga Wagga, St Vincent's and Shoalhaven) had lower than expected readmission and six (Canterbury, Prince of Wales, Campbelltown, Royal Prince Alfred, Gosford and Wyong) had higher than expected readmission (Figure 29).

Figure 29 Chronic obstructive pulmonary disease 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018



Chronic obstructive pulmonary disease 30-day readmission

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 49,828 index hospitalisations that met the inclusion criteria – with a principal diagnosis of COPD (ICD-10-AM codes J40–J44). Some patients had multiple discharges – 31,595 patients were included in the analyses.
- There were 1088 people (3%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 10,372 acute, emergency readmissions (all causes). After excluding 1,492 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 21 per 100 hospitalisations.

Among the 10,372 readmissions:

- 5,652 (54%) were for the same condition (i.e. principal diagnosis of COPD).
- 1,070 (10%) were for a condition related to COPD*.
- 370 (4%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 433 (4%) were potentially related to hospital care as they occurred within seven days of discharge.
- 954 (9%) were potentially related to hospital care but occurred outside the seven-day window.
- 1,893 (18%) were for other reasons.
- 8,792 (85%) were to the same hospital.

Age, sex and comorbidity

- Among the COPD index hospitalisations, there were fewer male patients (24,485) than female patients (25,343).
- Among males, 22% of index hospitalisations were followed by a readmission within 30 days, compared with 20% among females.
- After adjusting for age and comorbidity, sex was associated with readmission and males were at higher risk of readmission.

* Same ICD-10-AM chapter.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 33% of readmissions occurred in the seven days following discharge and about two-thirds of readmissions were for COPD or related conditions (Figure 30). Among the readmissions that were potentially related to hospital care, CHF was the most frequent cause (Table 5).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for COPD increased slightly with longer lengths of stay, up to 26% for stays of 13 days (Figure 31).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that a high proportion of readmissions to acute care were for COPD, regardless of the length of stay (Figure 32).

Table 5 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Potentially related to hospital care (not time sensitive)	Constipation (64)
	Pulmonary embolism without mention of acute cor pulmonale (51)
	Gastrointestinal haemorrhage (41)
Potentially related to hospital care (time sensitive, ≤7 days post discharge)	CHF (92)
	Acute subendocardial myocardial infarction (31)
	Chest pain (29)

Figure 30 Chronic obstructive pulmonary disease, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

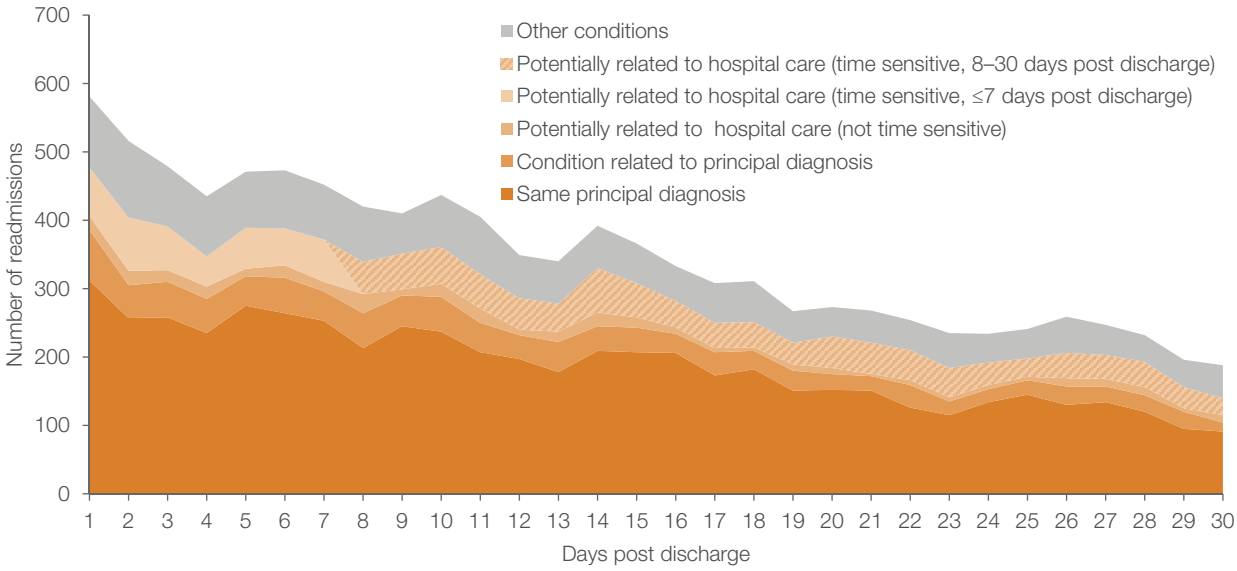


Figure 31 Chronic obstructive pulmonary disease, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

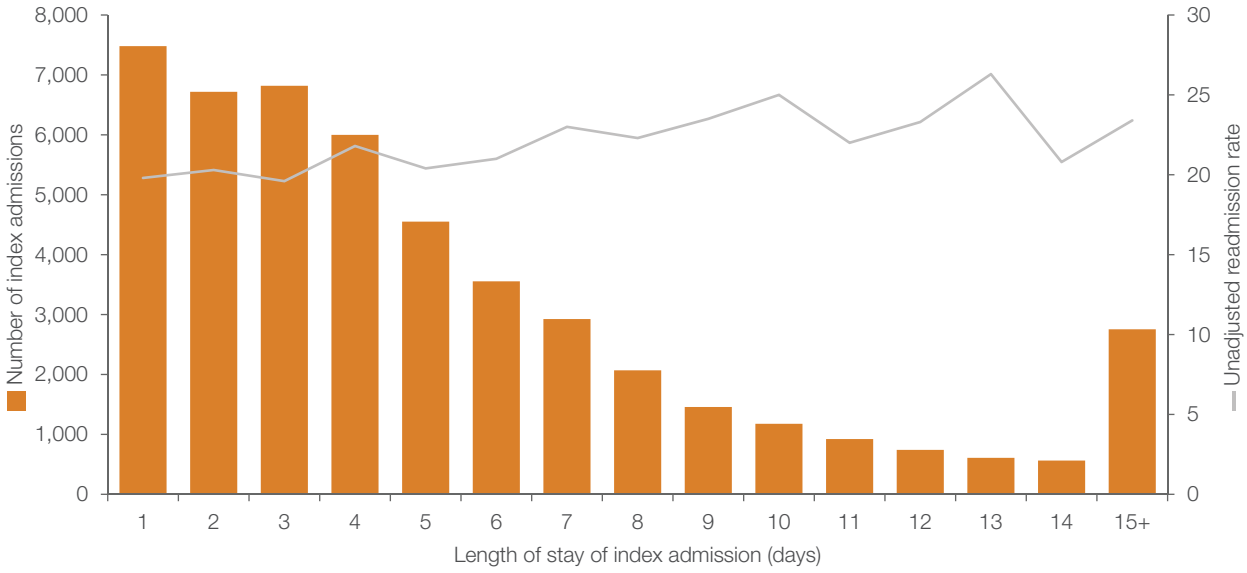
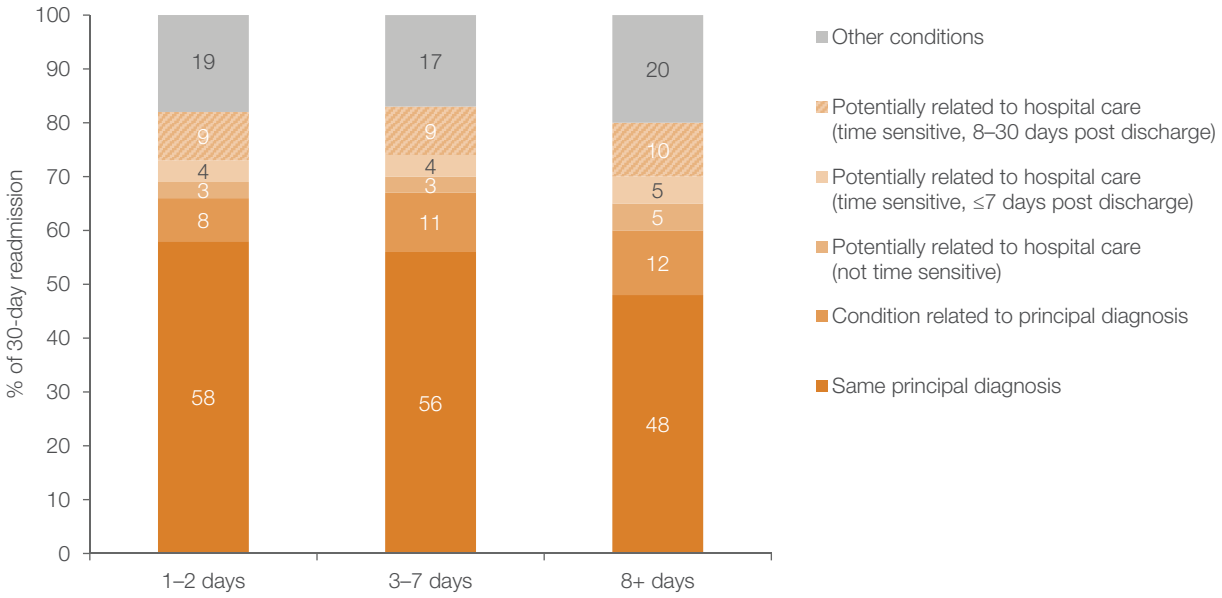


Figure 32 Chronic obstructive pulmonary disease, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



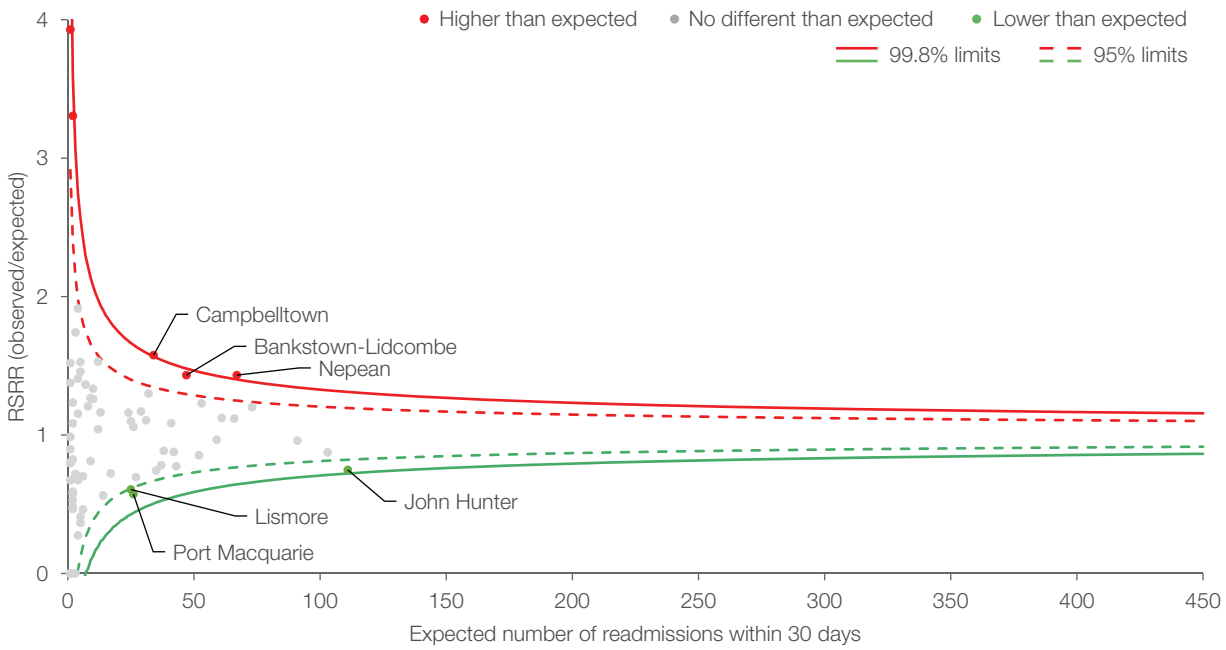
Hip fracture surgery

Hip fracture refers to fractures of the femur (thigh bone) within five centimetres of the distal (lower) part of the lesser trochanter. Hip fractures can occur at any age but are most common in elderly people.

The NSW 30-day readmission rate was 11 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for hip fracture surgery between July 2015 and June 2018, unadjusted readmission rates ranged from five to 17 per 100 hospitalisations.

Statistics such as RSRRs take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 34 hospitals (85%) with readmission results that were no different than expected. Three hospitals (Port Macquarie, Lismore and John Hunter) had lower than expected readmission and three (Campbelltown, Bankstown-Lidcombe and Nepean) had higher than expected readmission (Figure 33).

Figure 33 Hip fracture surgery 30-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018



Hip fracture surgery 30-day readmission

Key characteristics, NSW, July 2015 – June 2018

In the three-year period:

- There were 15,388 index hospitalisations that met the inclusion criteria with a principal diagnosis of hip fracture treated with surgery (ICD-10-AM codes S72.0, S72.1, S72.2). Some patients had multiple discharges – 15,005 patients were included in the analyses.
- There were 699 people (5%) who died in the 30 days following discharge, before any readmission.
- In the 30 days following discharge from acute care, there were 1,633 acute, emergency readmissions (all causes). After excluding 493 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 11 per 100 hospitalisations.

Among the 1,633 readmissions:

- 114 (7%) were for the same condition (i.e. principal diagnosis of hip fracture surgery).
- 238 (15%) were for a reason specifically related to hip fracture surgery (e.g. wound infection).
- 103 (6%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred.
- 186 (11%) were potentially related to hospital care as they occurred within seven days of discharge.
- 399 (24%) were potentially related to hospital care but occurred outside the seven-day window.
- 593 (36%) were for other reasons.
- 1,273 (78%) were to the same hospital.

Age, sex and comorbidity

- There were fewer male patients (4,602) than female patients (10,786) among the hip fracture surgery index hospitalisations.
- Among males, 13% of index hospitalisations were followed by a readmission within 30 days, compared with 9% for females.
- After adjusting for age and comorbidity, sex was significantly associated with readmission and males had higher risk of readmission.

* Same ICD-10-AM chapter.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 32% of readmissions to acute care occurred in the seven days following discharge (Figure 34). Among all the readmissions that were potentially related to hospital care, urinary tract infection was the most frequent cause (Table 6).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for hip fracture surgery was 6% for short stays of 1–2 days and then increased to 14% for stays of 15+ days (Figure 35).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that as length of stay increased, conditions unrelated to hip fracture surgery were increasingly responsible for readmissions to acute care (Figure 36).

Table 6 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Condition related to principal diagnosis (orthopaedic complications)	Pain in a joint, pelvic region, and thigh (30) Wound infection following a procedure (28) Unspecified injury of hip and thigh (23)
Potentially related to hospital care (not time sensitive)	Urinary tract infection (52) Anaemia, unspecified (12) Unspecified abnormalities of gait and mobility (8)
Potentially related to hospital care (time sensitive, ≤7 days post discharge)	Pneumonia (31) Septicaemia (20) Pneumonitis due to food and vomit (15)

Figure 34 Hip fracture surgery, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2015 – June 2018

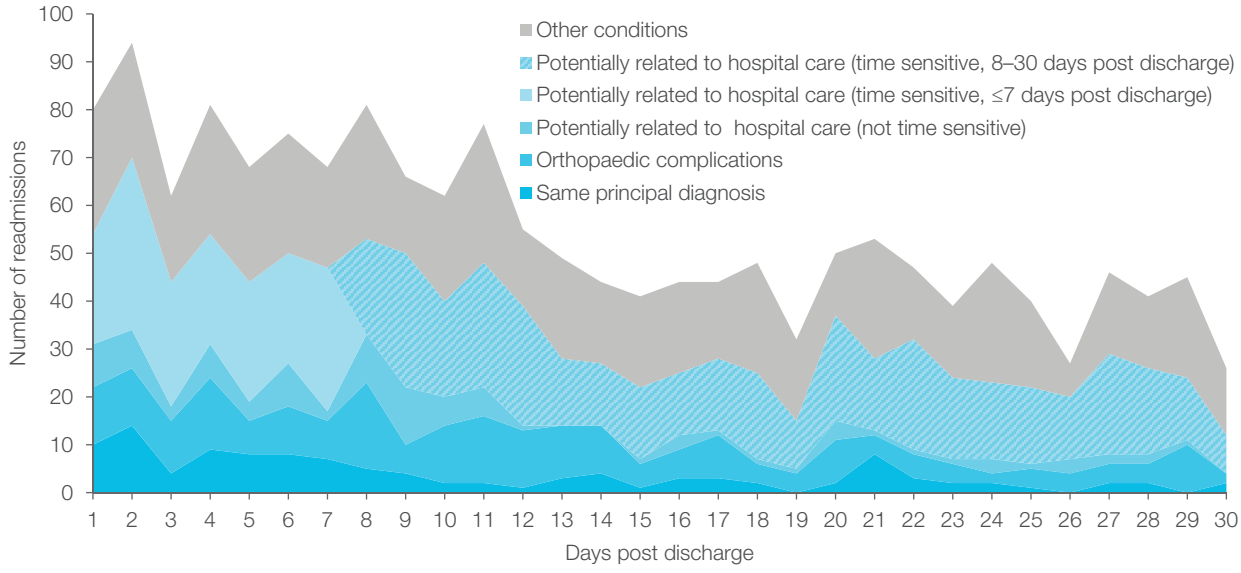


Figure 35 Hip fracture surgery, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

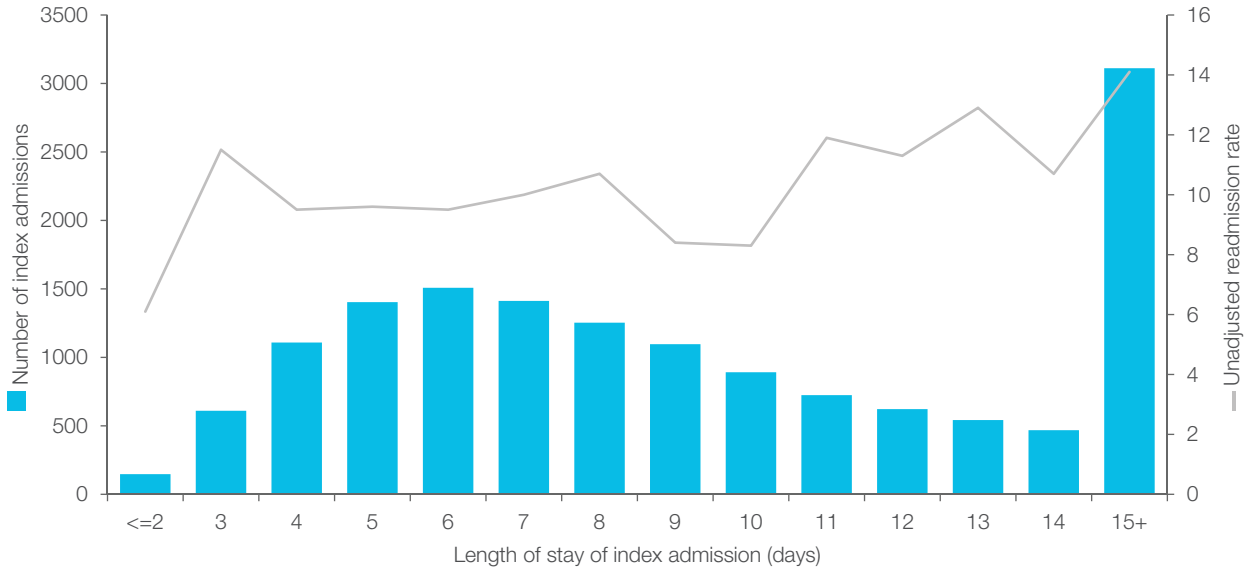
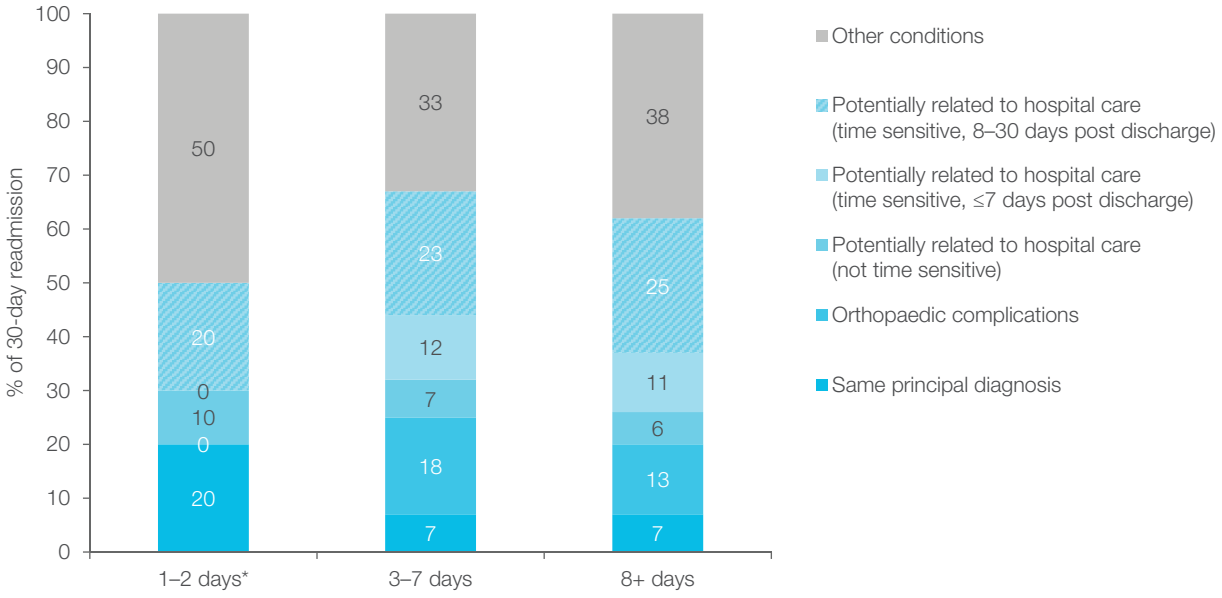


Figure 36 Hip fracture surgery, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



*Results should be interpreted with caution due to the small number of index hospitalisations (10) with a length of stay of 1–2 days for this condition.

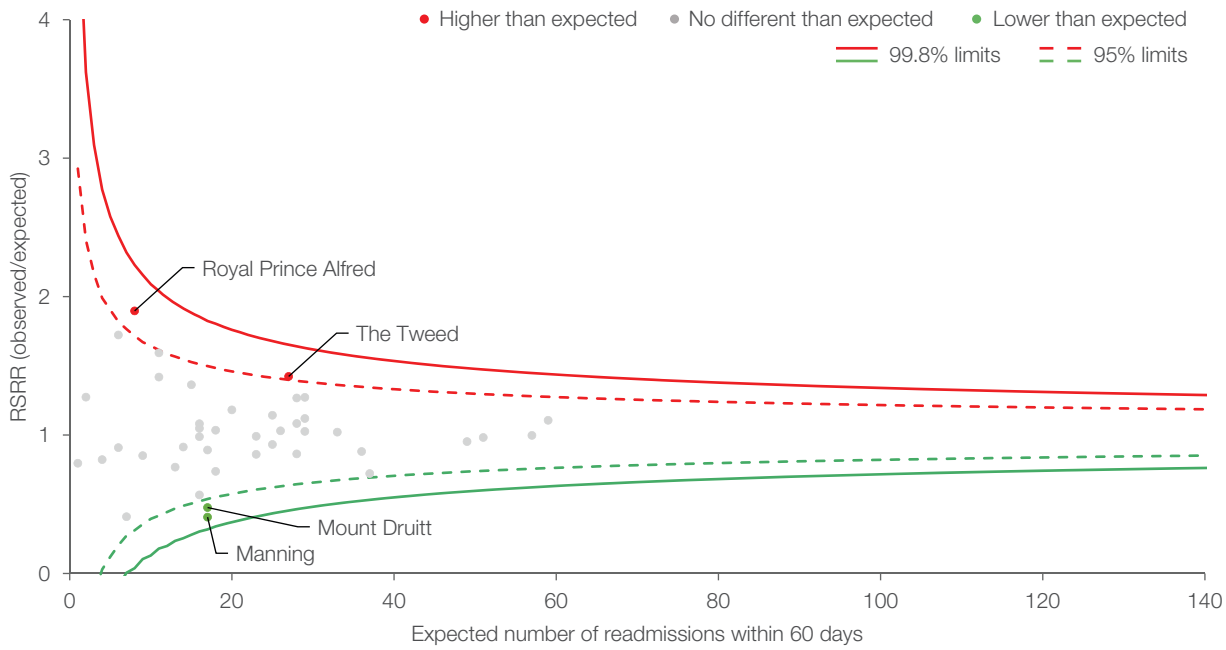
Total hip replacement

A total hip replacement removes a hip joint that has been damaged, usually by arthritis, replacing it with an artificial joint. The procedure alleviates pain, stiffness and muscle weakness.

The NSW 60-day readmission rate was 11 per 100 hospitalisations. For hospitals with at least 50 index hospitalisations for total hip replacement between July 2015 and June 2018, unadjusted readmission rates ranged from four to 27 per 100 hospitalisations.

Statistics such as RSRRs, take account of different patient factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 34 hospitals (89%) with readmission results that were no different than expected. Two hospitals (Manning and Mount Druitt) had lower than expected readmission and two hospitals (Royal Prince Alfred and The Tweed) had higher than expected readmission. (Figure 37).

Figure 37 Total hip replacement 60-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018



Total hip replacement 60-day readmissions

Key characteristics, NSW, July 2015 – June 2018

In the period:

- There were 9,566 index hospitalisations: 9,419 (98%) for an elective primary unilateral procedure and 147 (2%) for a bilateral procedure.
- There were seven people (<1%) who died within 60 days of discharge before any readmission.
- In the 60 days following discharge from acute care, there were 975 readmissions (all causes). After excluding 581 index hospitalisations without 60-days follow-up, this corresponds to an unadjusted readmission rate of 11 per 100 hospitalisations.

Among the 975 readmissions:

- 261 (27%) were for orthopaedic complications (within the time specified as attributable to hospital care), e.g. injury of sciatic nerve at hip and thigh level within seven days; injury of femoral artery within 15 days; dislocated hip within 60 days.
- 47 (5%) were for orthopaedic complications (but outside the time specified).
- 82 (8%) were potentially related to hospital care (i.e. adverse events or deficient management of comorbidity) within the time specified.
- 142 (15%) were potentially related to hospital care but outside the time specified (7, 15 or 30-day period post discharge).
- 443 (45%) were for other reasons.
- 582 (60%) were to the same hospital.

Age, sex and comorbidity

- Among the total hip replacement index hospitalisations, there were fewer male patients (4,588) than female patients (4,978).
- Both male and female patients experienced readmissions for 10% of index hospitalisations within 60 days.
- After adjusting for age and comorbidity, sex was not significantly associated with readmission.

*same ICD-10-AM chapter

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 39% of readmissions that occurred in the first seven days following discharge were for orthopaedic complications (Figure 38). Among these, infection and inflammatory reaction to internal joint prosthesis was the most frequent cause (Table 7).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for total hip replacement increased with longer lengths of stay, up to 22% for stays of 15+ days (Figure 39).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) index hospitalisations show that as length of stay grew, conditions unrelated to orthopaedic complications were increasingly responsible for readmission (Figure 40).

Table 7 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Orthopaedic complications (within time specified)	Infection and inflammatory reaction to internal joint prosthesis (48)
	Wound infection (36)
	Other complications of orthopedic prosthetic devices, implants and grafts (29)
Potentially related to hospital care (within time specified)	Constipation (6)
	Phlebitis and thrombophlebitis of other deep vessels of lower extremities (6)
	Anaemia, unspecified (4)
	Dyspnoea (4)
	Nausea and vomiting (4)

Figure 38 Total hip replacement, number of, and reasons for, readmissions following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2015 – June 2018

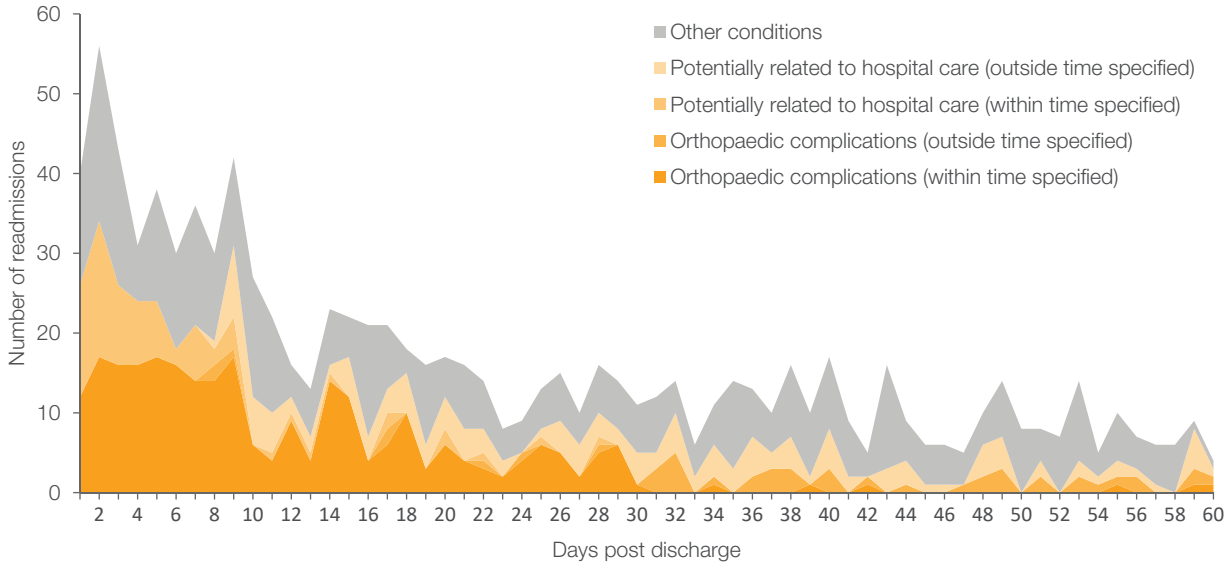


Figure 39 Total hip replacement, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

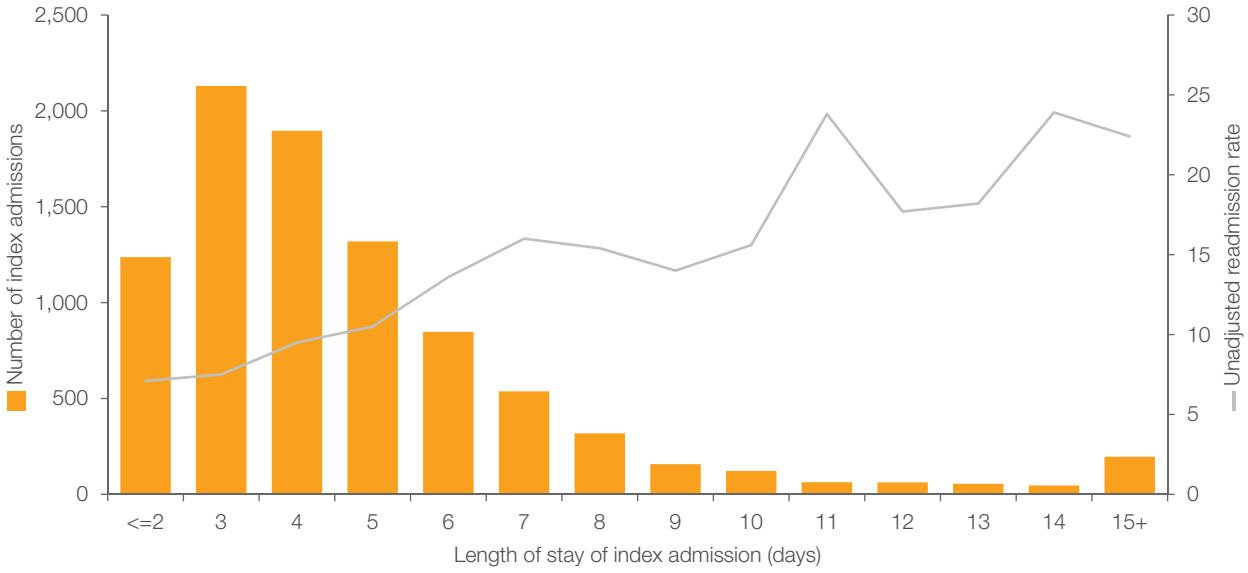
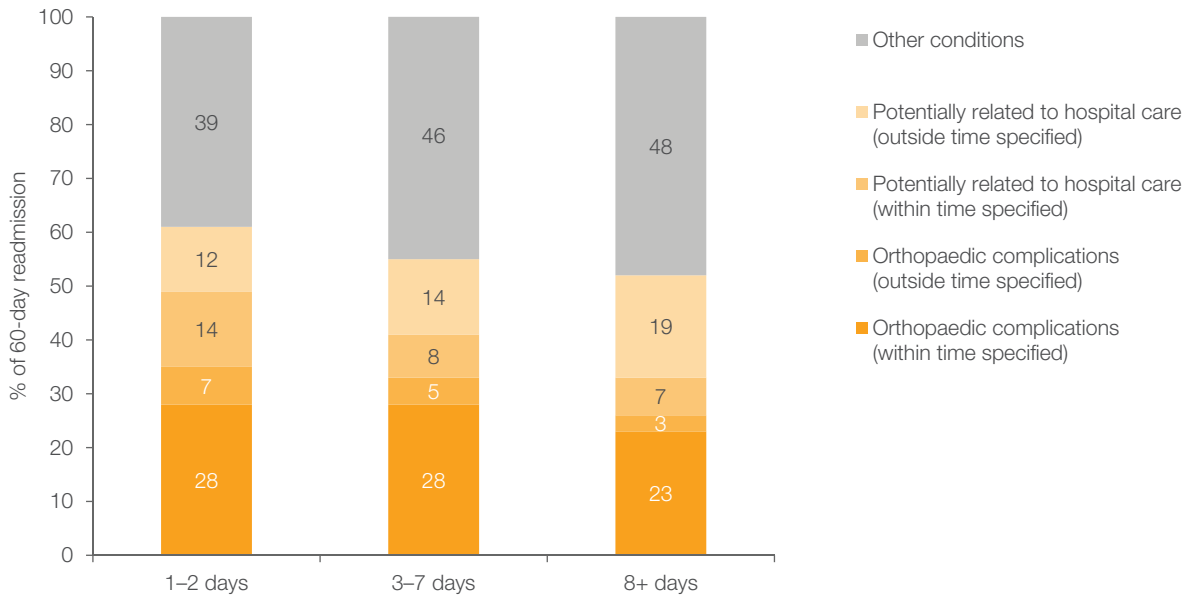


Figure 40 Total hip replacement, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



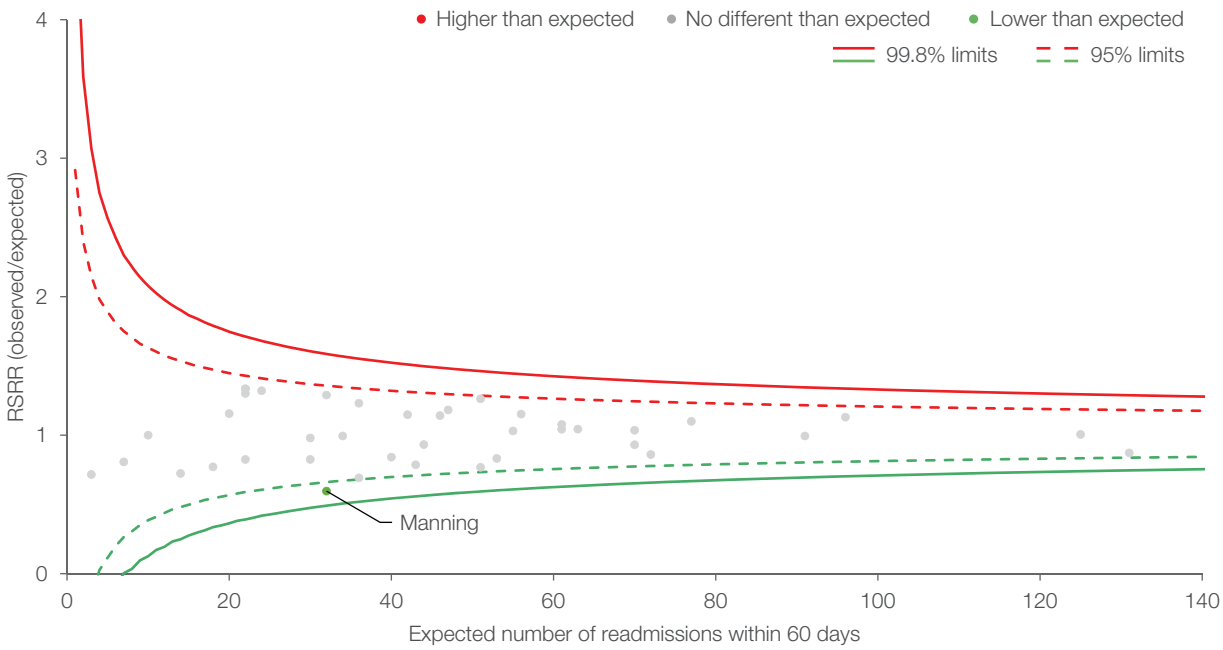
Total knee replacement

A total knee replacement removes a knee joint that has been damaged, usually by arthritis, replacing it with an artificial joint. The procedure alleviates pain, stiffness and muscle weakness.

The NSW 60-day readmission rate was 12 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for total knee replacement between July 2015 and June 2018, unadjusted 60-day readmission rates ranged from seven to 17 per 100 hospitalisations.

Statistics such as RSRRs, take account of different patient level factors (such as age and comorbidities recorded in the medical record) to assess hospital outcomes fairly. Among principal referral, major and district hospitals (peer groups A–C), there were 37 hospitals (97%) with readmission results no different than expected. One hospital (Manning) had lower than expected readmission and no hospitals had higher than expected readmission (Figure 41).

Figure 41 Total knee replacement 60-day risk-standardised readmission ratio, NSW public hospitals, July 2015 – June 2018



Total knee replacement 60-day readmissions

Key characteristics, NSW, July 2015 – June 2018

In the period:

- There were 16,984 index hospitalisations: 15,859 (93%) for an elective primary unilateral procedure and 1125 (7%) for a bilateral procedure.
- There were 6 people (<1%) who died within 60 days of discharge before any readmission.
- In the 60 days following discharge from acute care, there were 1,954 readmissions (all causes). After excluding 1,044 index hospitalisations without 60-day follow-up, this corresponds to an unadjusted readmission rate of 12 per 100 hospitalisations.

Among the 1,954 readmissions:

- 629 (32%) were for orthopaedic complications (within the time specified as attributable to hospital care), e.g. injury of sciatic nerve at hip and thigh level within seven days; injury of femoral artery within 15 days.
- 119 (6%) were for orthopaedic complications (but outside the time specified).
- 167 (9%) were for a condition potentially related to hospital care (i.e. adverse events or deficient management of comorbidity) within the time specified.
- 236 (12%) were potentially related to hospital care but outside the time specified (7, 15 or 30-day period post discharge).
- 803 (41%) were for other reasons.
- 1,181 (60%) were to the same hospital.

Age, sex and comorbidity

- Among the total knee replacement index hospitalisations, there were fewer male patients (7,115) than females (9,869).
- Among males 13% of index hospitalisations were followed by a readmission within 60 days, compared with 11% for females.
- After adjusting for age and comorbidities, sex remained significantly associated with readmission and males were at higher risk of readmission.

Exploring patterns of readmission

Detailed information about when readmissions occur within 30 days of discharge, and the reasons why, can highlight potential areas for improvement.[18] For example, a high number of potentially avoidable readmissions within seven days of discharge may indicate ineffective discharge planning.

About 48% of readmissions that occurred in the first seven days following discharge were for orthopaedic complications (Figure 42). Among these, wound infection was the most frequent cause (Table 8).

Too short a stay in hospital may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission[19–20]

Conversely, staying too long carries an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for total knee replacement increased with longer stays, up to 26% for 14 days, with slightly lower rates thereafter (Figure 43).

Reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations show that as length of stay increased, there was a greater proportion of readmissions that were potentially related to hospital care (for reasons other than orthopaedic complications) (Figure 44).

Table 8 Top three reasons for readmission, potentially related to hospital care, NSW

Category	Reason for readmission (n)
Orthopaedic complications (within time specified)	Wound infection (122)
	Infection and inflammatory reaction to internal joint prosthesis (95)
	Pain in a joint, lower leg (80)
Potentially related to hospital care (within time specified)	Phlebitis and thrombophlebitis of deep vessels of lower extremities (19)
	Constipation (11)
	Urinary tract infection (11)

Figure 42 Total knee replacement, number of, and reasons for readmission following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2015 – June 2018

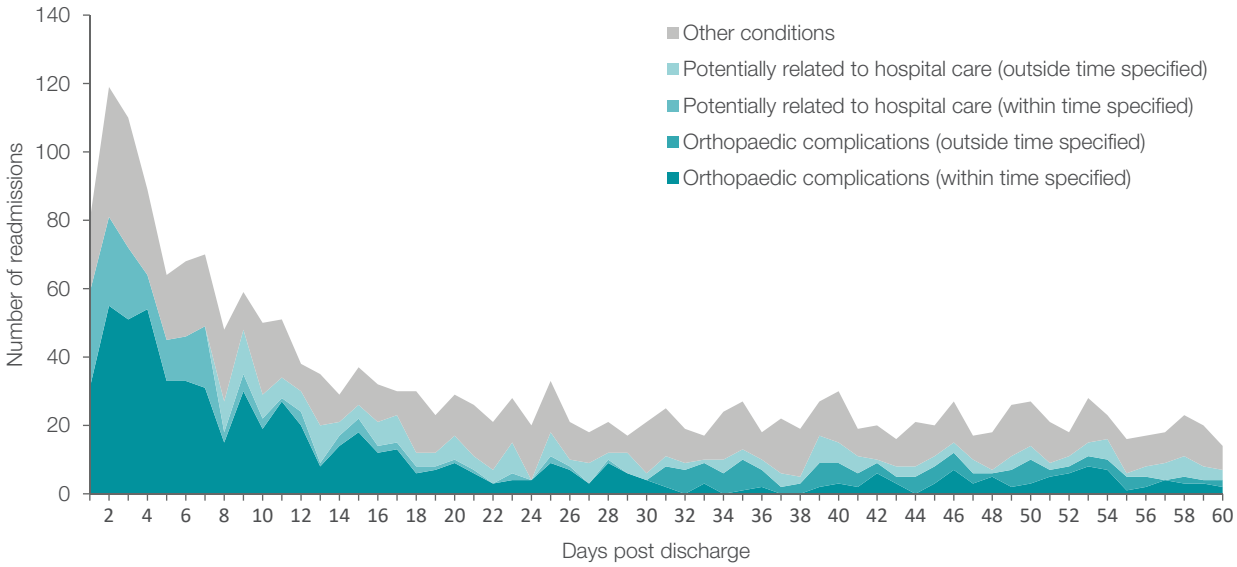


Figure 43 Total knee replacement, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2015 – June 2018

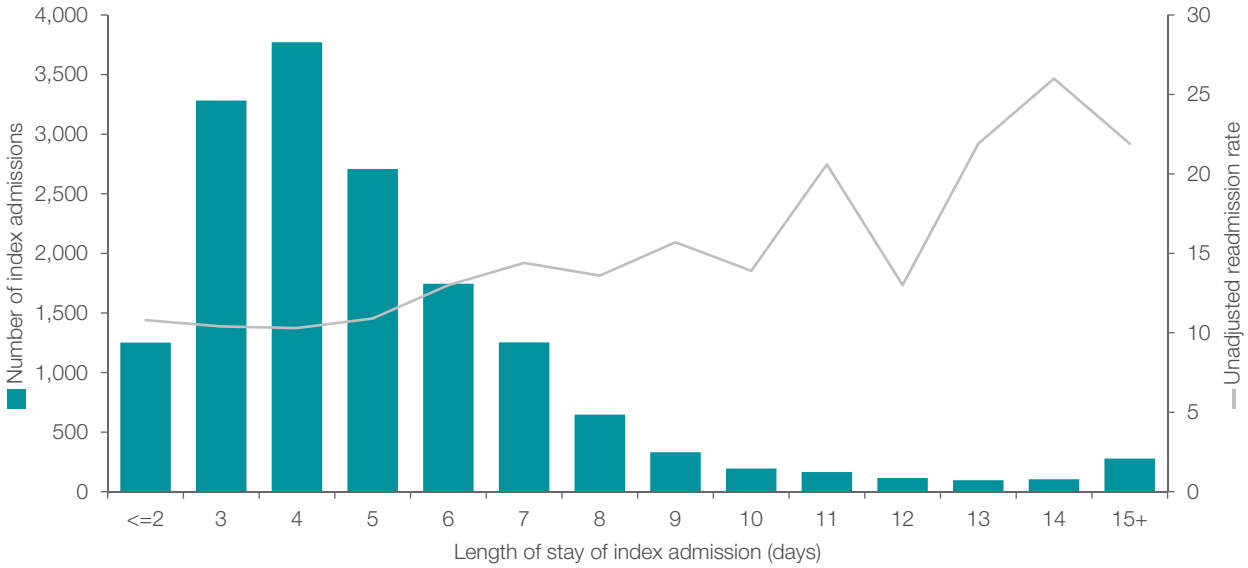
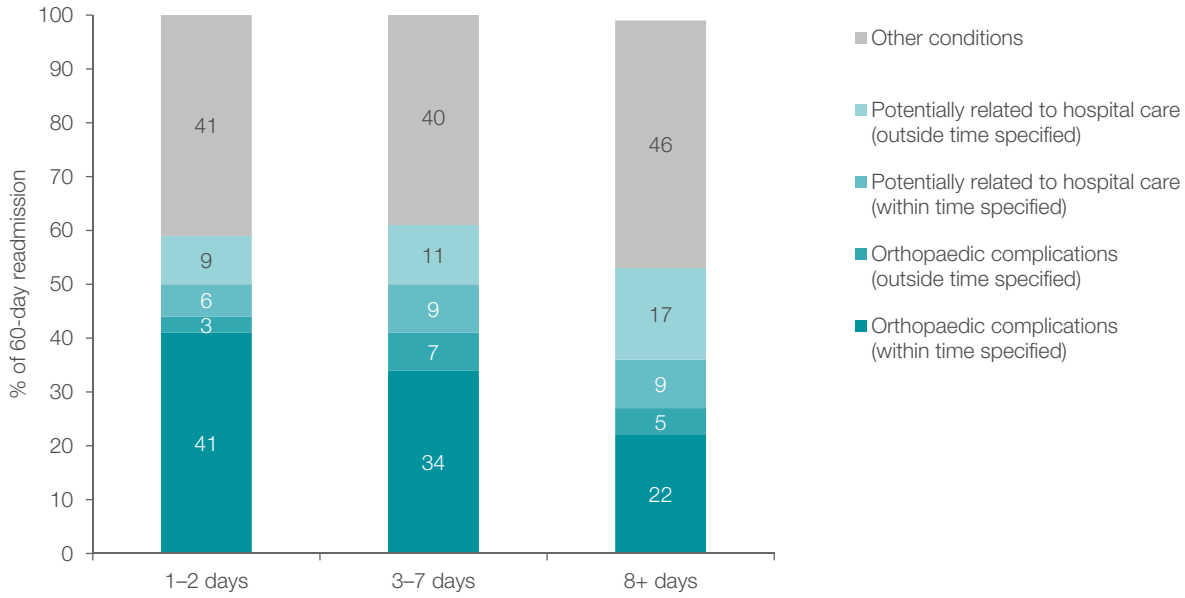


Figure 44 Total knee replacement, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2015 – June 2018



Appendix 1

Table 9 Distribution of NSW public hospitals for readmission results higher, lower or no different than expected, by condition, July 2015 – June 2018

● Higher than expected ● No different than expected ● Lower than expected

LHD	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Central Coast	Gosford Wyong	Gosford Wyong	Gosford Wyong	Wyong Gosford	Gosford Wyong	Gosford	Gosford Wyong	Gosford Wyong
Illawarra Shoalhaven	Wollongong Shellharbour Shoalhaven	Wollongong Shoalhaven	Shellharbour Milton Shoalhaven Wollongong	Milton Shoalhaven Shellharbour Wollongong	Shoalhaven Wollongong Shellharbour Milton	Shoalhaven Wollongong	Shoalhaven Wollongong	Shoalhaven Wollongong
Nepean Blue Mountains	Blue Mountains Nepean	Nepean Blue Mountains	Blue Mountains Lithgow Nepean	Blue Mountains Lithgow Nepean	Blue Mountains Lithgow Nepean	Nepean Blue Mountains	Nepean	Nepean
Northern Sydney	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde	Hornsby Royal North Shore Ryde
South Eastern Sydney	St George Sutherland Prince of Wales	Sutherland St George Prince of Wales	St George Sutherland Prince of Wales	St George Sutherland Prince of Wales Sydney & Sydney Eye	Prince of Wales St George Sutherland Sydney & Sydney Eye	Sutherland St George Prince of Wales	Sutherland Prince of Wales	Sutherland Prince of Wales
South Western Sydney	Bankstown-Lidcombe Bowral Campbelltown Fairfield Liverpool	Fairfield Bowral Liverpool Bankstown-Lidcombe Campbelltown	Campbelltown Bowral Liverpool Bankstown-Lidcombe Fairfield	Liverpool Campbelltown Bowral Bankstown-Lidcombe Fairfield	Campbelltown Bowral Bankstown-Lidcombe Fairfield Liverpool	Bankstown-Lidcombe Campbelltown Bowral Fairfield Liverpool	Bankstown-Lidcombe Bowral Fairfield	Bankstown-Lidcombe Fairfield Bowral
Sydney	Canterbury Concord Royal Prince Alfred	Royal Prince Alfred Canterbury Concord	Canterbury Concord Royal Prince Alfred	Canterbury Concord Royal Prince Alfred	Canterbury Royal Prince Alfred Concord	Canterbury Concord Royal Prince Alfred	Royal Prince Alfred Canterbury RPAH Institute Concord	Canterbury RPAH Institute Concord
Western Sydney	Auburn Blacktown Westmead	Blacktown Westmead	Auburn Blacktown Westmead	Blacktown Auburn Westmead	Auburn Blacktown Westmead	Westmead Blacktown	Mount Druitt Blacktown	Mount Druitt Westmead Blacktown
St Vincent's Health Network	St Vincent's	St Vincent's	St Vincent's	St Vincent's	St Vincent's	St Vincent's	St Vincent's	St Vincent's

● Higher than expected ● No different than expected ● Lower than expected

LHD	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Far West	Broken Hill	Broken Hill	Broken Hill	Broken Hill	Broken Hill		Broken Hill	Broken Hill
Hunter New England	Calvary Mater Armidale Belmont John Hunter Maitland Manning Tamworth	Calvary Mater Armidale Belmont John Hunter Maitland Manning Tamworth	Inverell Calvary Mater Tamworth Armidale Cessnock Muswellbrook Manning John Hunter Maitland Singleton Belmont	Tamworth Gunnedah Narrabri Belmont Cessnock Singleton Inverell Moree John Hunter Calvary Mater Manning Armidale Maitland Muswellbrook	Cessnock Inverell Gunnedah Moree Singleton Kurri Kurri Narrabri Calvary Mater Tamworth Manning Maitland Armidale Muswellbrook John Hunter Belmont	John Hunter Manning Armidale Tamworth Maitland	Manning Armidale John Hunter Tamworth Maitland	Manning Tamworth Armidale John Hunter Maitland
Mid North Coast	Coffs Harbour Kempsey Port Macquarie	Port Macquarie Coffs Harbour	Macksville Coffs Harbour Port Macquarie Kempsey	Coffs Harbour Port Macquarie Kempsey Macksville	Kempsey Port Macquarie Coffs Harbour Macksville	Port Macquarie Coffs Harbour	Port Macquarie Coffs Harbour	Port Macquarie Coffs Harbour
Murrumbidgee	Wagga Wagga Griffith	Wagga Wagga Griffith	Wagga Wagga Young Griffith Deniliquin	Deniliquin Wagga Wagga Young Griffith	Wagga Wagga Young Griffith Deniliquin	Wagga Wagga Griffith	Wagga Wagga	Wagga Wagga
Northern NSW	The Tweed Grafton Lismore	Murwillumbah Grafton Ballina The Tweed Lismore	Grafton The Tweed Lismore Maclean Ballina Murwillumbah Casino	Grafton Maclean Byron Central Casino The Tweed Lismore Ballina Murwillumbah	Lismore Grafton Maclean Byron Central Casino The Tweed Ballina Murwillumbah	Lismore The Tweed Grafton Murwillumbah	The Tweed Murwillumbah Grafton Lismore	Grafton Lismore The Tweed Murwillumbah
Southern NSW	Batemans Bay Goulburn Moruya Queanbeyan South East Regional	South East Regional	Batemans Bay Queanbeyan Goulburn Moruya South East Regional Cooma	Queanbeyan Cooma Batemans Bay Moruya Goulburn South East Regional	Queanbeyan Batemans Bay Moruya Cooma Goulburn South East Regional	South East Regional Goulburn	South East Regional Goulburn	South East Regional Goulburn
Western NSW	Bathurst Dubbo Orange	Bathurst Dubbo Orange	Orange Dubbo Cowra Mudgee Forbes Bathurst	Mudgee Cowra Forbes Bathurst Dubbo Orange	Orange Cowra Mudgee Bathurst Dubbo Forbes	Bathurst Dubbo Orange	Orange Dubbo Bathurst	Orange Dubbo Bathurst

Appendix 2

Prediction models

For each condition included in the report, NSW-level prediction models were developed using index admissions between 1 July 2015 and 30 June 2018. Fine and Gray competing risk models[9] were built taking into account patient level risk factors (age, sex and comorbidities) and competing risk of death.

The variables that were found to be significantly associated with readmission were retained in the final models and are listed in Table 10. C-statistics, which describe the prediction ability of the models, are also shown.

Table 10 Patient factors and comorbidities included in the final models

Condition	Patient factors and comorbidities	C statistic
AMI	Age, Age squared, Sex, History of acute myocardial infarction, Congestive heart failure ,Cardiac arrhythmia, Peripheral vascular disorder, Hypertension, Chronic pulmonary disease, Diabetes complicated, Lymphoma, Solid tumour without metastasis, Coagulopathy, Fluid and electrolyte disorders, Deficiency anaemia, Alcohol abuse/drug abuse/psychoses, Depression.	0.63
Ischaemic stroke	Congestive heart failure, Cardiac arrhythmia, Other neurological disorders, Diabetes complicated, Liver disease, Lymphoma, Solid tumour without metastasis, Coagulopathy, Weight loss, Fluid and electrolyte disorders, Deficiency anaemia.	0.60
CHF	History of congestive heart failure, Cardiac arrhythmia, Chronic pulmonary disease, Diabetes complicated, Renal failure, Metastatic cancer, Coagulopathy, Fluid and electrolyte disorders, Deficiency anaemia.	0.60
Pneumonia	Age, Sex, History of pneumonia, Congestive heart failure , Cardiac arrhythmia, Peripheral vascular disorder, Hypertension, Paralysis, Chronic pulmonary disease, Diabetes complicated, Renal failure, Liver disease, Lymphoma, Metastatic cancer, Solid tumour without metastasis, Rheumatoid arthritis collagen, Coagulopathy, Weight loss, Fluid and electrolyte disorders, Deficiency anaemia, Alcohol abuse/drug abuse/psychoses, Depression.	0.66
COPD	Age, Sex, History of chronic obstructive pulmonary disease, Congestive heart failure, Cardiac arrhythmia, Pulmonary circulation disorders, Peripheral vascular disorder, Hypertension, Diabetes uncomplicated, Diabetes complicated, Renal failure, Solid tumour without metastasis, Weight loss, Fluid and electrolyte disorders, Deficiency anaemia, Alcohol abuse/drug abuse/psychoses, Depression, Dementia.	0.64
Hip fracture surgery	Age, Sex, Congestive heart failure, Cardiac arrhythmia, Other neurological disorders, Chronic pulmonary disease, Diabetes complicated, Liver disease, AIDS/HIV, Fluid and electrolyte disorders, Depression, Dementia.	0.61
Total hip replacement	Age, Cardiac arrhythmia, Other neurological disorders, Chronic pulmonary disease, Diabetes uncomplicated, Diabetes complicated, Metastatic cancer, Rheumatoid arthritis/collagen, Coagulopathy, Weight loss, Alcohol abuse/drug abuse/psychoses, Depression.	0.65
Total knee replacement	Age, Age squared, Sex, Cardiac arrhythmia, Chronic pulmonary disease, Diabetes complicated, Renal failure, Lymphoma, Coagulopathy, Weight loss, Fluid and electrolyte disorders, Blood loss anaemia, Alcohol abuse/drug abuse/psychoses.	0.59

Appendix 3

How to interpret a funnel plot

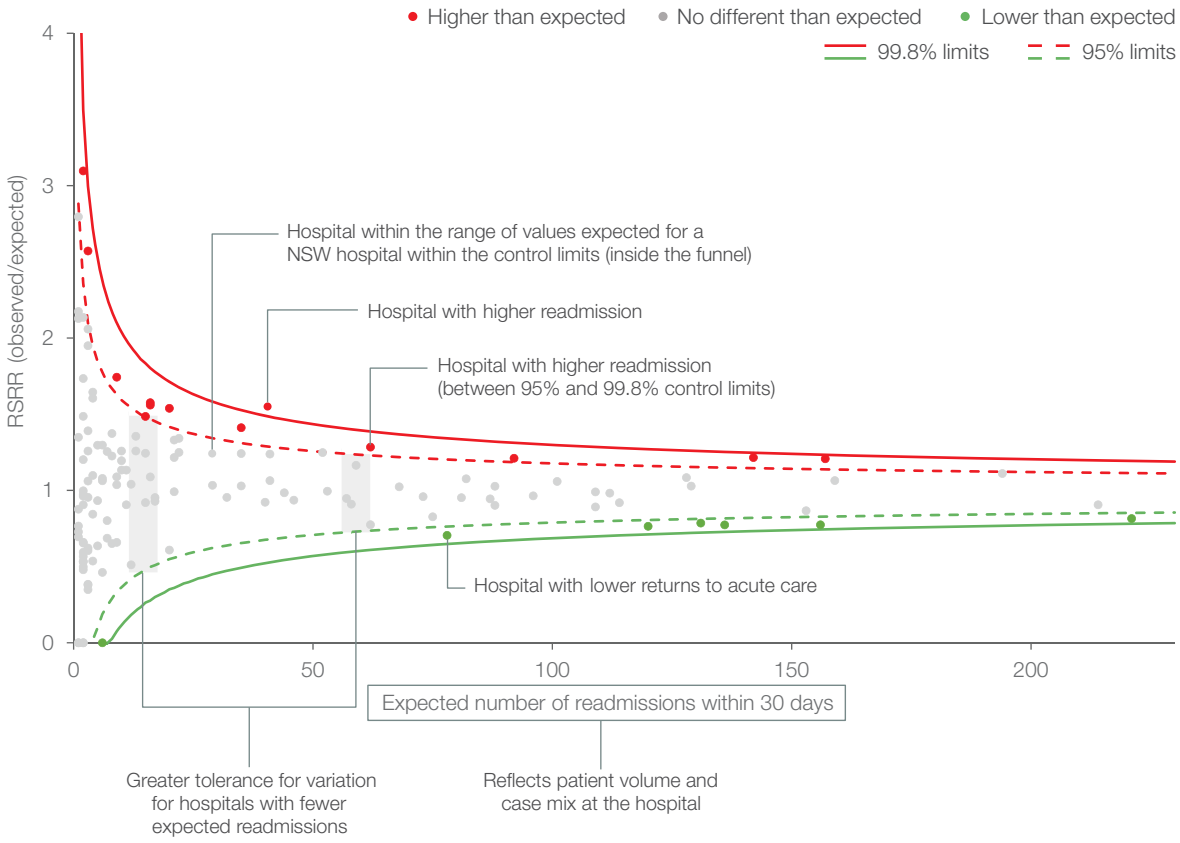
Readmission is influenced by a wide range of factors that interact in complex ways, meaning there will always be some level of variation in patient outcomes.

The 'funnel' shape that gives the funnel plot its name indicates the tolerance around this variability. Hospitals with fewer hospitalisations (those with a relatively low number of expected readmissions, and appearing towards the left hand side of the plot) will display greater variability and may have a high or low ratio by chance. Fair assessment about performance should take this into account.

Hospitals above the 95% limits of the funnel are considered to have higher than expected readmission; those below the 95% limits are considered to have lower than expected readmission. For hospitals outside 99.8% limits, there is greater confidence about their outlier status (Figure 45).

The limits quantify the level of confidence in interpreting the results. The probability that an 'in-control' hospital would fall outside the upper 95% control limit by chance alone is, at most, one in 40.

Figure 45 Annotated funnel plot



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bureau of health information

About the Bureau of Health Information

The Bureau of Health Information (BHI) is a board-governed organisation that provides independent information about the performance of the NSW healthcare system.

BHI was established in 2009 and supports the accountability of the healthcare system by providing regular and detailed information to the community, government and healthcare professionals. This in turn supports quality improvement by highlighting how well the healthcare system is functioning and where there are opportunities to improve.

BHI manages the NSW Patient Survey Program, gathering information from patients about their experiences and outcomes of care in public hospitals and other healthcare facilities.

BHI publishes a range of reports and information products, including interactive tools, that provide objective, accurate and meaningful information about how the health system is performing.

BHI's work relies on the efforts of a wide range of healthcare, data and policy experts. All of our assessment efforts leverage the work of hospital coders, analysts, technicians and healthcare providers who gather, codify and supply data. Our public reporting of performance information is enabled and enhanced by the infrastructure, expertise and stewardship provided by colleagues from NSW Health and its pillar organisations.

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