bureau of health information

The Insights Series

Exploring clinical variation in readmission

Return to acute care following discharge from hospital, eight clinical conditions, NSW

July 2012 – June 2015

BUREAU OF HEALTH INFORMATION

Level 11, 67 Albert Avenue
Chatswood NSW 2067
Australia
Telephone: +61 2 9464 4444
Email: BHI-enq@health.nsw.gov.au
bhi.nsw.gov.au

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Please note there is the potential for minor revisions of data in this report.
Please check the online version at **bhi.nsw.gov.au** for any amendments.

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Key findings

10 key findings

1. **At a NSW level, readmission rates have decreased over a 15 year period for four of the eight conditions** – changes ranged from an 8% increase for ischaemic stroke to an 11% decrease for acute myocardial infarction and total hip replacement.

2. **More recently, there has been an increase in readmissions following a pneumonia hospitalisation** – with the number of readmissions per 100 hospitalisations increasing from 13.0 to 14.1 between 2009–12 and 2012–15.

3. **In 2012–15, NSW readmission rates were lowest for total hip replacement (9 per 100 hospitalisations) and highest for congestive heart failure (23 per 100 hospitalisations)** – the limited number of international benchmarks available suggest NSW results are broadly in line with other systems – although recent studies suggest NSW readmissions are higher for joint replacements.

4. **For the non-surgical conditions, the majority of readmissions were either for the same or a similar condition, or were potentially related to hospital care received** – ranging from 54% of readmission for pneumonia to 73% for chronic obstructive pulmonary disease. For hip fracture surgery and joint replacements, about 40% of readmissions were for orthopaedic complications.

5. **Around four in 10 readmissions following acute myocardial infarction, ischaemic stroke and pneumonia hospitalisations occurred in the first week following discharge** – for the other conditions, around three in 10 readmissions occurred in the first week.

6. **There were 79 public hospitals included in the readmission analyses and for each condition, only a few hospitals were flagged as high outliers** – ranging from one hospital each for total hip and total knee replacement to seven hospitals for congestive heart failure.

7. **The number of high outlier hospital results in 2012–15 was similar to the number of low outlier hospital results** – with 31 higher than expected readmission results and 27 lower than expected readmission results.

8. **Higher and lower than expected readmission results occurred in hospitals of various sizes and geographical remoteness** – however higher than expected readmission results were more prevalent in larger (principal referral) hospitals.

9. **Five hospitals – Auburn, Bankstown/Lidcombe, Fairfield, Liverpool and Westmead – had higher than expected readmissions for multiple conditions in both 2009–12 and 2012–15** – however, the hospitals that had the most higher than expected readmission results in 2009–12 (Nepean and Wagga Wagga) saw improvements for several conditions in 2012–15.

10. **There has been an overall improvement in hospital results** – between 2009–12 and 2012–15, the number of lower than expected readmission results increased from 21 to 27; and the number of higher than expected hospital readmission results fell from 41 to 31.

Setting the scene

About this report

Background

Measures of unplanned readmission are used to inform assessments of healthcare performance and highlight areas for improvement.[1–7] However, not all readmissions can, or should, be avoided. Some occur when patients develop new health problems, and others are prompted by an acute deterioration in a longstanding chronic condition despite appropriate management. In many cases however, readmission is a poor outcome for patients.

Readmission can reflect underuse of recommended care, adverse events and complications of hospital care, inadequate discharge planning, or problems with coordination and integration of care across hospital, primary care and community settings.

In June 2015, BHI published *Return to acute care following hospitalisation, July 2009 – June 2012*[8] which focused on readmissions among patients hospitalised for acute myocardial infarction (AMI), ischaemic stroke, congestive (or chronic) heart failure (CHF), pneumonia, hip fracture surgery, total hip replacement or total knee replacement. In 2016, readmission information for the July 2009 – June 2012 period was released for chronic obstructive pulmonary disease (COPD)[9].

This volume provides an update of the readmission results. It is based on a risk-standardised readmission ratio (RSRR) that focuses on returns to acute care. The report assesses readmission to acute care following almost 210,000 discharges from a NSW public hospital following an acute hospitalisation for any of eight conditions during the period July 2012 – June 2015. It also contains historical data that pre-date public reporting efforts, covering three-year periods back to July 2000.

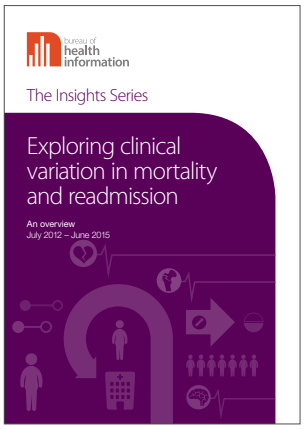
The report is published as part of a suite of reporting products that explore clinical variation in NSW public hospitals (see opposite page).

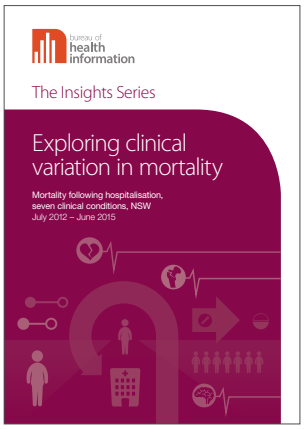
Measuring readmission

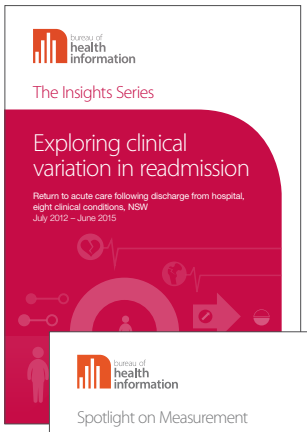
Assessments of unwarranted variation in readmission at a hospital level must take account of differences in unmodifiable patient factors. A hospital that treats older or sicker patients should not be expected to have the same rates of readmission as a hospital that treats younger patients or less complex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

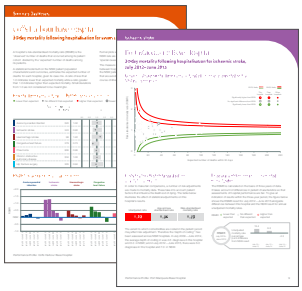
The RSRR uses a statistical model, based on a condition-specific NSW patient population, to calculate for each hospital an 'expected' number of readmissions, given the characteristics of their patients (such as age and comorbidity). It then compares that 'expected' number to the 'observed' number of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

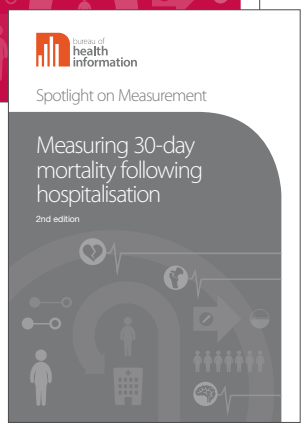
As with any measure, care is needed in interpretation. Each hospital's ratio is based on its particular patient cohort and so cannot be used in direct hospital comparisons. Some risk factors are not recorded in the available data, and so risk-standardisation is not perfect. RSRRs are best used as screening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

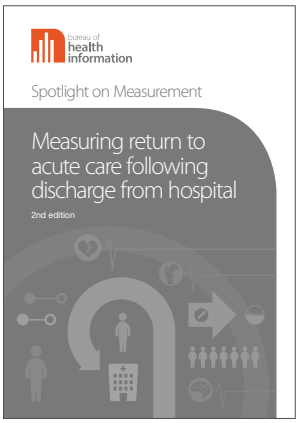












The *Exploring clinical variation* suite of reports includes: an overarching synthesis and summary report, two volumes that describe variation in patient outcome measures across NSW public hospitals; tailored hospital profiles that provide detailed information about patient cohorts and outcomes; and two method-based reports that describe the analytic approach and the sensitivity analyses that informed the development and validation of the measures used to assess performance.

Exploring clinical variation – an overview

A synthesis that compares and contrasts results for mortality and readmission measures in NSW. The overview reflects outcomes of care provided to patients hospitalised for any of nine different conditions during 2012–15. It summarises performance for 79 NSW public hospitals in 2012–15 and highlights changes in performance over time.

Exploring clinical variation in mortality

A volume focused on mortality in the 30 days following hospitalisation. It reports hospital-level performance using risk standardised mortality ratios (RSMRs) for seven conditions and features: funnel plots to display hospital results, descriptions of patient cohorts, distribution of higher and lower than expected performance across hospital peer groups, historical performance, and details about the effect of statistical modelling on hospital results.

Hospital profiles

Individual hospital profiles for 79 public hospitals outline key characteristics of patients admitted for the nine 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, the effect of statistical modelling on results and the distribution of higher than expected and lower than expected results across similar peer group hospitals.

Spotlight on Measurement

Two new editions of *Spotlight on Measurement* are available[10,11]. These reports are methods-based, and describe the development and validation processes that underpin the RSMR and RSRR measures. They feature cohort and outcome definitions, inclusions and exclusions, risk adjustment models, attribution protocols, and sensitivity analyses that explore issues such as variation in palliative care coding.

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

Readmission – Eight conditions

The eight conditions included in the report span different aspects of healthcare delivery and include acute and chronic, surgical and medical, general and specialised hospital services. Each condition has evidence-based clinical guidelines and well-defined models of best practice.[12]

Altogether the eight conditions represent a significant disease burden, accounting for about 10% of acute hospitalisations in NSW*, and they are known to have relatively high readmission rates.

Acute myocardial infarction (AMI)

- Occurs when blood supply to part of the heart is interrupted
- In July 2012 – June 2015, 30,488 patients were hospitalised for AMI
- 65% of hospitalised patients were male
- Average patient age was 70 years (39% were aged 75+ years)
- 2,108 patients died within 30 days of hospitalisation (seven deaths per 100 patients)
- 6% of male patients died; 9% of female patients died
- There were 28,105 discharges from acute care
- There were 4,534 (16%) patient returns to acute care within 30 days of discharge.

Ischaemic stroke

- Occurs when a blood vessel is blocked, depriving the brain of oxygen
- In July 2012 – June 2015, 15,475 patients were hospitalised for ischaemic stroke
- 55% of hospitalised patients were male
- Average patient age was 74 years (55% were aged 75+ years)
- 1,861 patients died within 30 days of hospitalisation (12 deaths per 100 patients)
- 9% of male patients died; 15% of female patients died
- There were 14,471 discharges from acute care
- There were 1,539 (11%) patient returns to acute care within 30 days of discharge.

Congestive (chronic) heart failure (CHF)

- Occurs when the heart is unable to pump adequately
- In July 2012 – June 2015, there were 27,484 patients hospitalised for CHF
- 51% of hospitalised patients were male
- Average patient age was 80 years (73% were aged 75+ years)
- 3,793 patients died within 30 days of hospitalisation (14 deaths per 100 patients)
- 14% of male patients died; 13% of female patients died
- There were 33,450 discharges from acute care
- There were 7,602 (23%) patient return to acute care within 30 days of discharge.

Pneumonia

- Occurs when one or both lungs are inflamed, usually due to infection
- In July 2012 – June 2015, 47,133 patients were hospitalised for pneumonia
- 52% of hospitalised patients were male
- Average patient age was 71 years (50% were aged 75+ years)
- 5,037 patients died within 30 days of hospitalisation (11 deaths per 100 patients)
- 11% of male patients died; 10% of female patients died
- There were 46,422 discharges from acute care
- There were 6,543 (14%) patient returns to acute care within 30 days of discharge.

* Of acute emergency hospitalisations for persons aged 15+ years.

The conditions differ in terms of the overall rate and patterns of readmission over the 30-day period following hospitalisation. Unadjusted 30-day readmission rates at the NSW level range from nine per 100 hospitalisations for total hip replacement to 23 per 100 hospitalisations for congestive heart failure (Figure 12).

Chronic obstructive pulmonary disease (COPD)

- Occurs when the lungs are unable to provide adequate oxygenation
- In July 2012 – June 2015, 30,525 patients were hospitalised for COPD
- 50% of hospitalised patients were male
- Average patient age was 74 years (51% were aged 75+ years)
- 3,160 patients died within 30 days of hospitalisation (10 deaths per 100 patients)
- 11% of male patients died; 9% of female patients died
- There were 47,359 discharges from acute care
- There were 10,293 (22%) patient returns to acute care within 30 days of discharge.

Hip fracture surgery

- A fracture in the upper quarter of the thigh bone (femur), treated with surgery
- In July 2012 – June 2015, 16,193 patients were hospitalised for hip fracture and had surgery
- 28% of those patients were male
- Average patient age was 83 years (82% were aged 75+ years)
- 1,093 patients died within 30 days of hospitalisation (7 deaths per 100 patients)
- 9% of male patients died; 6% of female patients died
- There were 14,581 discharges from acute care
- There were 1,485 (10%) patient returns to acute care within 30 days of discharge.

Total hip replacement

- Elective surgery to remove a damaged hip joint and replace it with an artificial joint
- Not included in the 30-day mortality analyses
- In July 2012 – June 2015, there were 8,312 patient discharges from acute care
- 48% of discharged patients were male
- There were 764 (9%) patient returns to acute care within 60 days of discharge.

Total knee replacement

- Elective surgery to remove a damaged knee joint and replace it with an artificial joint
- Not included in the 30-day mortality analyses
- In July 2012 – June 2015, there 14,961 patient discharges from acute care
- 39% of discharged patients were male
- There were 1,727 (12%) patient returns to acute care within 60 days of discharge.

Data and methods

Data sources

Data were drawn from the NSW Admitted Patient Data Collection and NSW Registry of Births, Deaths and Marriages, and were probabilistically linked by the Centre for Health Record Linkage. Data access was via SAPHaRI, Centre for Epidemiology and Evidence, NSW Ministry of Health.

The measure

The principal indicator used in this report is a risk-standardised readmission ratio (RSRR) (Figure 1). The RSRR describes for each hospital, the number of 'returns to acute care' in the 30 days (or for joint replacement, 60 days) following discharge compared with the 'expected' number of readmissions. The 'expected' number of readmissions is generated by a statistical model that takes into account patient characteristics that affect the likelihood of requiring readmission.

For each condition, principal diagnosis codes were used to identify patients discharged from acute care during the period July 2012 – June 2015. For hip fracture and joint replacement surgery, procedure codes and diagnosis-related group codes were also used to identify the index cohort.

Calculation of unadjusted readmission rates and hospital RSRRs excluded index cases that occurred less than 30 days (or for joint replacement, less than 60 days) from the end of the study period (30 June 2015) to avoid introducing bias with a truncated follow-up period. However, as competing risk regression models take into account different follow-up periods, index hospitalisations without complete follow-up information were included in building the NSW prediction models.

Readmissions that occurred within 30 days (or 60 days for joint replacements) of discharge from an acute care setting were included regardless of the principal diagnosis of the return. Returns to acute care in any NSW public or private hospital were included.

On the advice of clinicians and following sensitivity testing, the follow-up period for joint replacements was set at 60 days; and readmissions 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 common, scheduled procedures such as haemodialysis, chemotherapy and cataract surgery were excluded however.

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. If an acute admission was coded as ending in a transfer, and there was another acute admission within one day of that transfer, the second admission was concatenated into the same period of care. Returns to acute care following a type change were considered as a readmission unless noted as planned.

Prediction models

A competing risk model[13] developed for each condition draws on NSW public hospital patient population characteristics and outcomes to 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 1. SAS[14] and StataSE v12[15] were used for the analyses.

Interpretation

Funnel plots are used to determine whether RSRRs reach statistical significance (see Appendix 2 for a guide on how to interpret funnel plots). Control limits are calculated based on a Poisson distribution. Hospital results that fall outside the 95% control limits are considered to be 'special cause' outliers and results are flagged. The probability that an 'in-control' hospital would fall outside the upper 95% control limit by chance alone is, at most, one in 40.[16]

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 with at least 50 hospitalisations for the condition of interest in the three-year study period are reported publicly. Not all hospitals have results for all conditions. Results for hospitals with less than 1.0 expected readmissions are suppressed.

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 (Appendix 3).

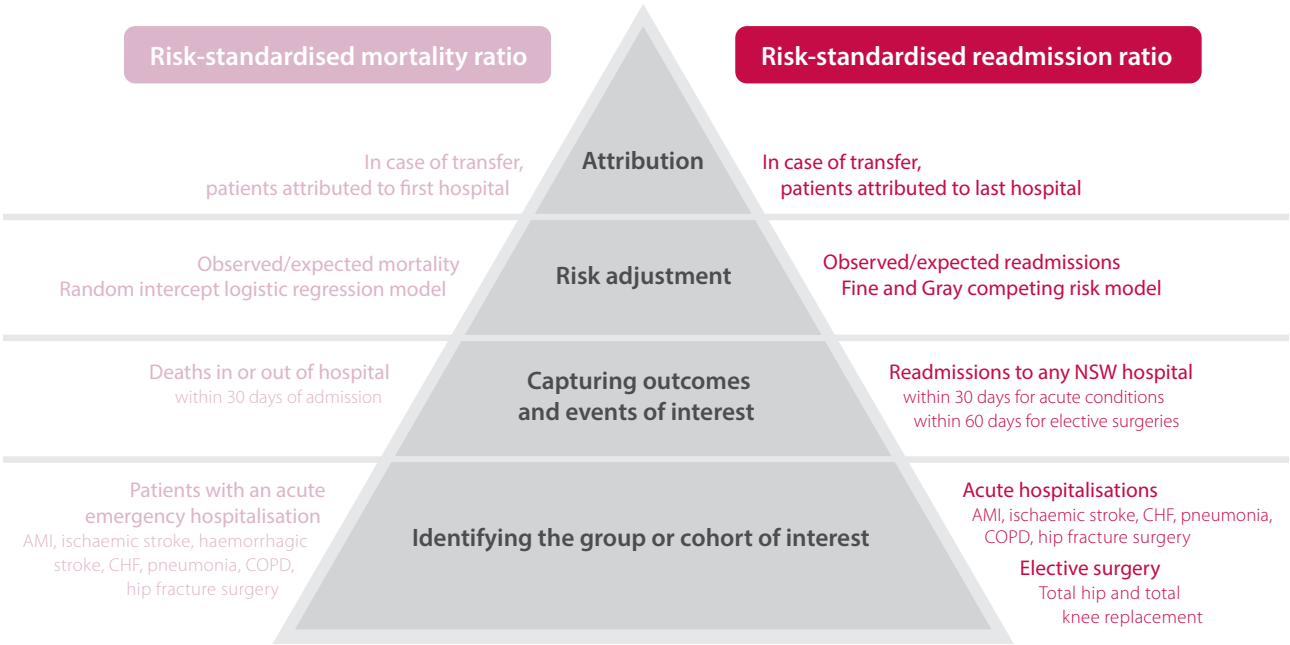
Characterising reasons for readmission

Returns to acute care within 30 days of discharge (or 60 days for elective surgical procedures) are categorised by the recorded principal diagnosis – the condition stated in the patient's medical record as chiefly responsible for the hospitalisation. 'Reasons for return to acute care' 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 that the return was related to hospital care), or for another condition. The six categories are:

1. Same principal diagnosis as the index hospitalisation
2. Condition clinically related to the index hospitalisation principal diagnosis (same ICD-AM-10 chapter)
3. Potentially related to hospital care (included at any time in the 30-day follow-up period)
4. Potentially related to hospital care (time sensitive, occurring on day 1–7)
5. Potentially related to hospital care (time sensitive, occurring 8–30 days post discharge)
6. Other condition.

This classification was based on draft specifications for acute myocardial infarction and surgical procedure readmissions developed by the Australian Institute of Health and Welfare.[17,18] For the joint replacement analyses, orthopaedic complications are reported in two categories: 'within' and 'outside' the time identified by clinical experts as potentially related to hospital care.

Figure 1 Risk-standardised ratios for assessing performance in mortality and readmission



Exploring readmission results

Readmission – NSW results

Between 2000 and 2015, NSW age-sex standardised rates of unplanned readmission or 'returns to acute care' improved for four conditions, most notably for AMI and total hip replacement (both decreased by 11%). However, for two conditions, ischaemic stroke and pneumonia, readmissions increased (by 8% and 6%, respectively) (Figures 2 and 4).

The conditions included in the report differed in the percentage of returns to acute care that were to the discharging hospital – ranging from 55% for total hip replacement to 85% for COPD (Figure 3).

The conditions also differed in terms of patients' average length of stay for the index (initial) hospitalisation – ranging from 5.3 days for COPD to 10.7 for hip fracture surgery. Across the conditions generally, higher readmission rates were seen for patients with longer lengths of stay in the index hospitalisation. This was particularly marked for pneumonia and total knee replacement patients (data not shown).

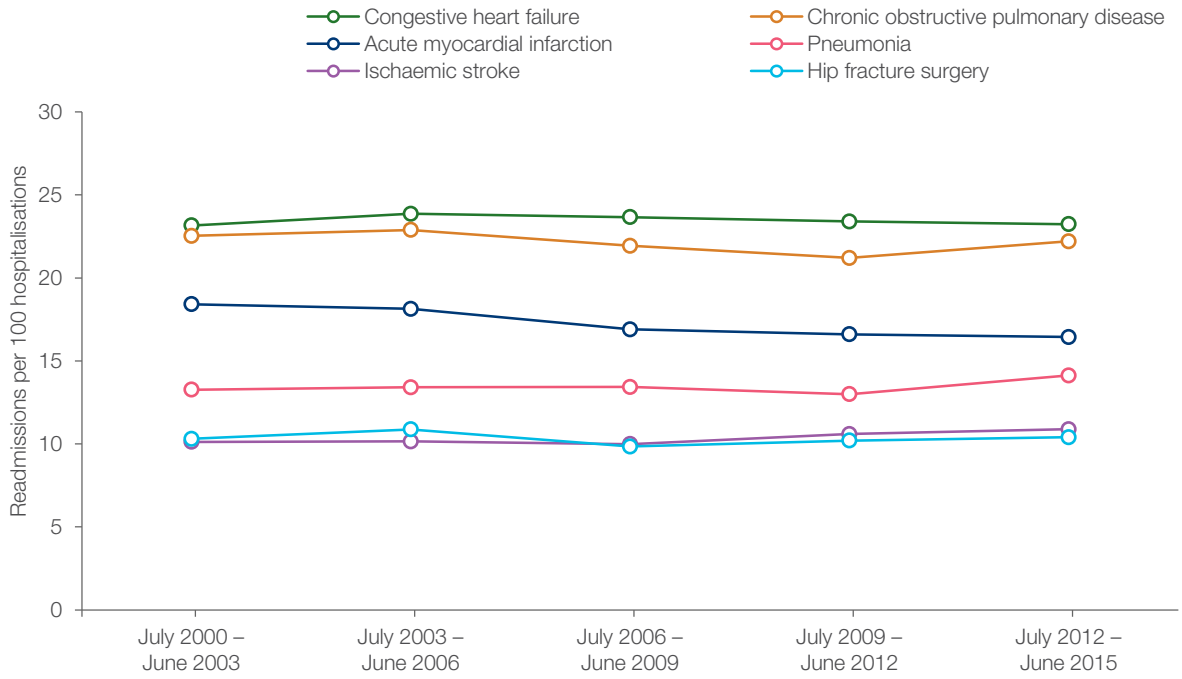
In terms of international comparisons, there are limited data for benchmarking NSW results. Available information suggests that NSW readmission rates are similar to those in other systems for most conditions (Table 2).

Table 2 NSW readmission rates, international context

Conditions	NSW (July 2012 – June 2015)	Comparators
AMI	16%	11%, 15%, 15%, 17%
Ischaemic stroke	11%	13%
CHF	23%	19%, 22%, 24%
Pneumonia	14%	14%, 16%, 17%
COPD	22%	20%
Hip fracture surgery	10%	9%, 15%
Total hip replacement	9%	8%*
Total knee replacement	12%	10%*

* Comparator data are pooled estimates for 90-day readmissions.
Source: References 19–24.

Figure 2 Readmission, age-sex standardised rate per 100 hospitalisations, six clinical conditions, NSW, July 2000 – June 2015



Note: Indirectly standardised using July 2009 – June 2012 NSW condition-specific hospitalisation cohorts as the standard population.

Figure 3 Percentage of readmissions for which patients returned to the discharging hospital, by condition, NSW, July 2012 – June 2015

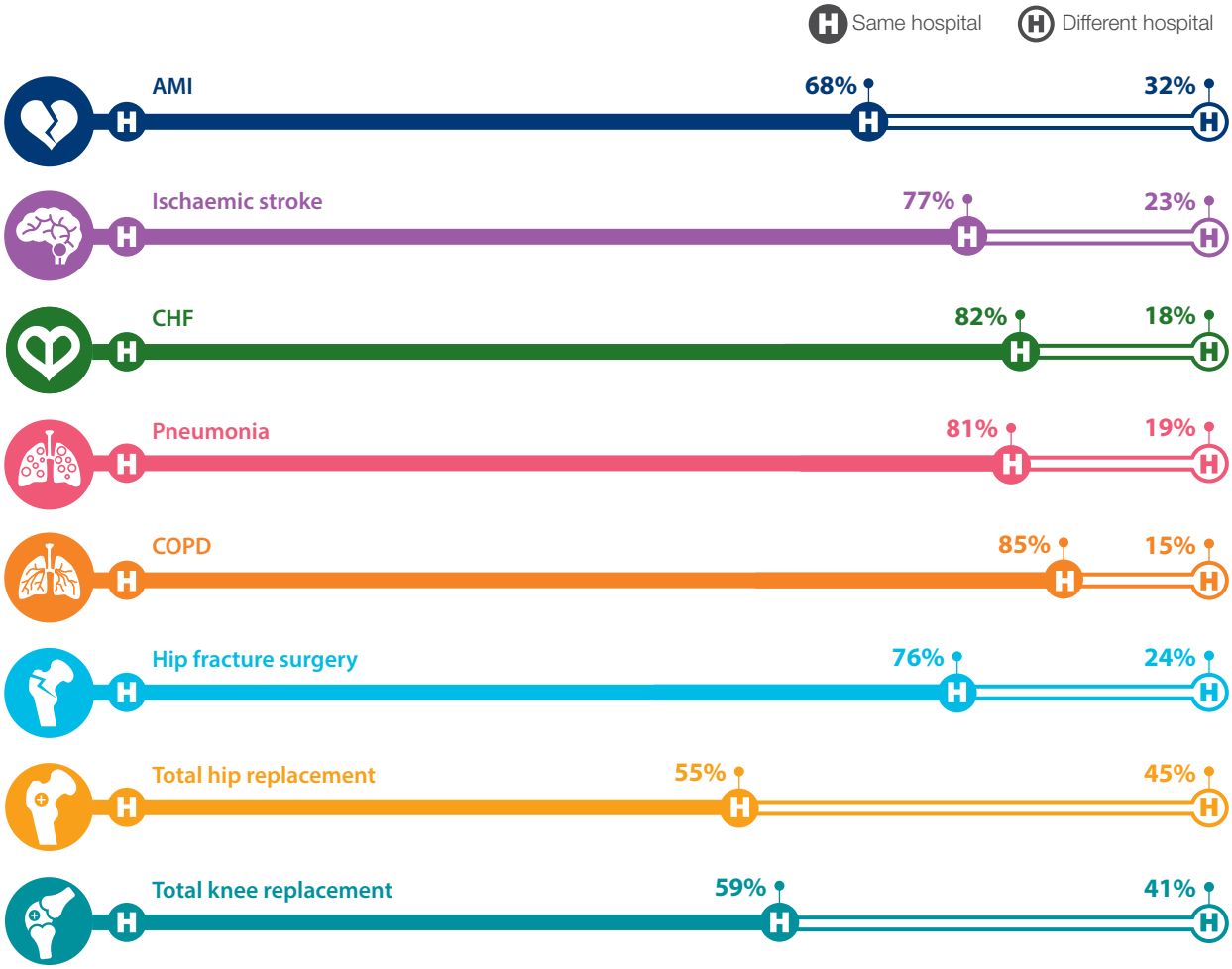
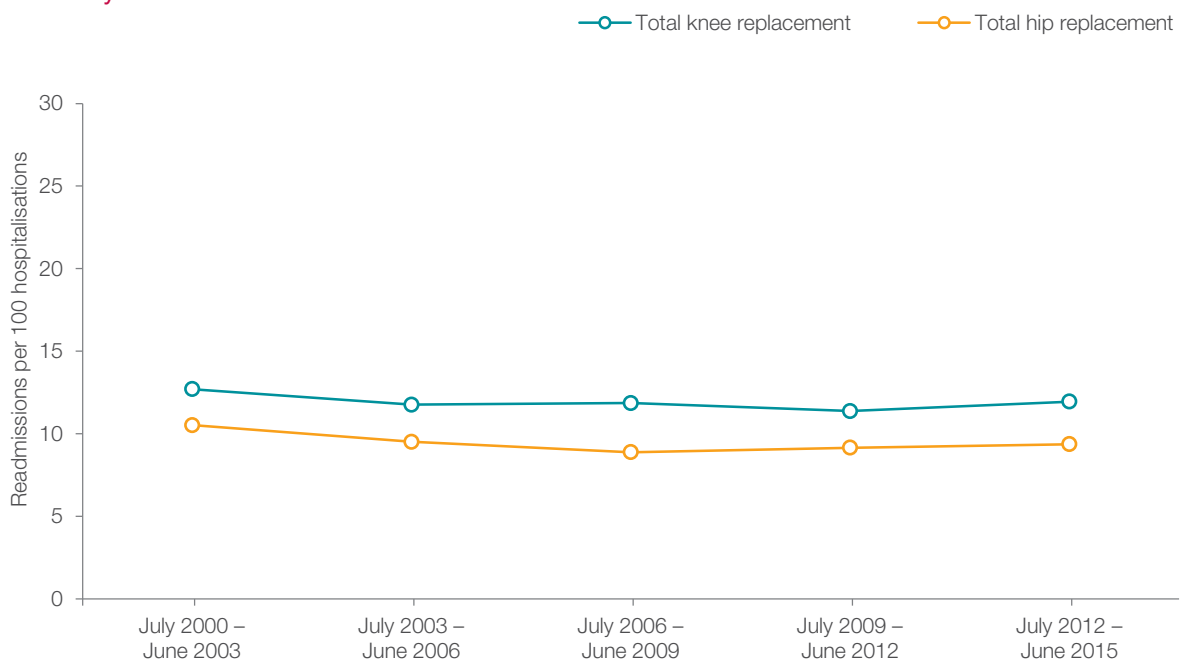


Figure 4 Readmission, age-sex standardised rate per 100 hospitalisations, two elective surgeries, NSW, July 2000 – June 2015



Note: Indirectly standardised using July 2009 – June 2012 NSW condition-specific hospitalisation cohorts as the standard population.

Readmission – Hospital-level results

Across the eight conditions, the number of hospitals* with lower than expected readmission ranged from one to six; and the number with higher than expected readmissions ranged from one to seven (Figure 5).

Within each set of analyses, the majority of hospitals had readmission results that were not significantly different to expected, once patient characteristics were taken into account – ranging from 31 hospitals (74%) for ischaemic stroke to 37 hospitals (94%) for total hip replacement (Figure 6).

Across all the conditions there were 31 higher than expected and 27 lower than expected readmission results.

There were 42 hospitals for which there were no readmission results or 'returns to acute care' that were significantly higher or lower than expected. Two hospitals (Gosford and Manning) had lower than expected readmission for three and four conditions respectively; and two hospitals (St George and Liverpool) had higher than expected readmission for three conditions (Figure 7).

Figure 5 Readmission results, by condition, NSW public hospitals, July 2012 – June 2015

	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Higher than expected readmission	Blacktown Liverpool	Bankstown/ Lidcombe Fairfield Liverpool Murwillumbah Royal Prince Alfred St George	Canterbury Cessnock Cowra Fairfield Lithgow Liverpool Nepean	Auburn St George Westmead	Auburn Campbelltown Mudgee Tamworth Young	Murwillumbah** The Tweed St George Goulburn Bankstown/ Lidcombe Westmead	Wagga Wagga	Prince of Wales
Lower than expected readmission	Gosford Prince of Wales	Gosford Hornsby Maitland Tamworth Wollongong	Armidale Hornsby Maclean Manning Royal North Shore Sutherland	Manning St Vincent's Sutherland	Manly Royal North Shore Singleton Wagga Wagga Queanbeyan	Dubbo Gosford Manning	Bathurst	Fairfield Manning

* Hospital results are shown for principal referral, major and district hospitals (peer groups A – C only).

** Hip fracture surgery was not conducted at Murwillumbah.

Figure 6 Number of public hospitals, by outlier status for readmission, by condition, NSW, July 2012 – June 2015

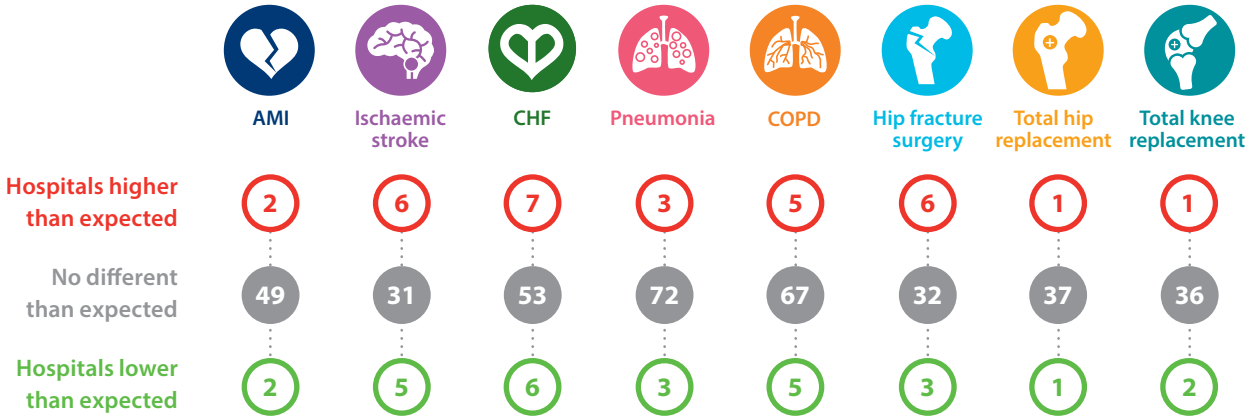


Figure 7 Readmission, concentration of outlier results across hospitals, NSW, July 2012 – June 2015

Among 79 referral, major and district hospitals, between July 2012 and June 2015:

Two hospitals had higher than expected readmission for three conditions

Five hospitals had higher than expected readmission for two conditions

15 hospitals had higher than expected readmission for one condition

57 hospitals did not have higher than expected readmission for any of the eight conditions*

* Not all hospitals have results for all eight conditions.

Readmission – By peer group and changes over time

Hospital peer groups

Not every hospital had sufficient patients to be reported in the risk-standardised readmission ratio analyses (50 or more index hospitalisations). To summarise peer group findings, any RSRR reported for a hospital is considered to be a 'result'. In all peer groups, the majority of hospital readmission results were no different than expected – 80% of principal referral, 85% of major, and 92% of district hospitals (Figure 8).

Among principal referral hospitals, 7% of results showed lower than expected readmission and 12% higher than expected. For major hospitals, 9% of results showed lower than expected readmission and 6% higher than expected; and for district hospitals, 3% of results showed lower than expected readmission and 5% higher than expected (Figure 8).

Higher and lower than expected readmission results were found across all peer groups. There was however a greater concentration of higher than expected results among principal referral hospitals (Figure 9).

Checking validity of measures

The readmission indicators have undergone extensive sensitivity testing to explore:

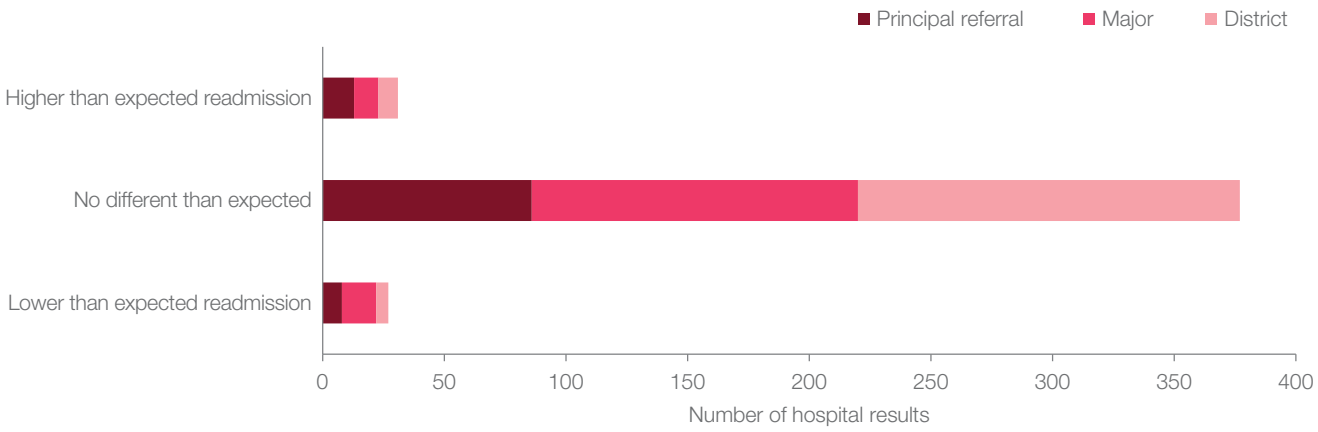
- Whether there were significant changes across NSW hospitals in coding of comorbidity in patients' records
- For hospitals that operate in partnerships, whether their results are affected when treated as a single unit
- The relative performance of hospitals for patients in different socioeconomic subgroups.

The results did not identify any significant methodological limitation in the risk-standardised ratio approach. For more detail, see *Spotlight on Measurement – Measuring return to acute care following discharge from hospital, 2nd edition*.

Figure 8 Readmission, all conditions, number and percentage of peer group results, NSW, July 2012 – June 2015

Hospital peer group	Lower than expected readmission	No different than expected readmission	Higher than expected readmission
Principal referral	8 results (7%)	86 results (80%)	13 results (12%)
Major	14 results (9%)	134 results (85%)	10 results (6%)
District	5 results (3%)	157 results (92%)	8 results (5%)

Figure 9 Readmission, all conditions, by hospital peer group, NSW, July 2012 – June 2015



Changes between 2009–12 and 2012–15

There were five hospitals that had lower than expected readmission results across both time periods and seven with higher than expected across both time periods. Three hospitals (Auburn, Fairfield and Westmead) had higher than expected readmission results for two conditions in both time periods (Figure 10).

Sixteen hospitals improved their status to 'lower than expected' readmission over the two time periods and one of these hospitals (Manning) did so for three conditions.

For 19 hospitals, there was an improvement in readmission results to 'no different than expected'. For one hospital (Nepean) the improvement was for four conditions; for two hospitals (Wagga Wagga and Milton), the improvement was for three conditions; and for four hospitals (Auburn, Bankstown/Lidcombe, Kempsey and Tamworth), the improvement was for two conditions (Figure 10).

There has been an overall improvement in hospital results in risk-adjusted readmission. Between 2009–12 and 2012–15, the number of 'lower than expected' hospital results increased from 21 to 27; and the number of 'higher than expected' hospital results fell from 41 to 31 (data not shown).

Figure 10 Hospitals with changed outlier status, readmission, NSW, 2009–12 and 2012–15

Higher than expected | No different than expected | Lower than expected

09–12	12–15	AMI	Ischaemic stroke	CHF	Pneumonia	COPD	Hip fracture surgery	Total hip replacement	Total knee replacement
Higher than expected	Higher than expected		Fairfield Liverpool	Nepean Fairfield	Auburn Westmead	Auburn	St George Westmead	Wagga Wagga	
No different	Higher than expected	Blacktown Liverpool	Bankstown/ Lidcombe Murwillumbah* Royal Prince Alfred St George	Canterbury Cessnock Cowra Lithgow Liverpool	St George	Campbelltown Mudgee Tamworth Young	Murwillumbah** The Tweed Goulburn Bankstown/ Lidcombe		Prince of Wales
Higher than expected	No different	Auburn Bankstown/ Lidcombe Kempsey Manning Tamworth	Wagga Wagga	Auburn Kempsey Milton	Lithgow Liverpool Milton Mount Druitt Nepean Wagga Wagga	Bateman's Bay Milton Parkes	Grafton Nepean	Bankstown/ Lidcombe Nepean Wollongong Wyong	Armidale Coffs Harbour Nepean Shoalhaven Tamworth Wagga Wagga
No different	Lower than expected	Gosford	Gosford Hornsby Maitland Tamworth Wollongong	Armidale Hornsby Maclean Royal North Shore Sutherland	Manning St Vincent's Sutherland	Manly Royal North Shore Singleton Queanbeyan	Manning Dubbo	Bathurst*	Manning
Lower than expected	Lower than expected	Prince of Wales		Manning		Wagga Wagga	Gosford		Fairfield

* <50 hospitalisations in 2009–12.

** Hip fracture surgery was not conducted at Murwillumbah.

Readmission – Reasons for returns to acute care

Variation in reasons for readmission, timing and length of stay

Readmission rates varied across the conditions. Across NSW public hospitals in 2012–15, unadjusted rates of readmission, or returns to acute care, ranged from nine per 100 discharges for total hip replacement to 23 per 100 discharges for CHF.

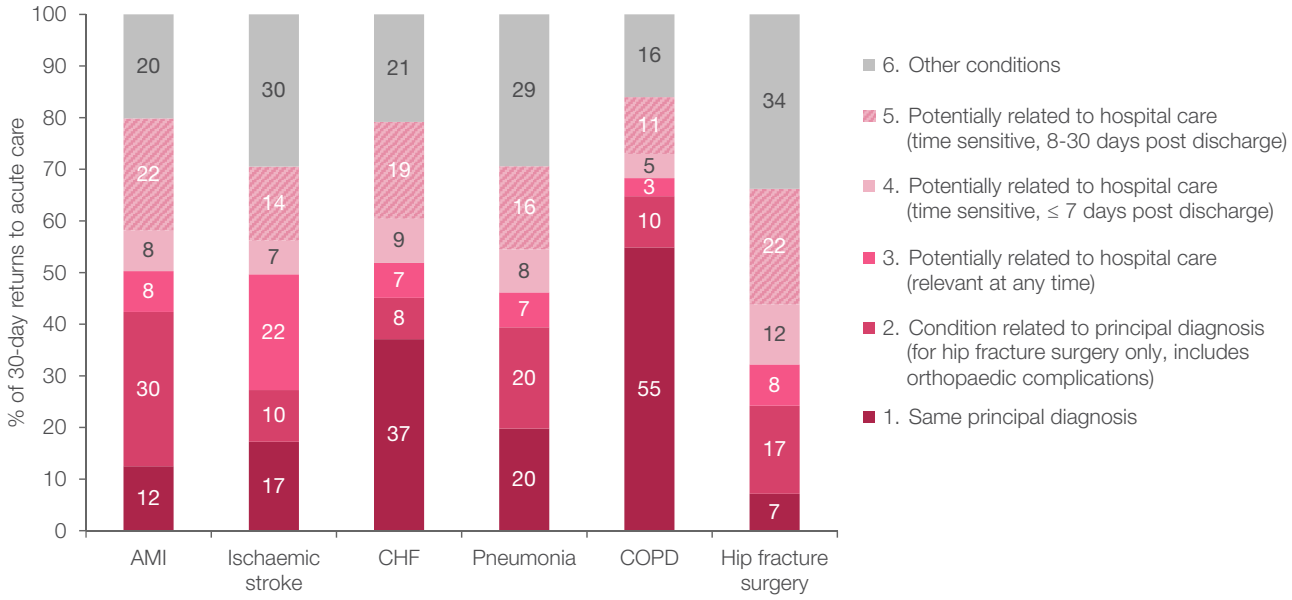
Reasons for readmission within 30 days also varied (Figures 11 and 12). The proportion that were for the same or a related condition ranged from 27% for ischaemic stroke to 65% for COPD while the proportion classified as 'potentially related to hospital care' (categories 3 and 4 in Figure 11) ranged from 8% for COPD to 29% for ischaemic stroke.

For the two elective surgeries, about 40% of readmission within 60 days were orthopaedic complications or were potentially related to hospital care (categories 1 and 3 in Figure 13).

The proportion of returns to acute care that occurred in the first three days following discharge ranged from about 15% for CHF, COPD, total knee replacement and hip fracture surgery, to 20% for AMI.

The average length of stay in acute care ranged from 5.3 days for COPD, to 10.7 days for hip fracture surgery. Variation at a hospital level was considerable. For example, the average length of stay for hip fracture surgery hospitalisations ranged from 7.0 to 16.7 days, and for CHF from 3.4 to 7.6 days (data not shown).*

Figure 11 Reasons for readmission, six clinical conditions, NSW public hospitals, July 2012 – June 2015



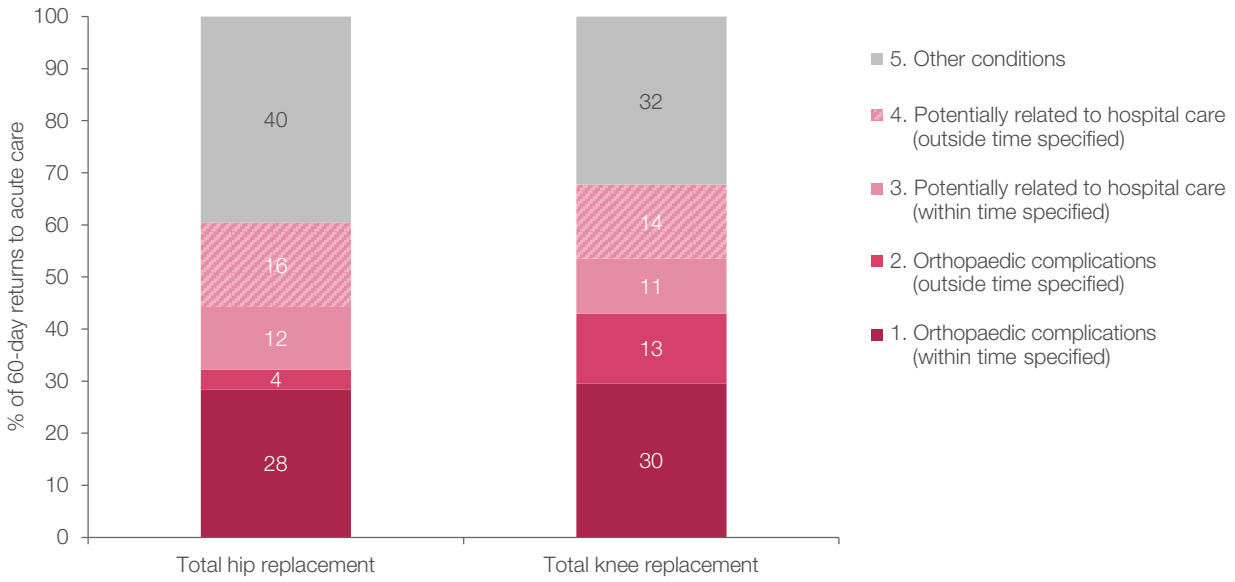
Note: Categories of reasons for readmission refer to: 1. The same principal diagnosis code as the index hospitalisation; 2. Condition related to principal diagnosis, in the same ICD-AM 10 chapter; 3. Potentially related to hospital care (not time sensitive) refer to complications such as pulmonary embolism; 4. Potentially related to hospital care if they occur in the first seven days following discharge e.g. urinary tract infection; 5. Same codes as category 4 but occurred beyond the seven day time period (less likely to be related to hospital care); 6. Other conditions.

* Includes peer group A-C hospitals with 50 or more index hospitalsiations.

Figure 12 Readmissions potentially related to hospital care, most frequent reasons, by condition

Condition	Reason for readmission was same as or related to index admission (*orthopaedic complication) Principal diagnosis (number of readmissions recorded)	Reason for readmission was potentially related to hospital care Principal diagnosis (number of readmissions recorded)
AMI	Acute subendocardial myocardial infarction (403) Congestive heart failure (330)	Pneumonia (48) Gastrointestinal haemorrhage (40)
Ischaemic stroke	Cerebral infarction (143) Transient cerebral ischaemic attack (52)	Pneumonitis due to food or vomit (70) Pneumonia (33)
CHF	Congestive heart failure (2,558) Left ventricular failure (224)	Acute kidney failure (130) Constipation (61)
Pneumonia	Pneumonia (1040) COPD (364)	Congestive heart failure (113) Pulmonary embolism (without cor pulmonale) (72)
COPD	COPD with acute lower respiratory infection (3,096) COPD with acute exacerbation (1,987)	Congestive heart failure (105) Constipation (71)
Hip fracture surgery	Wound infection following a procedure (41)* Pain in a joint, pelvic region and thigh (29)*	Urinary tract infection (67) Pneumonitis due to food and vomit (20)
Total hip replacement	Wound infection following a procedure (53)* Infection/inflammatory reaction to joint prosthesis (32)*	Phlebitis and thrombophlebitis of deep vessels (7) Urinary tract infection, site not specified (7)
Total knee replacement	Wound infection following a procedure (144)* Infection/inflammatory reaction to joint prosthesis (77)*	Phlebitis and thrombophlebitis of deep vessels (20) Cellulitis of lower limb (19)

Figure 13 Reasons for readmission, two elective surgeries, NSW public hospitals, July 2012 – June 2015



Note: Categories of reasons for readmission refer to: 1. Orthopaedic complications occurring within a time frame specified as likely to be related to hospital care e.g. other complications of anaesthesia within 7 days; 2. Orthopaedic complications outside time specified as likely to be related to hospital care which are the same codes as category 1; 3. Potentially related to hospital care (within time specified) e.g. pulmonary embolism; 4. Potentially related to hospital care (outside time specified) same codes as category 3; 5. Other conditions.

Condition-specific results

Acute myocardial infarction

NSW public hospitals

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 cells. The heart muscle suffers permanent damage if blood supply is not restored quickly.

Figure 14 summarises information on the number of and reasons for returns to acute care, as well as characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 16 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for AMI between July 2012 and June 2015, 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 49 hospitals (92%) with AMI readmission results that were no different than expected. Two hospitals (Blacktown and Liverpool) had higher than expected readmission and two hospitals (Gosford and Prince of Wales) had lower than expected readmission (Figure 15).

Of the two hospitals that had lower than expected readmission in 2012–15, only Prince of Wales also did so in preceding time periods (Figure 16).

Figure 14 Acute myocardial infarction 30-day readmissions in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 28,105 index hospitalisations that met the inclusion criteria – with a principal diagnosis of AMI (ICD-10-AM code I21). Some patients had multiple discharges and 26,506 patients were included in the analyses
- There were 421 (2%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 4,534 acute, emergency readmissions (all causes). After excluding 928 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 16 per 100 hospitalisations.

Among the 4,534 returns to acute care:

- 566 (12%) were for the same condition (i.e. principal diagnosis of AMI)
- 1,355 (30%) were for a condition related to AMI*
- 358 (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
- 356 (8%) were potentially related to hospital care as they occurred within seven days of discharge
- 985 (22%) were potentially related to hospital care but occurred outside the seven day window
- 914 (20%) were for other reasons
- 3,066 (68%) were to the same hospital.

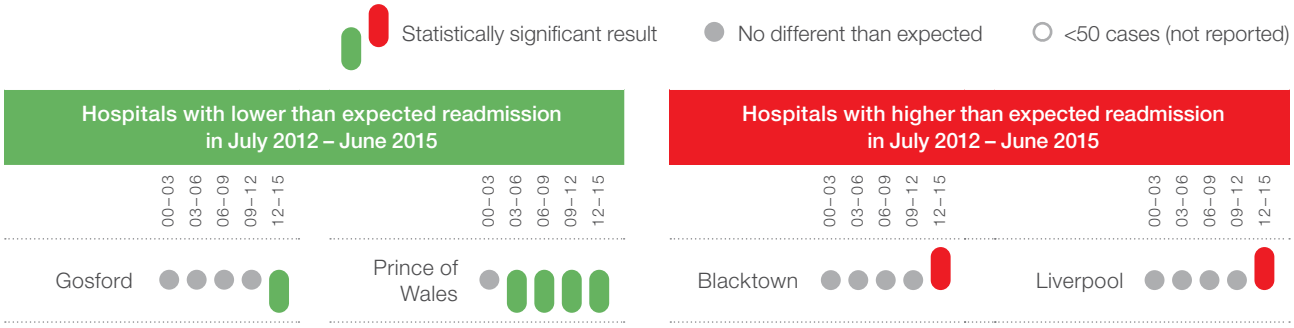
Age, sex and comorbidity

- Of the AMI index hospitalisations, there were more male patients (18,232) than female patients (9,873)
- Among males, 15% of index hospitalisations were followed by a readmission within 30 days, compared with 18% among females
- After adjusting for age and comorbidity; sex was not associated with higher risk of readmission.

* Same ICD-10-AM chapter.

Figure 15 Acute myocardial infarction 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 16 Acute myocardial infarction, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Acute myocardial infarction

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those readmissions, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

About 41% of returns to acute care occurred in the seven days following discharge and about half of these were for AMI or related conditions (Figure 17). Among the returns that were potentially related to hospital care, pneumonia was the most frequent cause (Table 3).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for AMI increased with increasing lengths of stay in the index hospitalisation, up to 22% following stays of 15+ days (Figure 18).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations reveals that as length of stay increased, there was a greater proportion of returns that were potentially related to hospital care (Figure 19).

Table 3 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
3. Potentially related to hospital care (relevant at any time)	Gastrointestinal haemorrhage (40) Acute kidney failure (33) Pulmonary embolism without mention of cor pulmonale (32)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	Pneumonia (48) COPD with acute lower respiratory infection (26) Syncope and collapse (21) Urinary tract infection (21)

Figure 17 Acute myocardial infarction, number of, and reasons for readmission, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

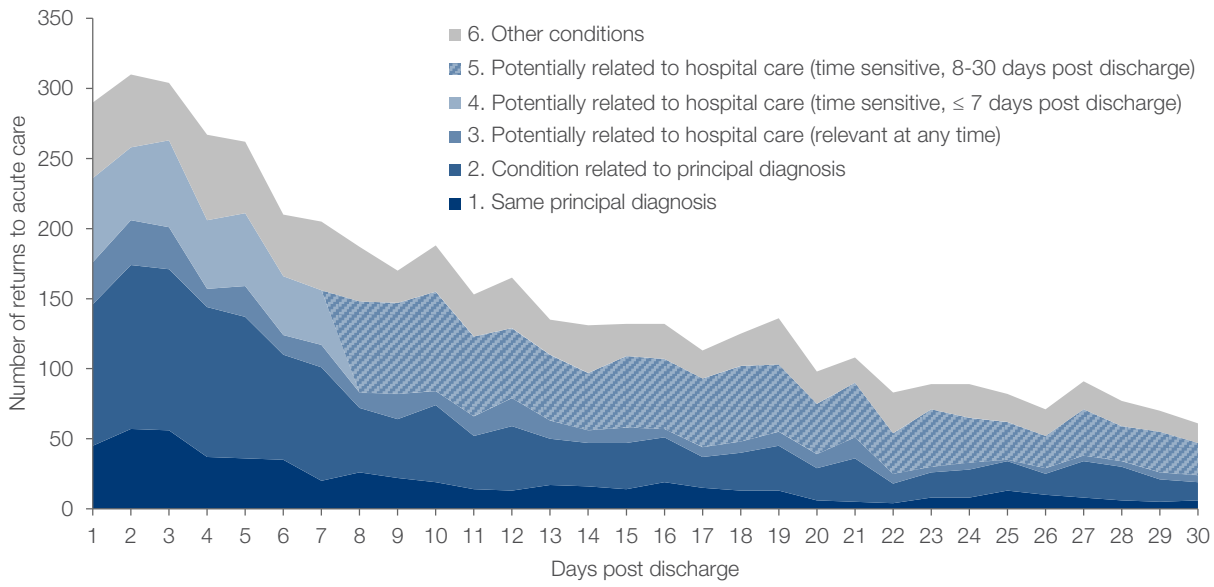


Figure 18 Acute myocardial infarction, length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals, July 2012 – June 2015

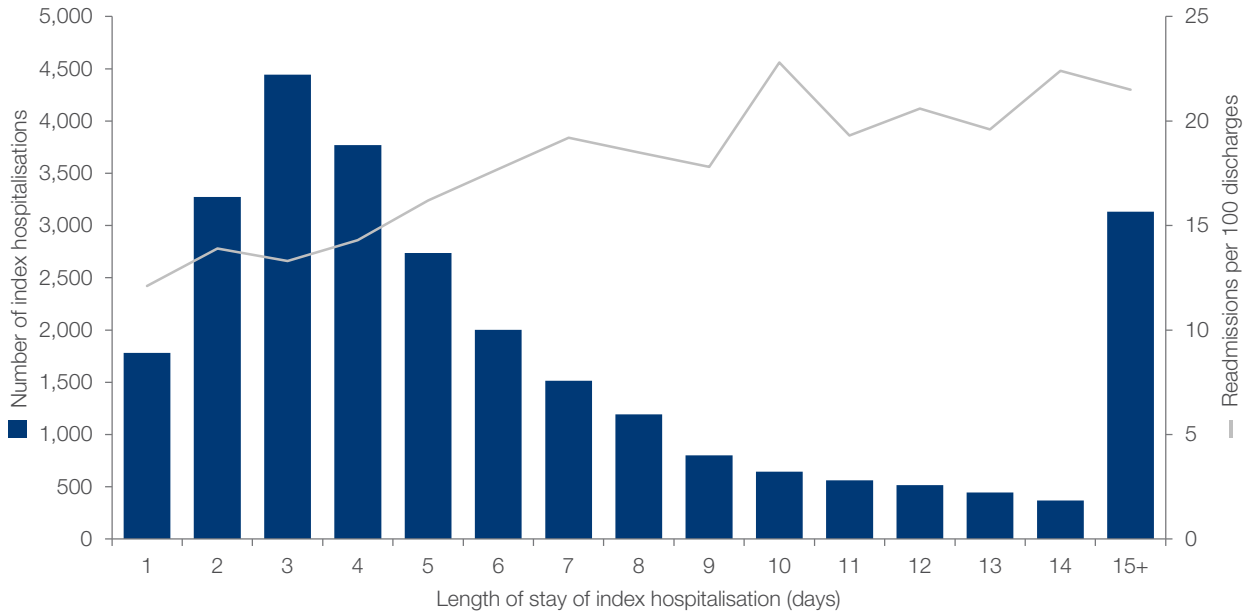
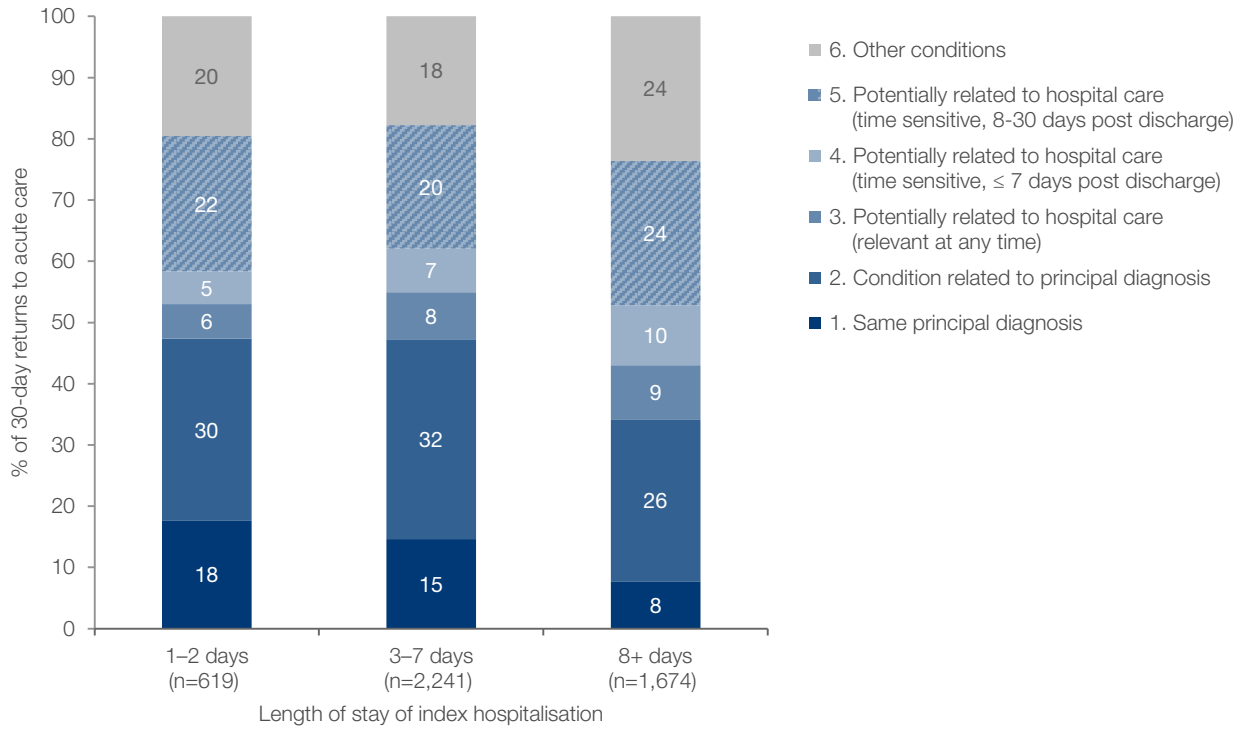


Figure 19 Acute myocardial infarction, length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Ischaemic stroke

NSW public hospitals

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.

Figure 20 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 11 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for ischaemic stroke between July 2012 and June 2015, unadjusted readmission rates ranged from four 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 31 hospitals (74%) with ischaemic stroke readmission results that were no different than expected. Five hospitals (Tamworth, Maitland, Hornsby, Gosford and Wollongong) had lower than expected readmission and six hospitals (Murwillumbah, Fairfield, Bankstown/Lidcombe, Royal Prince Alfred, St George and Liverpool) had higher than expected readmission (Figure 21).

Of the six hospitals that had higher than expected readmission in 2012–15, Fairfield and Liverpool also did so in the preceding time period of 2009–12 (Figure 22).

Figure 20 Ischaemic stroke readmission in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 14,471 index hospitalisations that met the inclusion criteria – with a principal diagnosis of ischaemic stroke (ICD-10-AM code I63). Some patients had multiple discharges and 13,967 patients were included in the analyses
- There were 823 (6%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 1,539 acute, emergency readmissions (all causes). After excluding 436 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 11 per 100 hospitalisations.

Among the 1,539 returns to acute care:

- 265 (17%) were for the same condition (i.e. principal diagnosis of ischaemic stroke)
- 154 (10%) were for a condition related to ischaemic stroke*
- 345 (22%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred
- 100 (7%) were considered potentially related to hospital care as they occurred within seven days of discharge
- 221 (14%) were for a condition considered potentially related to hospital care (but occurred outside the seven day window)
- 454 (30%) were for other reasons
- 1,188 (77%) were to the same hospital.

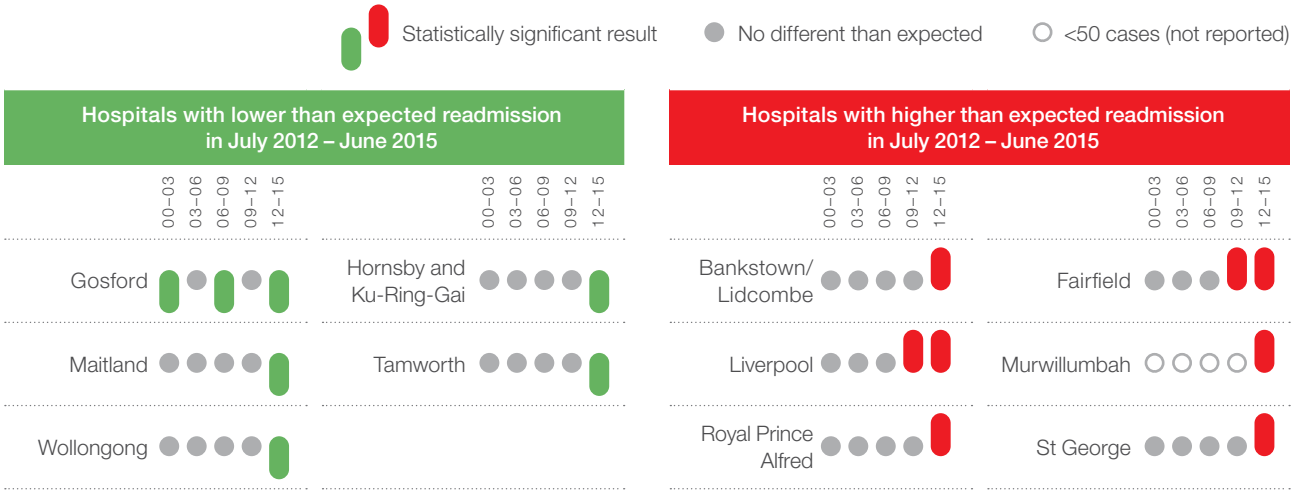
Age, sex and comorbidity

- Of the ischaemic stroke index hospitalisations, there were more male patients (7,994) than female patients (6,447). Among males, 10% of index hospitalisations were followed by a readmission within 30 days, compared with 12% among females
- After adjusting for age and comorbidity; sex was associated with higher risk of readmission; males were at lower risk of return.

* Same ICD-10-AM chapter.

Figure 21 Ischaemic stroke 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 22 Ischaemic stroke, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Ischaemic stroke

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

About 39% of returns to acute care occurred in the seven days following discharge and more than one in three of these were potentially related to hospital care (Figure 23). Among the returns that were potentially related to hospital care, pneumonitis was the most frequent cause (Table 4).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infection. The unadjusted readmission rate increased slightly with increasing lengths of stay up to a rate of 15% for stays of 15+ days (Figure 24).

Categorising the 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 returns that were potentially related to hospital care (Figure 25).

Table 4 Readmission, top three reasons in categories potentially related to hospital care, NSW

Category	Reason for readmission (n)
3. Potentially related to hospital care (relevant at any time)	Pneumonitis due to food and vomit (70) Pneumonia (33) Pulmonary embolism without mention of acute cor pulmonale (19)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	Chest pain (14) Urinary tract infection (13) Gastroenteritis and colitis (6)

Figure 23 Ischaemic stroke, number of, and reasons for readmission, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

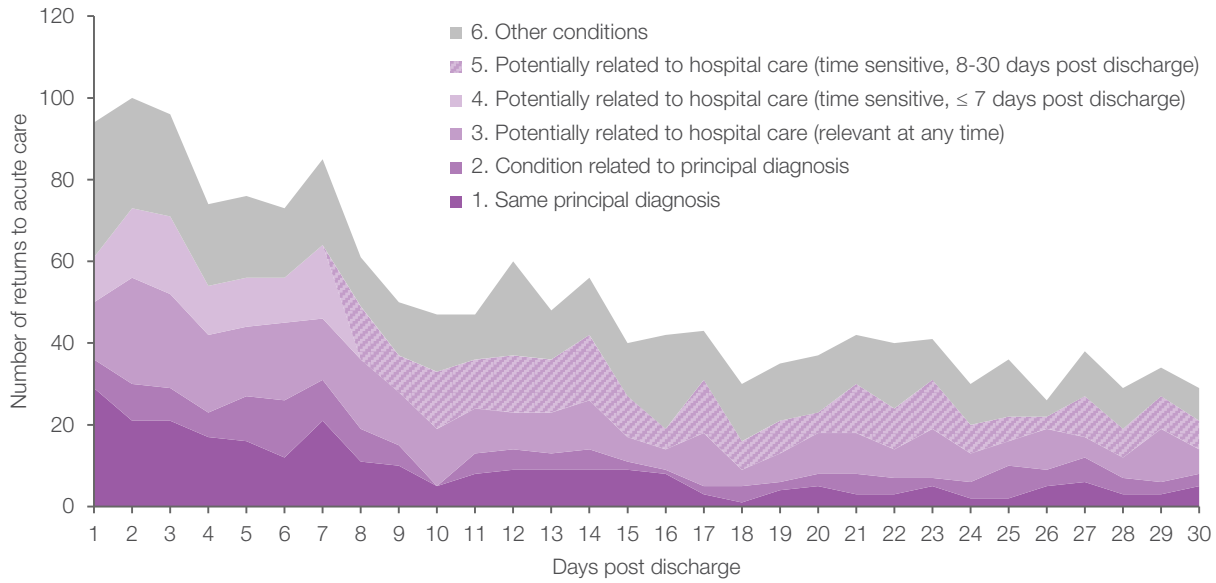


Figure 24 Ischaemic stroke, length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals, July 2012 – June 2015

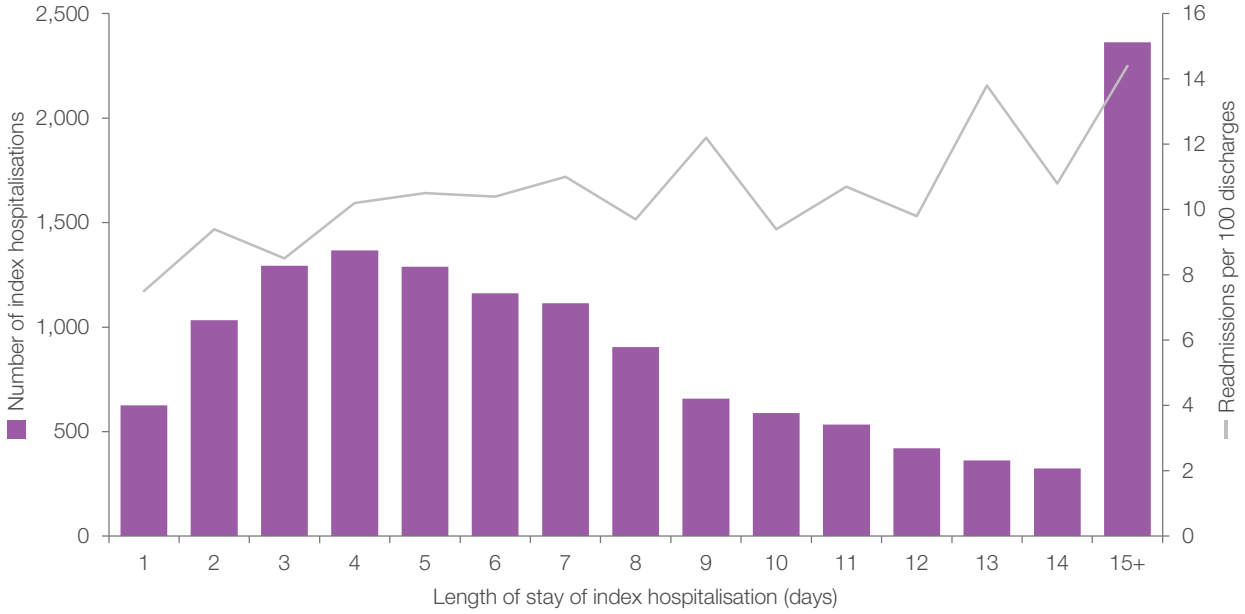
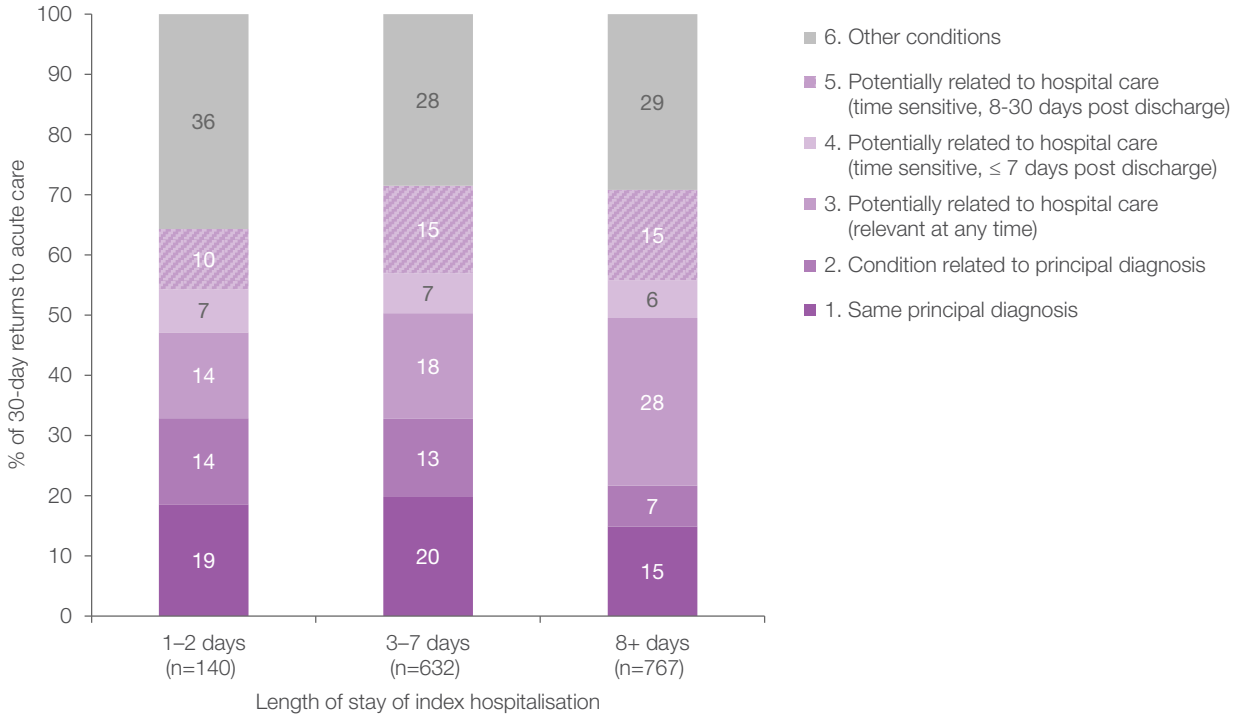


Figure 25 Ischaemic stroke, length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Congestive heart failure

NSW public hospitals

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.

Figure 26 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 23 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for CHF between July 2012 and June 2015, unadjusted readmission rates ranged from 12 to 33 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 53 hospitals (80%) with results that were no different than expected. Six hospitals (Armidale, Maclean, Manning, Hornsby, Sutherland and Royal North Shore) had lower than expected readmission and seven (Cowra, Lithgow, Cessnock, Canterbury, Fairfield, Nepean and Liverpool) had higher than expected readmission (Figure 27).

Of the six hospitals that had lower than expected readmission in 2012–15, Manning also did so in 2009–12. Of the seven hospitals that had higher than expected readmission in 2012–15, Fairfield and Nepean also did so in 2009–12 (Figure 28).

Figure 26 Congestive heart failure 30-day readmissions in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 33,450 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 – 25,461 patients were included in the analyses
- There were 1,205 (5%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 7,602 acute, emergency readmissions (all causes). After excluding 1,140 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 23 per 100 hospitalisations.

Among the 7,602 returns to acute care:

- 2,820 (37%) were for the same condition (i.e. principal diagnosis of CHF)
- 608 (8%) were for a condition related to CHF*
- 514 (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
- 649 (9%) were potentially related to hospital care as they occurred within seven days of discharge
- 1,427 (19%) were potentially related to hospital care but occurred outside the seven day window
- 1,584 (21%) were for other reasons
- 6,256 (82%) were to the same hospital.

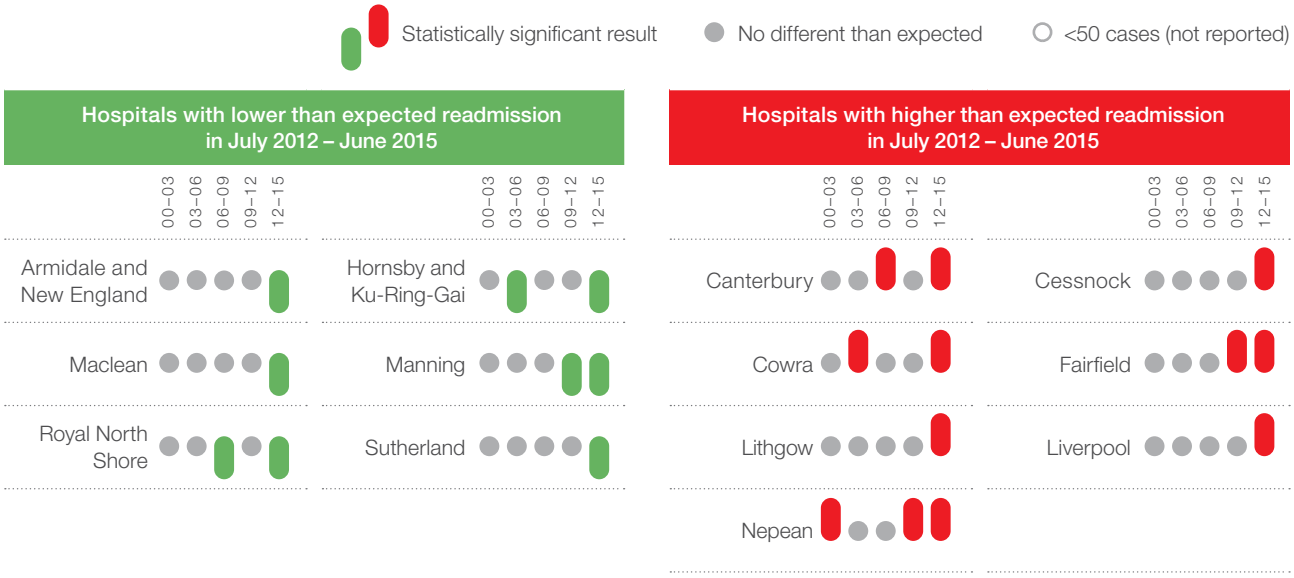
Age, sex and comorbidity

- Of the CHF index hospitalisations, there were more male patients (17,570) than female patients (15,880). Among males, 24% of index hospitalisations were followed by a readmission within 30 days, compared with 22% among females.
- After adjusting for age and comorbidities; sex was significantly associated with readmission; males were at higher risk of return.

* Same ICD-10-AM chapter

Figure 27 Congestive heart failure 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 28 Congestive heart failure, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Congestive heart failure

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of returns to acute care within seven days of discharge may, for example, point to problems with discharge planning.

Throughout the 30-day period, almost half of the returns to acute care were for CHF or related conditions. About a third of the readmissions were potentially related to hospital care (Figure 29). Among these, acute kidney failure was the most frequent cause (Table 5).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned readmission.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate increased slightly in step with increasing lengths of stay in the index hospitalisation (Figure 30).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) stays show similar profiles regardless of the length of stay in the index hospitalisation (Figure 31).

Table 5 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
3. Potentially related to hospital care (relevant at any time)	Acute kidney failure (130) Constipation (61) Gastrointestinal haemorrhage (44) Haemorrhagic disorder due to circulating anticoagulants (44)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	Pneumonia (59) Urinary tract infection (55) COPD with acute lower respiratory infection (46)

Figure 29 Congestive heart failure, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

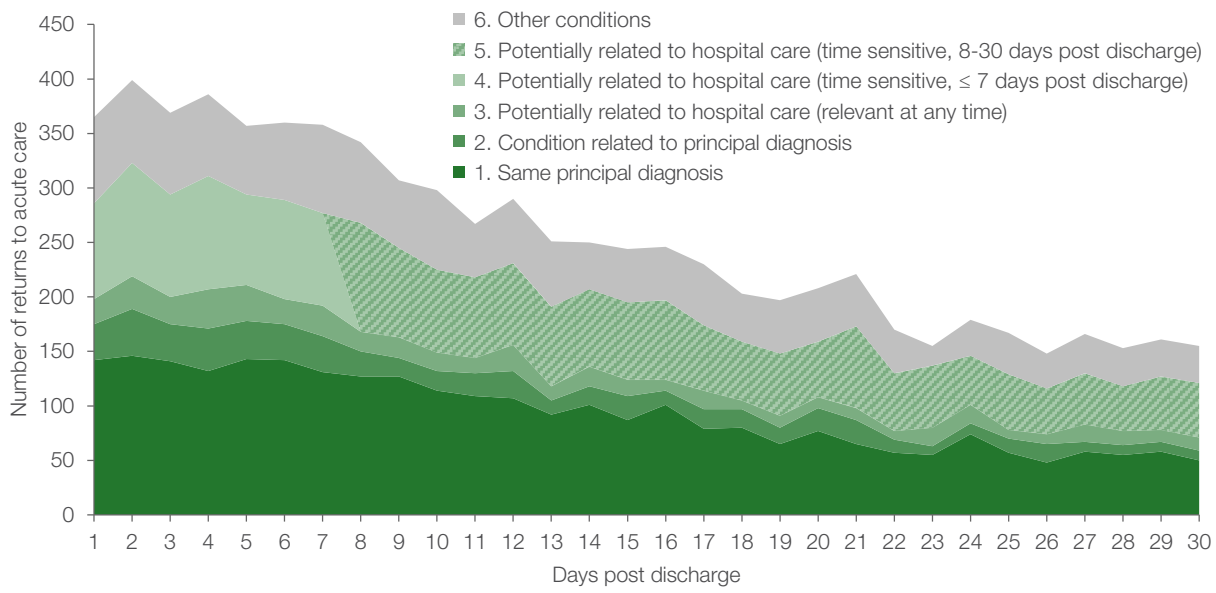


Figure 30 Congestive heart failure, length of stay of index hospitalisation and unadjusted readmission, NSW public hospitals, July 2012 – June 2015

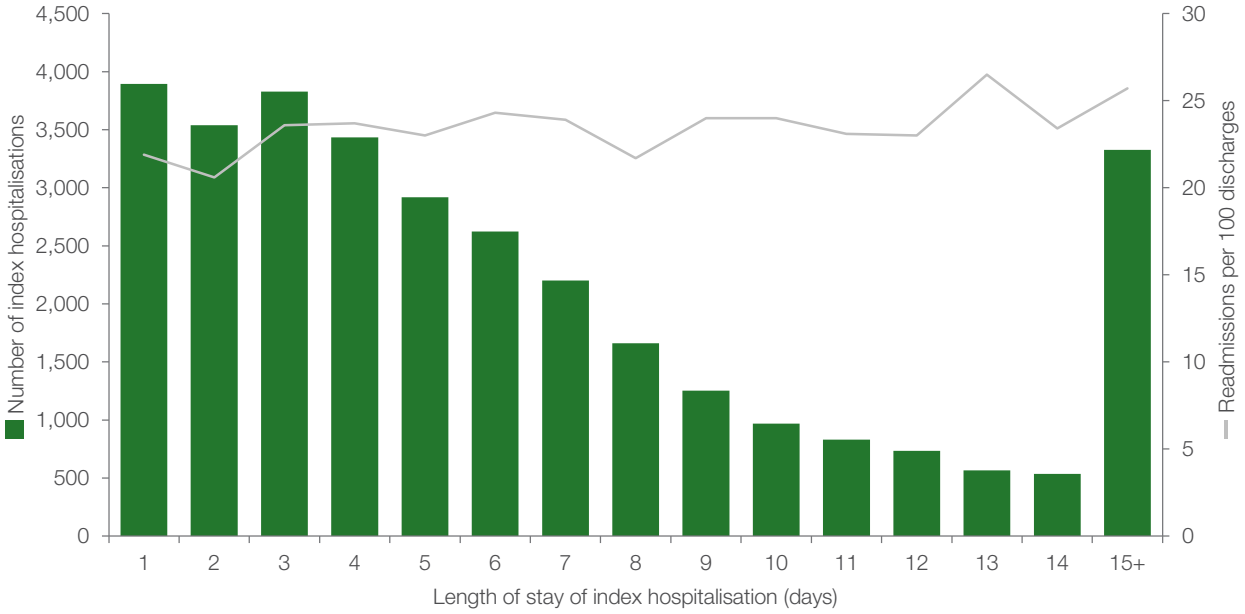
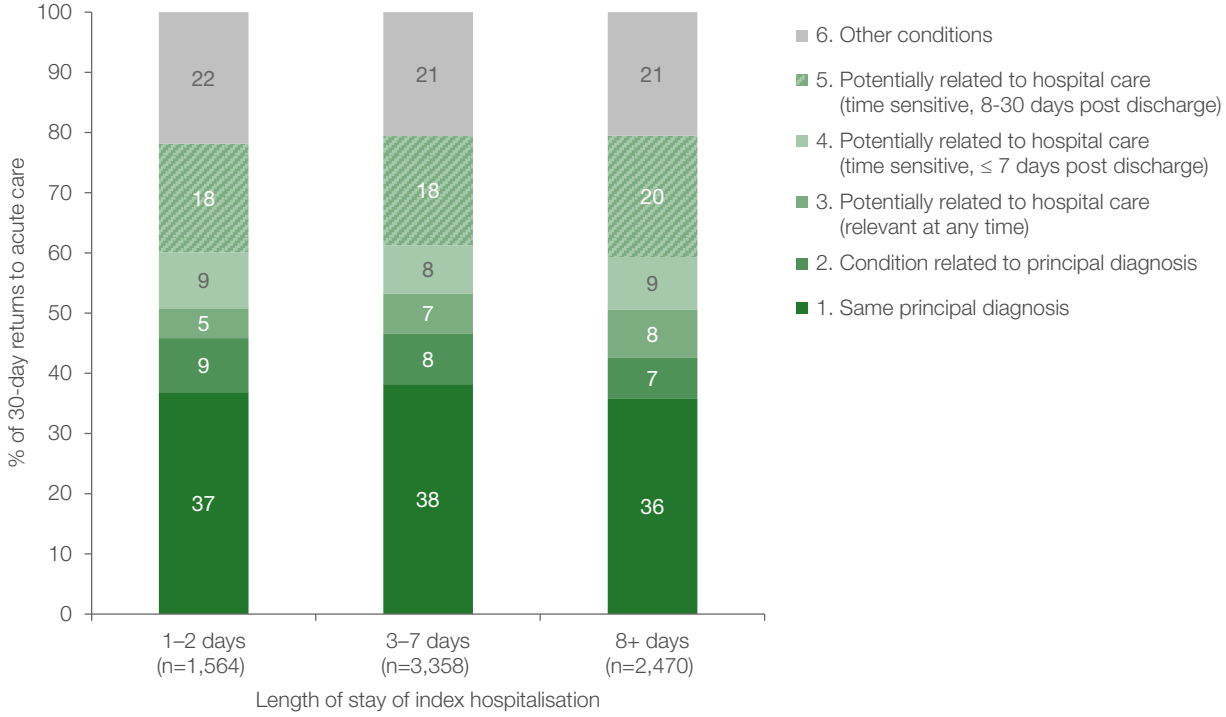


Figure 31 Congestive heart failure, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Pneumonia

NSW public hospitals

Pneumonia is an inflammatory condition of one or both lungs, usually due to infection. Symptoms may include fever, chills, cough with sputum production, chest pain and shortness of breath.

Figure 32 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 14 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for pneumonia between July 2012 and June 2015, unadjusted readmission rates ranged from four to 23 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 72 hospitals (92%) with results that were no different than expected. Three hospitals (Manning, St Vincent's and Sutherland) had lower than expected readmission and three hospitals (Auburn, St George and Westmead) had higher than expected readmission (Figure 33).

Of the three hospitals that had higher than expected readmission in 2012–15, Auburn and Westmead also did so in the preceding time period of 2009–12 (Figure 34).

Figure 32 Pneumonia 30-day readmissions in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 46,422 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 – 42,594 patients were included in the analyses
- There were 1,555 (4%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 6,543 acute, emergency readmissions (all causes). After excluding 1,671 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 14 per 100 hospitalisations.

Among the 6,543 returns to acute care:

- 1,292 (20%) were for the same condition (i.e. principal diagnosis of pneumonia)
- 1,284 (20%) were for a condition related to pneumonia*
- 442 (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
- 544 (8%) were potentially related to hospital care as they occurred within seven days of discharge
- 1,055 (16%) were potentially related to hospital care but occurred outside the seven day window
- 1,926 (29%) were for other reasons
- 5,304 (81%) were to the same hospital.

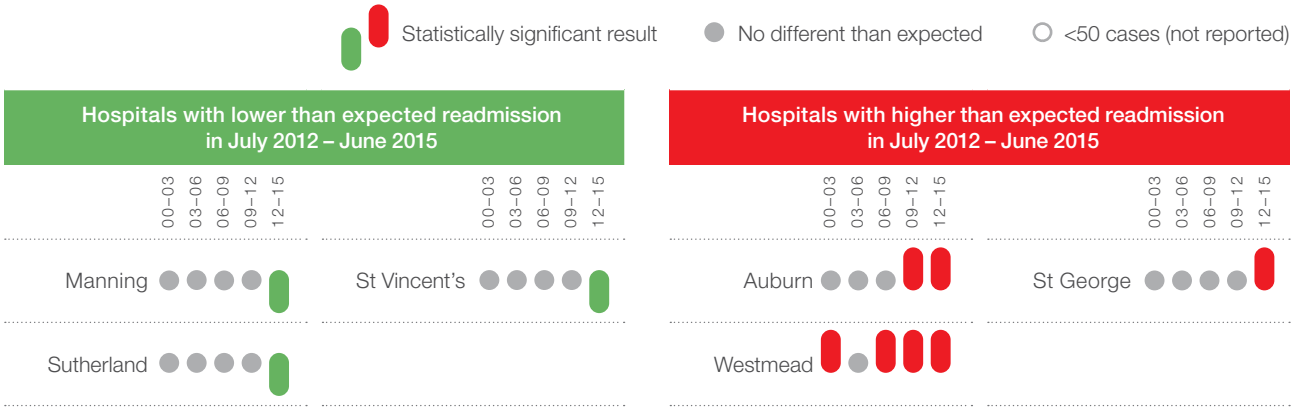
Age, sex and comorbidity

- Among the pneumonia index hospitalisations, there were more male patients (24,375) than female patients (22,047)
- Among males, 15% 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; males were at higher risk of return.

* Same ICD-10-AM chapter.

Figure 33 Pneumonia 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 34 Pneumonia, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Pneumonia

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

About 39% of returns to acute care occurred in the seven days following discharge and about one in three of these were potentially related to hospital care (Figure 35). Among the returns that were potentially related to hospital care, CHF was the most frequent cause (Table 6).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for pneumonia after an initial dip increased with increasing lengths of stay in the index hospitalisation, up to about 22% for stays of 12 days; and then decreased to a rate around 20% (Figure 36).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations shows that as length of stay increased, there was a lower proportion of returns to acute care for pneumonia (Figure 37).

Table 6 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
3. Potentially related to hospital care (relevant at any time)	Pulmonary embolism without mention of acute cor pulmonale (72) Acute kidney failure (58) Constipation (48)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	CHF (113) Acute subendocardial myocardial infarction (31) Chest pain (24)

Figure 35 Pneumonia, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

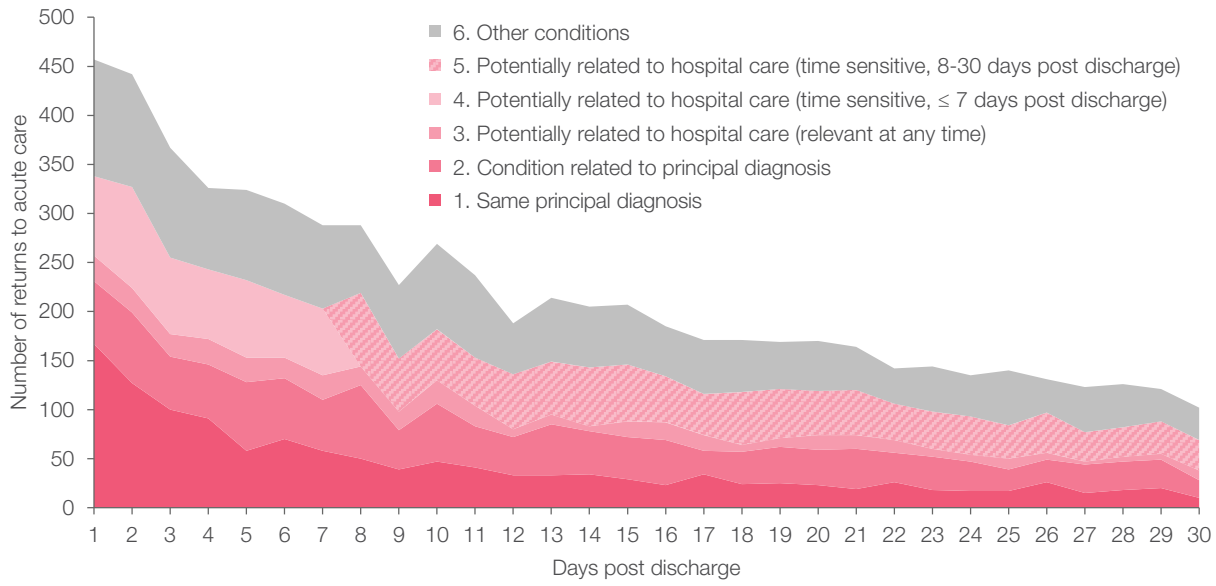


Figure 36 Pneumonia, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2012 – June 2015

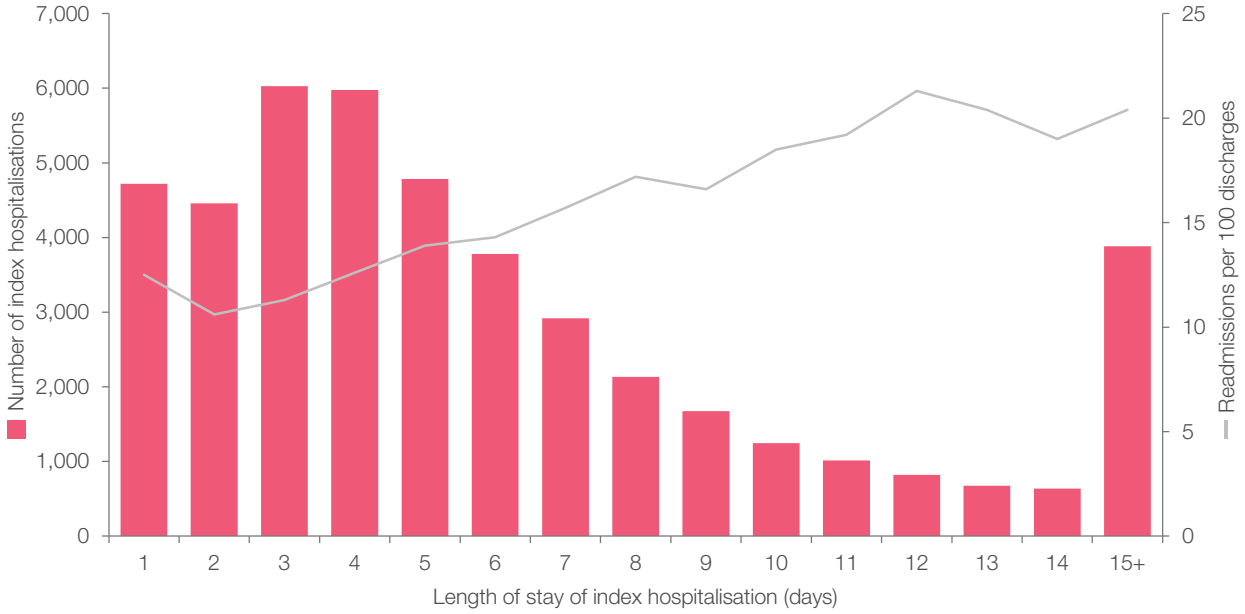


Figure 37 Pneumonia, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2012 – June 2015

Chronic obstructive pulmonary disease

NSW public hospitals

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.

Figure 38 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 22 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for COPD between July 2012 and June 2015, unadjusted readmission rates ranged from 11 to 44 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 67 hospitals (87%) with readmission results that were no different than expected. Five hospitals (Singleton, Queanbeyan, Manly, Royal North Shore and Wagga Wagga) had lower than expected readmission and five (Mudgee, Young Health Service, Auburn, Tamworth and Campbelltown) had higher than expected readmission (Figure 39).

Of the five hospitals that had lower than expected readmission in 2012–15, Wagga Wagga also did so in 2009–12. Of the five that had higher than expected readmission in 2012–15, Auburn also did so in 2009–12 (Figure 40).

Figure 38 Chronic obstructive pulmonary disease 30-day readmission in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 47,359 index hospitalisations that met the inclusion criteria – with a principal diagnosis of COPD (ICD-10-AM codes J40-J44). Some patients had multiple discharges – 29,218 patients were included in the analyses
- There were 860 (3%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 10,293 acute, emergency readmissions (all causes). After excluding 1,500 index hospitalisations without 30-day follow-up, this corresponds to an unadjusted readmission rate of 22 per 100 hospitalisations.

Among the 10,293 returns to acute care:

- 5,647 (55%) were for the same condition (i.e. principal diagnosis of COPD)
- 1,022 (10%) were for a condition related to COPD*
- 359 (3%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity) regardless of when they occurred
- 482 (5%) were potentially related to hospital care as they occurred within seven days of discharge
- 1,134 (11%) were potentially related to hospital care but occurred outside the seven day window
- 1,649 (16%) were for other reasons
- 8,696 (85%) were to the same hospital.

Age, sex and comorbidity

- Among the COPD index hospitalisations, there were more male patients (23,870) than female patients (23,489)
- Among males, 24% of index hospitalisations were followed by a readmission within 30 days, compared with 20% among females
- After adjusting for age and comorbidity, sex was significantly associated with readmission, males were at higher risk of return.

* Same ICD-10-AM chapter.

Figure 39 Chronic obstructive pulmonary disease 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

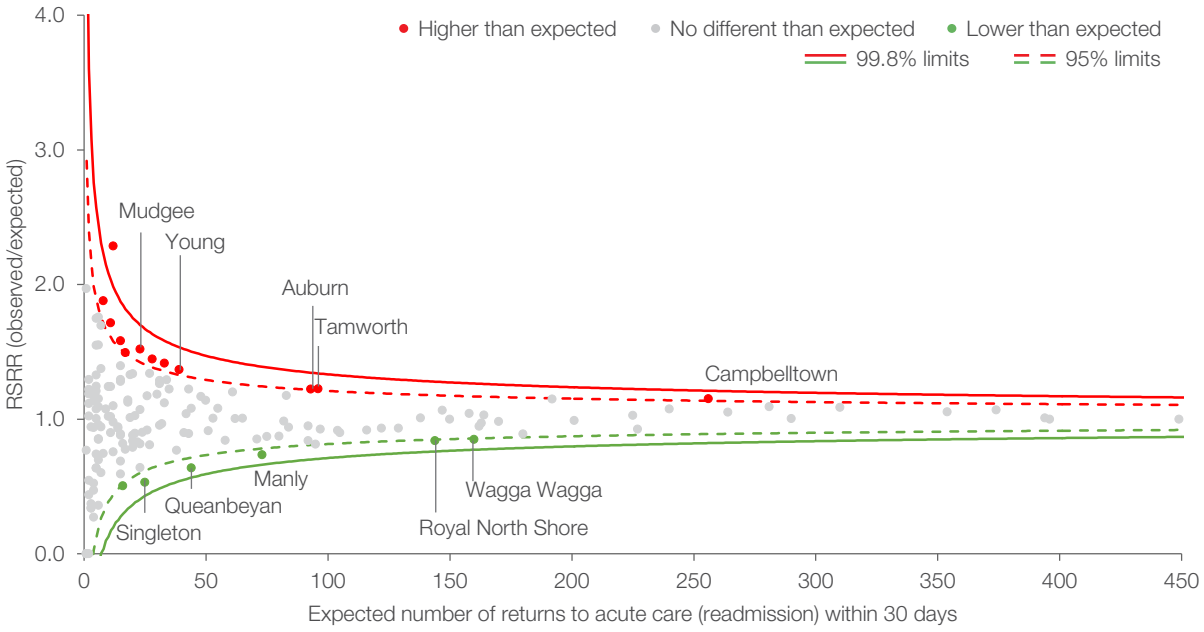
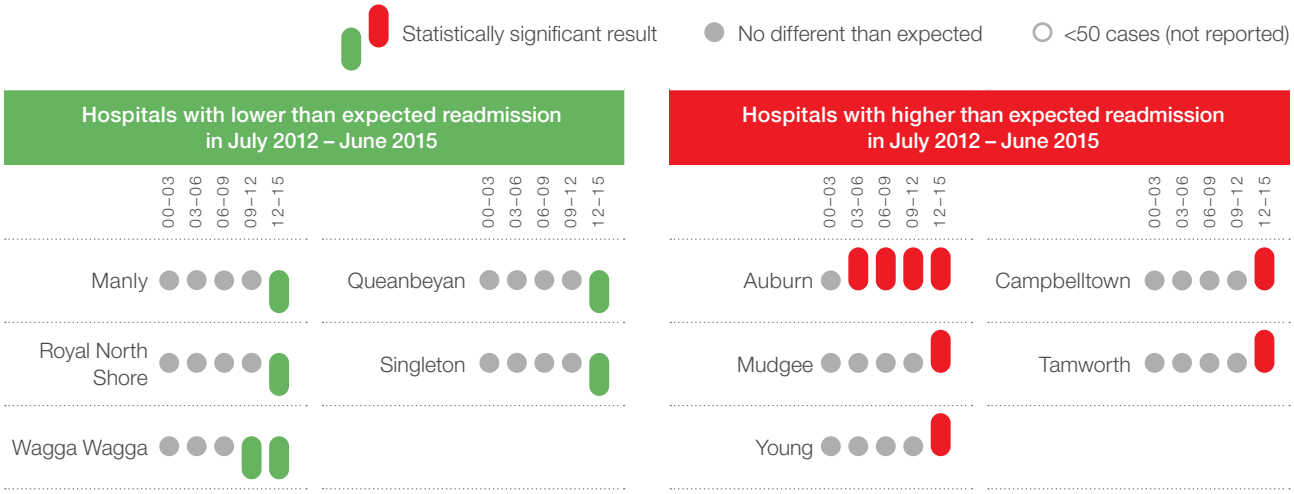


Figure 40 Chronic obstructive pulmonary disease, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Chronic obstructive pulmonary disease

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of returns to acute care within seven days of discharge may, for example, point to problems with discharge planning.

About 33% of returns to acute care occurred in the seven days following discharge and two thirds of returns were for COPD or related conditions (Figure 41). Among the returns that were potentially related to hospital care, CHF was the most frequent cause (Table 7).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for COPD increased slightly with increasing lengths of stay in the index hospitalisation, up to 27% for stays of 14 days (Figure 42).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations shows that a high proportion of returns to acute care were for COPD, regardless of the length of stay in the index hospitalisation (Figure 43).

Table 7 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
3. Potentially related to hospital care (relevant at any time)	Constipation (71) Pulmonary embolism without mention of acute cor pulmonale (41) Acute kidney failure (38)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	CHF (105) Chest pain (31) Acute subendocardial myocardial infarction (28)

Figure 41 Chronic obstructive pulmonary disease, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

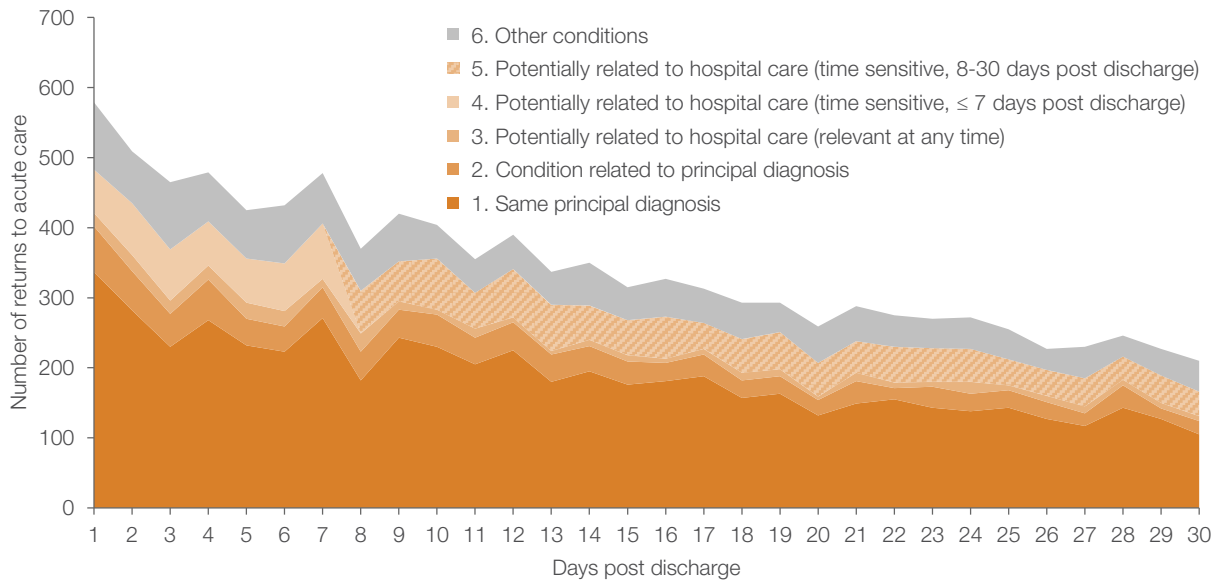


Figure 42 Chronic obstructive pulmonary disease, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2012 – June 2015

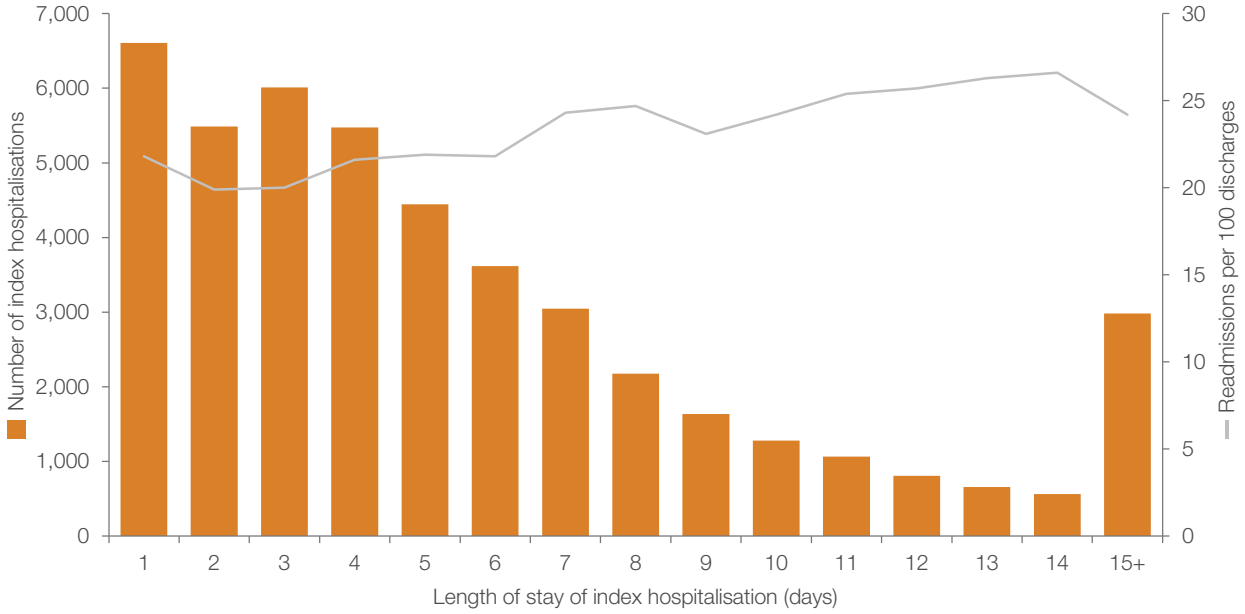
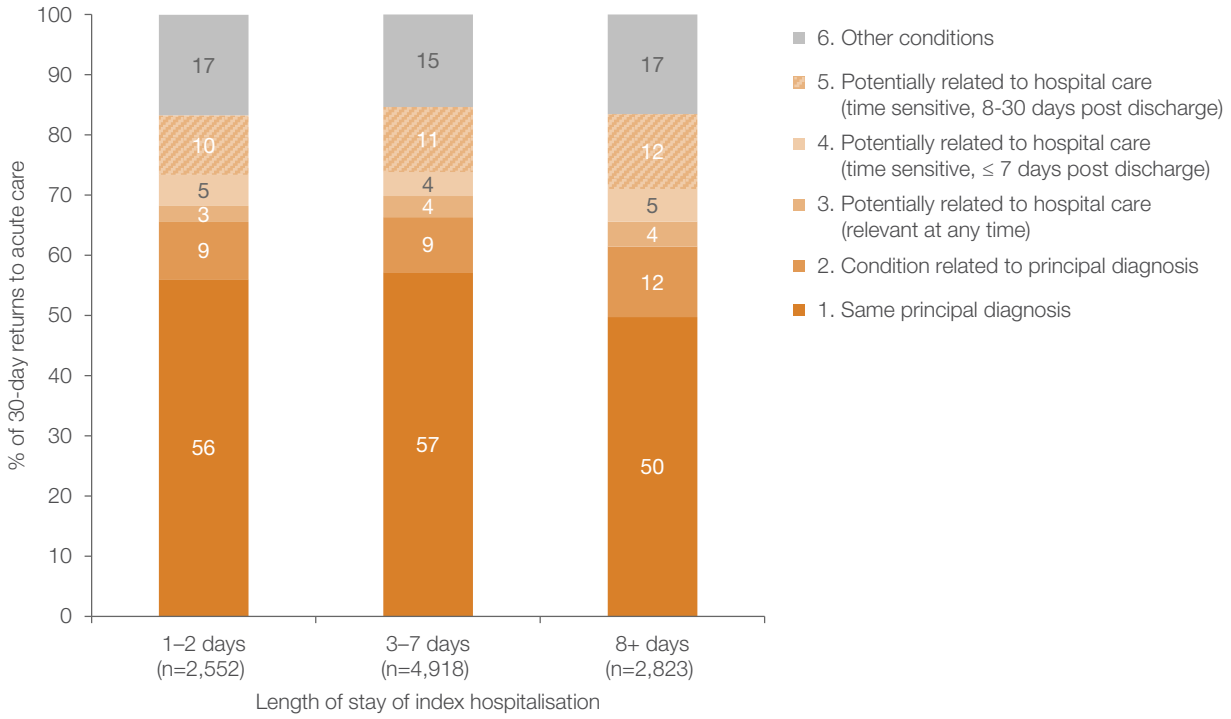


Figure 43 Chronic obstructive pulmonary disease, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Hip fracture surgery

NSW public hospitals

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.

Figure 44 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day readmission rate was 10 per 100 acute hospitalisations. For hospitals with at least 50 index hospitalisations for hip fracture surgery between July 2012 and June 2015, unadjusted readmission rates ranged from three to 23 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 32 hospitals (78%) with readmission results that were no different than expected. Three hospitals (Dubbo, Manning and Gosford) had lower than expected readmission and six (Goulburn, Murwillumbah, the Tweed, Bankstown/Lidcombe, St George and Westmead) had higher than expected readmission (Figure 45).

Of the three hospitals that had lower than expected readmission in 2012–15, Gosford also did so in 2009–12. Of the six hospitals that had higher than expected readmission in 2012–15, St George and Westmead also did so in 2009–12 (Figure 46).

Figure 44 Hip fracture surgery 30-day readmission in NSW: Key characteristics

In the three year period, July 2012 – June 2015:

- There were 14,581 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 – 14,190 patients were included in the analyses
- There were 630 (4%) people who died in the 30 days following discharge, before any readmission
- In the 30 days following discharge from acute care, there were 1,485 acute, emergency readmissions (all causes). After excluding 473 index hospitalisations without 30 day follow-up, this corresponds to an unadjusted readmission rate of 10 per 100 hospitalisations.

Among the 1,485 returns to acute care:

- 106 (7%) were for the same condition (i.e. principal diagnosis of hip fracture surgery)
- 253 (17%) were for a reason specifically related to hip fracture surgery (e.g. wound infection)
- 119 (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
- 172 (12%) were potentially related to hospital care as they occurred within seven days of discharge
- 333 (22%) were potentially related to hospital care but occurred outside the seven day window
- 502 (34%) were for other reasons
- 1,135 (76%) were to the same hospital.

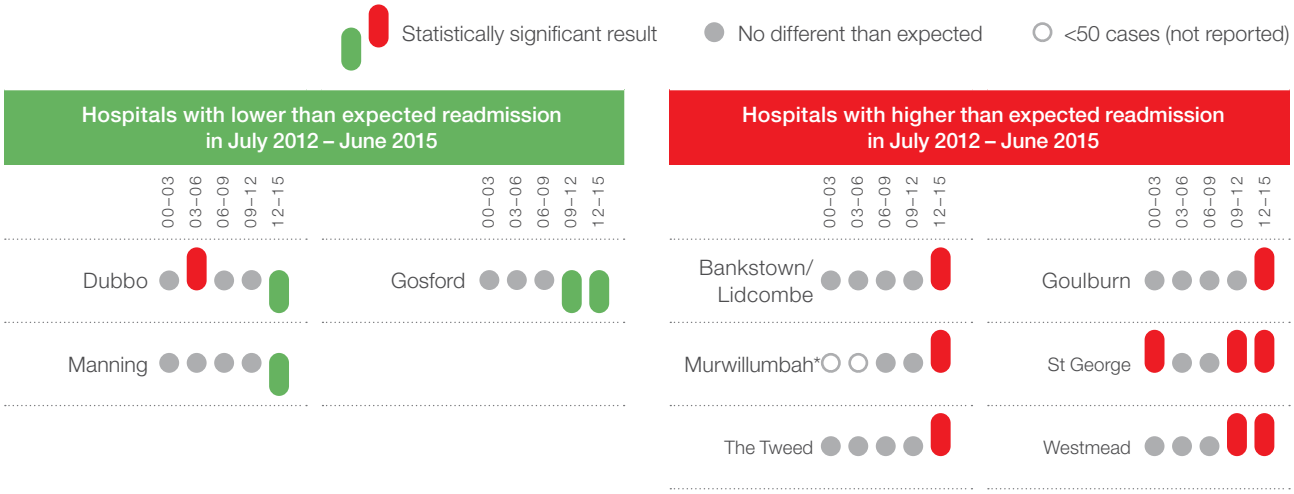
Age, sex and comorbidity

- Among the hip fracture surgery index hospitalisations, there were fewer male patients (3,982) than female patients (10,599)
- 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 were at higher risk of return.

* Same ICD-10-AM chapter.

Figure 45 Hip fracture surgery 30-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 46 Hip fracture surgery, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



* More than 5% of total patients underwent hip fracture surgery at another hospital.

Hip fracture surgery

Exploring patterns of readmission

Detailed information about when in the 30-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

About 33% of returns to acute care occurred in the seven days following discharge (Figure 47). Among all the returns that were potentially related to hospital care, urinary tract infection was the most frequent cause (Table 8).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for hip fracture surgery was 13% for short stays of 1–2 days and then fell to around 10%, climbing again to 13% for stays of 15+ days (Figure 48).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations shows that as length of stay increased, conditions unrelated to hip fracture surgery were increasingly responsible for returns to acute care (Figure 49).

Table 8 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
2. Condition related to principal diagnosis (orthopaedic complications)	Wound infection following a procedure (41) Pain in a joint, pelvic region, and thigh (29) Unspecified injury of hip and thigh (25)
3. Potentially related to hospital care (relevant at any time)	Urinary tract infection (67) Phlebitis and thrombophlebitis of deep vessels (11) Anaemia, unspecified (10)
4. Potentially related to hospital care (time sensitive, ≤ 7 days post discharge)	Pneumonitis due to food and vomit (20) Pneumonia (16) CHF (10)

Figure 47 Hip fracture surgery, number of, and reasons for readmission following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015

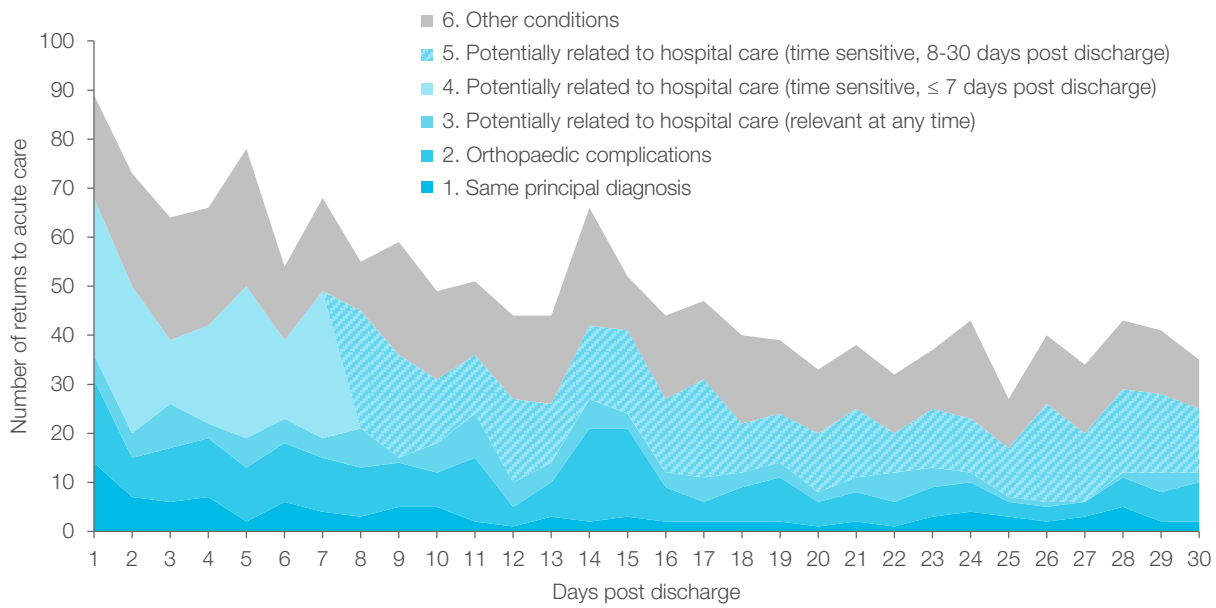


Figure 48 Hip fracture surgery, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2012 – June 2015

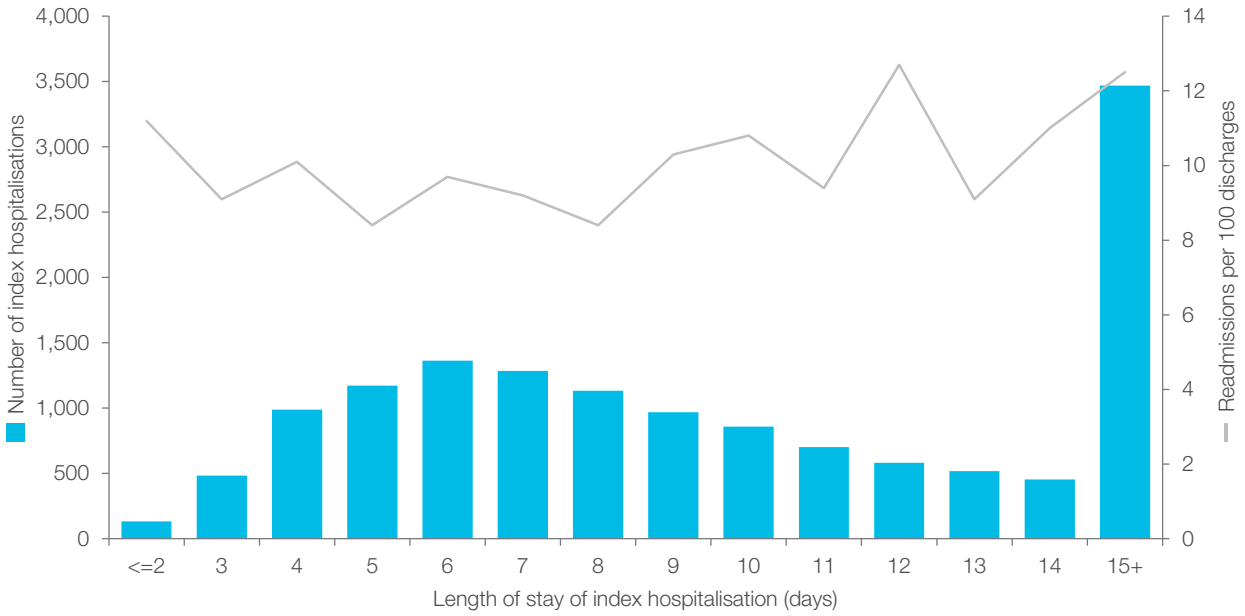
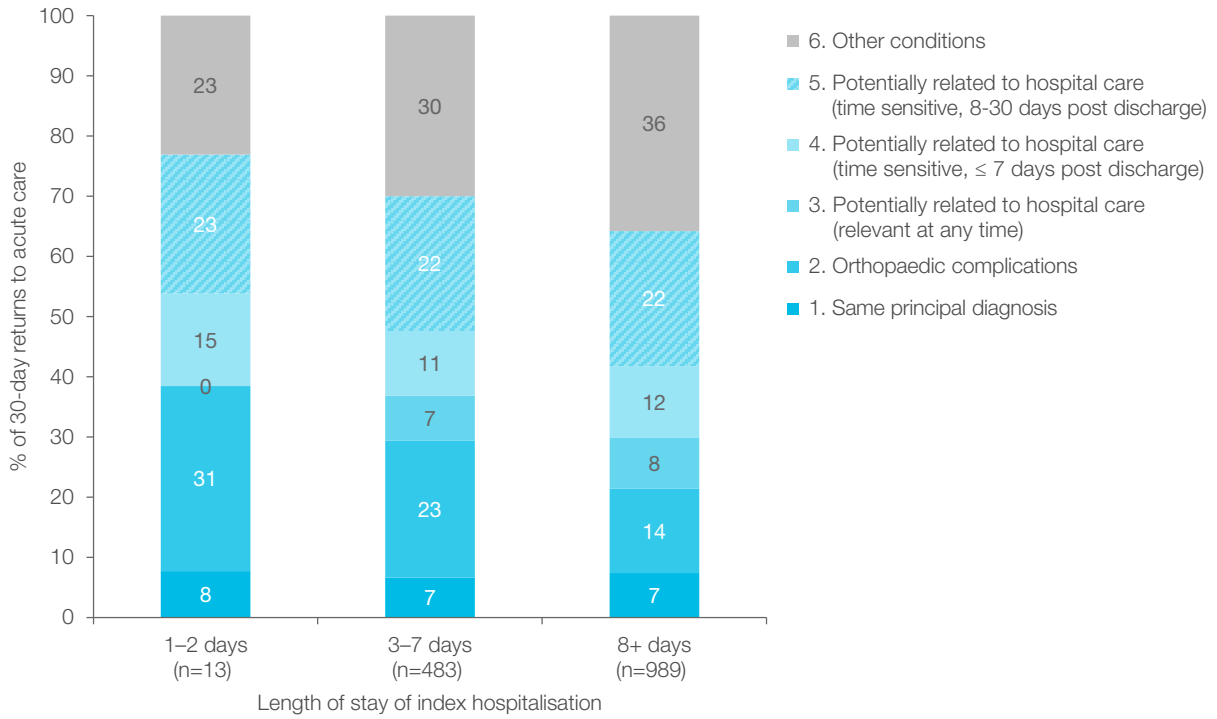


Figure 49 Hip fracture surgery, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Total hip replacement

NSW public hospitals

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.

Figure 50 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 60 days of discharge from an acute care setting.

The NSW 60-day readmission rate was nine per 100 hospitalisations. For hospitals with at least 50 index hospitalisations for total hip replacement between July 2012 and June 2015, unadjusted 60-day readmission rates ranged from two to 18 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 (95%) with readmission results that were no different than expected. One hospital (Bathurst) had lower than expected readmission and one hospital (Wagga Wagga) had higher than expected readmission (Figure 51).

Wagga Wagga also had higher than expected readmission in the preceding time period of 2009–12 (Figure 52).

Figure 50 Total hip replacement 60-day readmissions in NSW: Key characteristics

In the period, July 2012 – June 2015:

- There were 8,312 index hospitalisations: 8,218 (99%) for an elective primary unilateral procedure and 94 (1%) for a bilateral procedure
- There were six (<1%) persons who died within 60 days of discharge before any readmission
- In the 60 days following discharge from acute care, there were 764 readmissions (all causes). After excluding 530 index hospitalisations without 60 days of follow-up, this corresponds to an unadjusted readmission rate of nine per 100 hospitalisations.

Among the 764 returns to acute care:

- 217 (28%) 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
- 29 (4%) were for orthopaedic complications (but outside the time specified)
- 92 (12%) were potentially related to hospital care (i.e. adverse events or deficient management of comorbidity) regardless of when they occurred in the 60-day period
- 124 (16%) were potentially related to hospital care but outside the time specified (7, 15 or 30 day period post discharge)
- 302 (40%) were for other reasons
- 417 (55%) were to the same hospital.

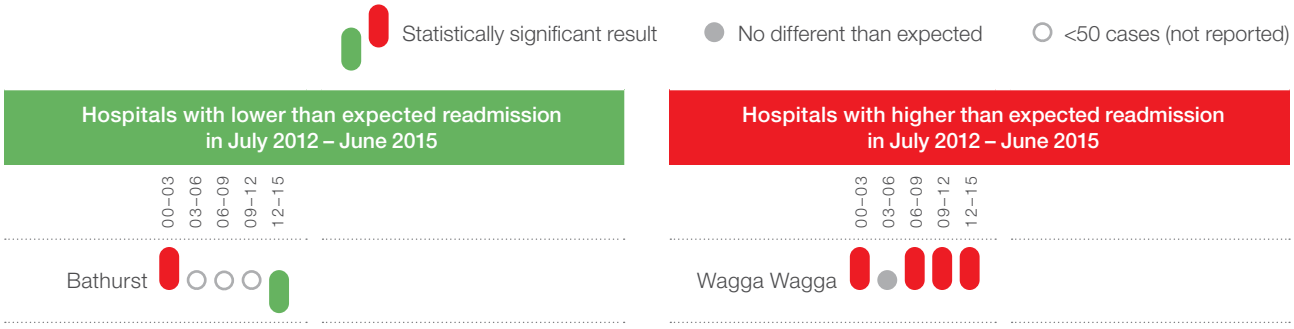
Age, sex and comorbidity

- Among the total hip replacement index hospitalisations, there were fewer male patients (3,956) than female patients (4,356)
- Among males, 10% of index hospitalisations were followed by a readmission within 60 days, compared with 8% for females
- After adjusting for age and comorbidity, sex remained significantly associated with readmission; males were at higher risk of return.

*same ICD-10-AM chapter

Figure 51 Total hip replacement 60-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

Figure 52 Total hip replacement, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Total hip replacement

Exploring patterns of readmission

Detailed information about when in the 60-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

The majority of returns to acute care that occurred in the first seven days following discharge were for orthopaedic complications (Figure 53). Among these, wound infection was the most frequent cause (Table 9).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for total hip replacement increased with increasing lengths of stay in the index hospitalisation, up to 22% for stays of 15+ days (Figure 54).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations shows that as length of stay increased, a greater proportion were potentially related to hospital care (for reasons other than orthopaedic complications) (Figure 55).

Table 9 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
1. Orthopaedic complications (within time specified)	Wound infection (53) Infection and inflammatory reaction to internal joint prosthesis (32) Pain in joint, pelvic region and thigh (25)
3. Potentially related to hospital care (within time specified)	Phlebitis and thrombophlebitis of deep vessels of lower extremities (7) Urinary tract infection (7) Anaemia (5)

Figure 53 Total hip replacement, number of, and reasons for, returns to acute care following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2012 – June 2015

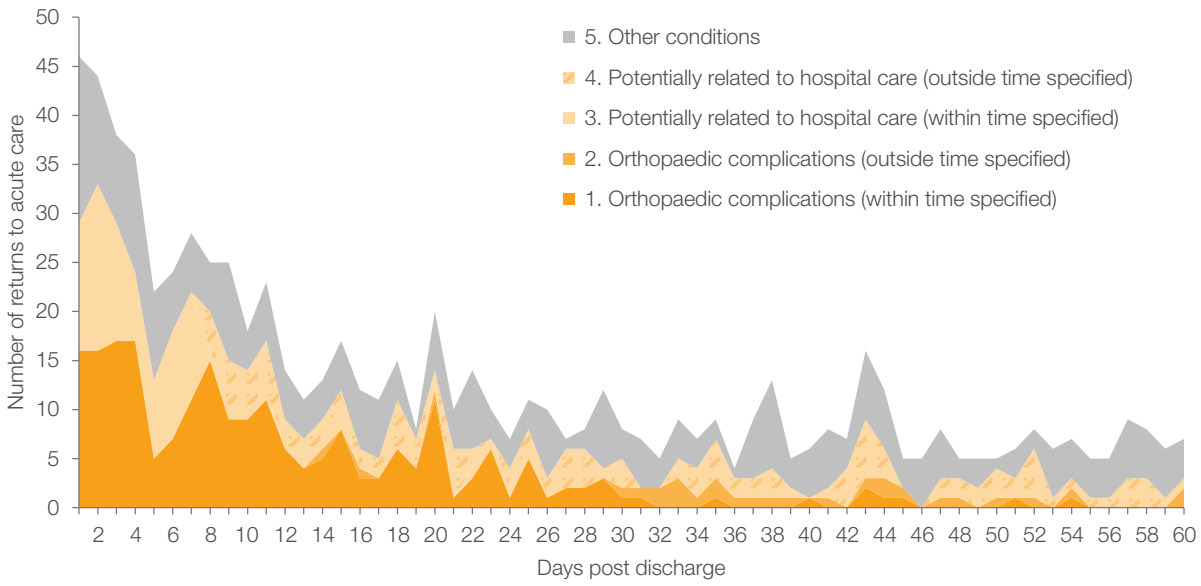


Figure 54 Total hip replacement, length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals, July 2012 – June 2015

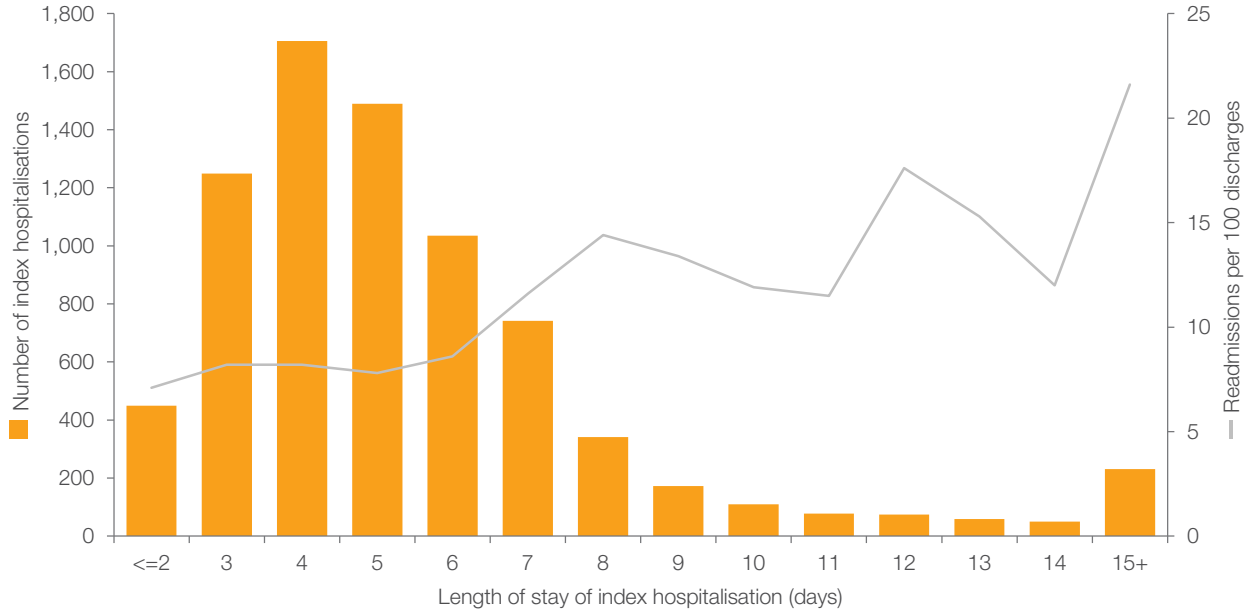
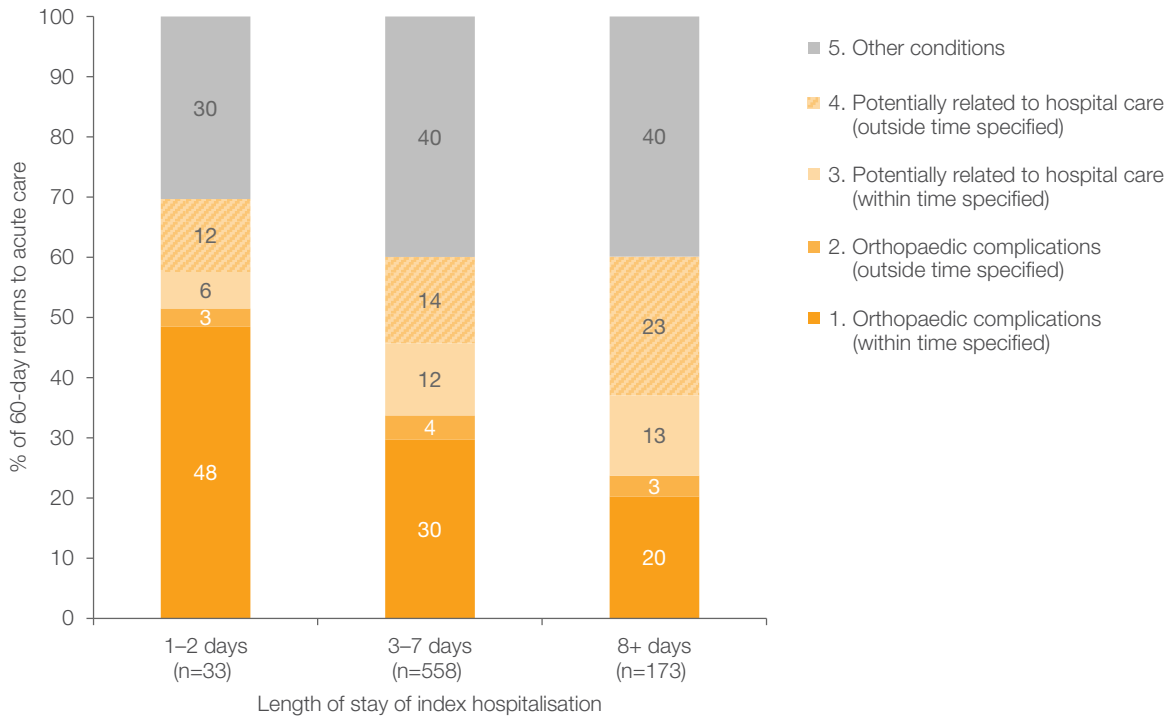


Figure 55 Total hip replacement, length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Total knee replacement

NSW public hospitals

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.

Figure 56 summarises information on the number of and reasons for returns to acute care, and characteristics of patients who returned within 60 days of discharge from an acute care setting.

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 2012 and June 2015, 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 36 hospitals (92%) with readmission results no different than expected. Two hospitals (Manning and Fairfield) had lower than expected readmission and one hospital (Prince of Wales) had higher than expected readmission (Figure 57).

Fairfield also had lower than expected readmission in the preceding time period of 2009–12 (Figure 58).

Figure 56 Total knee replacement 60-day readmissions in NSW: Key characteristics

In the period, July 2012 – June 2015:

- There were 14,961 index hospitalisations: 14,054 (94%) for an elective primary unilateral procedure and 907 (6%) for a bilateral procedure
- There were 6 (<1%) patients who died within 60 days of discharge before any readmission
- In the 60 days following discharge from acute care, there were 1,727 readmissions (all causes). After excluding 927 index hospitalisations without 60 days of follow-up, this corresponds to an unadjusted readmission rate of 12 per 100 hospitalisations.

Among the 1,727 returns to acute care:

- 510 (30%) 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 7 days; injury of femoral artery within 15 days
- 232 (13%) were for orthopaedic complications (but outside the time specified)
- 182 (11%) were for a condition potentially related to hospital care (i.e. adverse events or deficient management of comorbidity) regardless of when they occurred in the 60 day period
- 245 (14%) were potentially related to hospital care but outside the time specified (7, 15 or 30 day period post discharge)
- 558 (32%) were for other reasons
- 1,011 (59%) were readmitted to the same hospital.

Age, sex and comorbidity

- Among the total knee replacement index hospitalisations, there were fewer male patients (5,888) than females (9,073)
- Among males 13% of index hospitalisations were followed by a readmission within 60 days, compared with 10% for females
- After adjusting for age and comorbidities, sex remained significantly associated with readmission; males were at higher risk of return.

Figure 57 Total knee replacement 60-day risk-standardised readmission ratio, NSW public hospitals, July 2012 – June 2015

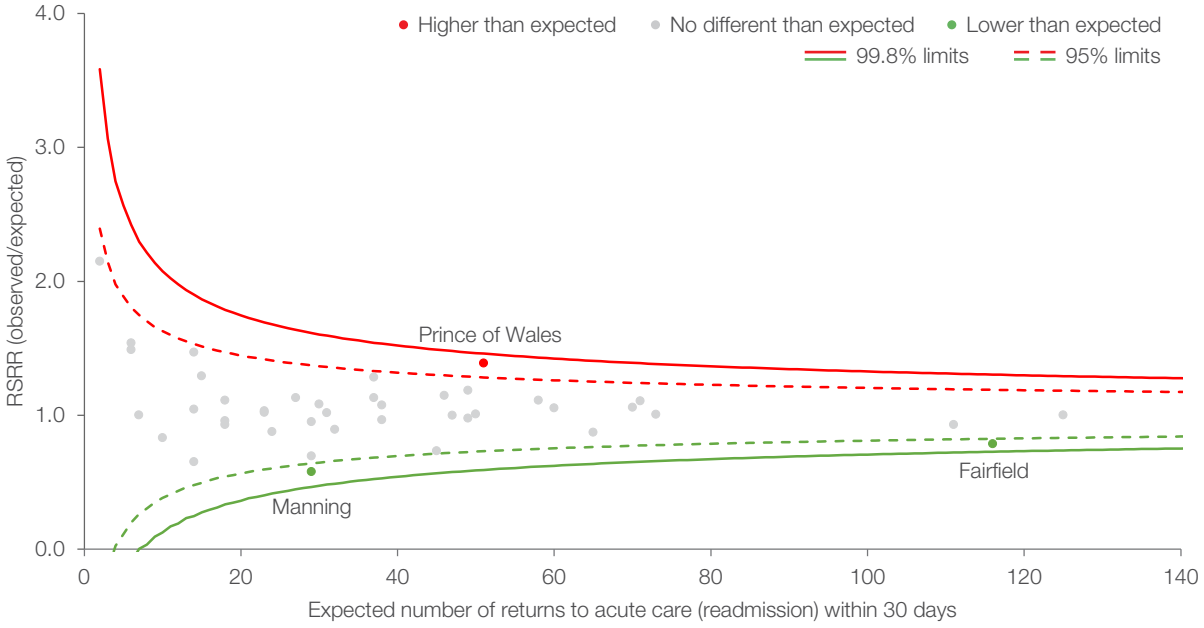
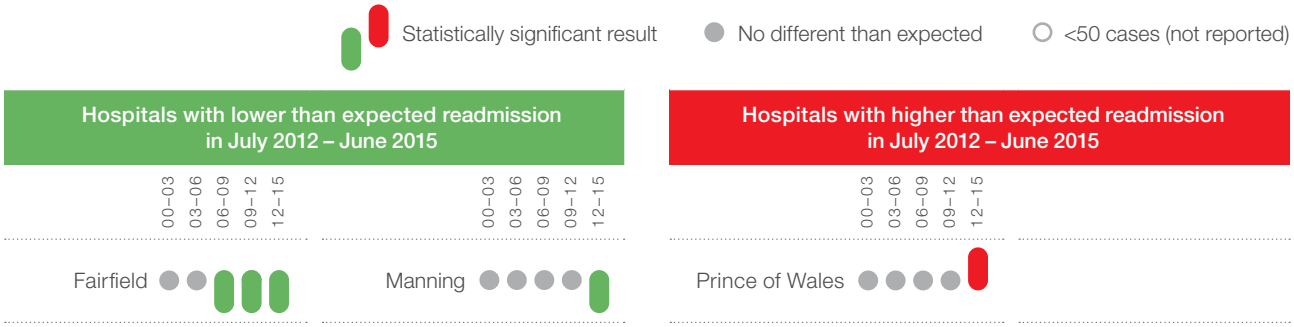


Figure 58 Total knee replacement, 15-year time series results for hospitals that were outliers in the period July 2012 – June 2015



Total knee replacement

Exploring patterns of readmission

Detailed information about when in the 60-day period following discharge readmissions occur, and the reasons for those returns, can highlight potential areas for improvement.[25] A high number of readmissions within seven days of discharge may, for example, point to problems with discharge planning.

Most of the returns to acute care which occurred in the first seven days following discharge were for orthopaedic complications (Figure 59). Among these, wound infection was the most frequent cause (Table 10).

Some studies have found a relationship between length of stay and the likelihood of readmission.[26,27] Lengths of stay that are too short may result in patients being discharged before their recovery is properly established and their condition stabilised, leading to an unplanned return to acute care.

Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired complications such as infections. The unadjusted readmission rate following hospitalisation for total knee replacement increased with increasing lengths of stay in the index hospitalisation, up to 25% for stays of 12 days, with slightly lower rates thereafter (Figure 60).

Categorising the reasons for readmission that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) hospitalisations reveals that as length of stay increased, there was a greater proportion of returns that were potentially related to hospital care (for reasons other than orthopaedic complications) (Figure 61).

Table 10 Readmission, top three reasons in categories potentially related to hospital care

Category	Reason for readmission (n)
1. Orthopaedic complications (within time specified)	Wound infection (144) Infection and inflammatory reaction to internal joint prosthesis (77) Other complications of internal orthopaedic prosthetic devices, implants and grafts (73)
3. Potentially related to hospital care (within time specified)	Phlebitis and thrombophlebitis of deep vessels of lower extremities (20) Cellulitis of lower limb (19) Other postprocedural disorders of circulatory system (17)

Figure 59 Total knee replacement: number of, and reasons for readmission following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2012 – June 2015

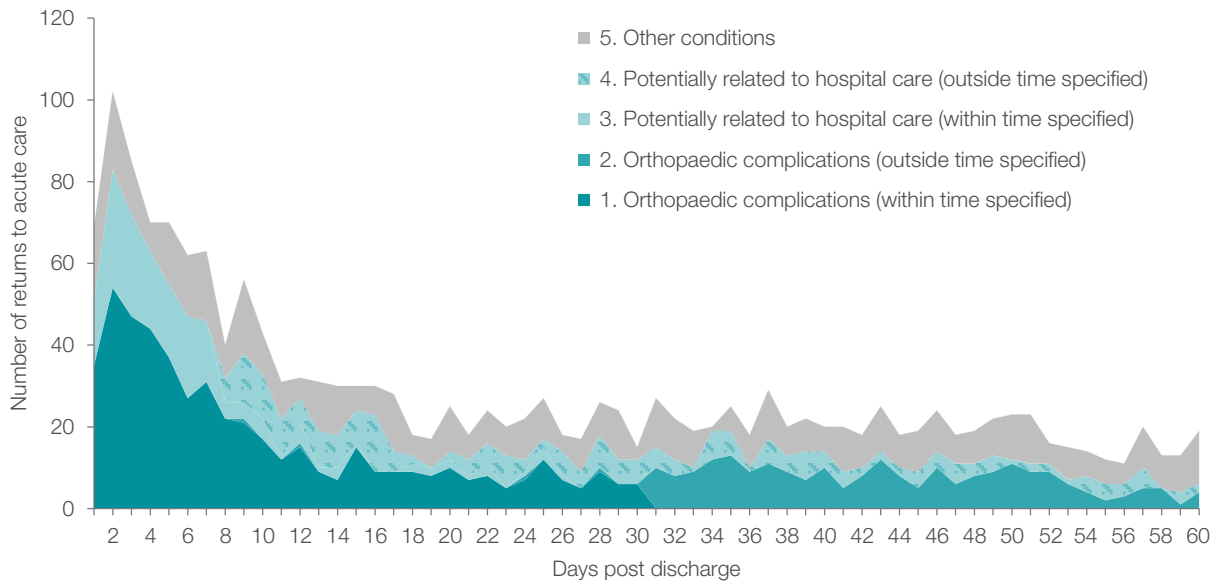


Figure 60 Total knee replacement, length of stay of index hospitalisation and unadjusted readmission rate, NSW public hospitals, July 2012 – June 2015

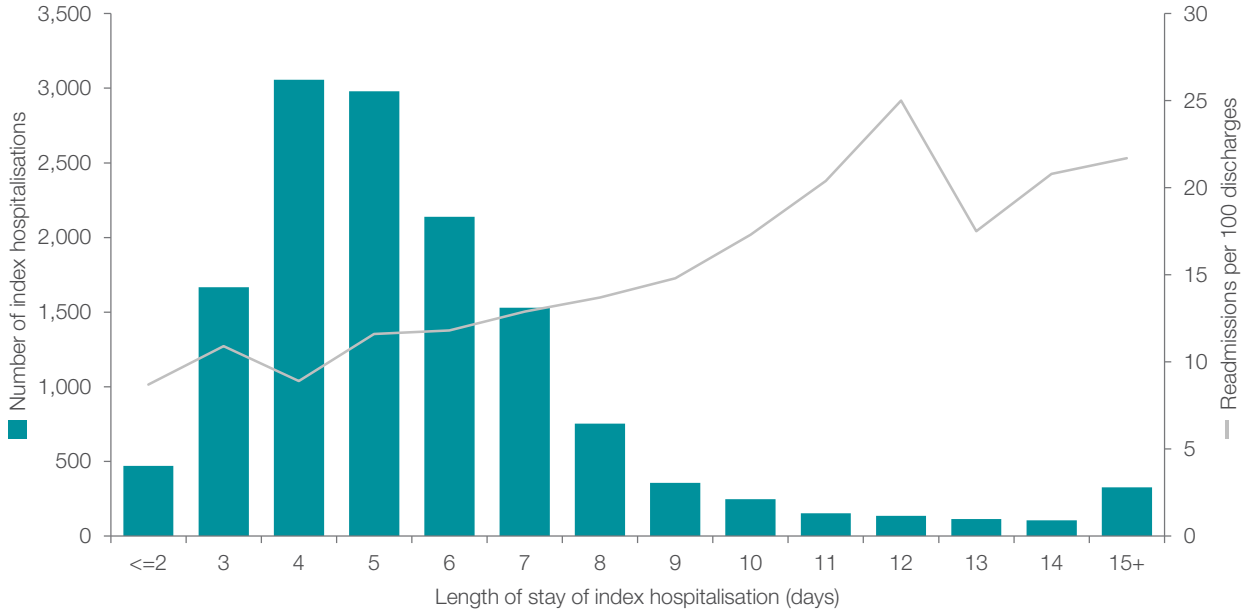
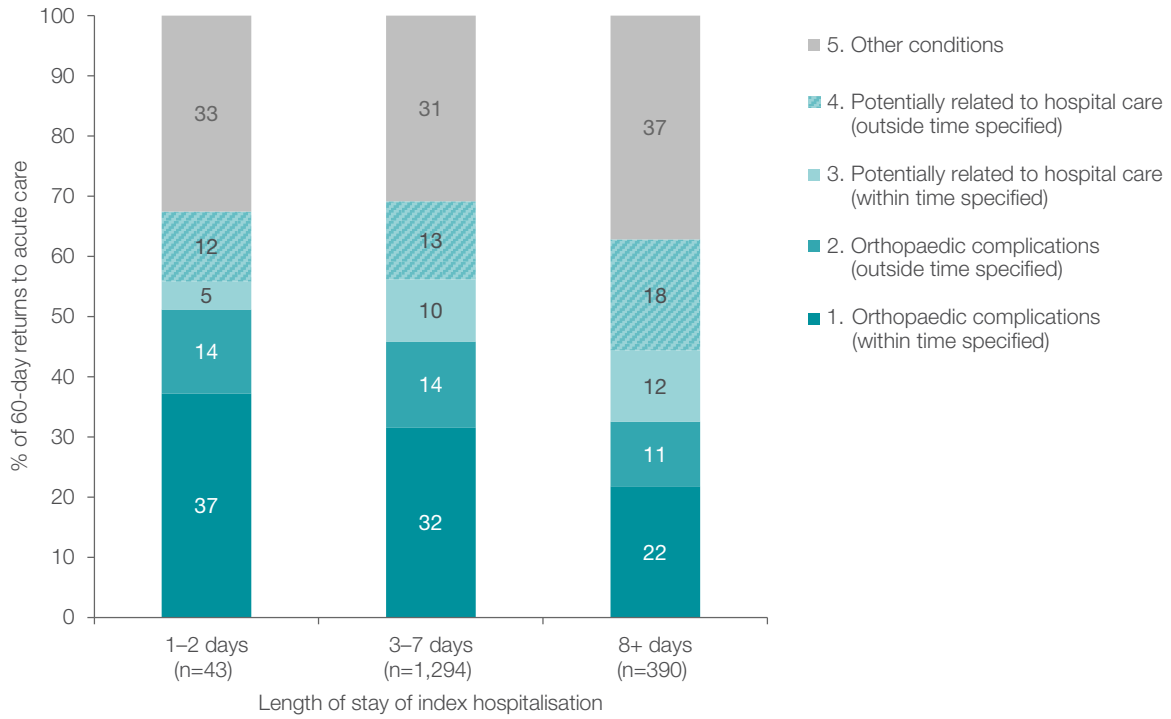


Figure 61 Total knee replacement, length of stay of index hospitalisation and readmission by principal diagnosis category, NSW public hospitals, July 2012 – June 2015



Appendices

Appendix 1

Prediction models

For each condition included in the report, NSW-level prediction models were developed using index admissions between 1 July 2012 and 30 June 2015. Fine and Gray competing risk models 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 Figure 62. C-statistics, that describe the prediction ability of the models, are also shown.

Figure 62 Patient factors and comorbidities included in the final models

Condition	Patient factors and comorbidities	C statistic
Acute myocardial infarction	Age, history of acute myocardial infarction, congestive heart failure, cardiac arrhythmia, pulmonary circulation disorders, other neurological disorders, chronic pulmonary disease, diabetes complicated, renal failure, metastatic cancer, solid tumour without metastasis, coagulopathy, weight loss, fluid and electrolyte disorders, depression	0.63
Ischaemic stroke	Sex, congestive heart failure, cardiac arrhythmia, chronic pulmonary disease, diabetes complicated, renal failure, liver disease, weight loss, fluid and electrolyte disorders, deficiency anaemia	0.60
Congestive heart failure	Age, sex, history of congestive heart failure, cardiac arrhythmia, other neurological disorders, chronic pulmonary disease, diabetes complicated, hypothyroidism, renal failure, liver disease, peptic ulcer disease (excluding bleeding), metastatic cancer, rheumatoid arthritis/collagen, coagulopathy, fluid and electrolyte disorders, deficiency anaemia, alcohol abuse/drug abuse/psychoses, dementia	0.60
Pneumonia	Age, sex, congestive heart failure, cardiac arrhythmia, pulmonary circular disorders, hypertension, other neurological disorders, chronic pulmonary disease, diabetes complicated, diabetes uncomplicated, renal failure, liver disease, lymphoma, metastatic cancer, solid tumour without metastasis, rheumatoid arthritis/collagen, weight loss, fluid and electrolyte disorders, deficiency anaemia, alcohol abuse/drug abuse/psychoses, depression	0.66
Chronic obstructive pulmonary disease	Age, sex, history of chronic obstructive pulmonary disease, congestive heart failure, cardiac arrhythmia, diabetes complicated, renal failure, lymphoma, metastatic cancer, solid tumour without metastasis, coagulopathy, weight loss, fluid and electrolyte disorders, deficiency anaemia, alcohol abuse/drug abuse/psychoses, depression	0.65
Hip fracture surgery	Sex, cardiac arrhythmia, paralysis, other neurological disorders, chronic pulmonary disease, diabetes complicated, renal failure, coagulopathy, fluid and electrolyte disorders, deficiency anaemia, dementia	0.60
Total hip replacement	Age, sex, cardiac arrhythmia, pulmonary circulation disorders, chronic pulmonary disease, diabetes complicated, diabetes uncomplicated, renal failure, liver disease, lymphoma, solid tumour without metastasis, depression	0.63
Total knee replacement	Age, sex, cardiac arrhythmia, pulmonary circulation disorders, diabetes complicated, liver disease, fluid and electrolyte disorders, blood loss anaemia, alcohol abuse/drug abuse/psychoses, depression	0.58

Appendix 2

How to interpret a funnel plot

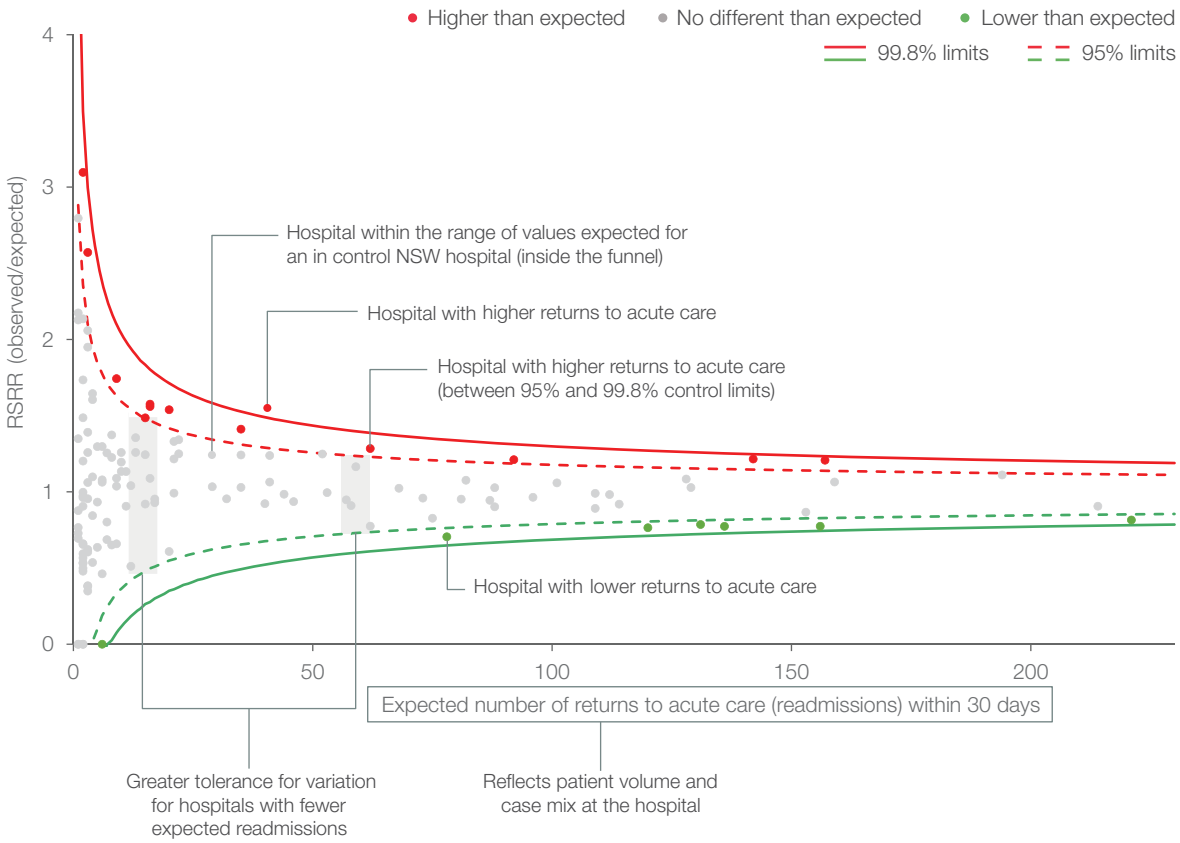
Return to acute care is influenced by a wide range of factors that interact in complex ways, meaning there will always be some level of variation in patient outcomes.

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 returns to acute care, 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 (i.e. returns to acute care); 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 63).

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 63 Annotated funnel plot



Appendix 3

The depth of comorbidity and secondary diagnoses coding

Indicators of readmission depend, to a certain extent, on the quality of hospital coding practices. An assessment of depth of coding was conducted, comparing hospitals and changes over time (Figure 64).

Depth of coding is defined as the average number of secondary diagnoses coded for index cases. In a small proportion of hospitals with higher than expected readmission, statistical significance was reached only with a full risk adjustment model (as opposed to unadjusted and age-and sex-standardised ratios).

Figure 64 Average number of secondary diagnoses, eight conditions, NSW and hospital range, 2009–12 and 2012–15

	Average number of secondary diagnoses (range across hospital peer groups A–C)	
Condition	July 2009 – June 2012	July 2012 – June 2015
Acute myocardial infarction	4.9 (1.6–7.2)	5.6 (3.3–9.4)
Ischaemic stroke	6.3 (3.5–9.2)	7.0 (3.7–9.4)
Congestive heart failure	4.8 (1.6–7.8)	5.9 (1.9–8.9)
Pneumonia	3.7 (1.0–6.6)	4.8 (1.0–8.4)
Chronic obstructive pulmonary disease	3.2 (1.1–5.8)	4.1 (1.2–8.2)
Hip fracture surgery	8.3 (5.3–11.4)	9.2 (6.0–12.5)
Total hip replacement	2.5 (1.0–5.7)	2.6 (1.1–5.6)
Total knee replacement	2.1 (0.8–3.8)	2.4 (1.0–4.5)

Flag red on full adjustment model only

There were four hospitals with higher than expected readmission only on the full adjustment model (one in peer group B and three in peer group C). Two of these results were for CHF and two were for COPD.

Flag green on full adjustment model only

There were two hospitals with lower than expected readmission only on the full adjustment model (both of these were in peer group A). One was for AMI and the other for pneumonia.

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The Bureau of Health Information (BHI) is the main source of information for the people of NSW about the performance of their public healthcare system. A NSW board-governed organisation, BHI is led by Chairperson Professor Carol Pollock and Chief Executive Jean-Frédéric Lévesque MD, PhD.

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External Advisors and Reviewers

Ian Brownwood, OECD

Jacqui Close, Neuroscience Australia

Professor Jason Fine, University North Carolina

Yana Gurevich, Kira Leeb, Kathleen Morris, Canadian Institute of Health Information

Isuru Ranasinghe, University of Adelaide

Professor David Spiegelhalter, University of Cambridge

Bureau of Health Information Project Team

Analytics

Huei-Yang (Tom) Chen

Julia Chessman

Bradley Drayton

Sadaf Marashi-Pour (Lead)

Research

Diana Arachi

Ariana Dobrovic

Kim Sutherland

Design

Ed Bury

Adam Myatt

Efren Sampaga

Mark Williams

Communications and Stakeholder Engagement

Rohan Lindeman

Karen Perini

Stephanie Watson

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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 public healthcare system.

BHI was established in 2009 to provide system-wide support through transparent reporting.

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

BHI publishes a range of reports and tools that provide relevant, accurate and impartial information about how the health system is measuring up in terms of:

- Accessibility – healthcare when and where needed
- Appropriateness – the right healthcare, the right way
- Effectiveness – making a difference for patients
- Efficiency – value for money
- Equity – health for all, healthcare that's fair
- Sustainability – caring for the future

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 report 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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