bureau of
**health
information**

The Insights Series

Return to acute care following hospitalisation

Insights into readmissions, NSW public hospitals,
July 2009 – June 2012

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Foreword

Unplanned readmissions following a recent discharge from hospital are measures that have been reported in various healthcare systems internationally for many years. Although some are unavoidable, readmissions can provide an indication that patient care could be improved and that more efficient use could be made of available resources.

Readmissions can reflect the quality of care provided in hospital or access to appropriate follow-up after discharge to non-acute settings. As one of a suite of performance indicators, readmissions can indicate whether more value for money could be achieved from a system perspective; or whether care could be improved for patients, avoiding unnecessary hospitalisations.

A recently released report from the Auditor-General of NSW recommended that limitations in existing specifications for measuring unplanned readmissions be addressed; and that enhanced analysis and reporting of length of stay and unplanned readmissions was required at the local health district and hospital levels. Our report provides a timely response to these recommendations and represents a significant and much-needed advance in the measurement and reporting of an important element of performance in NSW public hospitals.

The Bureau of Health Information has harnessed the opportunity of linked data to further the measurement of readmissions, using internationally recognised methods and Australian standards. This work, realised over the past 18 months, has enabled the development of clinically relevant measures focusing on patients' unplanned and unanticipated returns to an acute care setting.

While readmission is a generic concept, this enhanced measurement forms a part of a growing suite of clinical indicators that are useful to thoroughly assess performance of NSW public hospitals. It has enabled the assessment of the reasons for returns to acute care that are for the same diagnosis as the first or 'index' presentation, or that are for diseases that are clinically related, as well as those that are potentially related to the care provided in hospital.

The report also makes an important contribution to understanding the relationship between the duration of acute stays in hospital and the likelihood of return to acute care. It explores whether shorter stays are associated with returns to acute care for the presenting condition, indicating a premature discharge or lack of complete treatment or control of the disease; or whether longer stays are associated with more complications of care, hospital-acquired conditions and adverse events, indicating that longer stays expose patients to more iatrogenic harm.

This edition of *The Insights Series* presents the results of our analysis of 30-day returns to acute care for five clinical conditions, and 60-day returns to acute care for two elective surgical procedures. Accounting for almost 13% of all acute, overnight emergency returns to acute care in the state and spanning a range of conditions and procedures, the results relate to important care processes in hospital, in the community and the extent of integration of care across different settings.

The report is accompanied by a *Spotlight on Measurement* report that describes the methodological developments that underpin this work. In addition, detailed hospital profiles are provided to support local assessments and identification of potential reasons for outlying results, highlighting areas where quality improvement efforts could focus.

In line with our previous work on clinical variation in outcomes of care, exemplified by our recent report on 30-day mortality for five conditions, these measures provide a screening tool to target assessments and quality improvement efforts in areas of greater need, as well as identifying hospitals that are leading the way.

Dr Jean-Frédéric Lévesque
Chief Executive, Bureau of Health Information

Summary

Why measure returns to acute care?

Readmission to hospital is an outcome indicator that is widely reported internationally.[1-3] When used as one of a suite of measures, readmission rates, or more specifically rates of return to acute care, can be used to inform the assessment of quality of healthcare and highlight areas for improvement.[4-7]

Not all returns to acute care can, nor should, be avoided. Some are due to patients developing new health problems or to an acute deterioration in a longstanding chronic condition despite appropriate management. In many cases however, a return to acute care is a poor outcome for patients.

Emergency returns to acute care can reflect performance across different healthcare settings and elements of care. High rates can be the result of suboptimal treatment, 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.

Measuring returns to acute care fairly

Assessments of a hospital's performance in outcome measures such as the rate of return to acute care or mortality, if they are to be fair, must take account of differences in case mix. This entails determining the extent to which various patient factors such as age and comorbidities affect the likelihood of the outcome occurring; and when appropriate, making statistical adjustments to hospitals' results. This means, for example, that a hospital that treats older or sicker patients is not expected to have the same rates of readmission as a hospital that treats younger patients or less complex cases.

This edition of *The Insights Series* is based on an approach that is able to make such statistical adjustments. The risk standardised readmission ratio (RSRR) compares the observed number of returns to acute care that occurred shortly after discharge from a particular hospital with the expected number of returns

to acute care, given the characteristics of that hospital's patient population. Results are reported as higher than expected, no different than expected, or lower than expected.

The RSRRs that underpin this report provide specificity by separately assessing results for patients with particular diseases or who underwent certain procedures. They provide focus in concentrating on the clinically relevant acute phase of patient care – measuring and reporting in terms of patient returns to acute care.

Return to acute care following hospitalisation in NSW public hospitals

The return to acute care version of the RSRR:

- focuses on the period immediately following the assessment that a patient no longer requires acute care and is either discharged home or moves to a non-acute setting

- includes patients whose acute hospitalisation ends with discharge home, with a subsequent readmission to hospital; and patients whose acute hospitalisation ends with a 'discharge' to non-acute care, with a subsequent return to an acute care setting

- attributes outcomes to the hospital that discharges the patient from the acute care setting

- is reported, by condition or procedure, for hospitals that discharged at least 50 patients

- considers a 30-day period following discharge from acute care for clinical conditions; and a 60-day period following discharge from acute care for elective surgical procedures.

The report provides outcome information on two different types of hospitalisations. Section 1 presents results for five clinical conditions: acute myocardial infarction, ischaemic stroke, congestive heart failure, pneumonia and hip fracture surgery. Section 2 presents results for two elective surgical procedures: total hip replacement and total knee replacement.

The five conditions and two elective surgical procedures included in the report were selected as:

- They provide insights into a range of different types of condition – from acute emergencies to long term chronic conditions – across the medical-surgical spectrum

- They are relevant to highly prevalent conditions that cause significant ill health among the people of NSW

- There are established and validated approaches to measure and report readmissions for these conditions in other jurisdictions nationally and internationally[9-12]

- They align with previously published information on 30-day mortality following hospitalisation for acute myocardial infarction, ischaemic stroke, haemorrhagic stroke, pneumonia and hip fracture surgery.[13]

Section 1 is based on information from almost 130,000 acute hospitalisations in NSW public hospitals while Section 2 is based on a further 22,000 acute hospitalisations. Together the sections report on 15,400 returns to acute care – or around 13% of all acute, overnight, emergency returns to acute care among patients aged 15 years or over who were discharged from NSW public hospitals between July 2009 and June 2012.

The RSRR measures that underpin this report draw upon linked patient data. Returns to acute care that occured in a hospital different from the hospital within which the initial or 'index' hospitalisation occurred are not usually available to clinicians and managers in the discharging hospitals. The use of linked data resulted in greater sensitivity of the RSRRs, with a 25% increase in the capture of occasions patients returned to acute care.

What did we find?

For each of the conditions and procedures, only a small number of hospitals had RSRRs that were higher than expected. The percentage of hospitals with an RSRR no different than, or lower than expected was 91% for acute myocardial infarction, 91% for ischaemic stroke, 93% for congestive heart failure, 90% for pneumonia, 90% for hip fracture surgery, 87% for total hip replacement and 85% for total knee replacement (Figure 1).

Figure 1   NSW results at a glance

Condition	Hospitals with >49 cases	Hospitals RSRR as expected	Hospitals with high RSRR	Hospitals with low RSRR	Hospitals with RSRR as expected or low (%)
Acute myocardial infarction	53	46	5	2	91
Ischaemic stroke	47	42	4	1	91
Congestive heart failure	72	64	5	3	93
Pneumonia	78	67	8	3	90
Hip fracture surgery	42	35	4	3	90
Total hip replacement	39	32	5	2	87
Total knee replacement	40	31	6	3	85

Figure 2 30-day RSRRs, NSW public hospitals, July 2009 – June 2012

	Acute myocardial infarction	Ischaemic stroke	Congestive heart failure	Pneumonia	Hip fracture surgery
Hospitals with higher than expected RSRR	Auburn, Bankstown, Kempsey, Manning, Tamworth	Fairfield, Liverpool*, Shellharbour, Wagga Wagga	Auburn, Fairfield, Kempsey, Milton, Nepean	Auburn, Lithgow, Liverpool, Milton, Mt Druitt, Nepean, Wagga Wagga, Westmead	Grafton**, Nepean, St George, Westmead
Hospitals with RSRR no different than expected	46	42	64	67	35
Hospitals with lower than expected RSRR	Prince of Wales, Royal North Shore	Manning	Blue Mountains, Dubbo, Manning	Blue Mountains, Camden, Maitland	Gosford, John Hunter, Liverpool

Figure 3 60-day RSRRs, NSW public hospitals, July 2009 – June 2012

	Total hip replacement	Total knee replacement
Hospitals with higher than expected RSRR	Bankstown, Nepean, Wagga Wagga, Wollongong, Wyong	Armidale, Coffs Harbour, Nepean, Shoalhaven, Tamworth, Wagga Wagga
Hospitals with RSRR no different than expected	32	31
Hospitals with lower than expected RSRR	Hornsby, RPAH Institute of Rheumatology & Orthopaedics	Fairfield, Hornsby, RPAH Institute of Rheumatology & Orthopaedics

Across the conditions and procedures of interest, between four and eight hospitals had higher than expected RSRRs and between one and three hospitals had lower than expected RSRRs (Figures 2 and 3).

Concentration of outlier status across hospitals

The majority of NSW hospitals (73%) had no conditions or procedures for which their RSRRs were higher than expected. There were 21 (27%) hospitals with a higher than expected RSRR for at least one condition or procedure. Nepean recorded a higher than expected RSRR for three conditions and both procedures, Wagga Wagga for two conditions and both procedures and Auburn for three conditions. Conversely, there were 13 (17%) hospitals with a lower than expected RSRR for at least one condition or procedure. Blue Mountains and Manning recorded a lower than expected RSRR for two conditions, and Hornsby and the RPAH Institute of Rheumatology & Orthopaedics for both procedures. Hospitals with multiple RSRRs different from expected tended to be outliers in one direction only. Only three hospitals – Fairfield, Liverpool* and Manning – recorded both higher and lower than expected RSRRs (Figure 4).

* Data for ischaemic stroke patients admitted to Liverpool Hospital revealed a high use of type change separations (statistical discharges) and a high rate of return to acute care for these separations. It is not possible to ascertain the extent to which this idiosyncrasy affected the RSRR results for Liverpool Hospital.

** Data for hip fracture surgery patients discharged from Grafton Hospital revealed that of the total 14 returns to acute care, 11 (79%) underwent surgery at another hospital.

The total number of hospitalisations, observed and expected returns to acute care and RSRR results for all outlier hospitals are shown in Appendix 6.

Patterns, peer groups and geography

Higher than expected RSRRs were recorded in hospitals of different sizes (peer groups A-C), in both rural and urban settings, and in most local health districts (LHDs). Lower than expected RSRRs were recorded in major and district hospitals (peer groups B and C) but were predominantly achieved by principal referral hospitals (peer group A) situated in major cities.

Looking back to 2000

While the main focus of this report is the three year period July 2009 – June 2012, additional analyses on returns to acute care between July 2000 and June 2009 (in three-year blocks) are also presented to provide historical context. Over the 12 year time span, very few hospitals consistently recorded RSRRs that differed from expected levels.

One hospital, RPAH Institute of Rheumatology & Orthopaedics, recorded a lower than expected RSRR for all four periods for both total hip

replacement and total knee replacement. Three hospitals recorded an RSRR that was lower than expected for three of the four periods. They were Prince of Wales and Royal North Shore for acute myocardial infarction; and John Hunter for hip fracture surgery.

Five hospitals recorded an RSRR that was higher than expected for three or more periods. They were: Blacktown for ischaemic stroke; Kempsey for acute myocardial infarction and congestive heart failure; Tamworth for acute myocardial infarction; Westmead for pneumonia; and Wagga Wagga for total hip replacement.

Nepean Hospital had five RSRRs that were higher than expected in the period July 2009 – June 2012. Over time, Nepean had two periods with RSRRs higher than expected for acute myocardial infarction, congestive heart failure and pneumonia. Only pneumonia was high in the two most recent periods.

Figure 4 Concentration of results different from expected, NSW public hospitals, July 2009 – June 2012

	0	1 RSRR	2 RSRRs	3 RSRRs	4 RSRRs	5 RSRRs
Hospitals with higher than expected RSRR	57	Armidale, Coffs Harbour, Grafton**, Lithgow, Manning, Mt Druitt, St George, Shellharbour, Shoalhaven, Wollongong, Wyong	Bankstown, Fairfield, Kempsey, Liverpool*, Milton, Tamworth, Westmead	Auburn	Wagga Wagga	Nepean
Hospitals with lower than expected RSRR	65	Camden, Dubbo, Fairfield, Gosford, John Hunter, Liverpool, Maitland, Prince of Wales, Royal North Shore	Blue Mountains, Hornsby, Manning, RPAH Institute of Rheumatology & Orthopaedics			

* Data for ischaemic stroke patients admitted to Liverpool Hospital revealed a high use of type change separations (statistical discharges) and a high rate of return to acute care for these separations. It is not possible to ascertain the extent to which this idiosyncrasy affected the RSRR results for Liverpool Hospital.

** Data for hip fracture surgery patients discharged from Grafton Hospital revealed that of the total 14 returns to acute care, 11 (79%) underwent surgery at another hospital.

Variation in reasons for returns to acute care, timing and length of stay

Unadjusted rates of returns to acute care vary across the conditions and procedures. NSW rates were 17% for acute myocardial infarction, 11% for ischaemic stroke, 23% for congestive heart failure, 13% for pneumonia, 10% for hip fracture surgery, 9% for total hip replacement and 11% for total knee replacement.

Reasons for return to acute care also varied. For the five conditions of interest, patients returning to acute care within 30 days following hospitalisation for congestive heart failure were the most likely to return to hospital with the same principal diagnosis (37% of returns). Patients returning within 30 days following an ischaemic stroke hospitalisation were the most likely to return with a condition deemed to be potentially related to their initial stay, such as a complication or an adverse event (43% of returns). For the elective joint replacements, a lower proportion of returns to acute care were due to orthopaedic complications following total hip replacement (38%) than for total knee replacement (46%).

Temporal patterns of returns to acute care varied across the conditions and procedures. The percentage of returns to acute care that occurred in the first three days following discharge was 20% for acute myocardial infarction, 18% for ischaemic stroke, 16% for congestive heart failure, 19% for pneumonia, 15% for hip fracture surgery, 16% for total hip replacement and 14% for total knee replacement.

For the five clinical conditions of interest, the average length of stay in acute care ranged from six days for acute myocardial infarction and pneumonia, to 12 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 7–24 days, and for ischaemic stroke from 6–13 days.

For the elective procedures, the average length of stay was six days for both hip and knee replacements. Across hospitals, there was three-fold variation in the average length of stay for total hip replacements and two-fold variation for total knee replacements. There was no consistent pattern across hospitals – those with higher and lower than expected RSRRs had a mix of high, low and average length of stay results.

What's next?

A wide range of factors can affect rates of return to acute care. This means the measures are most usefully applied as screening tools. High rates should prompt local investigation to review which domain or domains of performance – if any – require attention, and mobilise improvement. To facilitate this process, the Bureau of Health Information (BHI) is releasing a detailed performance profile for each of the 78 hospitals included in this report.

For BHI, this work adds to the set of indicators available to measure hospital-level, clinically meaningful outcomes. This indicator development work will continue into the future.

This report is supplemented by:

- Performance profiles with detailed information tailored to each of the 78 hospitals included in this report

- An edition of *Spotlight on Measurement*[14] that outlines the rationale and analytical development of the RSRR and supporting measures.

Setting the scene

This section provides background information that contextualises the report's results. It addresses three main questions:

Why measure returns to acute care?

Why these five clinical conditions and two elective surgical procedures?

What data and methods were used in the analyses?

Introduction

Measures of readmission in the form of return to acute care are increasingly included in efforts to measure and report on performance in healthcare systems internationally.

Not all returns to acute care can, nor should be, prevented. Readmission in some cases represents the best option for patients affected by progression of disease despite optimal management, or the emergence of a new condition. In other cases however, a return to acute care is a poor outcome for patients. Returns can reflect quality of care – through shortcomings in clinical management, through hospital-acquired complications, adverse events or other patient safety-related issues.

Preventable or avoidable returns to acute care have important implications for system efficiency and sustainability. Various studies have estimated that approximately 25% of all acute, unplanned readmissions are avoidable.[15-18] This represents significant potential savings in terms of resources.

While returns to acute care can help assess performance in terms of effectiveness and efficiency, they can also be valuable signals that point to broader quality issues.

High rates of return to acute care can indicate problems with appropriateness of care in clinician admission practices, suboptimal care, premature discharge or lack of discharge planning, poor coordination and integration of care between hospital and community providers, or insufficient communication and engagement with patients about how to manage their condition.

Alternatively, returns to acute care may reflect issues with accessibility such as access to non-acute, community or primary care services or problems with timeliness of follow-up or post discharge support services. For example, availability of acute and sub-acute care in 'Hospital in the Home' services varies across NSW.[19-20]

Given the different aspects of performance measured and captured by return to acute care indicators, the case for their use in performance measurement and reporting efforts is compelling. However, because of the wide range of factors that can affect rates, the indicators are most usefully applied as screening tools. High rates should prompt local investigation to review which domain or domains of performance – if any – require attention, and mobilise improvement.

Figure 5   30-day returns to acute care per 100 hospitalisations (age and sex adjusted), NSW public hospitals, July 2000 – June 2012
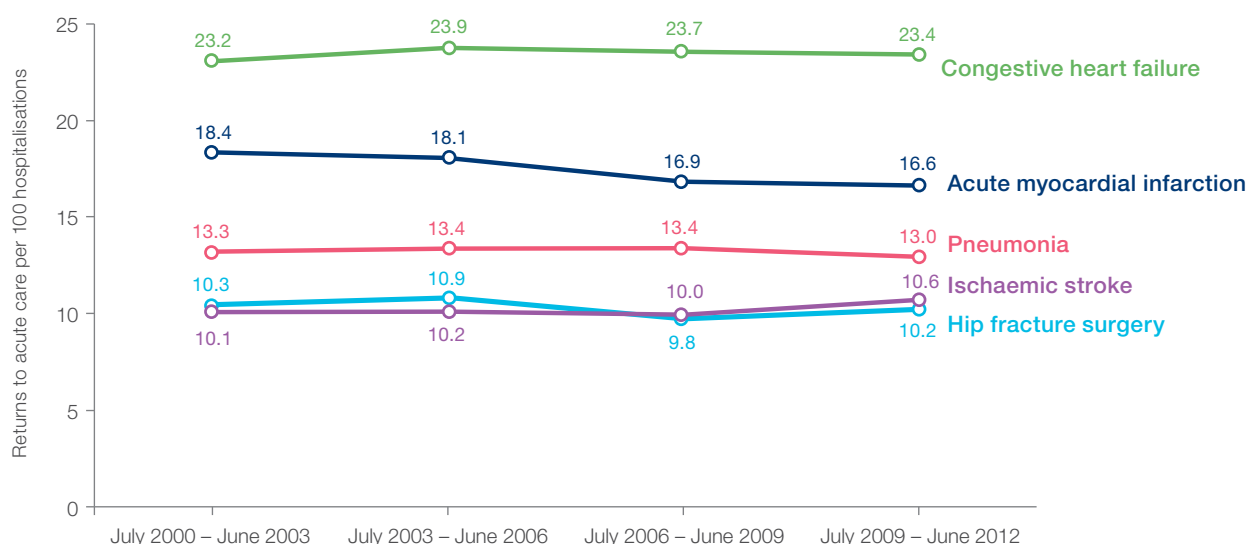
Five clinical conditions and two elective surgical procedures

This edition of *The Insights Series* provides NSW and hospital level return to acute care data for five clinical conditions: acute myocardial infarction, ischaemic stroke, congestive heart failure, pneumonia and hip fracture surgery; and for two elective surgical procedures: total hip replacement and total knee replacement.

The report delivers comprehensive hospital-level information, using a measure that controls for case mix and captures all emergency returns to acute care that occurred for the clinical conditions, in the 30 days following discharge; and for the elective surgical procedures, that occurred in the 60 days following discharge - regardless of whether they were to the same or to different hospitals.

These five conditions and two elective surgical procedures were selected because:

- They provide insights into a range of different types of conditions – from acute emergencies to long term chronic conditions

- Evidence-based guidelines outlining best practice care are widely available

- There are established and validated approaches to measure and report readmissions for these conditions in other jurisdictions nationally or internationally [9-12]

- The analysis supplements previously published information on 30-day mortality following hospitalisation for acute myocardial infarction, ischaemic stroke, haemorrhagic stroke, pneumonia and hip fracture surgery.[13]

Altogether, these conditions and surgical procedures accounted for 15,400 returns to acute care – or around 13% of all acute, overnight, emergency returns to acute care among patients aged 15 years or over who were discharged from NSW public hospitals between July 2009 and June 2012.

Over the 12-year period July 2000 – June 2012, rates of return to acute care in NSW decreased following hospitalisation for total hip replacement by 13%. Rates also fell for total knee replacement (10%), acute myocardial infarction (10%), pneumonia (2%), and hip fracture surgery (1%). However, rates increased by 5% following hospitalisation for ischaemic stroke and by 1% for congestive heart failure (Figures 5 and 6).

Figure 6   60-day returns to acute care per 100 hospitalisations (age and sex adjusted), NSW public hospitals, July 2000 – June 2012
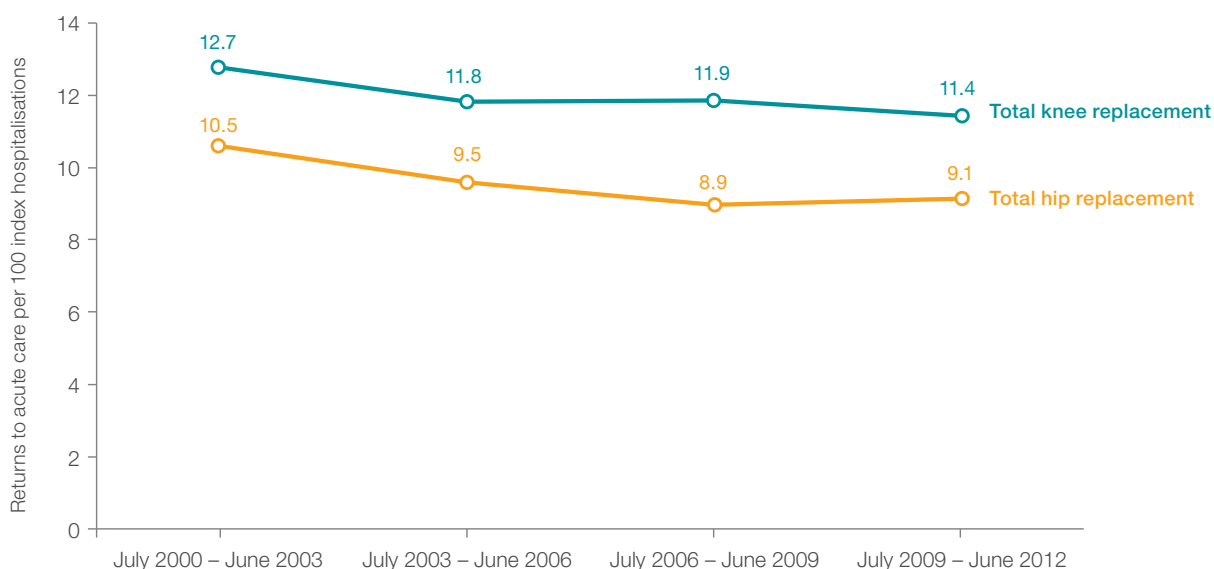
Looking internationally, unadjusted rates of return to acute care recorded in NSW public hospitals are broadly in line with those reported by other healthcare reporting agencies in developed countries (Figure 7).

While unadjusted rates provide context for interpreting the NSW state and hospital level results, they do not take account of differences in case mix and other patient-level factors, and cannot be used to reflect meaningfully on relative hospital performance.

This report is based on a clinically relevant measure of readmission, specifically adapted for use in NSW. The risk standardised readmission ratio (RSRR) is an approach that is able to make appropriate adjustments for patient factors and hospital volumes to examine variation in hospital performance.

The BHI version of RSRRs focuses on 'returns to acute care', using a similar approach to readmission measures in the United States[1] and Canada[3]. For patients whose acute hospitalisation ends with discharge home, a return to acute care involves readmission to hospital; while for patients whose acute hospitalisation ends with a 'discharge' to non-acute care, a return involves a move back into an acute care setting.

Developing measures of readmissions for NSW

In April 2015, a report released by the Auditor-General of NSW recommended that limitations in existing specifications for measuring unplanned readmissions be addressed. In particular, it identified the need for:

- the use of linked data to capture readmissions to any hospital, rather than relying on a measure only able to capture readmissions to the same hospital from which a patient was initially discharged

- the ability to differentiate reasons for readmission so as to inform interpretation and guide improvement

- the use of different follow-up periods appropriate to the principal diagnosis of the initial hospitalisation (e.g. the need for extended follow-up periods for hospitalisations for hip replacement)

- local health district and hospital level analysis and reporting of length of stay and unplanned readmissions.

Figure 7   NSW rates of return to acute care in international context

Condition	Number of index hospitalisations July 2009 – June 2012	Unadjusted 30-day returns to acute care	International comparators*
Acute myocardial infarction	26,497	17%	12%[a], 18%[b]
Ischaemic stroke	12,367	11%	7%[a], 14%[b], 12%[c]
Congestive heart failure	28,877	23%	23%[b]
Pneumonia	41,089	13%	18%[b]
Hip fracture surgery	13,565	10%	13%[c]

* Indicative data from the:

a. Canadian Institute for Health Information
b. Centers for Medicare & Medicaid Services (US)
c. Health and Social Care Information Centre (England)

Data and methods

Development of the BHI return to acute care measurement approach has drawn on extensive research, analysis and international experience. Details of the development process and indicator definitions are provided in *Spotlight on Measurement.*[14]

Data and analytic software

The analysis used admitted patient data drawn from the NSW Ministry of Health's Health Information Exchange (HIE) and fact of death data drawn from the NSW Registry of Births, Deaths and Marriages. These data were probabilistically linked by the Centre for Health Record Linkage (CheReL). The linked data were accessed via the SAPHaRI data warehouse, administered by the Centre for Epidemiology and Evidence.[21] The analysis used StataSE v12.[22], SAS/BASE and SAS/STAT software.[23]

Risk standardised readmission ratios (RSRRs)

The hospital level results in this report are based on risk standardised readmission ratios (RSRRs). A competing risk model [24] developed for each of the five clinical conditions and two surgical procedures of interest, draws on the NSW public hospital patient population's characteristics and outcomes to estimate the expected number of returns to acute care for each hospital, given its case mix.[†]

A hospital's RSRR compares the number of returns to acute care that were observed or actually occurred with the estimate generated by the model to form a ratio (observed/expected). A ratio of less than 1.0 indicates lower than expected returns, and a ratio higher than 1.0 indicates a higher than expected returns. Small deviations from 1.0 are not considered to be meaningful.

The significance of the RSRRs is determined using a funnel plot with control limits at 95% and 99.8% (see page 69).

Other key features of the RSRR:

- Principal diagnosis ICD-10 AM codes are used to identify relevant index hospitalisations. Any hospitalisation that includes one or more transfers (within 24 hours) to another hospital for acute care is considered as a single 'period of care'

- Index hospitalisations and returns to acute care are attributed to the hospital that discharged the patient home or to a non-acute care setting

- Returns to acute care that occur within 30 days of discharge from an acute care setting are included regardless of the principal diagnosis of the return

- Returns to acute care to any NSW public or private hospital are included.

Follow-up periods

In line with most international efforts to measure unplanned readmissions, the RSRRs developed for use in a NSW context set the follow-up period at 30 days. With the exception of non-emergency (i.e. planned) admissions, all returns to acute care within the 30 day period after discharge are included in the calculation of the RSRR.

On the advice of clinicians and following sensitivity testing, the follow-up period for the elective procedure RSRRs was set at 60 days; and returns to acute care included non-emergency readmissions. This enabled the measure to capture 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.

[†] Competing risks prevent an event of interest from occurring. In this case, a patient's death would prevent any return to acute care and so estimates of expected return to acute care must take account of this competing risk.

Significant results

Hospitals positioned outside the 95% control limits are noted as having a higher or lower than expected RSRR. Hospitals with an RSRR of zero (i.e. zero observed returns to acute care) are not reported.

RSRRs should not be used to compare results between hospitals; they support comparison of each hospital with the NSW result. Because of the way that adjustments for patient characteristics are made, this is the only valid comparison for each hospital.

RSRRs do not distinguish returns to acute care that are avoidable from those that are a reflection of the natural course of illness. They do not provide, by themselves, a diagnostic of quality and safety of care.

Suppression and nominal reporting

Modelling is unreliable in hospitals with very small patient volumes (<1.0 expected returns to acute care during the study period). Data for these hospitals are suppressed.

The modelling approach that underpins the RSRR is applicable to many small hospitals with expected returns to acute care >1.0. However, results for smaller hospitals can be disproportionately affected by a small increase or decrease in the number of returns to acute care. To ensure fairness and protect patient confidentiality, data for hospitals with fewer than 50 discharged patients for a condition or procedure between July 2009 and June 2012 are not reported publicly. The de-identified data for these hospitals is included in the construction of the funnel plots.

Given these reporting rules, each condition and procedure has a different number of hospitals included in the analysis. Hospitals in peer groups other than A–C are not named in the report. Hospital performance profiles for each of the five clinical conditions and two surgical procedures are available for peer group A–C hospitals that discharged at least 50 patients meeting the inclusion criteria between July 2009 and June 2012 (see Appendix 4 for description of peer groups).

Index hospitalisations with less than 30 days of follow up information

Calculation of unadjusted rates of return to acute care and hospital RSRRs excluded index cases that occurred less than 30 days from the end of the study period (30 June 2012) 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 a full 30 days of follow up information were included in building the NSW prediction models.

Private hospital results

Results for returns to acute care following an index hospitalisation in a private hospital are not reported, nor were these hospitalisations included in the NSW level predictive modelling. Returns to acute care for which patients were admitted to a private hospital within the follow-up period following discharge from a public hospital were however, included in the RSRR.

Characterising reasons for returns to acute care

Returns to acute care within 30 days of discharge (or 60 days for elective surgical procedures) were stratified by the principal diagnosis. This is the condition recorded in the patient's medical record as chiefly responsible for the hospitalisation. The reasons for returning to acute care were stratified as follows:

- Same principal diagnosis as the index hospitalisation

- Condition clinically related to the index hospitalisation principal diagnosis e.g. following an index hospitalisation for acute myocardial infarction, a return to acute care treatment of angina

- Condition potentially related to hospital care, including adverse events, complications or suboptimal management of comorbidity e.g. diabetes. There are three sub-categories here:

  1. Potentially related to hospital care (not time sensitive)

  2. Potentially related to hospital care (if occurring on days 1-7)

  3. Potentially related to hospital care (time sensitive but beyond the 7 day window)

- Other condition.

The comorbidity and complication diagnoses were based on draft specifications for acute myocardial infarction and specific surgical procedure readmissions recently developed by the Australian Institute of Health and Welfare.[25, 26] These diagnoses are condition or procedure-specific and considered to be potentially related to the initial hospitalisation if the return to acute care occurred within 30 days (e.g. the same or related clinical diagnoses, adverse drug reactions) or seven days (e.g. urinary tract infection, diabetes). The complications associated with hospital care are consistent with those identified in a report recently published by the Australian Commission on Safety & Quality in Healthcare.[25]

Section 1:
Results for five clinical conditions

For each of the five clinical conditions: acute myocardial infarction, ischaemic stroke, congestive heart failure, pneumonia and hip fracture surgery, the following information is presented:

- 30-day RSRRs

- Number of, and reasons for, returns to acute care in the 30 days following discharge

- A comparison of length of stay of the initial 'index' hospitalisation and rates of return to acute care

- Distribution of the reasons for returns to acute care for short, medium and long lengths of stay.

Acute myocardial infarction returns to acute care

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. If blood supply is not restored quickly, the heart muscle suffers permanent damage.

Figure 8 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 rate of return to acute care was 17 per 100 acute hospitalisations. For hospitals that recorded at least 50 index hospitalisations for AMI between July 2009 and June 2012, unadjusted rates of return to acute care ranged from 9 to 29 per 100 hospitalisations. These unadjusted rates cannot be used to make meaningful assessments of hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 46 hospitals (87%) with an RSRR no different from expected, given their patients' characteristics. Five hospitals (9%) had a higher than expected RSRR and two hospitals (4%) had a lower than expected RSRR (Figure 9).

Across peer groups, two principal referral hospitals (peer group A) had lower than expected RSRRs and one had a higher than expected RSRR. Two major hospitals (peer group B) had higher than expected RSRRs (Figure 10).

Figure 8   Acute myocardial infarction: 30-day returns to acute care in NSW in the period, July 2009 – June 2012

There were 25,737 people aged 15 years and over admitted to a public hospital with a principal diagnosis of AMI (ICD-10-AM code I21, I22); In total, there were 27,325 index hospitalisations that met the inclusion criteria. There were 407 (2%) people who died in the 30 days following discharge, before any return to acute care.

Within 30 days of discharge from acute care, there were 4,453 acute, emergency returns to acute care (all causes); after excluding 828 index hospitalisations without 30 day follow-up this corresponds to an unadjusted rate of return to acute care rate of 17 per 100 hospitalisations.

Among the 4,453 returns to acute care:

- 603 (14%) were for the same condition (i.e. principal diagnosis of AMI)
- 1,462 (33%) were for a condition related to AMI (e.g. angina)
- 344 (8%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity), but not time sensitive
- 339 (8%) were for a condition potentially related to hospital care if occurring within 7 days of discharge
- 909 (20%) were for a condition potentially related to hospital care but occurring outside the 7 day window
- 796 (18%) were for other reasons
- 3,042 (68%) were returned to the same hospital, 876 (20%) returned to different but similarly urban or rural hospitals, 413 (9%) returned to more rural, 56 (1%) to more urban and 16 (0.4%) to private hospitals.

More males (17,619) were hospitalised for AMI than females (9,706). Among males, 15% of index hospitalisations were followed by a return to acute care within 30 days, compared with 18% for females. Although females were at higher risk of return to acute care within 30 days, after adjusting for age and comorbidities; sex was no longer associated with higher risk of return.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

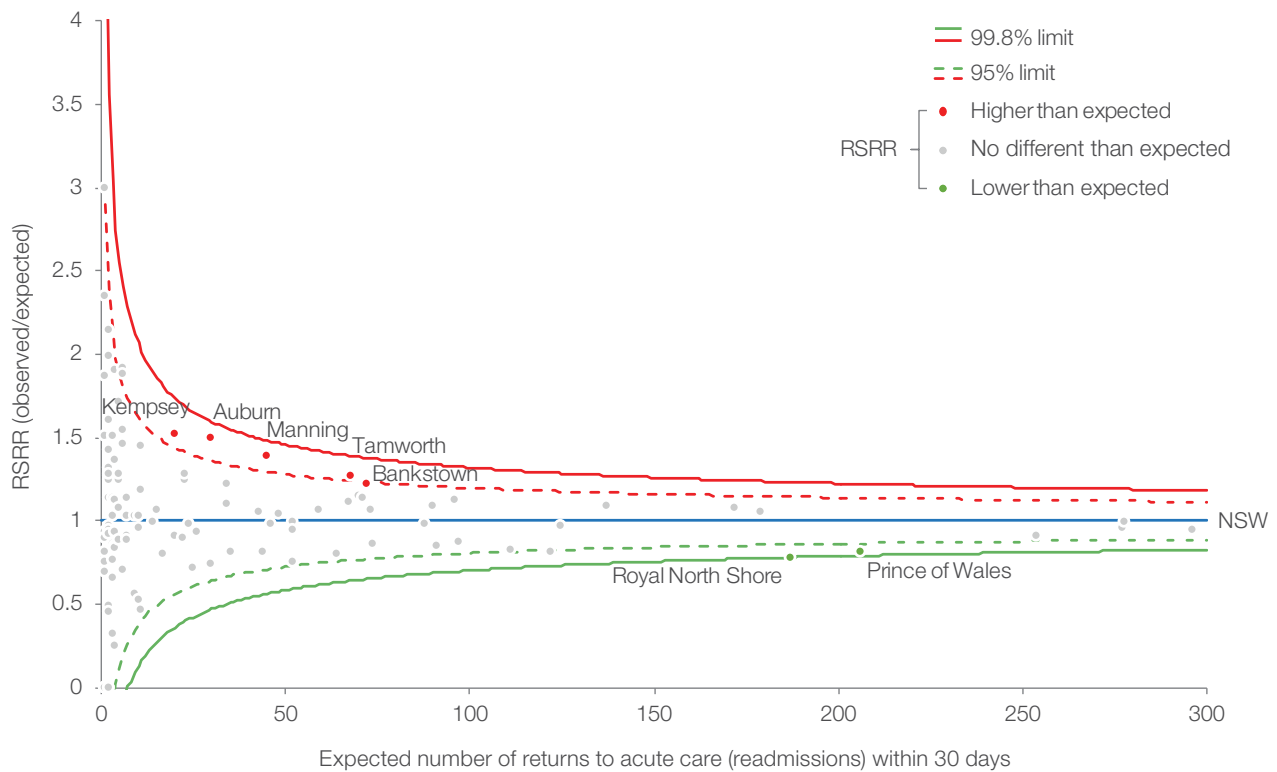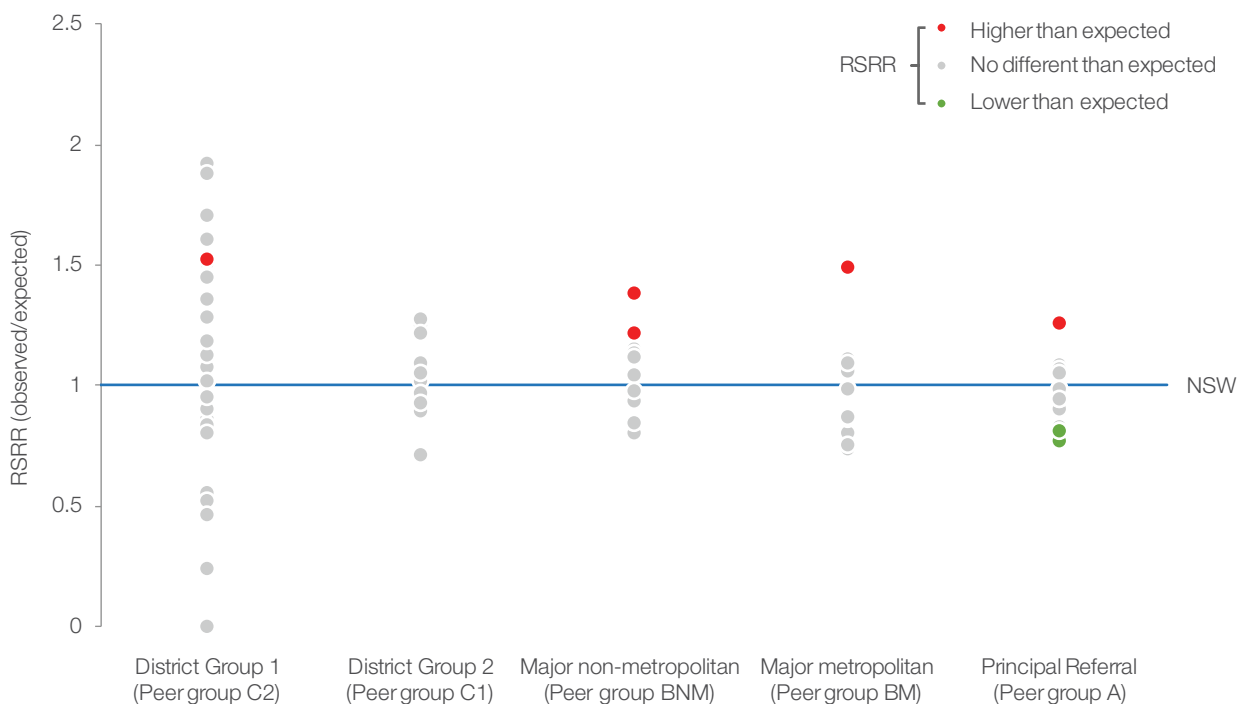## Figure 9 Acute myocardial infarction: 30-day RSRR, NSW public hospitals, July 2009 – June 2012

Figure 10 Acute myocardial infarction: 30-day RSRR by peer group, July 2009 – June 2012

Acute myocardial infarction

Exploring patterns of return to acute care

Detailed information about when in the 30-day period following discharge returns to acute care occur, and the reasons for those returns, can highlight potential areas for improvement.[28] A high number of returns to acute care within seven days of discharge may, for example, point to problems with discharge planning.

Returns to acute care that occurred in the seven days following discharge were most likely to be for AMI or another cardiac condition, such as angina. The number of returns to acute care that were unrelated either to AMI or to the index hospitalisation remained fairly constant throughout the 30-day period (Figure 11).

Some studies have found a relationship between length of stay and the likelihood of returning to acute care.[29,32] 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 rate of return to acute care following hospitalisation for AMI increased with increasing lengths of stay in the index hospitalisation, up to about 10 days. This levelled off to a fairly steady rate (around 20%) for stays of 11 days or longer (Figure 12).

Categorising the reasons for returns to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay reveals that potentially hospital-acquired complications are responsible for a greater proportion of returns to acute care as length of stay increases (Figure 13).

Figure 11 Acute myocardial infarction: number of, and reasons for, returns to acute care following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2009 – June 2012
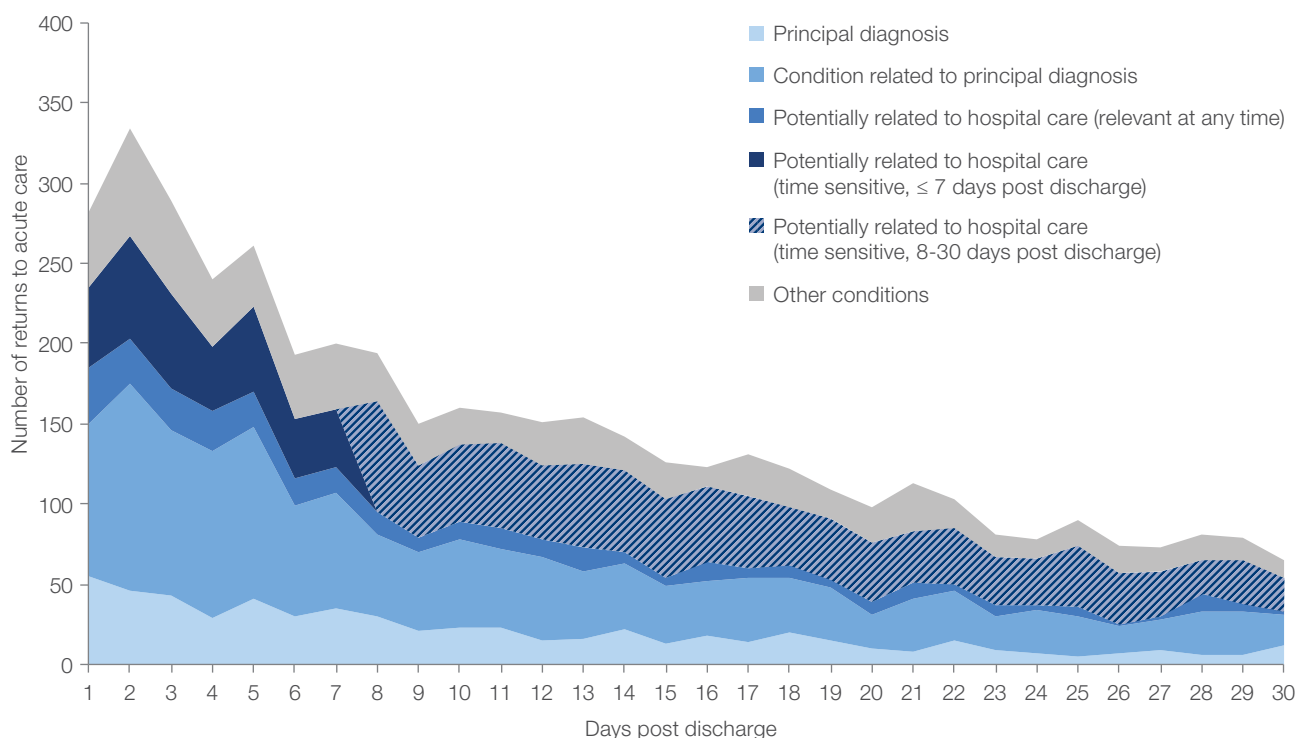
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 12 Acute myocardial infarction: length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals July 2009 – June 2012
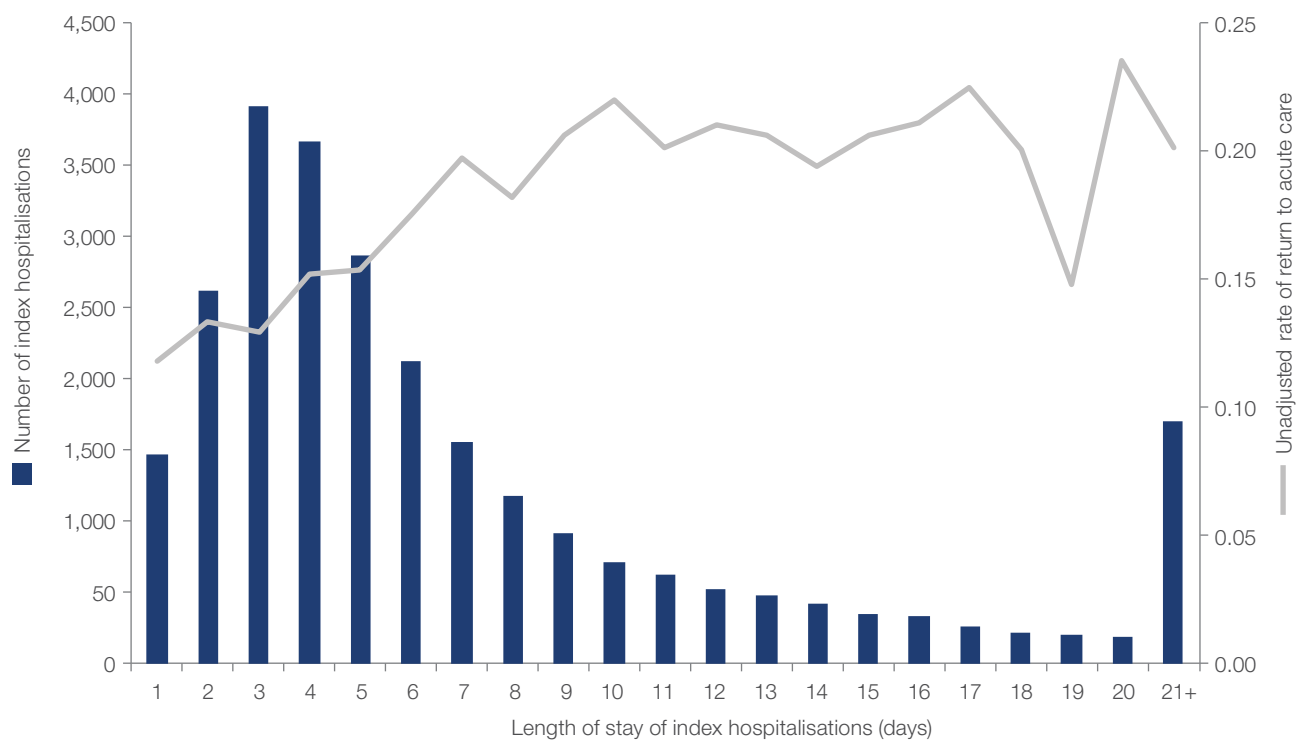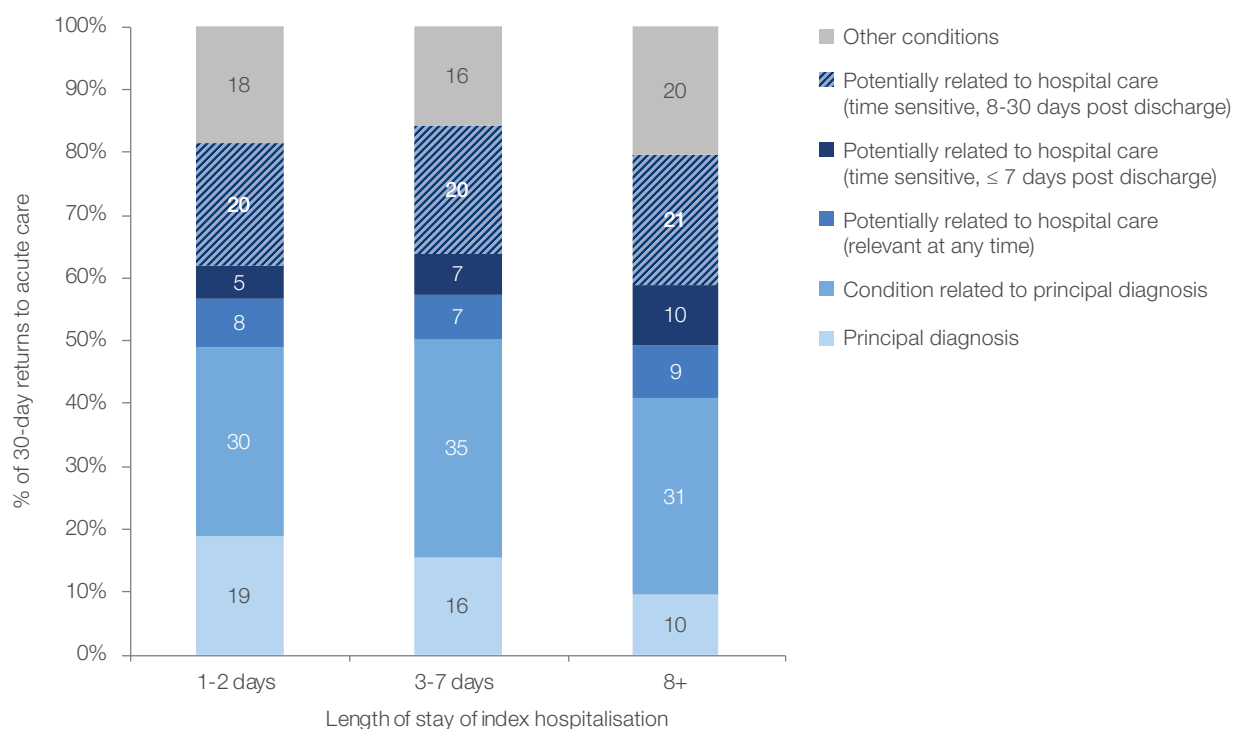

Figure 13 Acute myocardial infarction: length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2009 – June 2012

Ischaemic stroke returns to acute care

NSW public hospitals

Ischaemic stroke occurs when a blood vessel is blocked, depriving the brain of oxygen and nutrients. Consequently, the area of the brain affected is damaged.

Figure 14 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 rate of return to acute care rate was 11 per 100 acute hospitalisations. For hospitals that recorded at least 50 index hospitalisations for ischaemic stroke between July 2009 and June 2012, unadjusted rates of return to acute care ranged from 5 to 24 per 100 hospitalisations. These unadjusted rates are not suitable for use in assessing hospital performance.

In order to assess hospital outcomes fairly, statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 42 hospitals (89%) with an RSRR no different from expected, given their patients' characteristics. Four hospitals (9%) had a higher than expected RSRR and one hospital (2%) had a lower than expected RSRR (Figure 15).

Across peer groups, the lower than expected RSRR was recorded in a peer group B hospital. Higher than expected RSRRs were recorded in hospitals across peer groups A–C (Figure 16).

Figure 14 **Ischaemic stroke: 30-day returns to acute care in NSW in the period, July 2009 – June 2012**

There were 12,410 people aged 15 years and over admitted to a public hospital with a principal diagnosis of ischaemic stroke (ICD-10-AM code I 63). In total there were 12,776 index hospitalisations that met the inclusion criteria. There were 634 (5%) people who died in the 30 days following discharge, before any return to acute care.

Within 30 days of discharge from acute care, there were 1,321 acute, emergency returns to acute care (all causes); after excluding 408 index hospitalisations without 30 days follow-up, this corresponds to an unadjusted rate of return to acute care of 11 per 100 hospitalisations.

Among the 1,321 returns to acute care.

- 253 (19%) were for the same condition (i.e. principal diagnosis of ischaemic stroke)
- 129 (10%) were for a condition related to ischaemic stroke (e.g. transient cerebral ischaemic attack)
- 279 (21%) were for a condition potentially related to hospital care (e.g. adverse events, complications or deficient management of comorbidity), but not time sensitive
- 89 (7%) were for condition potentially related to hospital care if occurring within 7 days of discharge
- 201 (15%) were for a condition potentially related to hospital care but occurring outside the 7 day window
- 370 (28%) were for other reasons
- 1,022 (77%) returned to the same hospital, 227 (20%) returned to different but similarly urban or rural hospitals of similar, 47 (4%) to more rural, 25 (2%) to more urban, 7 (0.5%) to private hospitals.

While more males (6,968) were hospitalised for ischaemic stroke than females (5,808), there was no significant difference between males and females in risk of returns to acute care.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 15 Ischaemic stroke: 30-day RSRR, NSW public hospitals, July 2009 – June 2012

Legend:
- 99.8% limit
- 95% limit
- RSRR
  - Higher than expected
  - No different than expected
  - Lower than expected

Labels on chart: Shellharbour, Fairfield, Liverpool *, Wagga Wagga, Manning, NSW

Y-axis: RSRR (observed/expected)
X-axis: Expected number of returns to acute care (readmissions) within 30 days
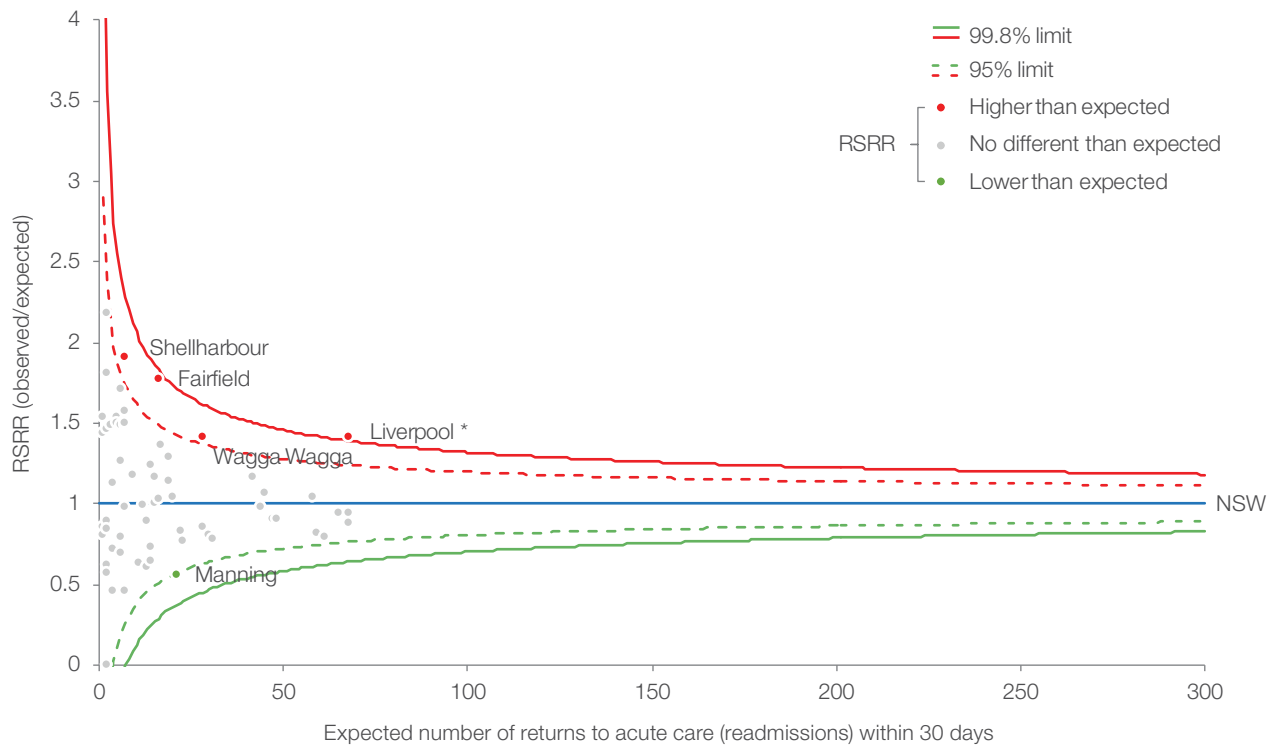
Figure 16 Ischaemic stroke: 30-day RSRR by peer group, July 2009 – June 2012

Legend:
- RSRR
  - Higher than expected
  - No different than expected
  - Lower than expected

Y-axis: RSRR (observed/expected)

X-axis categories: District group 1 (Peer group C2), District group 2 (Peer group C1), Major non-metropolitan (Peer group BNM), Major metropolitan (Peer group BM), Principal referral (Peer group A)

Label: NSW
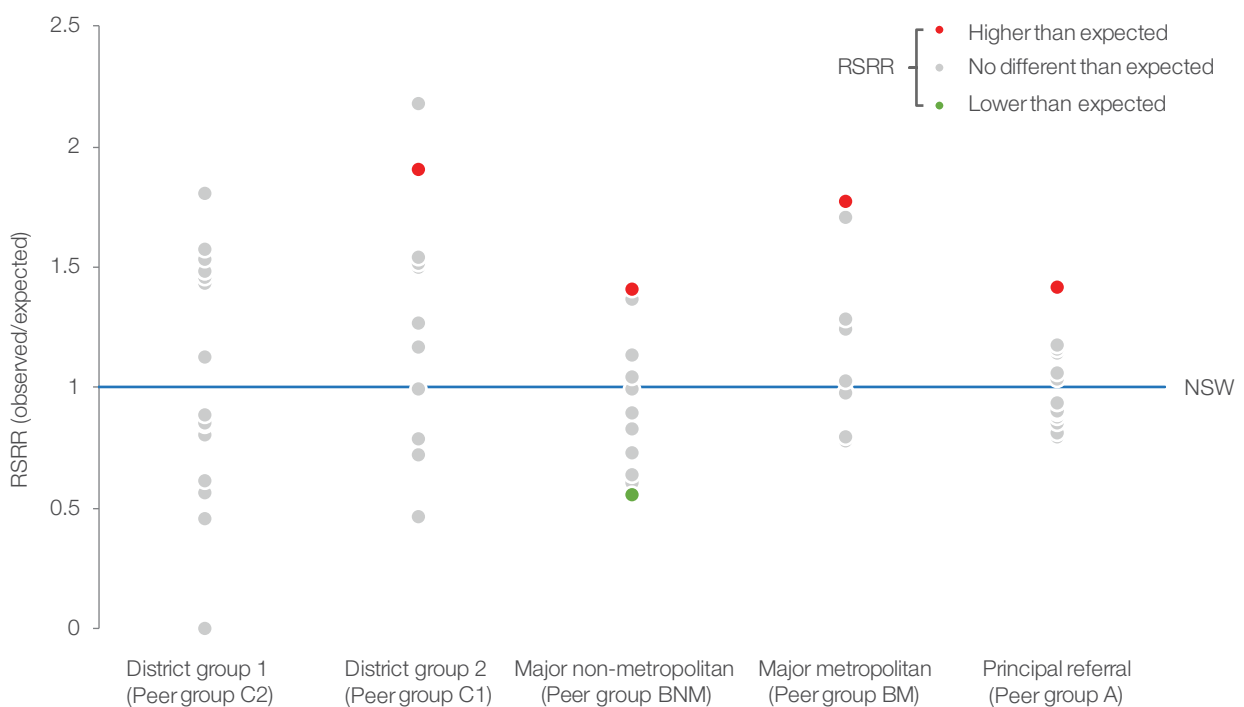
* Data for ischaemic stroke patients admitted to Liverpool Hospital revealed an extremely high use of type change separations (statistical discharges) and a high rate of return to acute care for these separations. It is not possible to ascertain the extent to which this idiosyncrasy affected the RSRR results for Liverpool Hospital.

Ischaemic stroke

Exploring patterns of return to acute care

Following discharge from an ischaemic stroke, hospitalisation occurred with decreasing frequency over the study period of 1–30 days post discharge. Details about when in the 30-day period following discharge returns to acute care occur, and the reasons for those returns, can highlight potential areas for improvement.[28]

For ischaemic stroke hospitalisations, returns to acute care that occurred in the first three days following discharge were most likely to be for ischaemic stroke or a related neurological condition, such as a transient ischaemic attack. The number of returns to acute care that were unrelated either to ischaemic stroke, or to the index hospitalisation, remained fairly constant throughout the 30-day period (Figure 17).

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.[27, 30]

The unadjusted rate of return to acute care following hospitalisation for ischaemic stroke remained fairly constant (around 12–14%) regardless of the length of stay of the index hospitalisation (Figure 18).

Categorising the reasons for return to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay suggests that hospital-acquired complications are responsible for a greater proportion of returns to acute care as length of stay increases (Figure 19).

Figure 17 Ischaemic stroke: number of, and reasons for, returns to acute care following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2009 – June 2012

See *Spotlight on Measurement* and Appendix 5 for data specifications.
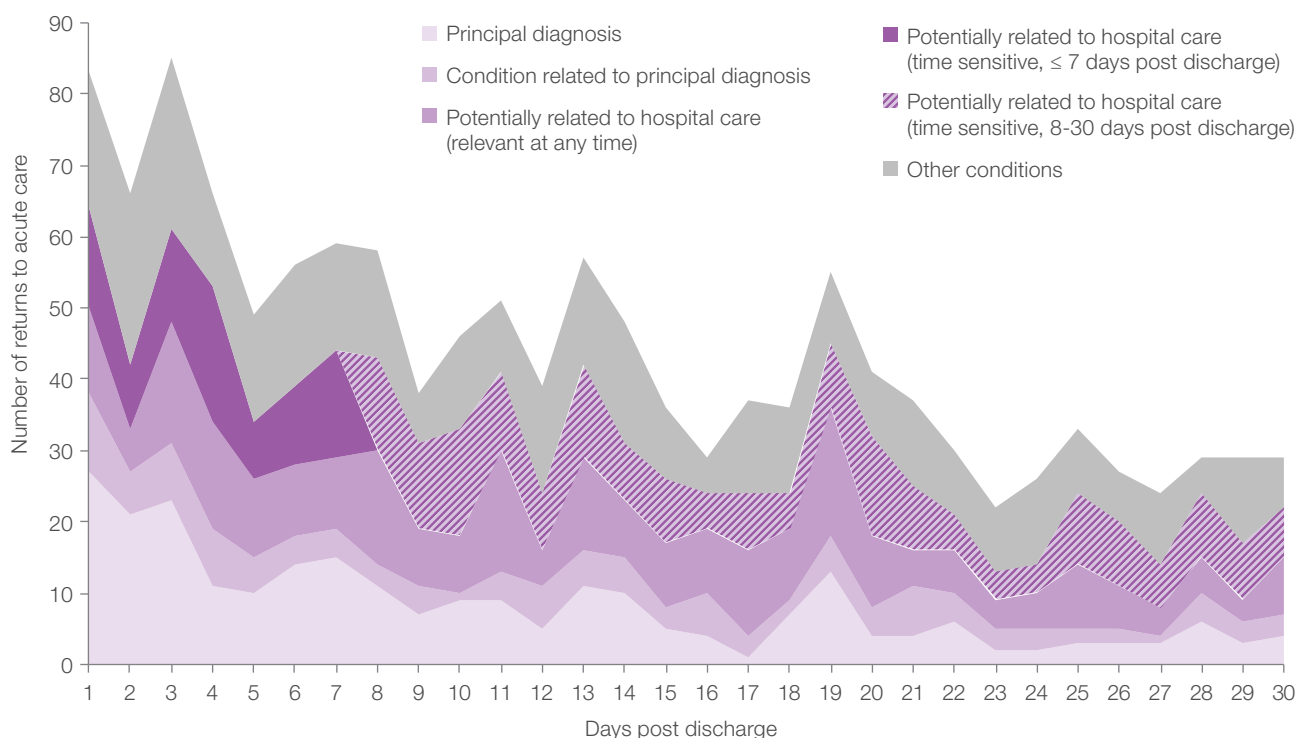
Figure 18 Ischaemic stroke: length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals July 2009 – June 2012
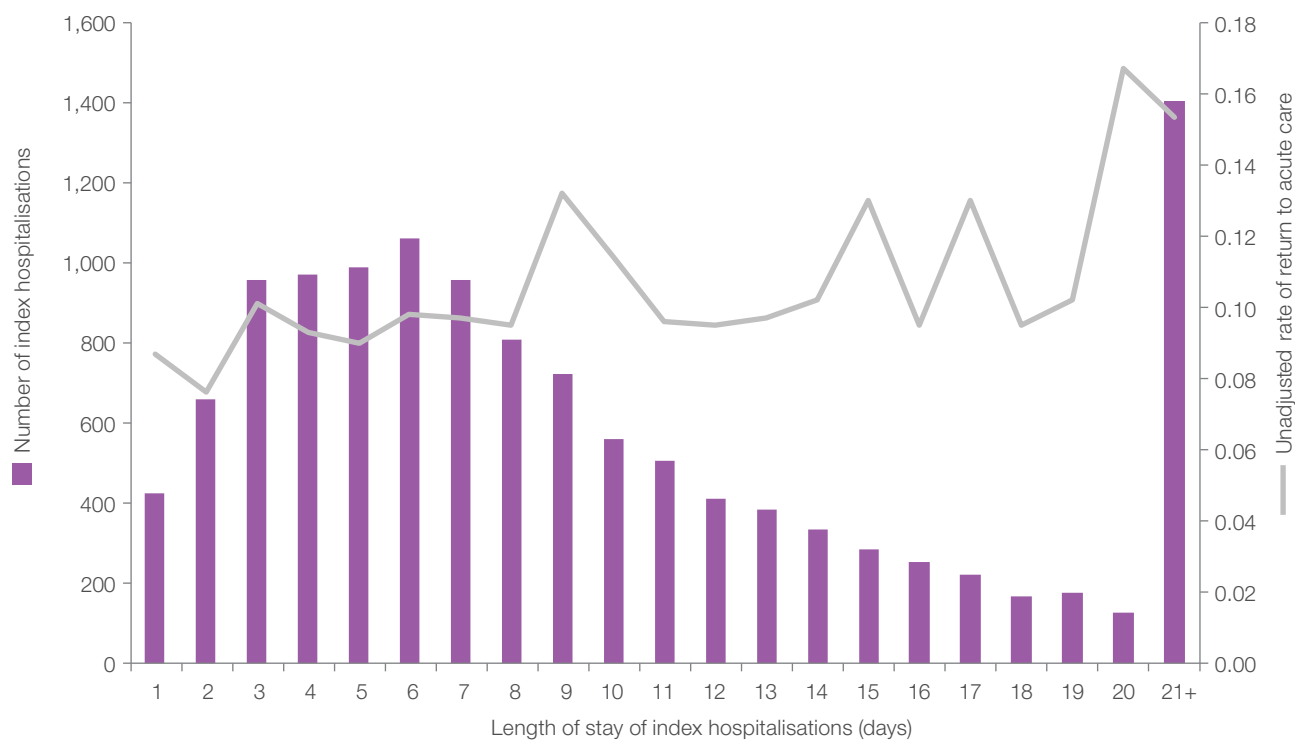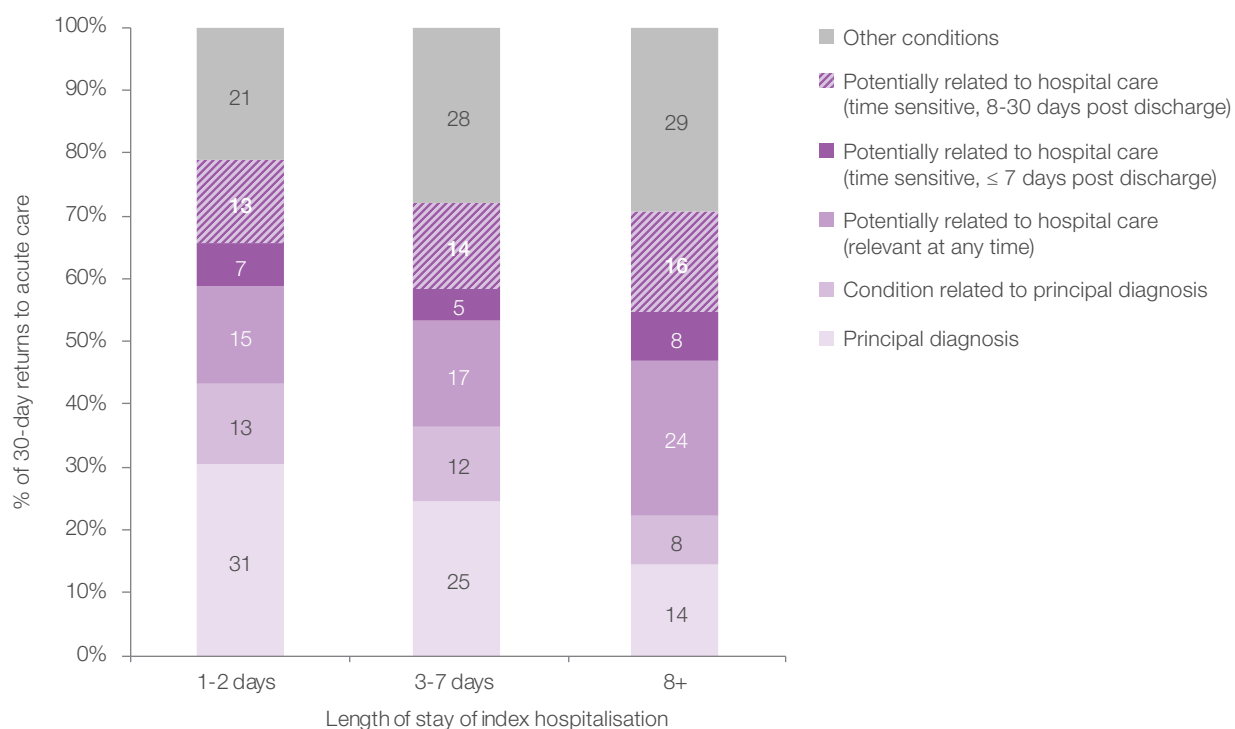

Figure 19 Ischaemic stroke: length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2009 – June 2012

Congestive heart failure returns to acute care

NSW public hospitals

Congestive heart failure (CHF) is a complex syndrome that can result from structural or functional disease involving either or both sides of the heart. It is a progressive condition in which the heart is unable to pump blood effectively enough to meet the body's needs.

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 rate of return to acute care was 23 per 100 hospitalisations. For hospitals that recorded at least 50 index hospitalisations for CHF between July 2009 and June 2012, unadjusted rates of return to acute care ranged from 15 to 34 per 100 hospitalisations. These unadjusted rates are not suitable for use in assessing hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 64 hospitals (89%) with an RSRR no different from expected, given their patients' characteristics. Five hospitals (7%) had a higher than expected RSRR and three hospitals (4%) had a lower than expected RSRR (Figure 21).

Across NSW, the hospitals that recorded lower than expected RSRRs were in peer groups B and C. Higher than expected RSRRs were recorded in hospitals across peer groups A–C (Figure 22).

Figure 20 **Congestive heart failure: 30-day returns to acute care in NSW in the period, July 2009 – June 2012**

There were 20,050 people aged 15 years and over admitted to a public hospital with a principal diagnosis of CHF (ICD-10-AM codes I11.0,I13.0,I13.2,I50.0,I50.1,I50.9). In total, there were 29,961 index hospitalisations. There were 957 people who died in the 30 days following discharge, before any return to acute care.

Within 30 days of discharge from acute care, there were 6,850 acute, emergency returns to acute care (all causes); after excluding 1,080 index hospitalisations without 30 day follow-up, this corresponds to an unadjusted rate of return to acute care of 23 per 100 hospitalisations.

Among the 6,850 returns to acute care

- 2,543 (37%) were for the same condition (i.e. a principal diagnosis of CHF)
- 744 (11%) were for a condition related to congestive heart failure e.g. acute myocardial infarction
- 442 (6%) were for a condition potentially related to hospital care i.e. adverse events, complications or deficient management of comorbidity attributable to the index hospitalisation, but not time sensitive
- 502 (7%) were for a condition potentially related to hospital are within 7 days of discharge
- 1,332 (19%) were for a condition potentially related to hospital care but occurring outside the 7 day window
- 1,287 (19%) were for other reasons
- 5,608 (82%) were to the same hospital – 977 (14%) patients were readmitted to different but similarly urban or rural hospitals, 150 (2%) to more rural, 115 (2%) to more urban and 29 (0.4%) to private hospitals.

While more males (15,425) were hospitalised than females (14,536), there was no significant difference between males and females in risk of return to acute care.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 21 Congestive heart failure: 30-day RSRR, NSW public hospitals, July 2009 – June 2012
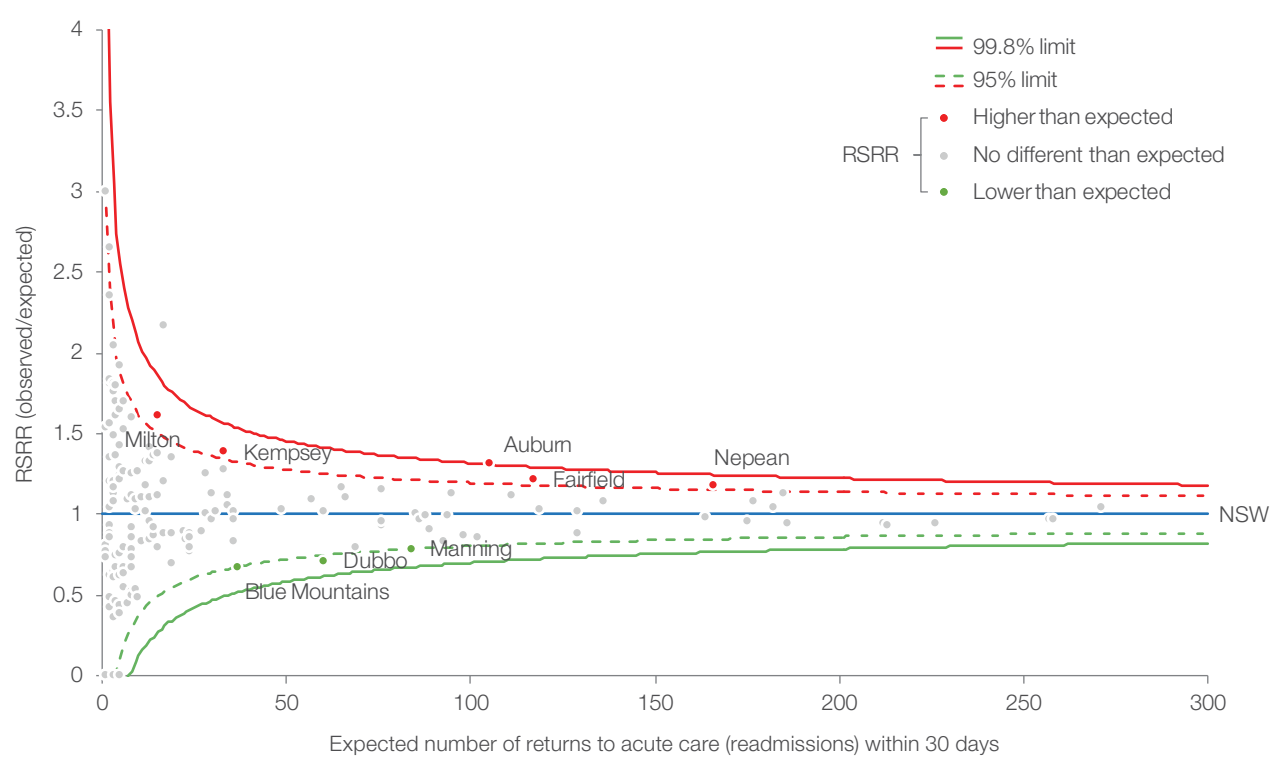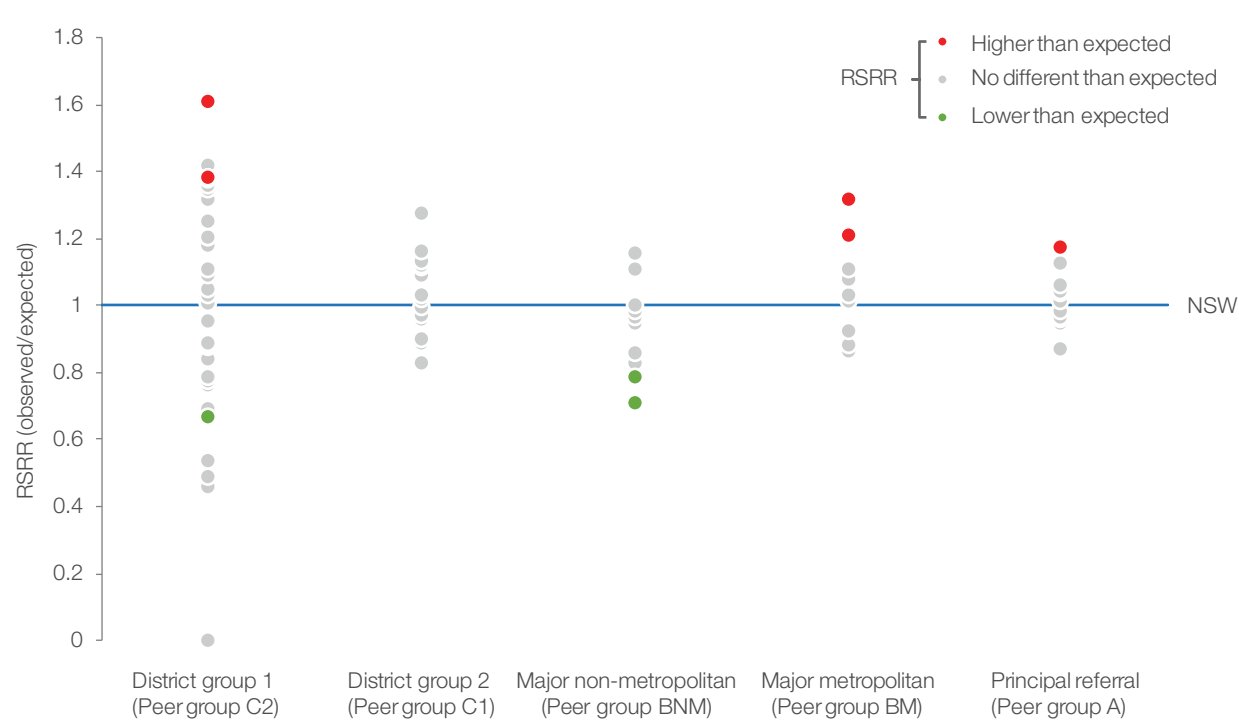

Figure 22 Congestive heart failure: 30-day RSRR by peer group, July 2009 – June 2012

Congestive heart failure

Exploring patterns of return to acute care

Returns to acute care following discharge from a congestive heart failure (CHF) hospitalisation generally occurred with decreasing frequency over the study period of 1–30 days post discharge. Exploring patterns regarding the timing of, and reasons for, returns to acute care can identify areas for improvement.[28]

For CHF hospitalisations, returns to acute care that occurred in the first two days following discharge were most likely to be for CHF or a cardiac condition, such as acute myocardial infarction. The number of returns to acute care that were unrelated either to CHF or to the index hospitalisation remained fairly constant throughout the 30-day period (Figure 23).

The relationship between length of stay and return to acute care is of considerable interest to clinicians, managers and policymakers. Short lengths of stay are sometimes thought to result in patients being discharged before their condition has been adequately stabilised, leading to an unplanned return to acute care. Conversely, stays that are too long carry an increased risk of hospital-acquired complications such as infections.[29, 32]

The unadjusted rate of return to acute care following hospitalisation for CHF remained fairly constant (around 25%) regardless of the length of stay of the index hospitalisation (Figure 24).

Examining reasons for return to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay reveal little variation in the reasons for return to acute care in relation to the length of stay in the index CHF hospitalisation (Figure 25).

Figure 23 Congestive heart failure: number of, and reasons for, return to acute care following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2009 – June 2012
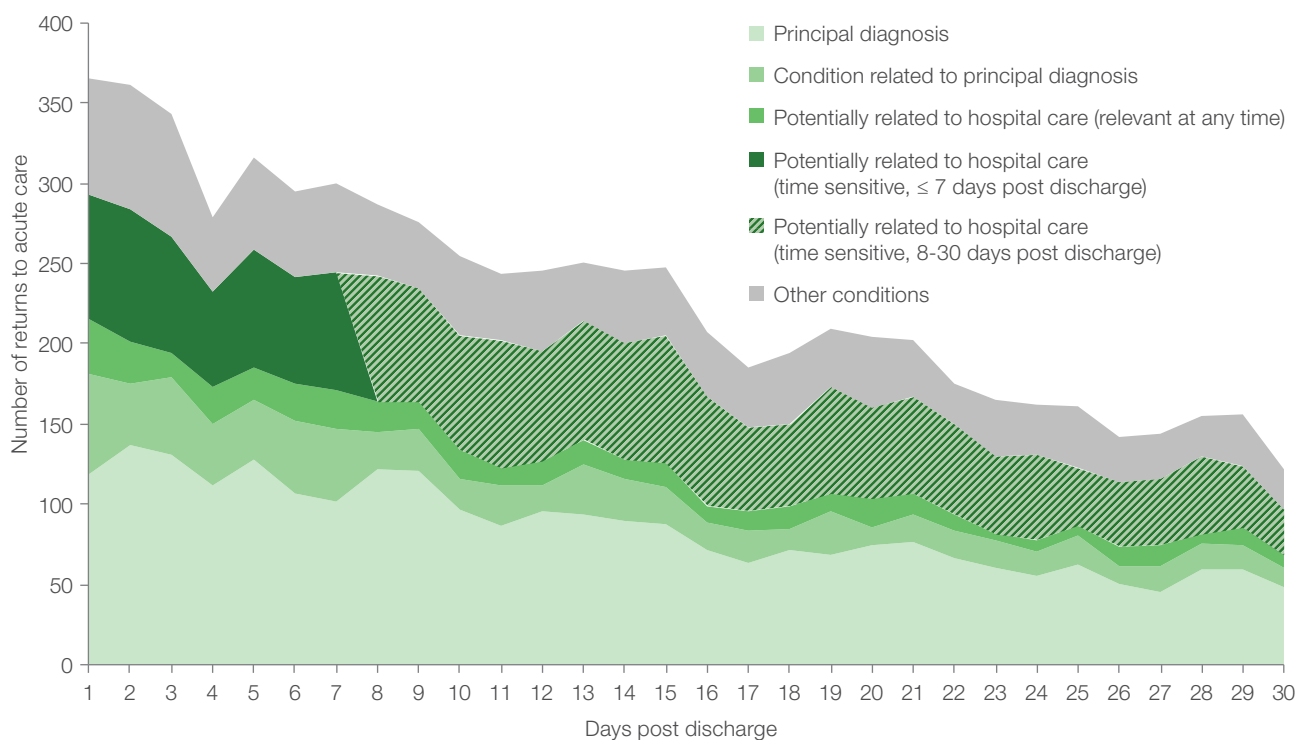
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 24 Congestive heart failure: length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals July 2009 – June 2012
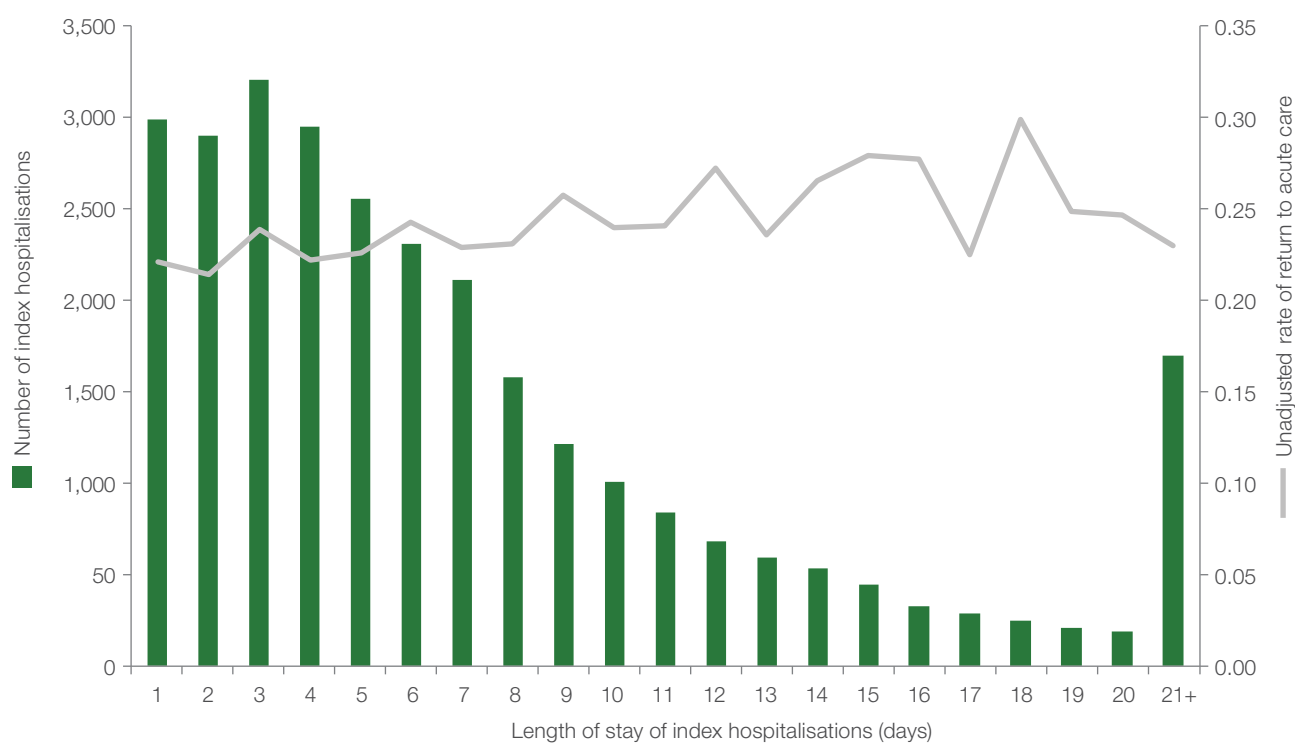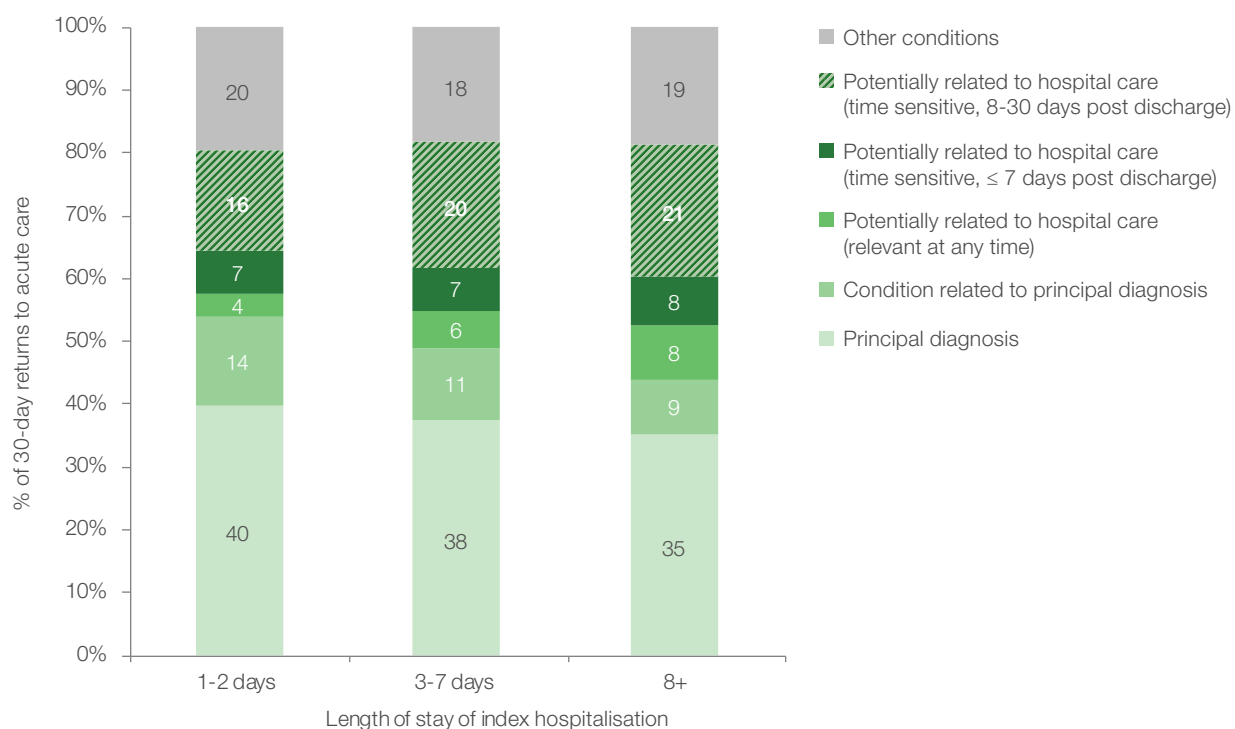

Figure 25 Congestive heart failure: length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2009 – June 2012

Pneumonia returns to acute care

NSW public hospitals

Pneumonia is an inflammatory condition of one or both lungs, usually due to infection by bacteria or viruses.

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

The NSW 30-day return to acute care rate was 13 per 100 acute hospitalisations. For hospitals that recorded at least 50 index hospitalisations for pneumonia between July 2009 and June 2012, unadjusted rates of return to acute care rates ranged from 3 to 23 per 100 hospitalisations. These unadjusted rates are not suitable for use in assessing hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs) take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 67 hospitals (81%) with an RSRR no different from expected, given their patients' characteristics. Eight hospitals (10%) had a higher than expected RSRR and three hospitals (4%) had a lower than expected RSRR (Figure 27).

Across NSW, lower than expected RSRRs were recorded in hospitals across peer groups A–C. Smaller hospitals i.e. non-metropolitan major (peer group BNM) and district (peer group C) recorded lower than expected RSRRs (Figure 28).

Figure 26 **Pneumonia: 30-day returns to acute care in NSW in the period, July 2009 – June 2012**

There were 39,663 people aged 18 years and over admitted to a public hospital with a principal diagnosis of pneumonia (ICD-10-AM code J13, J14,J15,J16,J18). In total there were 42,777 index hospitalisations. There were 1,123 (3%) people who died in the 30 days following discharge, before any return to acute care.

Within 30 days of discharge from acute care there were 5,412 acute, emergency returns to acute care (all causes). After excluding 1,688 index hospitalisations without 30 day follow-up, this corresponds to an unadjusted rate of return to acute care of 13 per 100 hospitalisations.

Among the 5,412 returns to acute care:

- 1,020 (19%) were for the same condition (i.e. principal diagnosis of pneumonia)

- 914 (17%) were for a condition clinically related to pneumonia (e.g. chronic obstructive lung disease)

- 409 (8%) were for a condition potentially related to hospital care (i.e. adverse events, complications or deficient management of comorbidity), but not time sensitive

- 491 (9%) were a condition potentially related to hospital care within 7 days of discharge

- 943 (17%) were a condition potentially related to hospital care but occurring outside the 7-day window

- 1,635 (30%) were for other reasons

- 4,323 (80%) were to the same hospital, 753 (14%) patients were readmitted to different but similarly urban or rural hospitals, 108 (2%) to more urban, 128 (2%) to more rural and 34 (0.6%) to private hospitals.

More males (22,388) were hospitalised than females (20,388). Among males, 14% of index hospitalisations were followed by a return to acute care within 30 days, compared with 12% for females. After adjusting for age and comorbidities, sex remained significantly associated with returns to acute care; males were at a higher risk of return to acute care.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

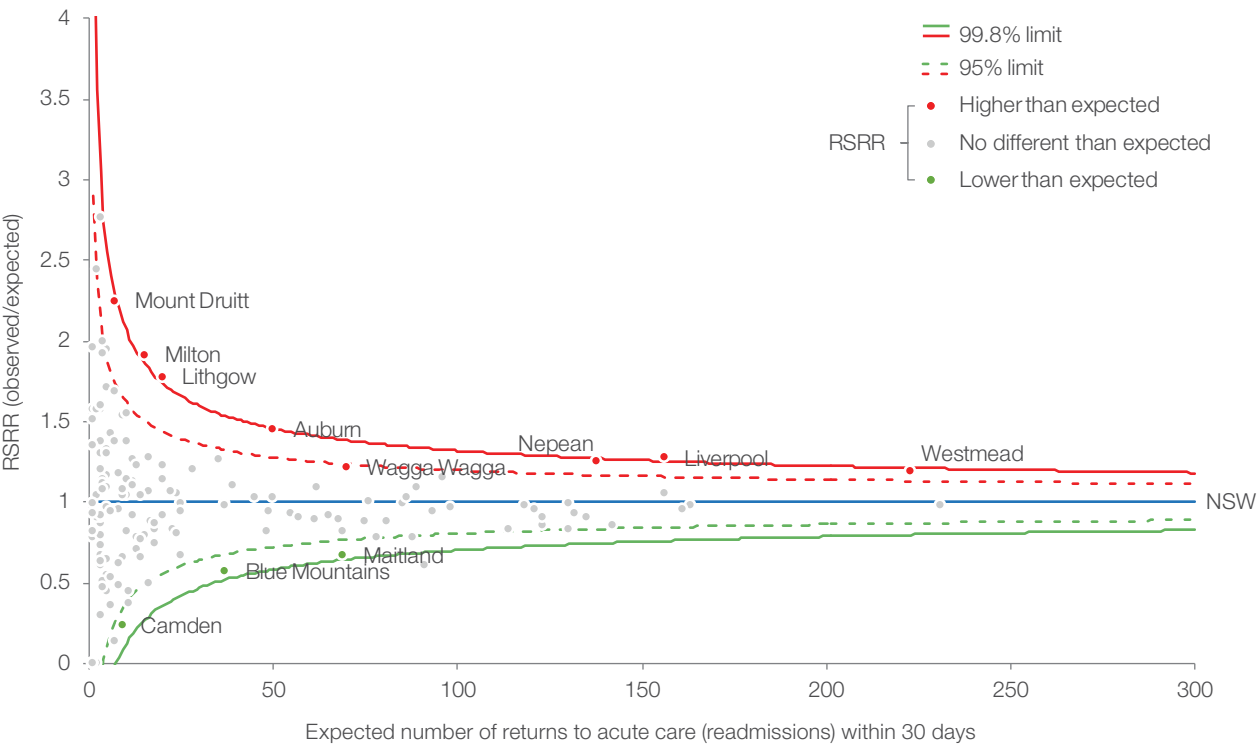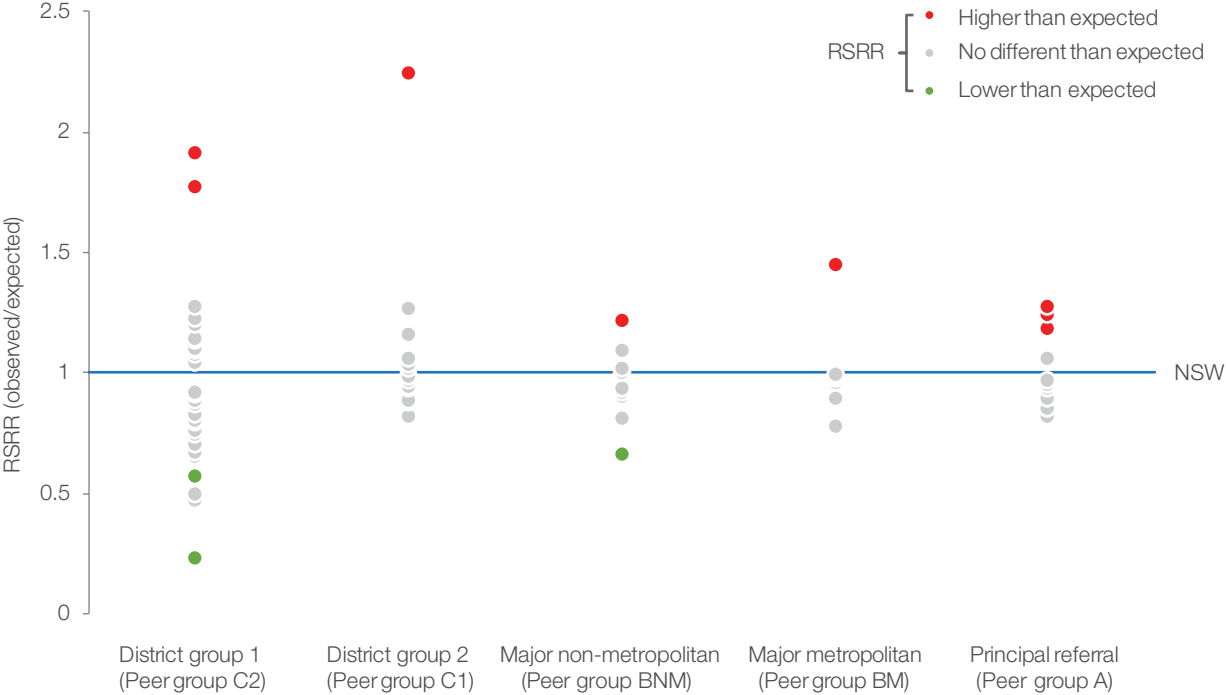**Figure 27 Pneumonia: 30-day RSRR, NSW public hospitals, July 2009 – June 2012**

Figure 28 Pneumonia: 30-day RSRR by peer group, July 2009 – June 2012

Pneumonia

Exploring patterns of return to acute care

Returns to acute care following discharge from a hospitalisation for pneumonia generally occurred with decreasing frequency over the study period of 1–30 days post discharge. Understanding patterns of timing and reasons for return to acute care can inform efforts to improve care.[28]

Following pneumonia hospitalisations, returns to acute care that occurred in the first two days following discharge were most likely to be for pneumonia or a related condition. This may indicate these patients were discharged prematurely. The number of return to acute care that were unrelated either to pneumonia or to the index hospitalisation remained fairly constant throughout the 30-day period (Figure 29).

Improving our understanding of the interplay between length of stay and returns to acute care can also help guide improvements to care. Short lengths of stay may result in patients being discharged before their condition has been adequately

stabilised, leading to an unplanned return to acute care. Conversely, stays that are too long carry an increased risk of hospital-acquired complications such as infections.[29,32]

The unadjusted rate of returns to acute care following hospitalisation for pneumonia dipped to a low of around 10% for lengths of stay of three days and subsequently climbed steadily with lengthening stays to a maximum of around 20% at stays of 21+ days (Figure 30).

Examining reasons for return to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay inverse the relationship between longer length of stay and the proportion of returns to acute care that were for respiratory conditions (Figure 31).

Figure 29 Pneumonia: number of, and reasons for, returns to acute care following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2009 – June 2012
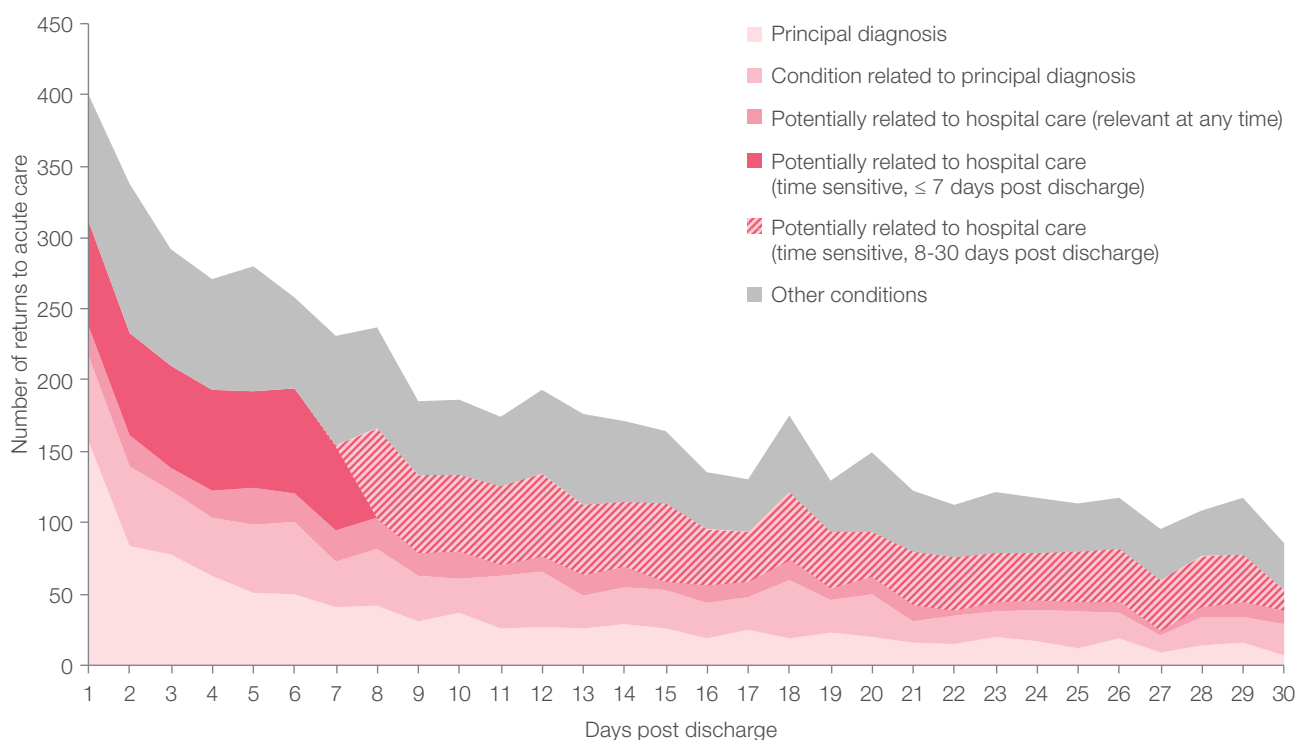
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 30 Pneumonia: length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals July 2009 – June 2012

Figure 31 Pneumonia: length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2009 – June 2012

Hip fracture surgery returns to acute care

NSW public hospitals

A hip fracture is a fracture of the femur (thigh bone) within 5cm of the distal (lower) part of the lesser trochanter (part of the hip). Hip fractures can occur at any age, but are most common in older adults.

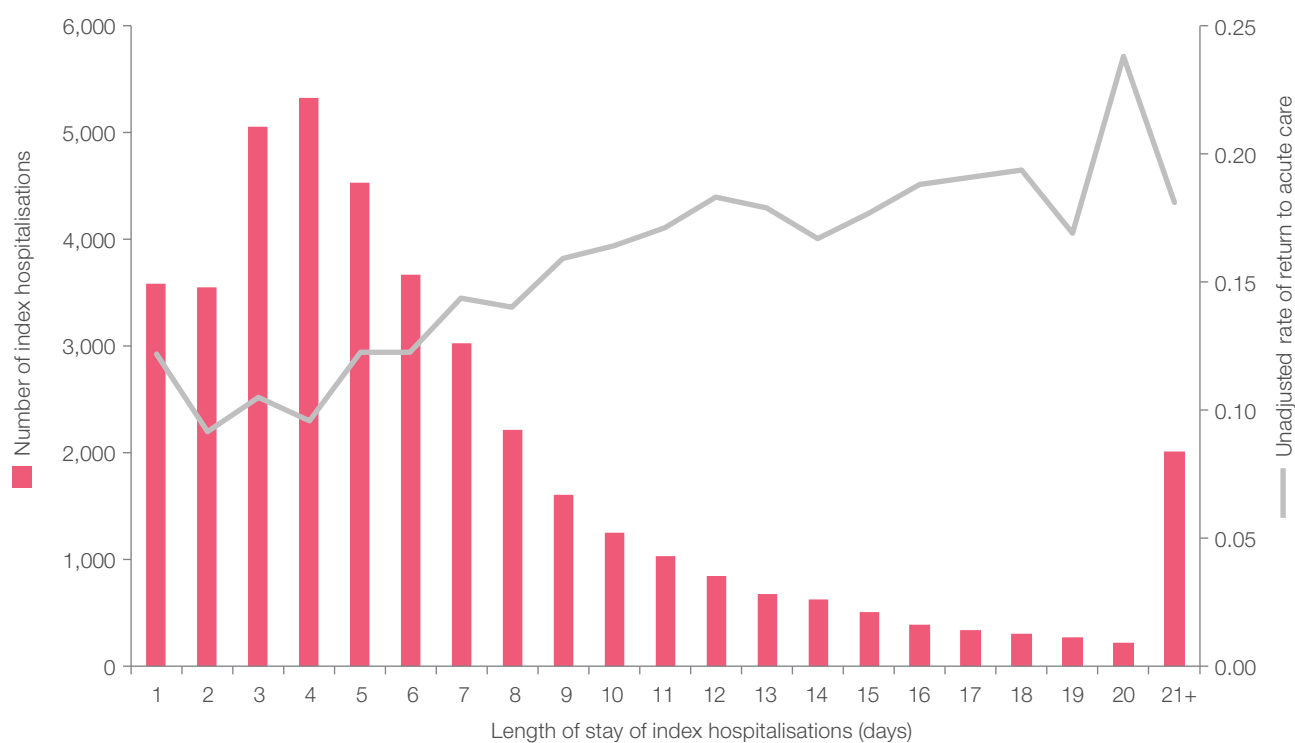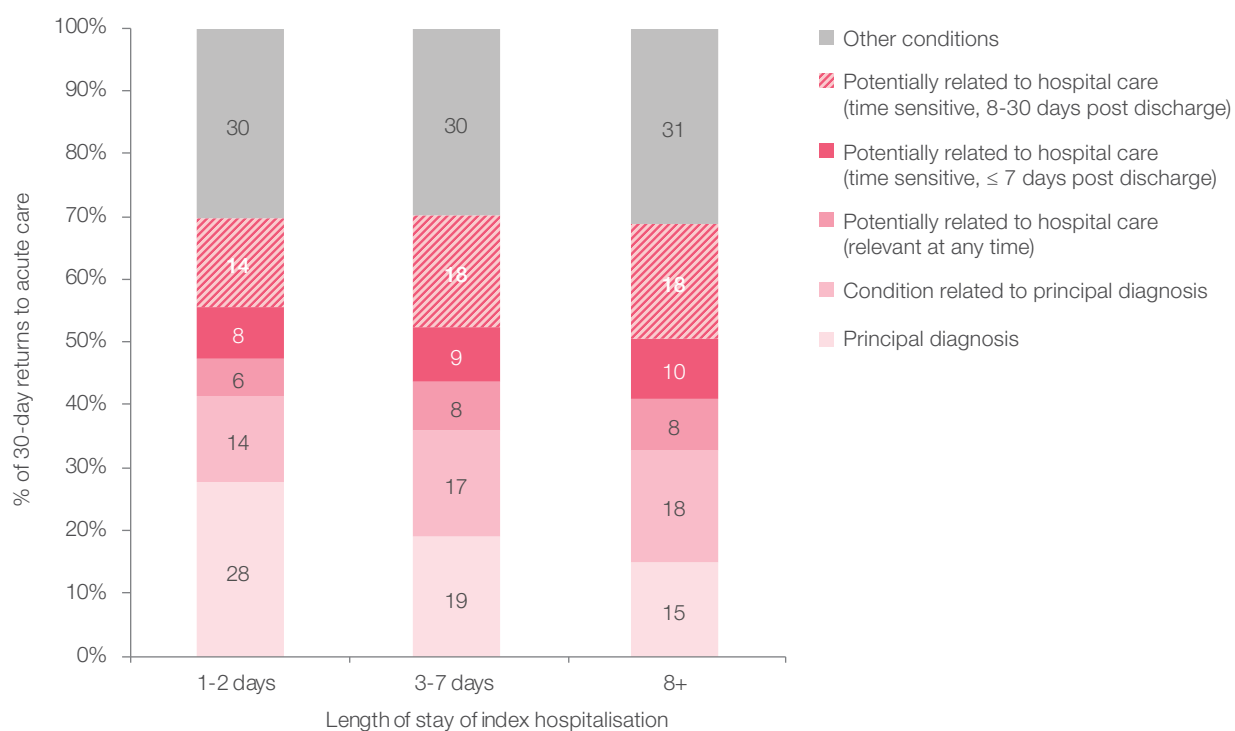Figure 32 summarises information on the number of and reasons for returns to acute care, and the characteristics of patients who returned within 30 days of discharge from an acute care setting.

The NSW 30-day rate of return to acute care was 10 per 100 acute hospitalisations. For hospitals that recorded at least 50 index hospitalisations for hip fracture surgery between July 2009 and June 2012, unadjusted rates of return to acute care ranged from 3 to 17 per 100 hospitalisations. These unadjusted rates are not suitable for use in assessing hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 35 hospitals (83%) with an RSRR no different from expected, given their patients' characteristics. Four hospitals (10%) had a higher than expected RSRR and three hospitals (7%) had a lower than expected RSRR (Figure 33).

Across NSW, lower than expected RSRRs were only recorded in principal referral hospitals (peer group A). The greatest concentration of higher than expected RSRRs was also recorded among principal referral hospitals (Figure 34).

Figure 32 **Hip fracture surgery: 30-day unplanned returns to acute care in NSW in the period, July 2009 – June 2012**

There were 13,666 people aged 50 years and over admitted to a public hospital with a principal diagnosis of hip fracture treated with surgery. In total, there were 14,035 hospitalisations. There were 602 (4%) people who died in the 30 days following discharge, before any return to acute care.

Within 30 days of discharge from acute care, there were 1,396 acute, emergency returns to acute care (all causes). After excluding 19 index hospitalisations without 30 day follow-up, this corresponds to an unadjusted rate of return to acute care of 10 per 100 hospitalisations.

Among the 1,396 returns to acute care:

- 78 (6%) were for the same condition (i.e. principal diagnosis of fractured hip)
- 223 (16%) were for a condition specifically related to hip fracture surgery (e.g. wound infection)
- 112 (8%) were for a condition potentially related to hospital care (i.e. adverse events, general complications or deficient management of comorbidity), but not time sensitive
- 177 (13%) were for a condition potentially related to hospital care within 7 days of discharge
- 357 (26%) were for a condition related to hospital care but occurring outside the 7 day window
- 449 (32%) were for other reasons
- 1,036 (74%) were to the same hospital, 269 (19%) patients returned to different but similarly urban or rural hospitals, 50 (4%) to more rural, 22 (2%) to more urban and 19 (1%) to private hospitals.

Fewer males (3,797) were hospitalised than females (10,238). Among males 13% returned to acute care within 30 days, while among females 9% returned within 30 days. After adjusting for age and comorbidities, sex remained significantly associated with returns to acute care; males were at higher risk of return.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 33 Hip fracture surgery: 30-day RSRR, NSW public hospitals, July 2009 – June 2012

Legend:
— 99.8% limit
— 95% limit
RSRR:
- Higher than expected
- No different than expected
- Lower than expected

Y-axis: RSRR (observed/expected)
X-axis: Expected number of returns to acute care (readmissions) within 30 days

Labelled points: Grafton, Nepean, St George, Westmead, Liverpool, Gosford, John Hunter, NSW
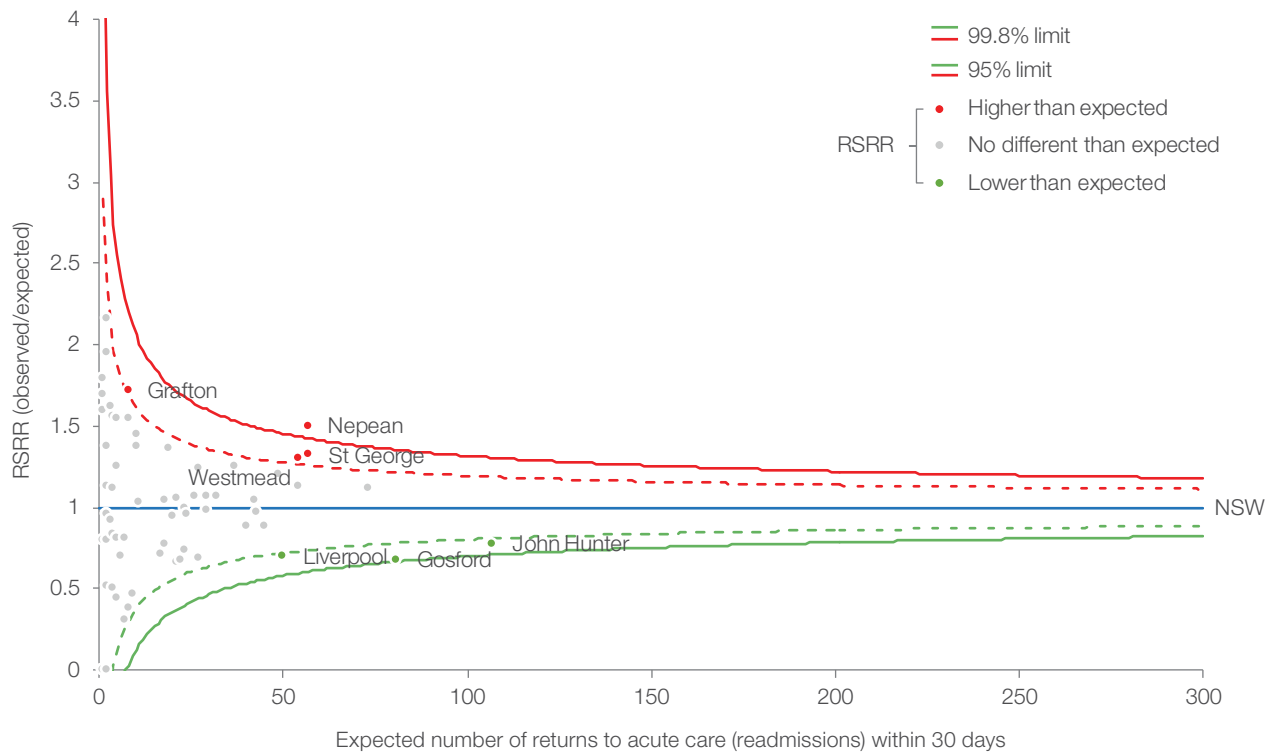
Figure 34 Hip fracture surgery: 30-day RSRR by peer group, July 2009 – June 2012

Legend:
RSRR:
- Higher than expected
- No different than expected
- Lower than expected

Y-axis: RSRR (observed/expected)

X-axis categories:
District group 1 (Peer group C2)
District group 2 (Peer group C1)
Major non-metropolitan (Peer group BNM)
Major metropolitan (Peer group BM)
Principal referral (Peer group A)
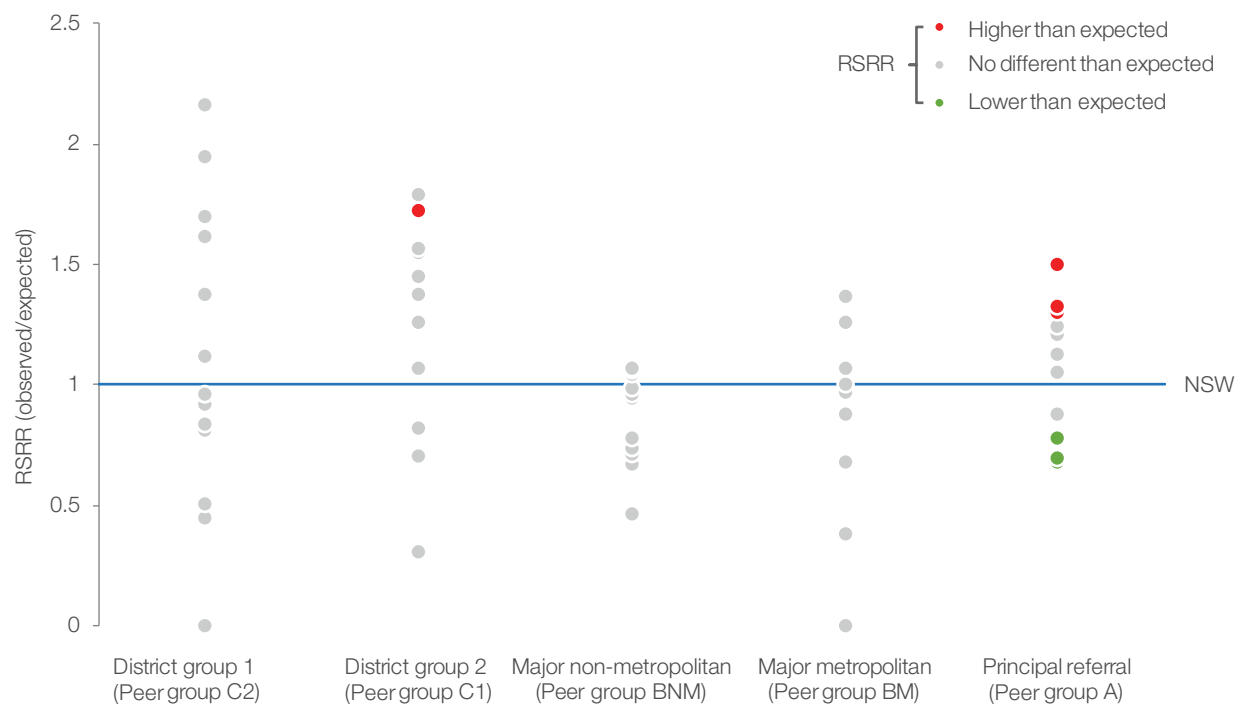
Hip fracture surgery

Exploring patterns of return to acute care

Returns to acute care following discharge from a hospitalisation for hip fracture surgery occurred with a slowly decreasing frequency for the 30-days post discharge. Understanding patterns of timing and reasons for return to acute care can inform efforts to improve care.[28]

Following hospitalisations for hip fracture surgery, returns to acute care that occurred in the first 7 days following discharge were most likely to be for conditions potentially related to the initial hospitalisation (e.g. a complication or adverse event). The number of returns to acute care unrelated to the index stay remained fairly constant throughout the 30-day period (Figure 35).

Improving our understanding of the interplay between length of stay and rates of return to acute care can also help guide improvements to care. Short lengths of stay may result in patients being discharged before their condition has been

adequately stabilised, leading to an unplanned return. Conversely, stays that are too long carry an increased risk of hospital-acquired complications such as infections.[29, 32]

The unadjusted rate of return to acute care following hospitalisation for hip fracture surgery remained fairly constant (around 10%) regardless of the length of stay of the index hospitalisation (Figure 36).

Examining reasons for returns to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay reveals the strong impact that other conditions can have on return to acute care following short lengths of stay (Figure 37).

Figure 35 Hip fracture surgery: number of, and reasons for, returns to acute care following hospitalisation, day 1–30 post discharge, NSW public hospitals, July 2009 – June 2012
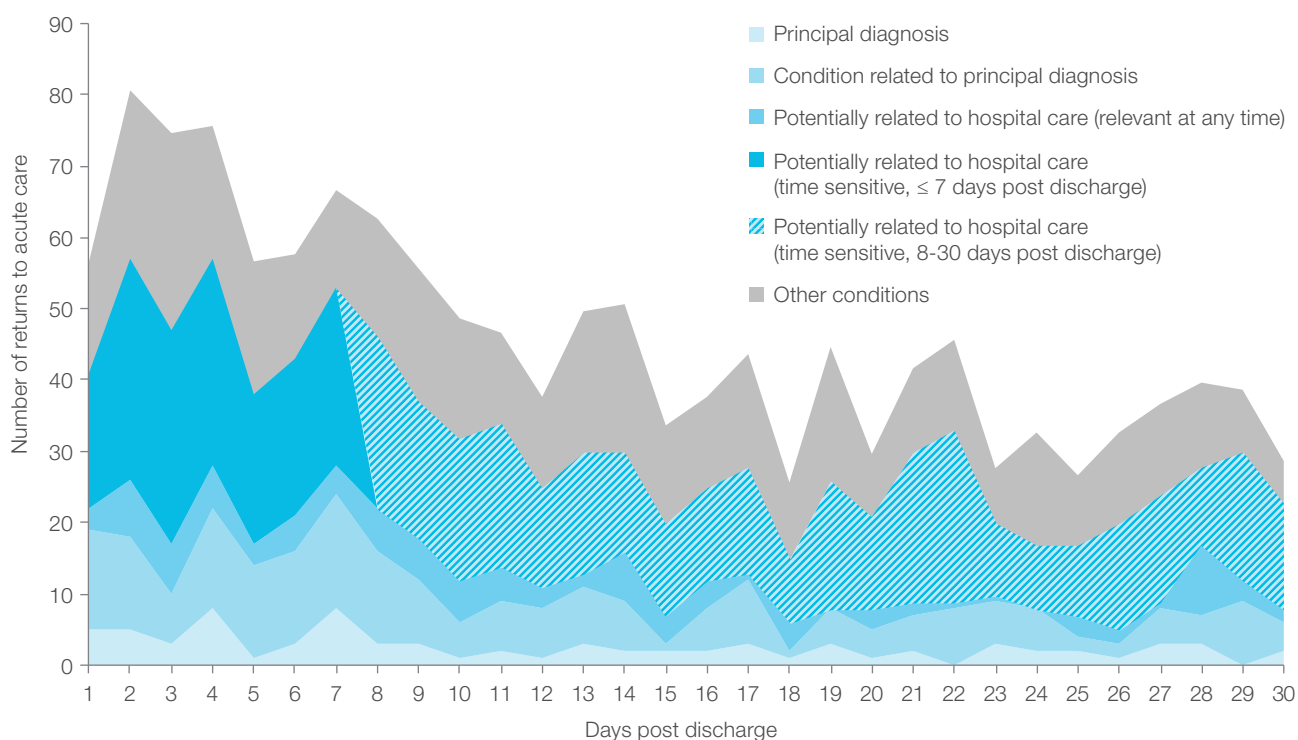
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 36 Hip fracture surgery: length of stay of index hospitalisation and unadjusted rate of return to acute
care, NSW public hospitals July 2009–June 2011

Figure 37 Hip fracture surgery: length of stay of index hospitalisation and return to acute care by principal
diagnosis category, NSW public hospitals, July 2009 – June 2012

Exploring results across five clinical conditions

Comparing local health districts

Local health districts (LHDs) are key organisational entities in the NSW public healthcare system. They ensure the provision of health services for their populations in a wide range of settings – from primary care posts in the remote outback to metropolitan tertiary and quarternary health centres.
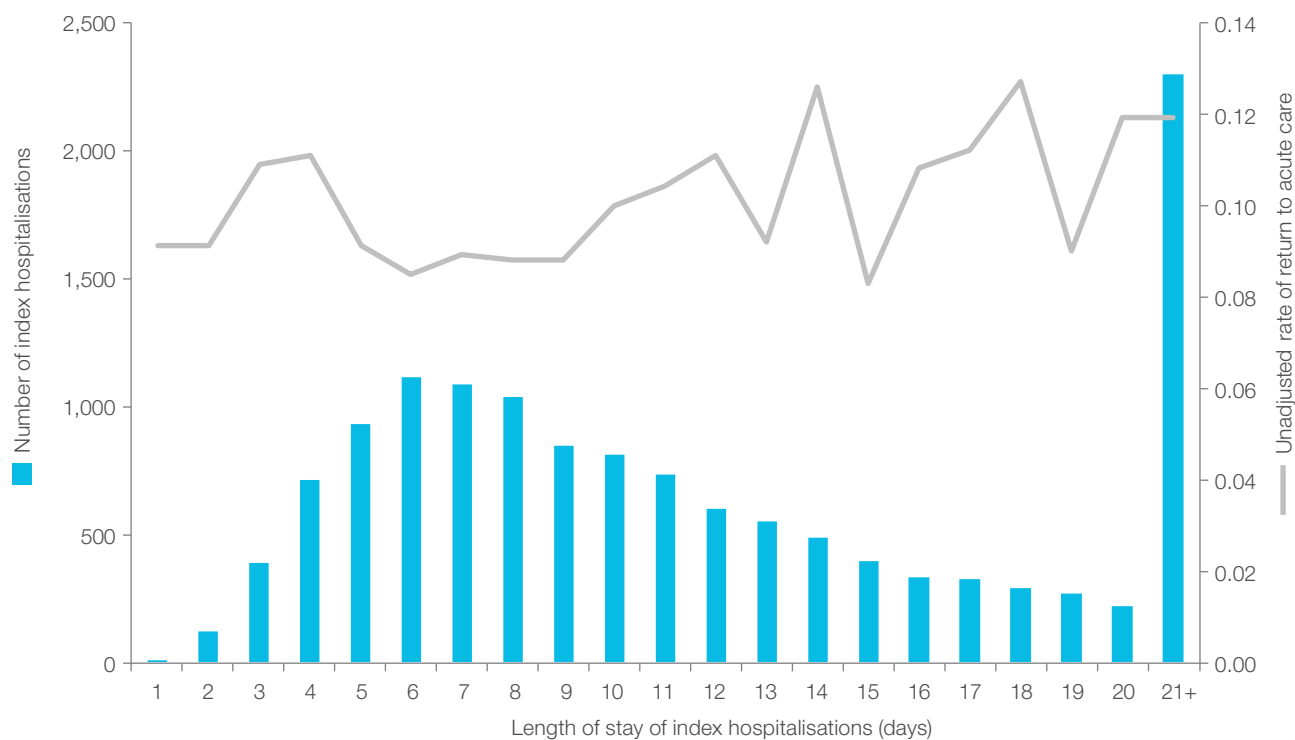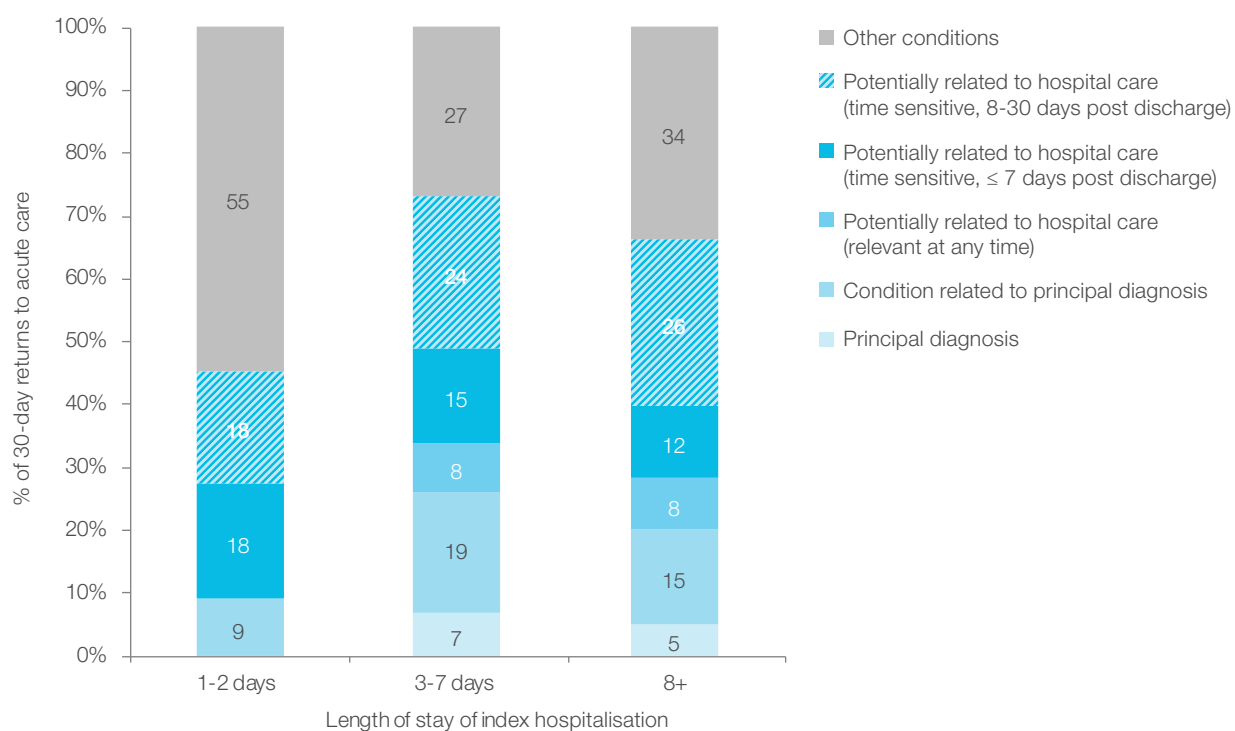
LHDs vary considerably in size, resident populations and in the number and types of hospitals that are within their boundaries. They also differ in terms of the availability of inpatient non-acute, ambulatory and community services.

Across the five conditions included in the report, there was marked variation in the number of index hospitalisations that occurred across LHDs (Figure 38).

Summarising the results from the RSRR analysis according to each hospital's LHD helps inform regional efforts to catalyse and coordinate improvement. It provides, at a glance, information about patterns of higher than expected and lower than expected RSRRs, across the five clinical conditions, in different hospital peer groups, among the 16 LHDs across NSW (including St Vincent's Health Network).

At an LHD level of analysis, Hunter New England LHD had the highest number of lower than expected RSRRs, and Western Sydney LHDs had the highest number of higher than expected RSRRs (Figure 39).

Figure 38 **Number of index hospitalisations, LHDs, July 2009 – June 2012**

	Acute myocardial infarction	Ischaemic stroke	Congestive heart failure	Pneumonia	Hip fracture surgery
Central Coast	1,188	776	1,404	2,020	853
Far West	139	53	171	189	7
Hunter New England	3,650	1,506	3,990	5,280	1,931
Illawarra Shoalhaven	1,429	891	1,757	2,656	858
Mid North Coast	1,033	462	1,016	1,902	592
Murrumbidgee	653	404	1,509	2,106	409
Nepean Blue Mountains	1,134	573	1,141	2,029	662
Northern NSW	1,429	411	1,383	2,157	737
Northern Sydney	2,201	1,294	2,284	3,874	1,810
South Eastern Sydney	2,706	1,424	2,648	3,664	1,430
South Western Sydney	3,111	1,538	3,023	3,721	1,282
Southern NSW	530	266	1,126	1,701	218
St Vincent's	607	243	680	829	261
Sydney	2,868	962	2,465	2,712	1,038
Western NSW	1,061	513	1,466	2,938	657
Western Sydney	2,747	1,049	2,809	3,298	820

Index hospitalisations with less than 30 days follow-up have been excluded.

Figure 39 Hospital RSRR results, by LHD and condition, NSW, July 2009 – June 2012
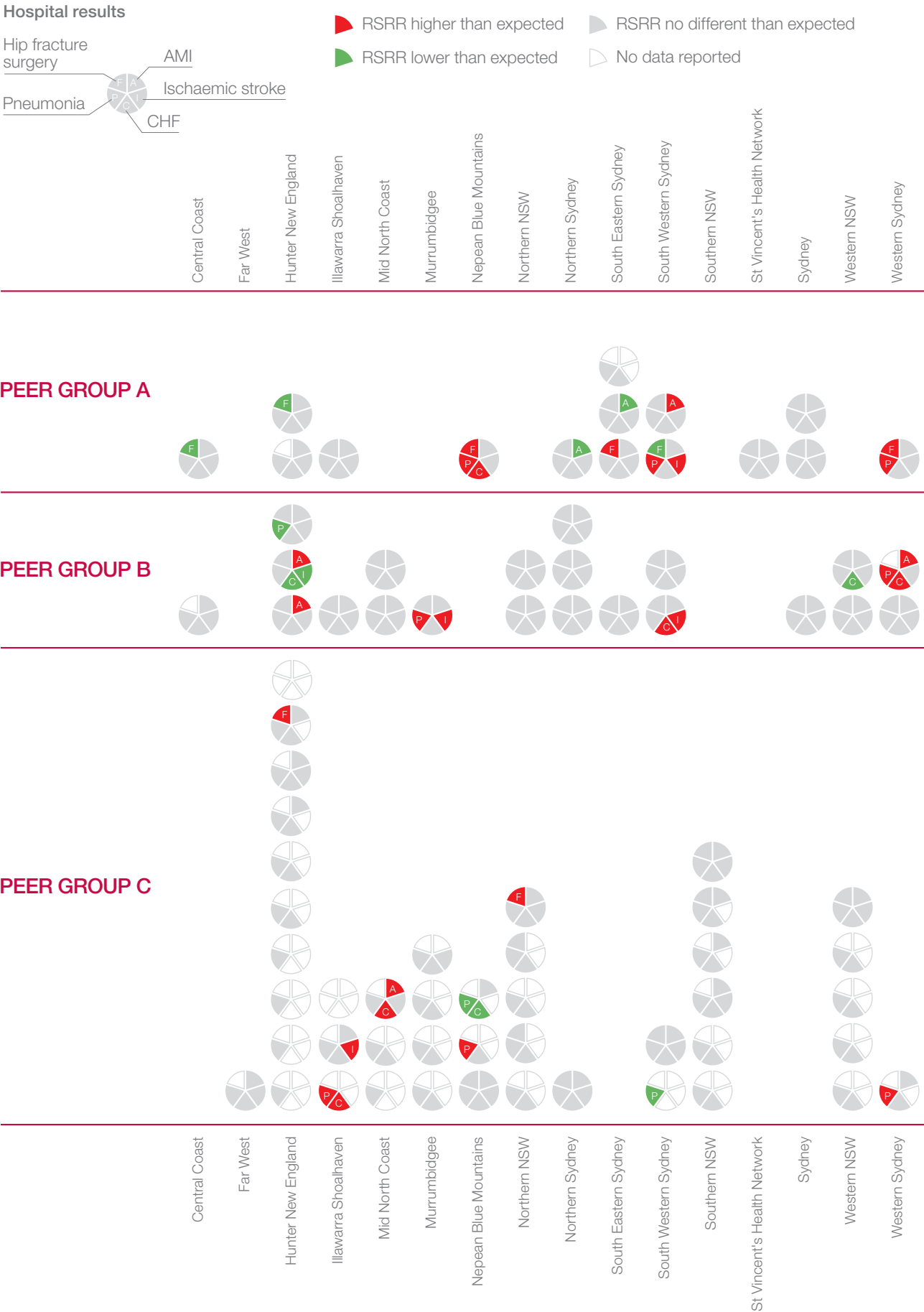
Exploring results across five clinical conditions

Peer group comparisons

Risk standardised readmission ratios (RSRRs) are not suitable to make direct comparisons of hospital results. Each hospital's RSRR is specific to its particular patient case mix and the volume of cases it handles, so direct comparisons can be misleading. However, it is meaningful to compare patterns of outlier results and examine the distribution of higher or lower than expected RSRRs across different geographies or peer groups.[33]

Peer group A hospitals, unsurprisingly, account for the majority of hospitalisations for the conditions of interest. However, for acute myocardial infarction, the combined number of hospitalisations in peer group B and C hospitals represent 40% of the total (Figures 40 and 41).

Higher than expected RSRRs were recorded across peer group A, B and C hospitals (Figure 42).

Figure 40 Number of index hospitalisations by peer group and clinical condition, July 2009 – June 2012

	Peer group A	Peer group B	Peer group C	Other peer groups
Acute myocardial infarction	15,214	7,625	2,772	886
Ischaemic stroke	6,769	3,888	1,363	347
Congestive heart failure	12,528	8,718	5,431	2,200
Pneumonia	14,962	13,002	8,847	4,278
Hip fracture surgery	7,055	4,573	1,500	428

Figure 41 Hospitals with higher or lower than expected return to acute care by peer group, NSW, July 2009 – June 2012

	District Group 2 (C2)	District Group 1 (C1)	Major non-metropolitan (BNM)	Major metropolitan (BM)	Principal referral (A)
Acute myocardial infarction					
Higher	Kempsey		Manning, Tamworth	Auburn	Bankstown
Lower					Prince of Wales, Royal North Shore
Ischaemic stroke					
Higher		Shellharbour	Wagga Wagga	Fairfield	Liverpool*
Lower			Manning		
Congestive heart failure					
Higher	Kempsey, Milton			Auburn, Fairfield	Nepean
Lower	Blue Mountains		Dubbo, Manning		
Pneumonia					
Higher	Lithgow, Milton	Mt Druitt	Wagga Wagga	Auburn	Liverpool, Nepean, Westmead
Lower	Blue Mountains, Camden		Maitland		
Hip fracture surgery					
Higher		Grafton**			Nepean, St George, Westmead
Lower					Gosford, John Hunter, Liverpool

* Data for ischaemic stroke patients admitted to Liverpool Hospital revealed a high use of type change separations (statistical discharges) and a high rate of return to acute care for these separations. It is not possible to ascertain the extent to which this idiosyncrasy affected the RSRR results for Liverpool Hospital.

** Data for hip fracture surgery patients discharged from Grafton Hospital revealed that of the total 14 returns to acute care, 11 (79%) underwent surgery at another hospital.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 42 Concentration of outlier RSRRs across peer groups, NSW public hospitals, July 2009 – June 2012

	Peer group	Number of hospitals	Proportion of results within each peer group relative to NSW average

Legend: ■ Significantly lower RSRR ■ No different ■ Significantly higher RSRR

Acute myocardial infarction
- A — 14 — 14% (lower), 7% (higher)
- B — 21 — 14% (higher)
- C — 18 — 6% (higher)

Ischaemic stroke
- A — 14 — 7% (higher)
- B — 21 — 5% (lower), 10% (higher)
- C — 12 — 8% (higher)

Congestive heart failure
- A — 15 — 7% (higher)
- B — 21 — 10% (lower), 10% (higher)
- C — 36 — 3% (lower), 6% (higher)

Pneumonia
- A — 15 — 20% (higher)
- B — 21 — 5% (lower), 10% (higher)
- C — 42 — 5% (lower), 7% (higher)

Hip fracture surgery
- A — 13 — 23% (lower), 23% (higher)
- B — 19 — (no different)
- C — 10 — 10% (higher)

Exploring results across five clinical conditions

Patterns over time

While the main focus of this report is the three year period July 2009 to June 2012, additional analyses of returns to acute care since 2000 (in three year blocks) were conducted to provide historical context.

Within each time period, hospital RSRRs were calculated and outlier status was determined using the NSW results for the same time period.

Four hospitals recorded an RSRR that was higher than expected for three or more periods. They were Blacktown for ischaemic stroke; Kempsey for acute myocardial infarction and congestive heart failure; Tamworth for acute myocardial infarction and Westmead for pneumonia (Figure 43).

Figure 43 Outliers for 30-day RSRRs, public hospital peer groups A–C, four three-year periods,
July 2000 – June 2003; July 2003 – June 2006; July 2006 – June 2009; July 2009 – June 2012

	RSRR outside control limits			
	One period	Two periods	Three periods	Four periods
Acute myocardial infarction				
RSRR higher than expected	Auburn, Bankstown, Cessnock, Goulburn, Hawkesbury, Lismore, Orange, Shellharbour, Wagga Wagga, Wollongong	Manning, Nepean		Kempsey, Tamworth
RSRR lower than expected	Bega, St Vincent's, Sutherland		Prince of Wales, Royal North Shore	
Ischaemic stroke				
RSRR higher than expected	Campbelltown, Canterbury, Coffs Harbour, Dubbo, Fairfield, Liverpool, Shellharbour	Grafton, Wagga Wagga	Blacktown	
RSRR lower than expected	Manning, John Hunter, Sutherland	Gosford, Royal North Shore		
Congestive heart failure				
RSRR higher than expected	Auburn, Blacktown, Canterbury, Cowra, Dubbo, Fairfield, Forbes, Mt Druitt, Parkes, Tumut	Milton, Nepean	Kempsey	
RSRR lower than expected	Blue Mountains, Dubbo, Hornsby, Manning, Prince of Wales, Royal North Shore	John Hunter		

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Three hospitals recorded an RSRR that was lower than expected for three periods. They were: John Hunter for hip fracture surgery, and Prince of Wales and Royal North Shore for AMI (Figure 44).

Time series results for each NSW hospital (peer group A–C) for the five conditions is available at: **www.bhi.nsw.gov.au**

Figure 44 **Outliers for 30-day RSRRs, public hospital peer groups A–C, four three-year periods, July 2000 – June 2003; July 2003 – June 2006; July 2006 – June 2009; July 2009 – June 2012**

	RSRR outside control limits			
	One period	Two periods	Three periods	Four periods
Pneumonia				
RSRR higher than expected	Auburn, Forbes, Liverpool, Milton, Orange, Port Macquarie, Singleton, Wagga Wagga, Wollongong	Blacktown, Broken Hill, Kempsey, Lithgow, Mt Druitt, Nepean, Wyong	Westmead	
RSRR lower than expected	Belmont, Calvary Mater, Camden, Campbelltown, John Hunter, Maclean, Maitland, Manly, Queanbeyan, Ryde, Sydney, Tweed	Blue Mountains, Concord		
Hip fracture surgery				
RSRR higher than expected	Campbelltown, Dubbo, Campbelltown, Nepean, Westmead	Blacktown, Grafton, St George		
RSRR lower than expected	Bega, Gosford, Liverpool		John Hunter	

Exploring results across five clinical conditions

Comparing conditions

The five clinical conditions included in this report provide insights into a range of different diseases – from acute emergencies to long term chronic conditions. Patients with the conditions follow different pathways and have different care requirements during and after hospitalisation for acute care.

Rates of return to acute care varied across the conditions. NSW rates were 17% for acute myocardial infarction, 11% for ischaemic stroke, 23% for congestive heart failure, 13% for pneumonia and 10% for hip fracture surgery.

Across conditions there was also marked variation in patterns of time to return to acute care (Figure 45) and the reasons for return to acute care (Figure 46).

The proportion of returns to acute care that occurred in the first three days following discharge was 20% for acute myocardial infarction, 18% for ischaemic stroke, 16% for congestive heart failure, 19% for pneumonia and 15% for hip fracture surgery.

Patients returning within 30 days of a congestive heart failure hospitalisation were the most likely to return to hospital with the same principal diagnosis (37%). Patients returning within 30 days of discharge following an ischaemic stroke hospitalisation were the most likely to return with complication or adverse event potentially related to their initial acute care (53%) (Figure 47).

While variations between conditions provide interesting context at a NSW level, at a hospital level making these sort of comparisons may reveal hospital-wide issues. The individual hospital performance profiles published alongside this report will facilitate hospital-level review.[28, 33]

Figure 45 Cumulative incidence of returns to acute care within 30 days by condition, NSW public hospitals, July 2009 – June 2012
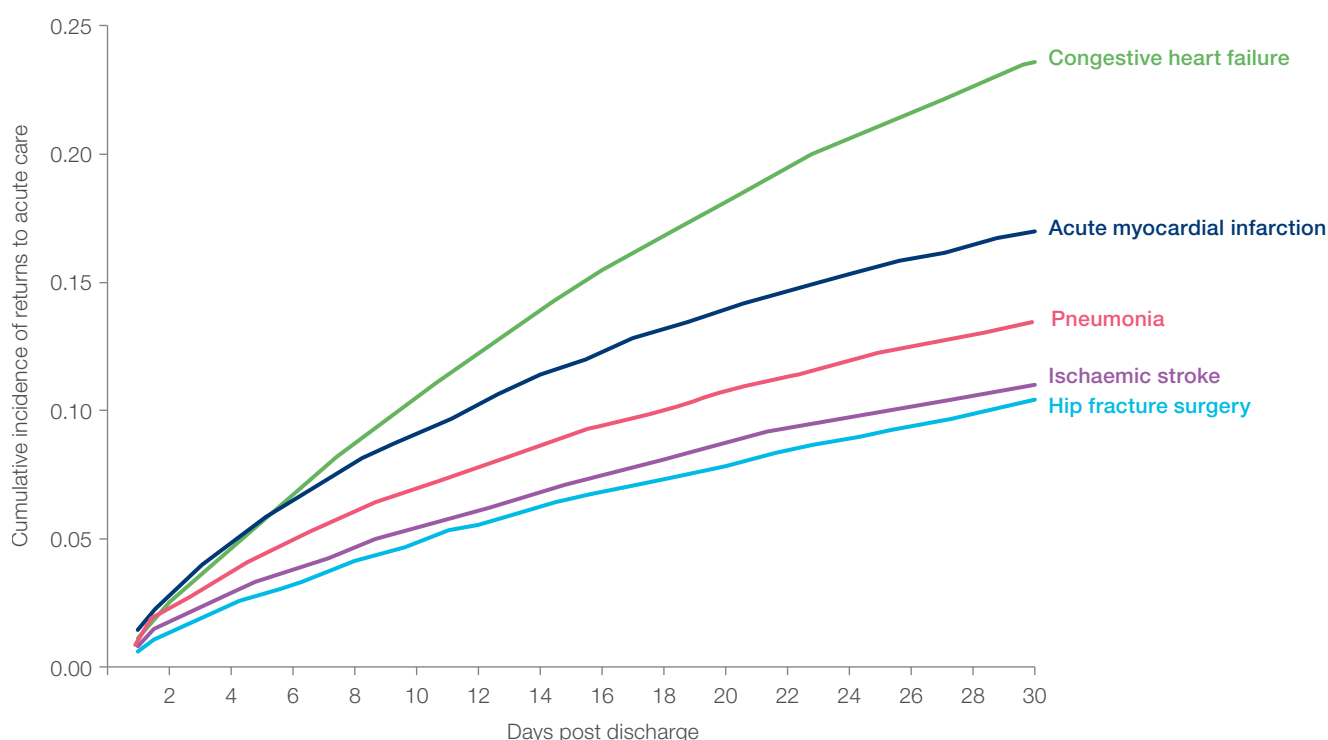
See *Spotlight on Measurement* and Appendix 5 for data specifications.

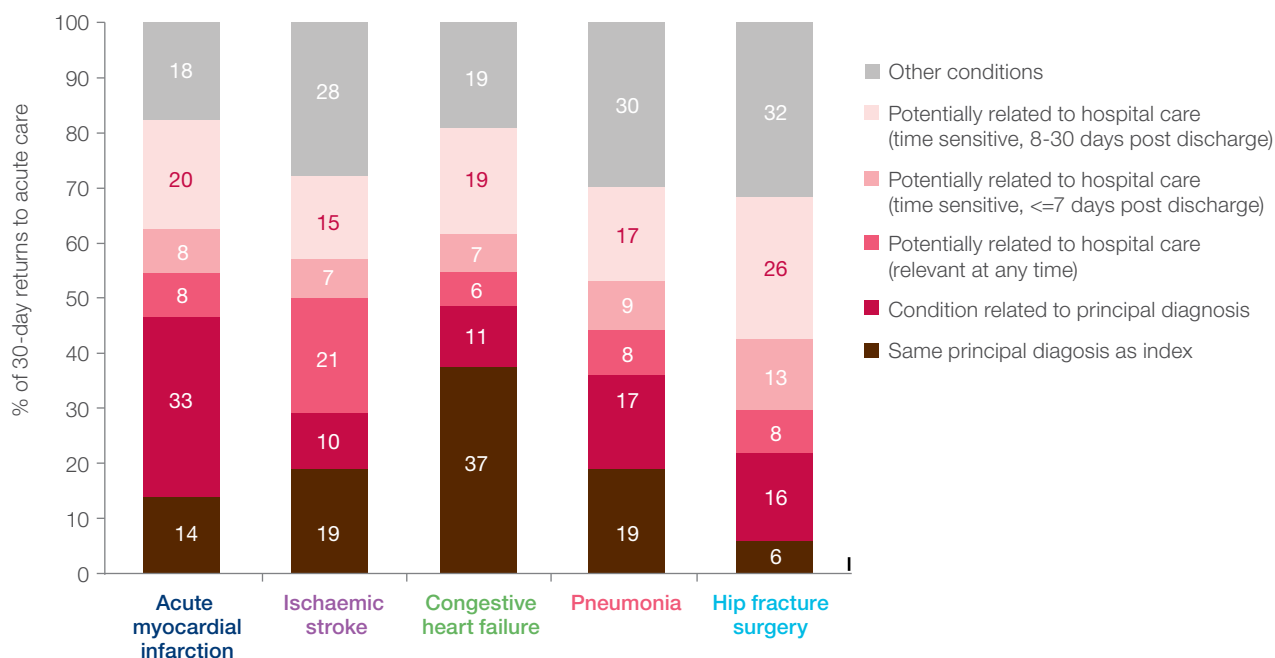**Figure 46** Return to acute care diagnoses by condition, NSW public hospitals, July 2009 – June 2012

Legend:
- Other conditions
- Potentially related to hospital care (time sensitive, 8-30 days post discharge)
- Potentially related to hospital care (time sensitive, <=7 days post discharge)
- Potentially related to hospital care (relevant at any time)
- Condition related to principal diagnosis
- Same principal diagnosis as index

Figure 47 Hospitals with RSRRs lower and higher than expected for multiple conditions, July 2009 – June 2012

	Peer group	Acute myocardial infarction	Ischaemic stroke	Congestive heart failure	Pneumonia	Hip fracture surgery
Total hospitals		**53**	**47**	**72**	**78**	**42**
Manning	BNM	●	●	●		
Blue Mountains	C2			●	●	
Liverpool	A1		●		●	●
Nepean	A1			●	●	●
Westmead	A1				●	●
Auburn	BM	●		●	●	
Fairfield	BM		●	●		
Wagga Wagga	BNM		●		●	
Kempsey	C1	●		●		
Milton	C1			●	●	

Exploring results across five clinical conditions

Return to acute care and length of stay

Research evidence about the relationship between length of stay and readmission is mixed. Some studies have found that excessively short stays can lead to higher readmission rates.[30,31] Conversely, longer stays have been associated with higher infection rates and other adverse events.[32] While there is evidence of a relationship between length of stay and rates of readmission, some studies have found that it is possible at a hospital level to decrease both lengths of stay and readmissions.[29]

Figure 48 summarises NSW data for rates of return to acute care and average length of stay across the five conditions of interest.

Across NSW public hospitals, there is considerable variation in the length of stay. There is no clear association between average length of stay and peer group (Figures 49 and 50).

Among hospitals with either higher or lower than expected RSRRs, there is no clear pattern of length of stay.

Figure 48 **Returns to acute care and average length of stay, NSW public hospitals, July 2009 – June 2012**

	30-day return to acute care (unadjusted)	Average length of stay (days)
Acute myocardial infarction	17%	6
Ischaemic stroke	11%	11
Congestive heart failure	23%	7
Pneumonia	13%	6
Hip fracture surgery	10%	12

Figure 49 Number of index hospitalisations by peer group and clinical condition, July 2009 – June 2012
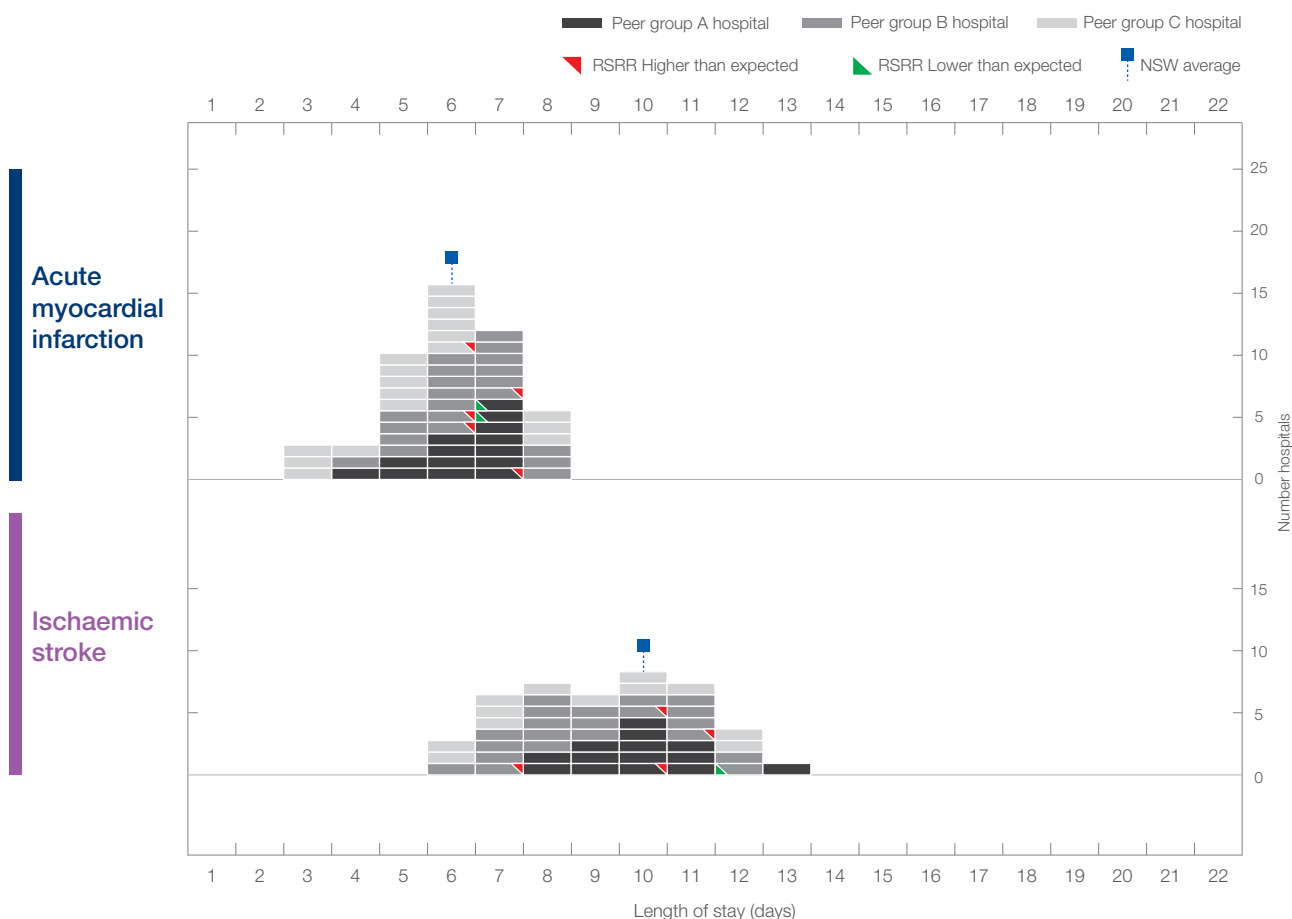
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 50 Average length of stay (index episodes excluding transfers) by hospital, NSW public hospitals, July 2009 – June 2012
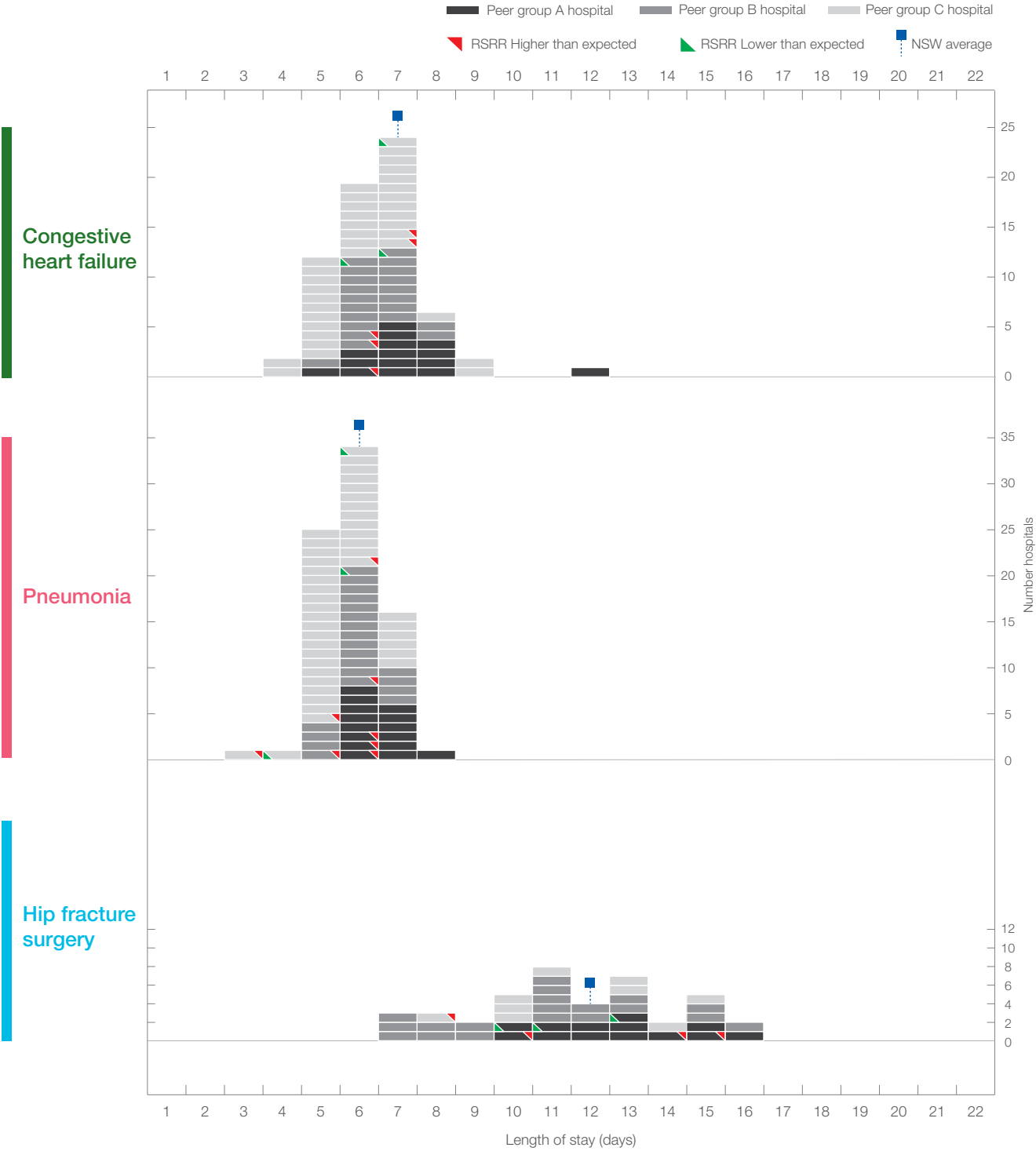
Section 2:
Results for two elective surgical procedures

For each of the two elective, primary procedures – total hip replacement and total knee replacement – the following information is presented:

- 60-day RSRRs

- Number of, and reasons for, returns to acute care in the 60 days following discharge

- A comparison of length of stay of the initial 'index' hospitalisation and the rate of return to acute care

- Distribution of the reasons for return to acute care by index lengths of stay.

Total hip replacement returns to acute care

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 51 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 rate of return to acute care was 9 per 100 acute hospitalisations. For the 39 hospitals that recorded at least 50 index hospitalisations for total hip replacements between July 2009 and June 2012, unadjusted 60-day rates of return to acute care ranged from 2 to 17 per 100 hospitalisations. These unadjusted rates cannot be used to make meaningful assessments of hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 32 hospitals (82%) with a RSRR no different than expected, given their patients' characteristics. Five hospitals (13%) had a higher than expected RSRR and two hospitals (5%) had a lower than expected RSRR (Figure 52).

Across peer groups, there was one principal referral hospital (peer group A) and one major metropolitan hospital (peer group B) that had higher and lower than expected RSRRs (Figure 53).

Figure 51 Total hip replacement: 60-day return to acute care in NSW public hospitals, July 2009 – June 2012

There were 7,354 people aged 18 years and over admitted to a public hospital for an elective, primary total hip replacement. In total there were 7,773 index hospitalisations: 7,702 (99%) for a unilateral procedure and 71 (1%) for a bilateral procedure. There were 2 (<1%) people who died within 60 days of discharge before any return to acute care.

Within 60 days of discharge from discharge or transfer to a non-acute setting, there were 698 returns to acute care (all causes). After excluding 34 index hospitalisations without 60 day follow-up, this corresponds to an unadjusted rate of return to acute care of 9 per 100 hospitalisations.

Among the 698 returns to acute care:

- 227 (33%) had principal diagnoses for complications of total hip replacement (e.g. wound infection, dislocation within the time specified)
- 37 (5%) were for total hip replacement complications outside the time specified
- 79 (11%) were for a condition potentially related to hospital care (i.e adverse events or deficient management of comorbidity), but not time sensitive
- 111 (16%) were for a condition potentially related to hospital care outside the time (7, 15 or 30 day period post discharge)
- 224 (35%) were for other reasons
- 421 (60%) patients returned to the same hospital, 156 (22%) patients returned to different but similarly urban or rural hospitals, 68 (10%) returned to more rural, 36 (5%) to more urban and 17 (2%) to private hospitals.

More females (4,216) were hospitalised for total hip replacement than males (3,557). Among females, 8% of index hospitalisations were followed by a return to acute care within 60 days of discharge, compared with 10% of males. After adjusting for age and comorbidities, sex remained significantly associated with return to acute care; males were more likely to return.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 52 Total hip replacement: 60-day RSRR, NSW public hospitals, July 2009 – June 2012
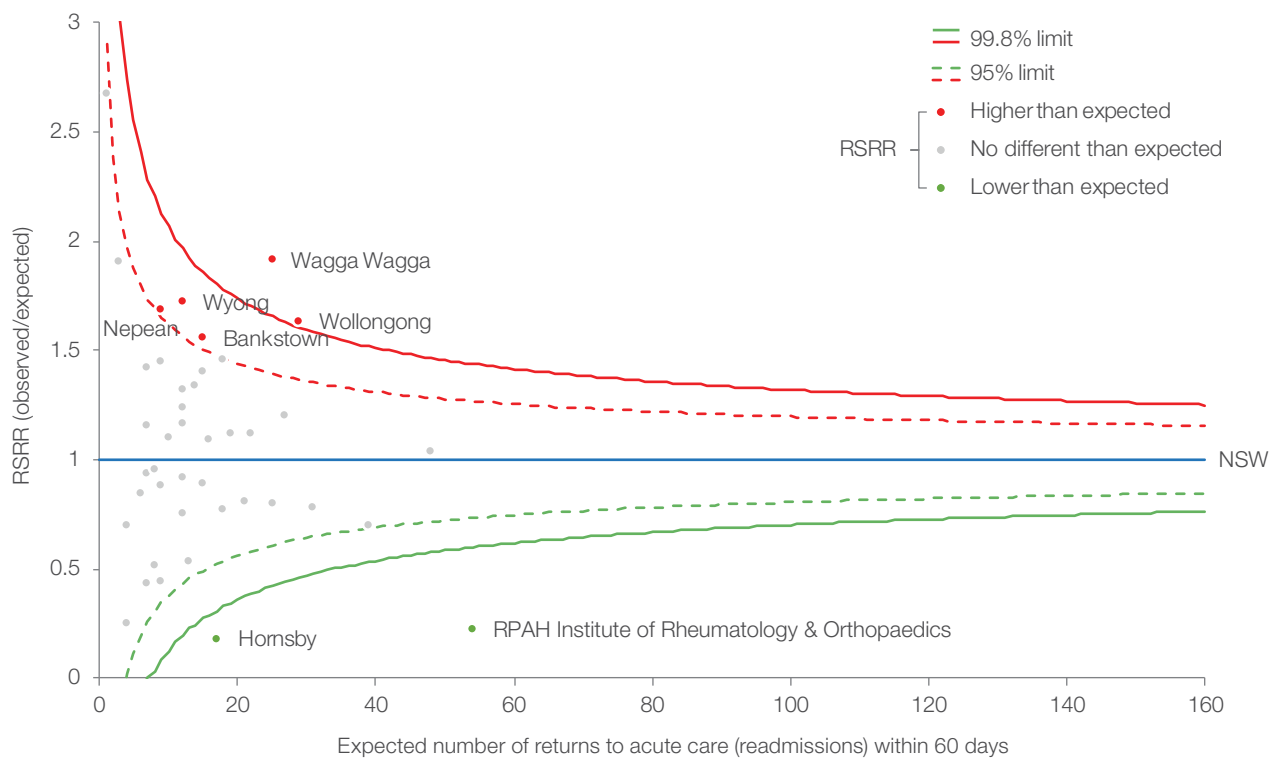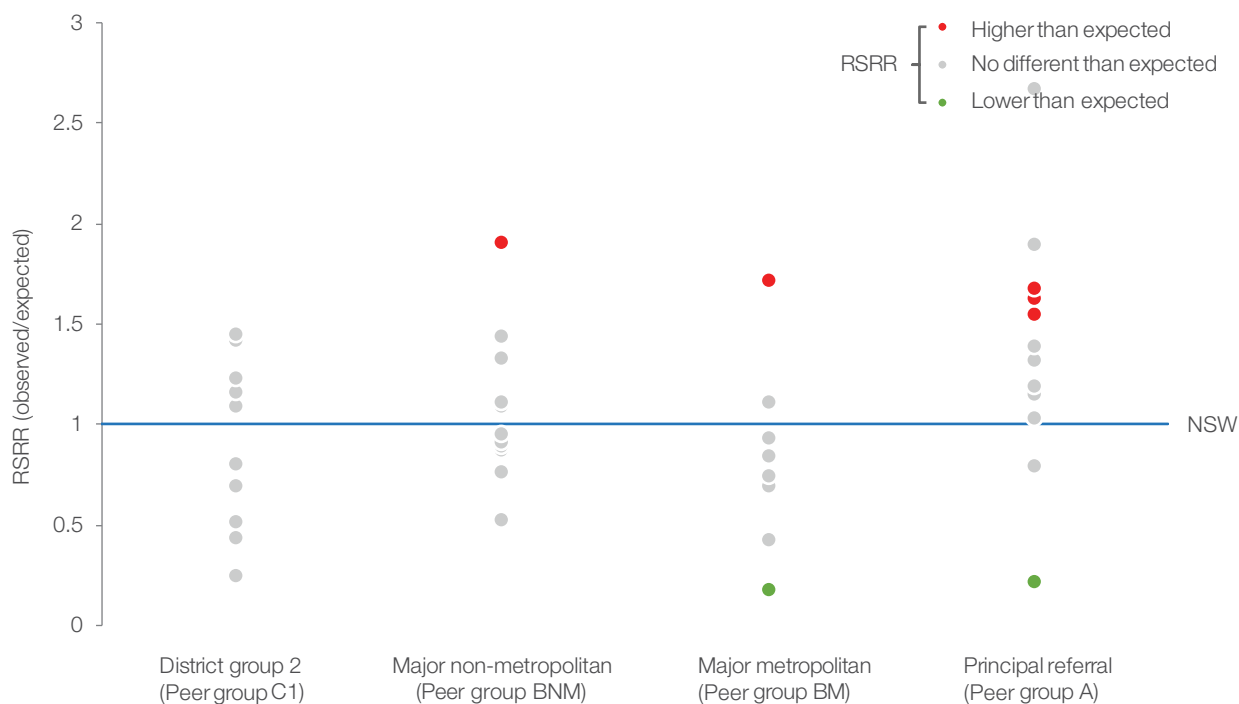

Figure 53 Total hip replacement: 60-day RSRR by peer group, July 2009 – June 2012

Total hip replacement

Exploring patterns of returns to acute care

Detailed information about when in the 60-day period following discharge returns to acute care occured, and the reasons for those returns, can help highlight areas for improvement.[28] A high number of returns to acute care within seven days of discharge may, for example, point to problems with discharge planning.

Returns to acute care that occurred in the seven days following discharge were most likely to be for orthopaedic complications. The number of returns to acute care that were unrelated either to the total hip replacement procedure or to the index hospitalisation remained fairly constant throughout the 60-day period (Figure 54).

Some studies have found a relationship between length of stay of index hospitalisations and the likelihood of returning to acute care.[7,8] 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 a return to acute care. Conversely, lengths of stay that are too long carry an increased risk of hospital-acquired conditions such as infections. [32]

The unadjusted rate of return to acute care following hospitalisation for total hip replacement showed a U-shaped curve with higher rates of return to acute care for relatively short and relatively long index hospitalisations (Figure 55).

Examining reasons for return to acute care after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay reveals that hospital-acquired complications were responsible for a greater proportion of returns to acute care as length of stay increased (Figure 56).

Figure 54 Total hip replacement: number of, and reasons for, returns to acute care following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2009 – June 2012
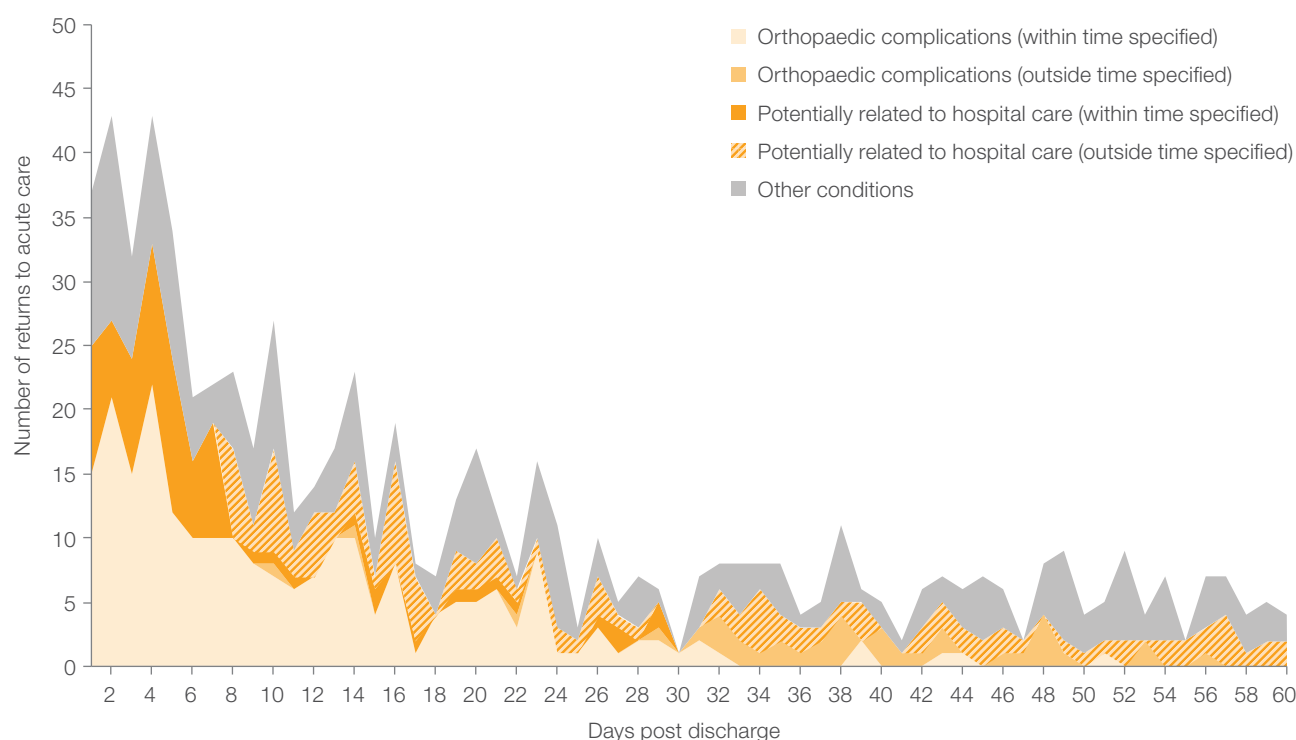
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 55 Total hip replacement: length of stay of index hospitalisation and unadjusted rate of return to acute care, NSW public hospitals July 2009 – June 2012
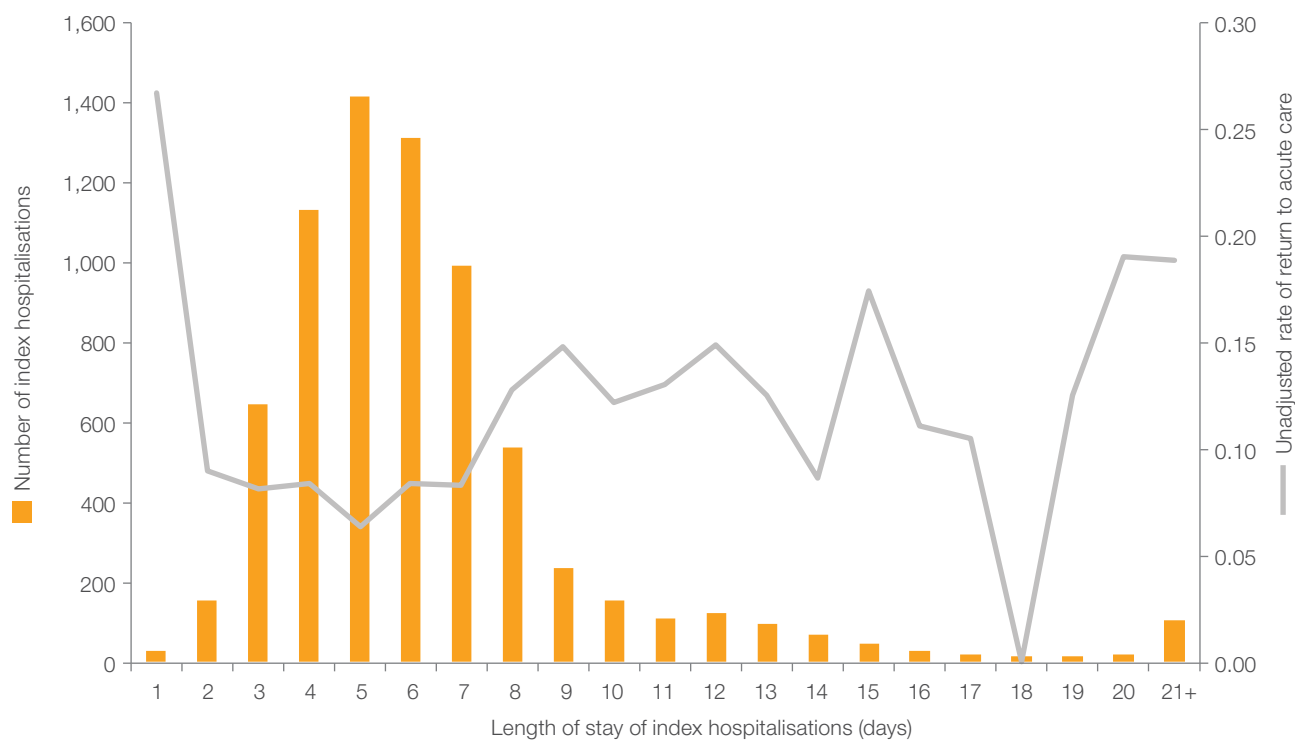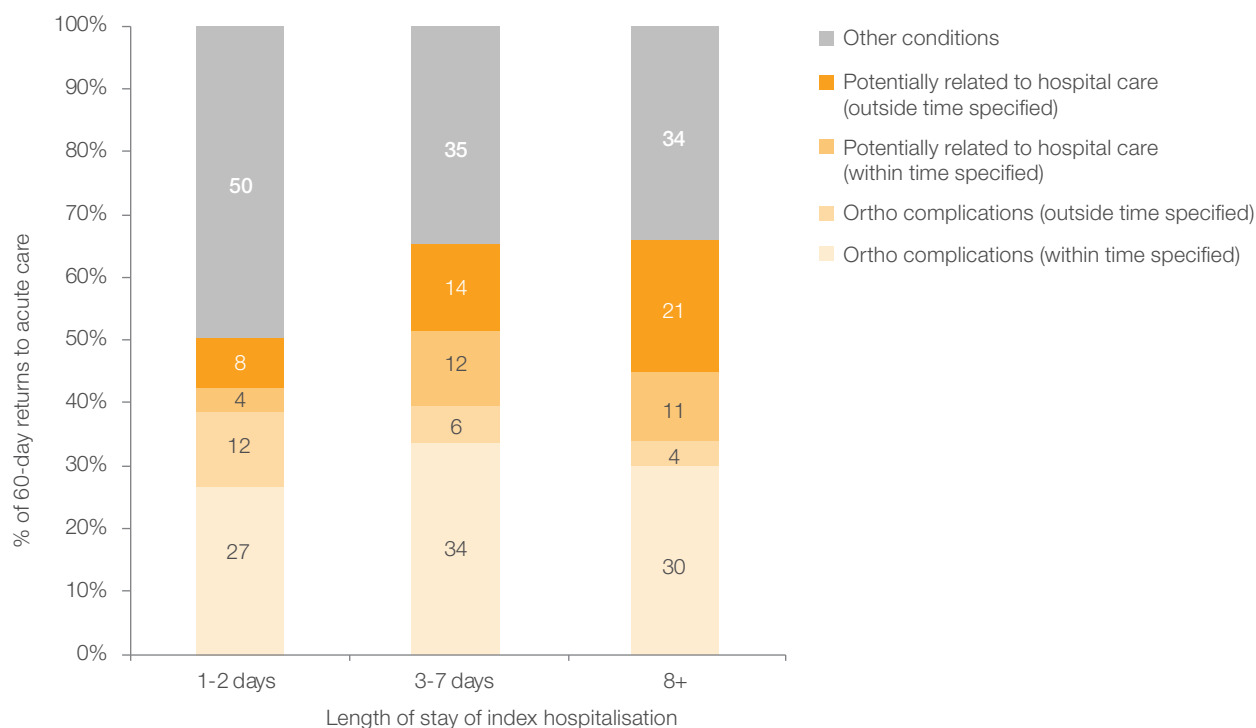

Figure 56 Total hip replacement: length of stay of index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals July 2009 – June 2012

Total knee replacement returns to acute care

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

The NSW 60-day rate of return to acute care was 11 per 100 acute hospitalisations. For the 40 hospitals that recorded at least 50 index hospitalisations for total knee replacement between July 2009 and June 2012, the unadjusted 60-day rates of return to acute care ranged from 5 to 20 per 100 hospitalisations. These unadjusted rates cannot be used to make meaningful assessments of hospital performance.

Statistical techniques, such as risk standardised readmission ratios (RSRRs), take account of different patient level factors (such as age and other illnesses recorded in the medical record) to assess hospital outcomes fairly.

After adjustment, there were 31 hospitals (78%) with a RSRR no different than expected, given their patients' characteristics. Six hospitals (15%) had a higher than expected RSRR and three hospitals (8%) had a lower than expected RSRR (Figure 58).

Across NSW, higher than expected RSRRs were recorded in peer groups A–C. A principal referral hospital (peer group A) and two major metropolitan hospitals (peer group B) recorded lower than expected RSRRs (Figure 59).

Figure 57 Total knee replacement: 60-day return to acute care in NSW public hospitals, July 2009 – June 2012

There were 12,898 people aged 18 years and over admitted to a public hospital for an elective, primary total knee replacement. In total there were 13,870 index hospitalisations: 13,204 (95%) for a unilateral procedure and 666 (5%) for a bilateral procedure. There was 1 (<1%) person who died within 60 days of discharge before any return to acute care.

Within 60 days of discharge from discharge or transfer to a non-acute setting, there were 1,533 returns to acute care (all causes). After excluding 50 index hospitalisations without 60 days of follow-up, this corresponds to an unadjusted rate of return to acute care of 11 per 100 hospitalisations.

Among the 1,533 returns to acute care:
- 493 (32%) were for complications of total knee replacement (e.g. wound infection)
- 220 (14%) were for orthopaedic complications outside the time specified
- 154 (10%) were for a condition potentially related to hospital care (i.e adverse events or deficient management of comorbidity attributable to the index hospitalisation), but not time sensitive
- 232 (15%) for a condition potentially related to hospital care outside the time specified 7, 15 or 30 day period post discharge
- 434 (28%) were for other reasons
- 997 (65%) returned to the same hospital, 336 (22%) returned to a different but similarly urban or rural hospital, 105 (7%) returned to a more rural, 56 (4%) to a more urban and 39 (3%) to private hospitals.

More females (8,380) were hospitalised for total knee replacement than males (5,490). Among females, 10% of index hospitalisations were followed by a return to acute care within 60 days, compared with 12% for males. After adjusting for age and comorbidities, sex remained significantly associated with returns to acute care; males were at higher risk of return.

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 58 Total knee replacement: 60-day RSRR, NSW public hospitals, July 2009 – June 2012

Figure 59 Total knee replacement: 60-day RSRR by peer group, July 2009 – June 2012
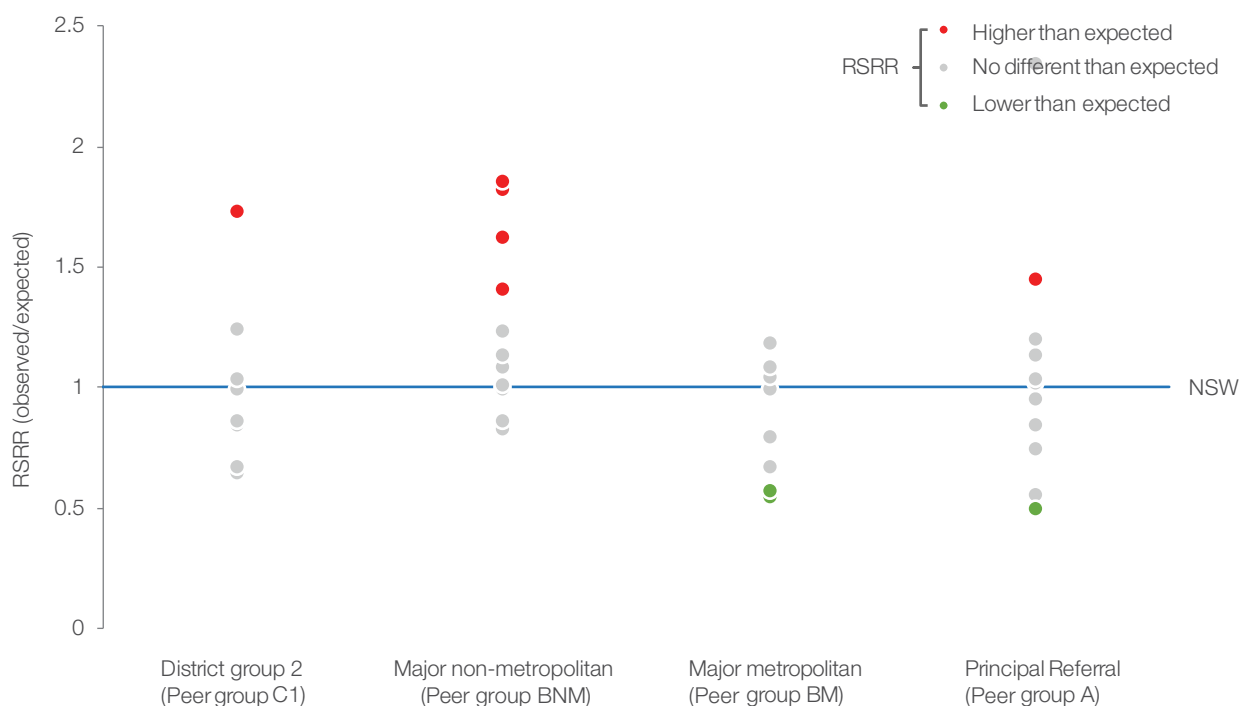
Total knee replacement

Exploring patterns of returns to acute care

Detailed information about when in the 60-day period following discharge returns to acute care occurred, and the reasons for those readmissions, can help highlight areas for improvement.[28] A high number of returns to acute care within seven days of discharge may, for example, point to problems with discharge planning.

Returns to acute care that occurred in the seven days following discharge were most likely to be for orthopaedic complications. The number of returns to acute care that were unrelated either to the total knee replacement procedure or to the index hospitalisation increased around day 30 post discharge (Figure 60).

Some studies have found a relationship between length of stay of index hospitalisations and the likelihood of unplanned return to acute care.[7,8]

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.[32]

The unadjusted rate of return to acute care following hospitalisation for total knee replacement increased as the length of stay for the index hospitalisation increased (Figure 61).

Categorising the reasons for return to acute care that occurred after short (1–2 days), medium (3–7 days) or long (8+ days) lengths of stay shows that hospital-acquired complications were responsible for a decreasing proportion of return to acute care as length of stay increases (Figure 62).

Figure 60   Total knee replacement: number of, and reasons for return to acute care following hospitalisation, day 1–60 post discharge, NSW public hospitals, July 2009 – June 2012
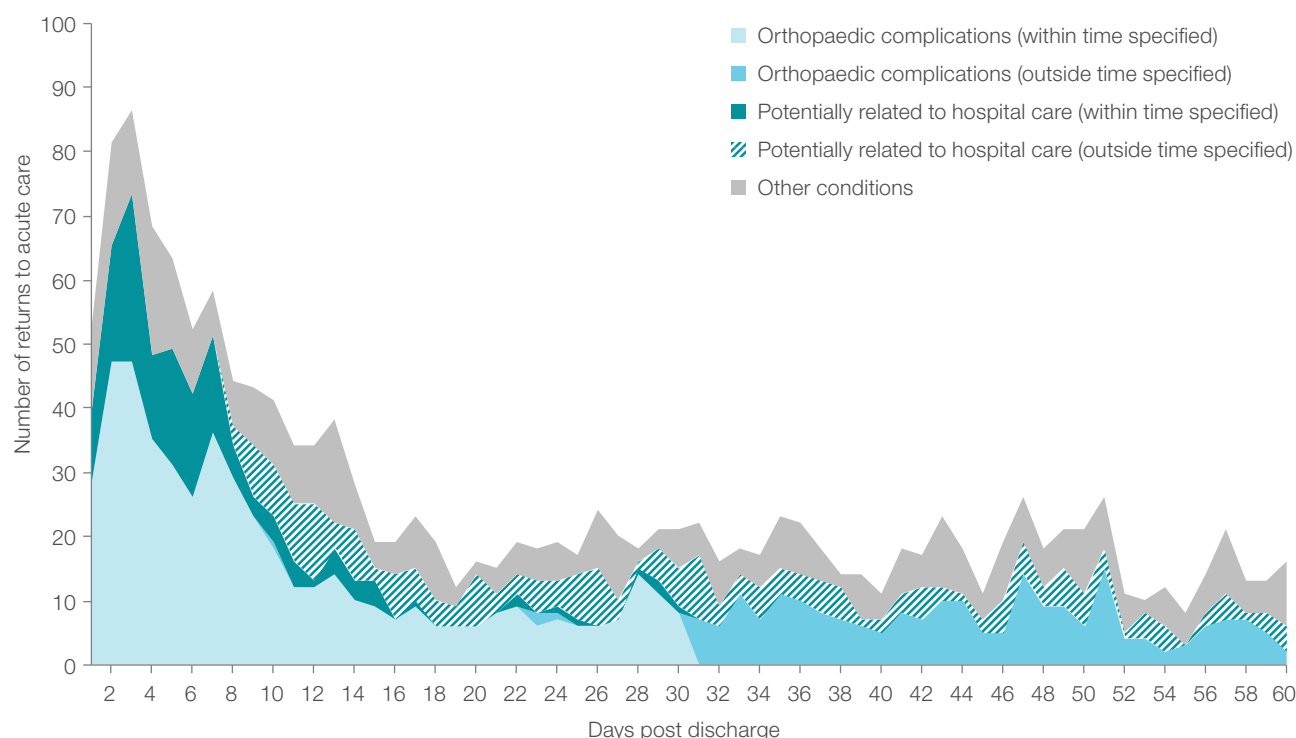
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 61 Total knee replacement: length of stay of index hospitalisation and unadjusted rates of return to acute care, NSW public hospitals, July 2009 – June 2012
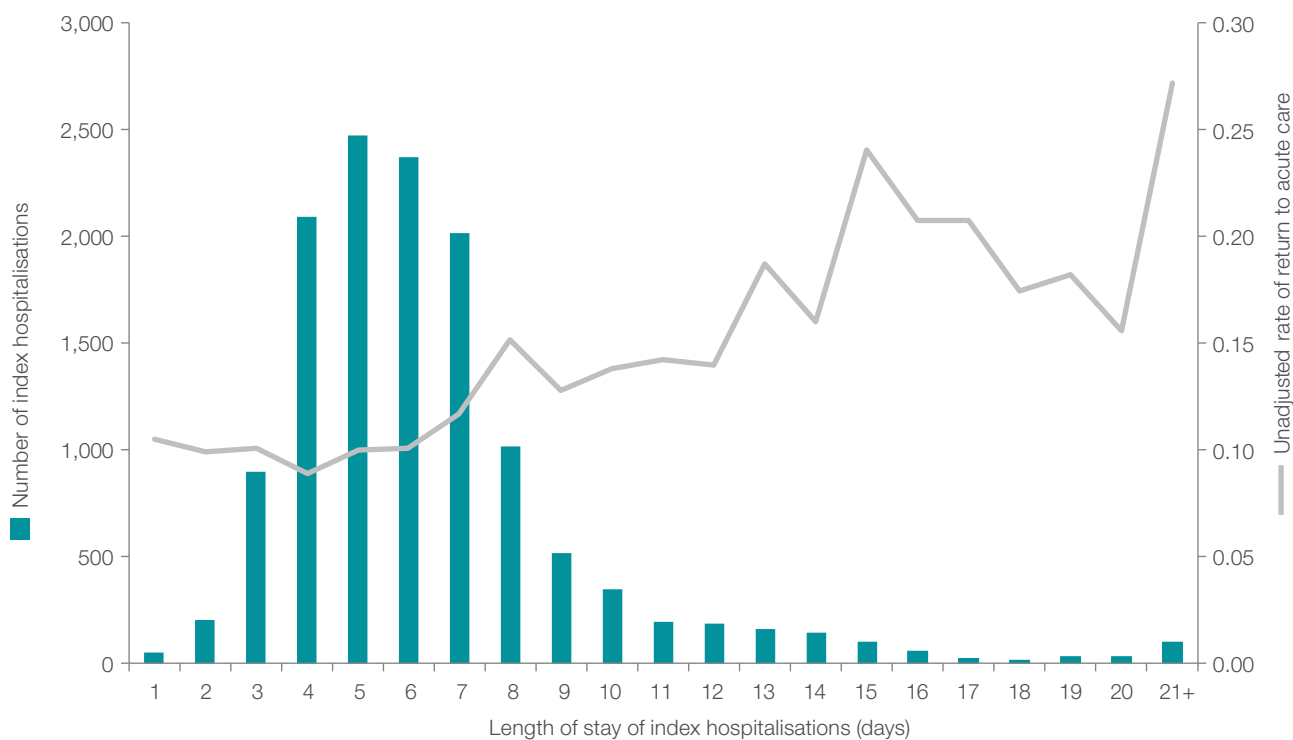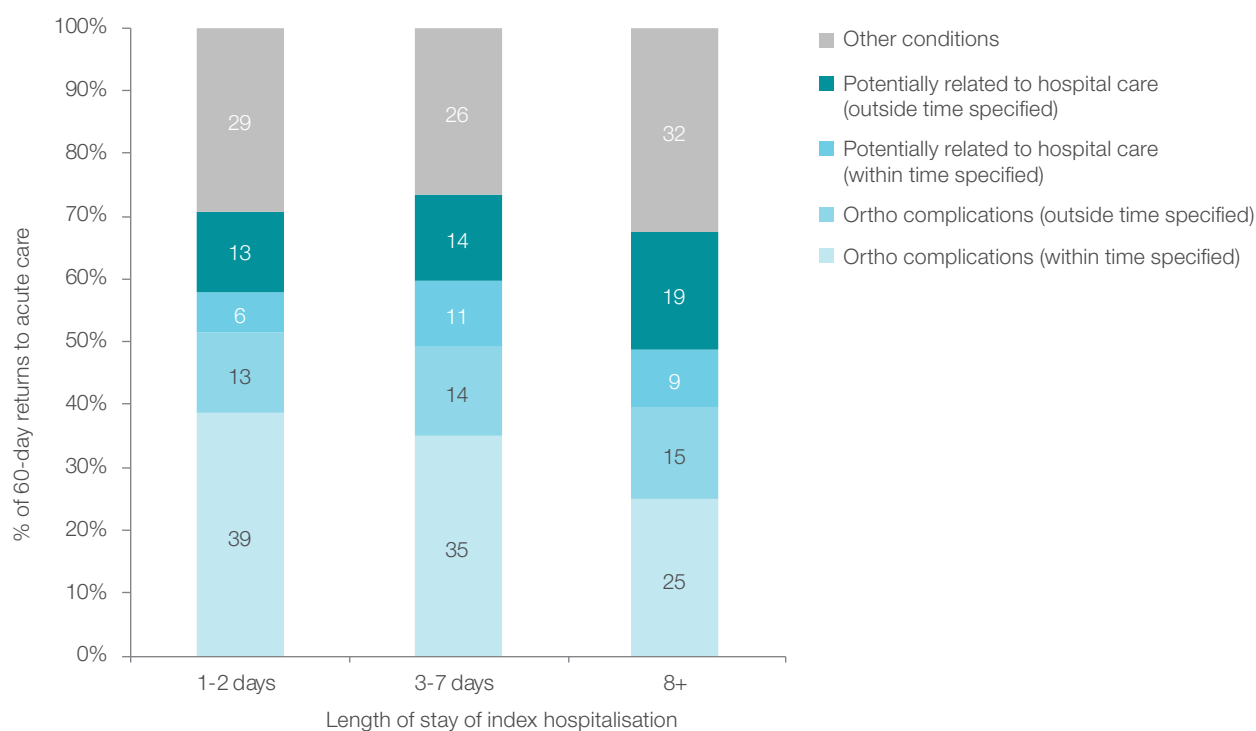

Figure 62 Total knee replacement: length of stay of the index hospitalisation and return to acute care by principal diagnosis category, NSW public hospitals, July 2009 – July 2012

Exploring results for two elective surgical procedures

Comparing local health districts

Local health districts (LHDs) are key organisational entities in the NSW public healthcare system. They ensure the provision of health services for their populations in a wide range of settings – from primary care posts in the remote outback to metropolitan tertiary health centres.

LHDs vary considerably in size, resident populations and in the number and types of hospitals that are within their boundaries. They also differ in terms of the availability and provision of inpatient non-acute, ambulatory and community services.

Across the two procedures included in the report, there was marked variation in the number of index hospitalisations that occurred across LHDs (Figure 63).

Summarising the results from the RSRR analysis according to each hospital's LHD helps inform regional efforts to catalyse and coordinate improvement. It provides, at a glance, information about patterns of higher than expected and lower than expected RSRRs, across the two procedures, in different hospital peer groups, among the 16 LHDs across NSW (including St Vincent's Health Network).

At an LHD level of analysis, Northern Sydney and Sydney LHDs had one hospital with lower than expected RSRR for both total hip replacement and total knee replacement. Murrumbidgee and Nepean Blue Mountains LHDs had one hospital with higher than expected RSRRs for both total hip replacement and total knee replacement (Figure 64).

Figure 63 Number of index hospitalisations, LHDs, July 2009 – June 2012

	Total hip replacement	Total knee replacement
Central Coast	460	709
Far West	51	110
Hunter New England	962	1643
Illawarra Shoalhaven	398	675
Mid North Coast	273	428
Murrumbidgee	372	734
Nepean Blue Mountains	342	673
Northern NSW	413	748
Northern Sydney	543	756
South Eastern Sydney	540	967
South Western Sydney	319	539
Southern NSW	120	101
St Vincent's Health Network	748	1784
Sydney	1053	1907
Western NSW	352	695
Western Sydney	311	575

Index hospitalisations with less than 30 days follow-up have been excluded.
See *Spotlight on Measurement* and Appendix 5 for data specifications.

Hospital results

Total hip replacement

Total knee replacement

RSRR higher than expected

RSRR lower than expected

RSRR no different than expected

No data reported

PEER GROUP A

PEER GROUP B

PEER GROUP C

Exploring results for two elective surgical procedures

Peer group comparisons

Risk standardised readmission ratios (RSRRs) are not suitable to make direct comparisons of hospital results. Each hospital's RSRR is specific to its particular patient case mix and the volume of cases it handles, so direct comparisons can be misleading. However, it is meaningful to compare patterns of outlier results and examine the distribution of higher or lower than expected RSRRs across different geographies or peer groups.[33]

Peer group B hospitals had the most hospitalisations for the procedures of interest (Figure 65).

One peer group A hospital and two major metropolitan hospitals had lower than expected RSRRs for both procedures. The greatest concentration of higher than expected RSRRs are among the non-metropolitan major hospitals (Figure 66 and 67).

Figure 65 **Number of index hospitalisations by peer group and elective procedure, July 2009 – June 2012**

	Peer group A	Peer group B	Peer group C
Total hip replacement	2,945	3,099	1,213
Total knee replacement	4,843	6,047	2,154

Figure 66 **Distribution of hospitals with more or fewer than expected returns to acute care by peer group, NSW, July 2009 – June 2012**

	District group 1	Major non-metropolitan	Major metropolitan	Principal referral
Total hip replacement				
Higher than expected RSRR		Wagga Wagga	Wyong	Bankstown, Nepean, Wollongong
Lower than expected RSRR			Hornsby	RPAH Institute of Rheumatology & Orthopaedics
Total knee replacement				
Higher than expected RSRR	Armidale	Coffs Harbour, Shoalhaven, Tamworth, Wagga Wagga		Nepean
Lower than expected RSRR			Fairfield, Hornsby	RPAH Institute of Rheumatology & Orthopaedics

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 67 Concentration of outlier RSRRs across peer groups, NSW public hospitals, July 2009 – June 2012
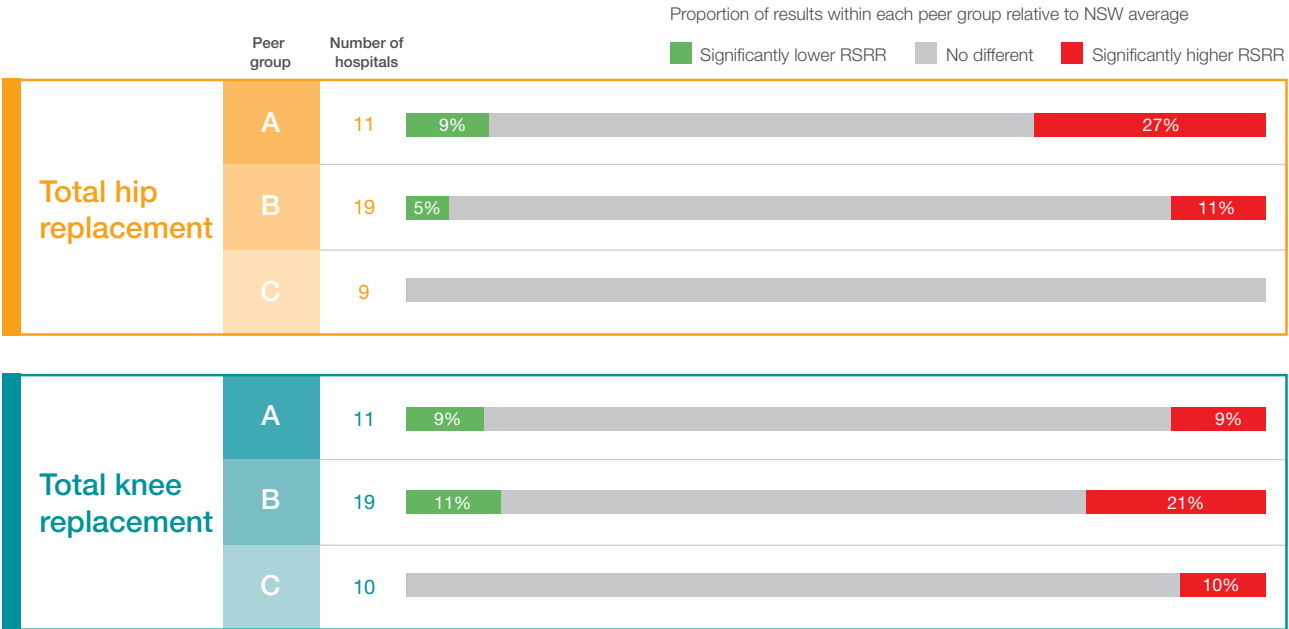
Exploring results for two elective surgical procedures

Patterns over time

While the main focus of this report is the three-year period July 2009 to June 2012, additional analyses on return to acute care since 2000 (in three year blocks) were conducted to provide historical context for the results.

One hospital, RPAH Institute of Rheumatology & Orthopaedics, recorded an RSRR that was lower than expected in four time periods for both total hip replacement and for total knee replacement (Figure 68).

One hospital, Wagga Wagga, recorded an RSRR that was higher than expected in three time periods for total hip replacement (Figure 69).

Time series results for each NSW hospital (peer group A–C) for the two elective procedures is available at: **www.bhi.nsw.gov.au**

Research evidence about the relationship between length of stay and readmission (or return to acute care) is mixed. Some studies have found that excessively short stays can lead to higher readmission rates. [27, 28] Conversely, longer stays have been associated with higher infection rates and other adverse events.[29] While there is evidence of a relationship between length of stay and rates of readmission, some studies have found that it is possible at a hospital level to decrease both lengths of stay and readmissions.[30]

For both procedures, the average length of stay was six days for both total hip and total knee replacements.

Across NSW public hospitals, there was around two-fold variation in the length of stay. Average lengths of stay were longer in peer group A hospitals. (Note: no adjustment has been made for patient level factors or severity in this analysis).

Additional analyses found that among hospitals that had either higher or lower than expected RSRRs, there was no clear pattern of length of stay.

Figure 68 Outliers for 60-day RSRRs, public hospital peer groups A–C, four three-year periods, July 2000 – June 2003; July 2003 – June 2006; July 2006 – June 2009; July 2009 – June 2012

	RSRR outside control limits			
	1 out of 4 periods	2 out of 4 periods	3 out of 4 periods	4 out of 4 periods
Total hip replacement				
RSRR higher than expected	Bankstown, Bathurst, Bega, Gosford, Nepean Orange, Sutherland, Wollongong, Wyong		Wagga Wagga	
RSRR lower than expected	Hornsby			RPAH Institute of Rheumatology & Orthopaedics
Total knee replacement				
RSRR higher than expected	Armidale, Bathurst, Coffs Harbour, Hawkesbury, John Hunter, Nepean, Shoalhaven, Wollongong, Wyong	Bega, Mt Druitt, Tamworth, Wagga Wagga		
RSRR lower than expected		Bowral, Fairfield, Hornsby		RPAH Institute of Rheumatolgy & Orthopaedics

See *Spotlight on Measurement* and Appendix 5 for data specifications.

Figure 69 Average length of stay (index episodes excluding transfers) by hospital, NSW public hospitals, July 2009 – June 2012
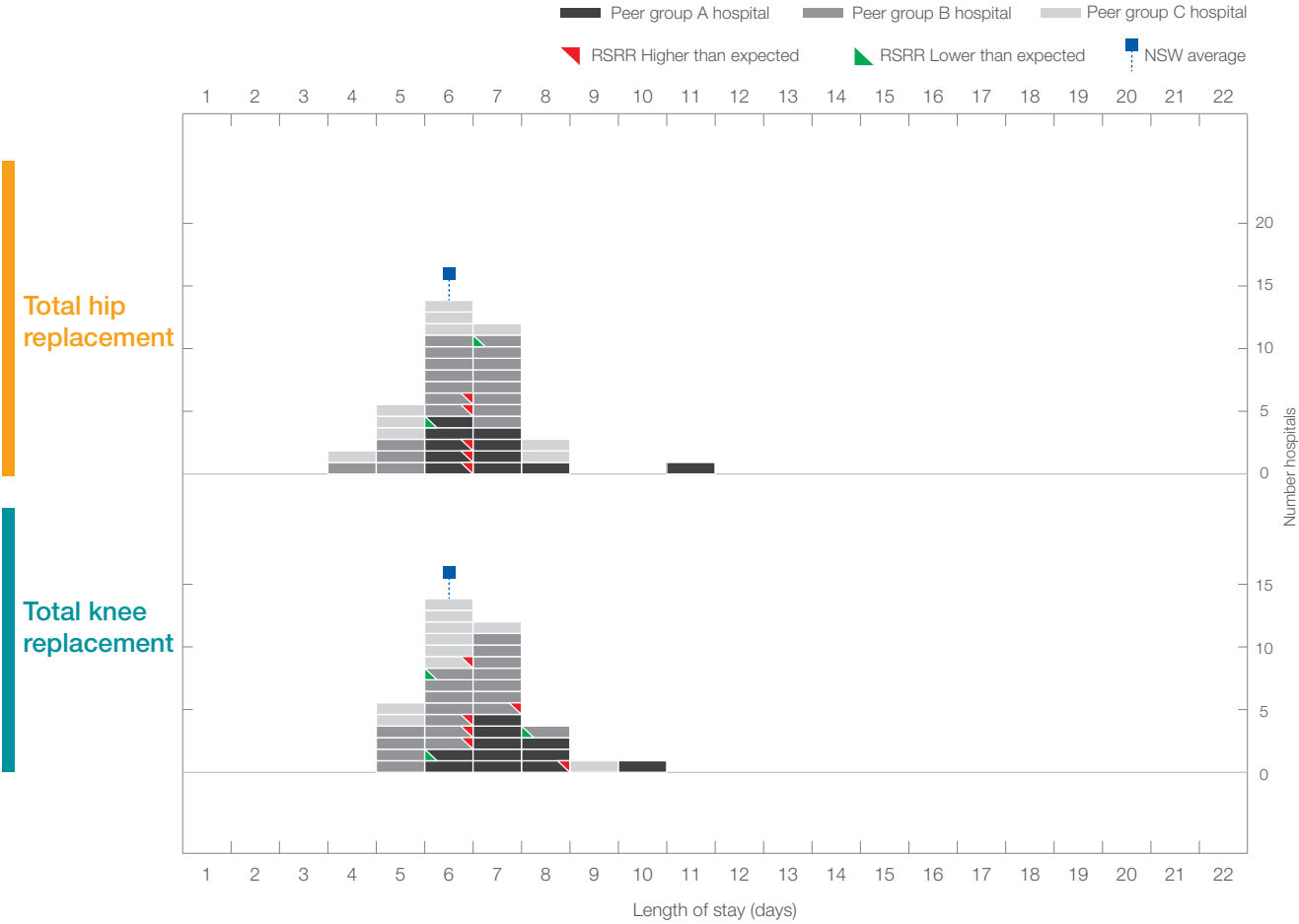
Exploring results for two elective surgical procedures

Comparing procedures

Across the two procedures, rates of 60-day return to acute care were 9 per 100 hospitalisations for total hip replacement and 11 per 100 hospitalisations for total knee replacement (Figure 70).

The percentage of returns to acute care that occurred in the first three days following discharge was 16% for total hip replacement and 14% for total knee replacement. However, over the full 60-day study period, the incidence patterns were similar (Figure 71).
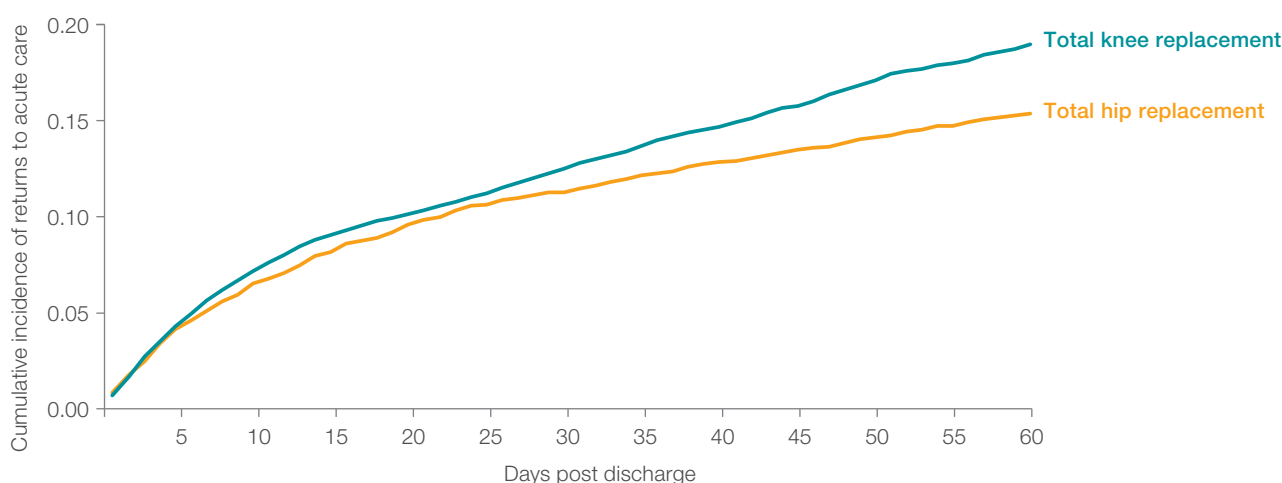
As in-hospital management of orthopaedic complications may not require hospitalisation within 24 hours of diagnosis, both planned and unplanned return to acute care were considered as potentially related. Common planned hospitalisations such as haemodialysis and chemotherapy were excluded.

The reasons for return to acute care were fairly similar across the two procedures (Figure 72). Approximately 60% of returns to acute care within 60 days of discharge for both procedures were due to orthopaedic complications or conditions potentially related to hospital care.

Figure 70 Comparing total hip and total knee replacement procedures, NSW public hospitals, July 2009 – June 2012

Procedure	Number of procedures (index hospitalisations)	60-day return to acute care (unadjusted)	Hospitals (n)
Total hip replacement	7,739	9%	39
Total knee replacement	13,820	11%	40

Figure 71 Cumulative incidence of return to acute care within 60 days by procedure, NSW public hospitals, July 2009 – June 2012

See *Spotlight on Measurement* and Appendix 5 for data specifications.
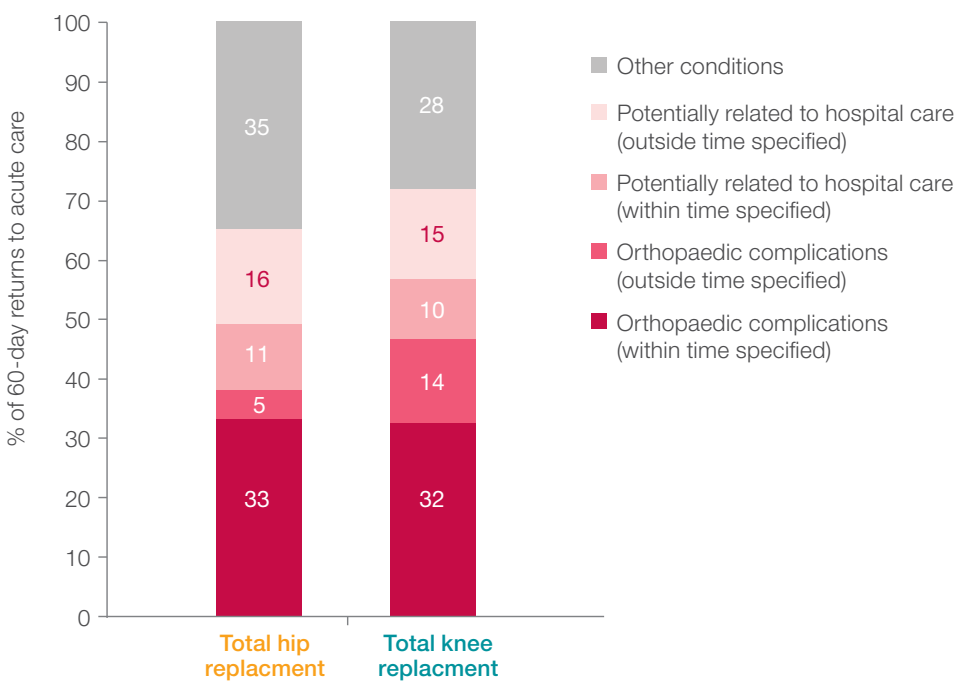
Appendix 1

How to interpret cumulative incidence of returns to acute care

Information about the distribution of unplanned returns to acute care over the 30-day period following discharge may indicate aspects of care that need to be assessed (e.g. a high number of returns to acute care occurring within two days of discharge should prompt a review of discharge processes).

However, an emergency return to acute care is not the only patient outcome measure that may occur during the follow up period. When a patient dies they can no longer return to acute care. The cumulative probability curve derived using the competing risks approach estimates the probability of return to acute care by each day after discharge, while allowing for the possibility of the competing risk of death to occur. In the example below 5% of patients were returned to acute care by day 12.
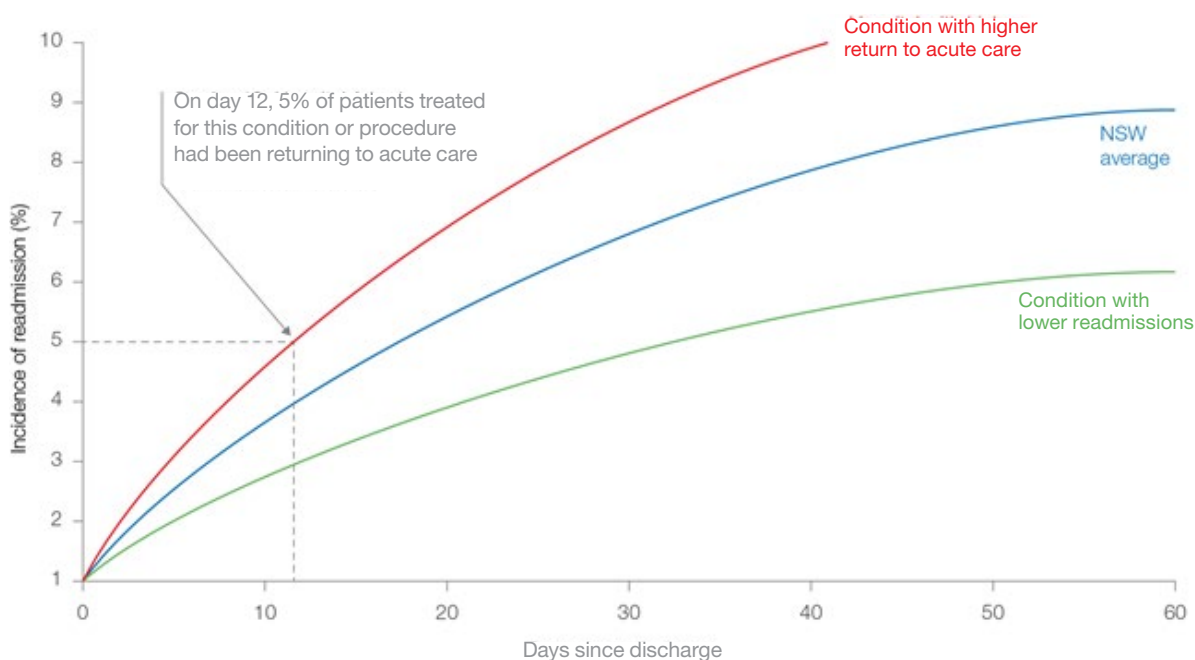
Appendix 2

How to interpret funnel plots

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.

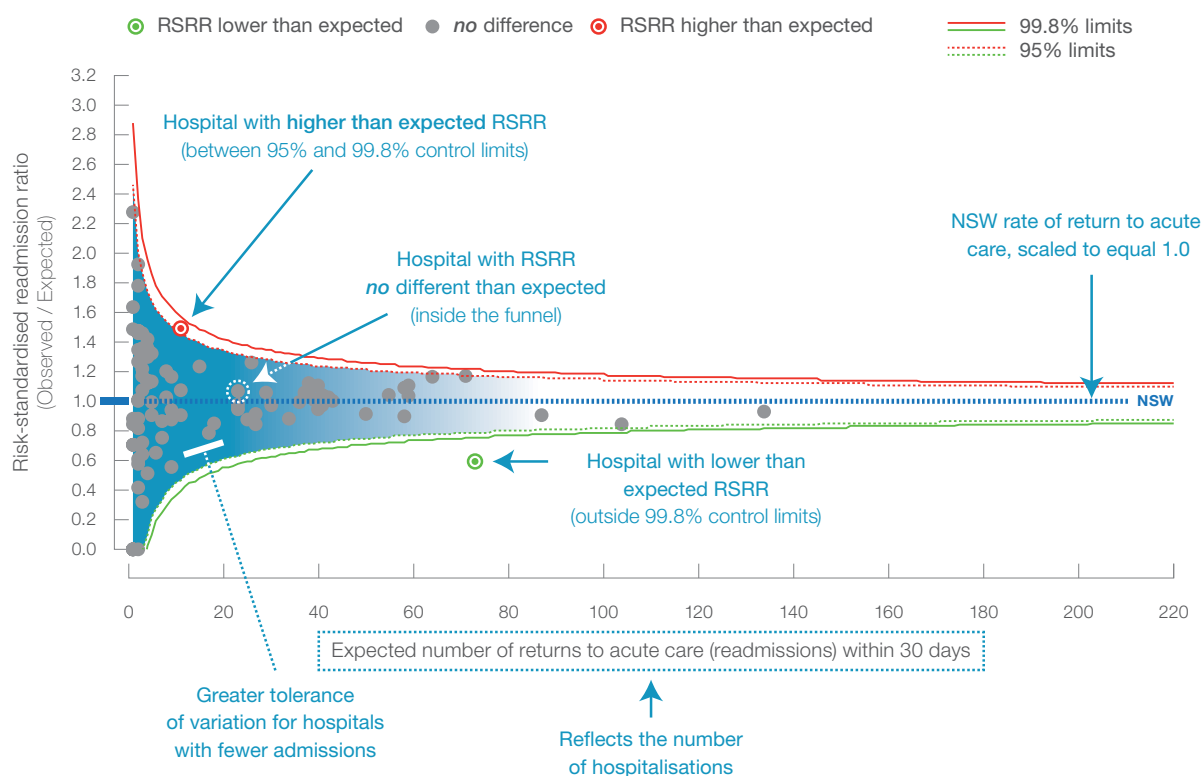The 'funnel' shape that gives the funnel plot its name indicates the tolerance around this variability. Hospitals with fewer hospitalisations (those with a relatively low number of expected returns to acute care, and appearing towards the left hand side of the plot) will display greater variability and 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 RSRRs; those below the 95% limits are considered to have lower than expected RSRRs. For hospitals outside 99.8% limits, there is greater confidence about their outlier status.

The limits quantify the level of confidence in interpreting the results. For example, if 20 hospitals were outside the 95% limit, one would be there by chance only.

Legend: ⊙ RSRR lower than expected ● *no* difference ⊙ RSRR higher than expected — 99.8% limits ···· 95% limits

Risk-standardised readmission ratio (Observed / Expected)

Hospital with **higher than expected** RSRR (between 95% and 99.8% control limits)

Hospital with RSRR *no* different than expected (inside the funnel)

NSW rate of return to acute care, scaled to equal 1.0

Hospital with lower than expected RSRR (outside 99.8% control limits)

Greater tolerance of variation for hospitals with fewer admissions

Expected number of returns to acute care (readmissions) within 30 days

Reflects the number of hospitalisations

Appendix 3

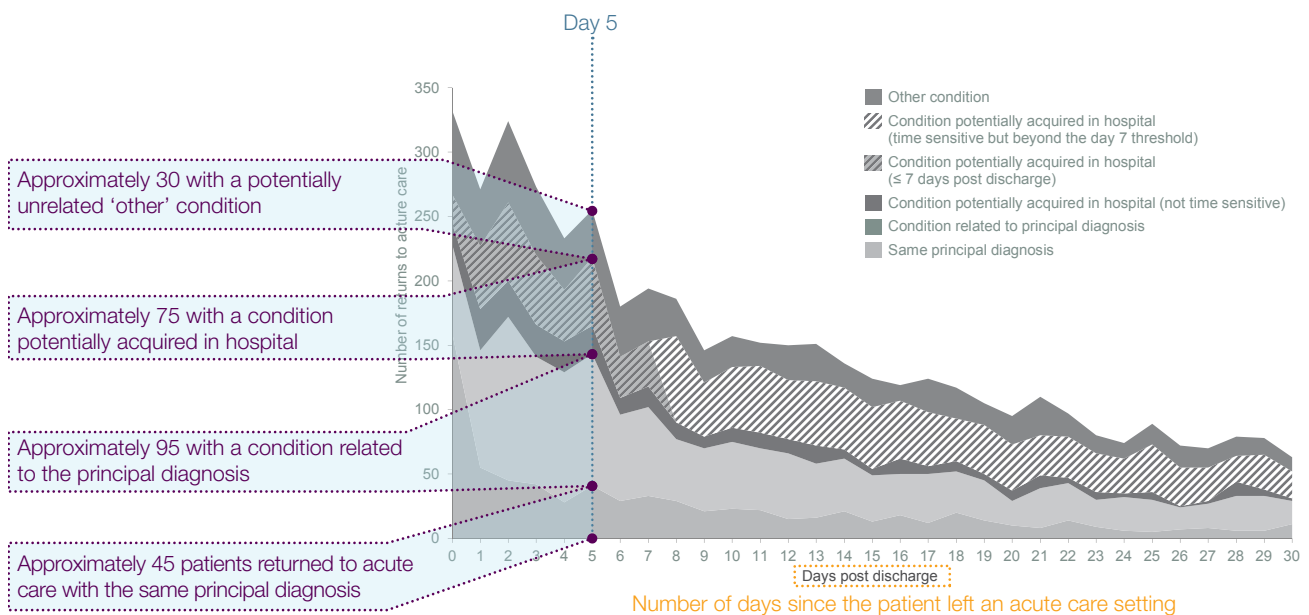## How to interpret return to acute care diagnosis graph

Returns to acute care within 30 and 60 days of discharge were stratified by principal diagnosis. This is the condition recorded in the patient's medical record as chiefly responsible for the hospitalisation. The returns to acute care were stratified as follows:

- Same principal diagnosis as index hospitalisation

- Condition clinically related to the index hospitalisation principal diagnosis (e.g. following an index hospitalisation for acute myocardial infarction, return to acute care for angina)

- Condition potentially related to hospital care including adverse events, complications and poor management of comorbidity (e.g. diabetes)

There are three sub-categories here:

- – Potentially related to hospital care (but not time sensitive)

- – Potentially related to hospital care (if occurring on day 1-7)

- – Potentially related to hospital care (time sensitive but outside the 7-day window)

- Other condition.

The comorbidity and complication diagnoses were based on draft specifications for acute myocardial infarction and specific surgical procedures recently developed by the Australian Institute of Health and Welfare.[23,24]

Approximately 30 with a potentially unrelated 'other' condition

Approximately 75 with a condition potentially acquired in hospital

Approximately 95 with a condition related to the principal diagnosis

Approximately 45 patients returned to acute care with the same principal diagnosis

Day 5

Number of returns to acute care

Other condition

Condition potentially acquired in hospital (time sensitive but beyond the day 7 threshold)

Condition potentially acquired in hospital (≤ 7 days post discharge)

Condition potentially acquired in hospital (not time sensitive)

Condition related to principal diagnosis

Same principal diagnosis

Days post discharge

Number of days since the patient left an acute care setting

Appendix 4

Hospital peer groups

Group	Name	Description
A	Principal referral	Very large hospitals providing a broad range of services,
BM/BNM	Major	Large metropolitan (BM) and non-metropolitan (BNM) hospitals
C1	District group 1	Medium sized hospitals treating 5,000–10,000 patients annually
C2	District group 2	Medium sized hospitals treating 2,000-5,000 patients annually typically in regional and rural locations
D-F		Small non-acute, remote acute and multi-purpose services generally treating <2000 patients annually

Appendix 5

Data notes

- Hospitals with < 50 index hospitalisations are not reported publicly

- Data for hospitals with expected emergency returns to acute care of < 1 are suppressed

- Data are for risk-standardised readmission ratios. Tables include data for peer groups A – C2 only

- To make RSRRs comparable over time, a reference population is required. The time series RSRRs for each hospital are based on the reference years July 2009 – June 2012. Assessment of hospital performance is based on the NSW average within each period.

- Patients are assigned to the discharging hospital.
  Returns to acute care are for all causes.

- Source: SAPHaRI, Centre for Epidemiology and Evidence, NSW Ministry of Health.

Appendix 6

Outlier hospital returns to acute care

Number of index hospitalisations, observed and expected returns to acute care and RSRR,
for outlier hospitals, July 2009 – June 2012

	Outlier hospital	Number of index hospitalisations	Observed number of returns to acute care	Expected number of returns to acute care	Risk standardised readmission ratio
Acute myocardial infarction	*Higher than expected RSRR*				
	Auburn	171	44	29.52	1.49
	Bankstown	335	86	68.24	1.26
	Kempsey	107	30	19.69	1.52
	Manning	231	62	44.90	1.38
	Tamworth	458	88	72.01	1.22
	Lower than expected RSRR				
	Prince of Wales	1,210	167	206.37	0.81
	Royal North Shore	1,147	144	187.42	0.77
Ischaemic stroke	*Higher than expected RSRR*				
	Fairfield	157	28	15.78	1.77
	Liverpool*	610	96	67.80	1.42
	Shellharbour	59	14	7.34	1.91
	Wagga Wagga	276	39	27.74	1.41
	Lower than expected RSRR				
	Manning	205	12	21.47	0.56
Congestive heart failure	*Higher than expected RSRR*				
	Auburn	452	138	104.73	1.32
	Fairfield	483	142	117.03	1.21
	Kempsey	144	46	33.28	1.38
	Milton	71	24	14.92	1.61
	Nepean	735	195	166.31	1.17
	Lower than expected RSRR				
	Blue Mountains	160	25	37.36	0.67
	Dubbo	276	43	60.48	0.71
	Manning	357	66	83.89	0.79
Pneumonia	*Higher than expected RSRR*				
	Auburn	412	72	49.78	1.45
	Lithgow	171	35	19.71	1.78
	Liverpool	1089	198	155.63	1.27
	Milton	132	29	15.17	1.91
	Mount Druitt	64	15	6.68	2.25
	Nepean	1079	172	138.03	1.25
	Wagga Wagga	542	85	69.97	1.21
	Westmead	1599	264	222.86	1.18
	Lower than expected RSRR				
	Blue Mountains	293	21	36.80	0.57
	Camden	71	2	8.50	0.24
	Maitland	520	46	69.23	0.66

* Data for ischaemic stroke patients admitted to Liverpool Hospital revealed a high use of type change separations (statistical discharges) and a high rate of return to acute care for these separations. It is not possible to ascertain the extent to which this idiosyncrasy affected the RSRR results for Liverpool Hospital.

** Data for hip fracture surgery patients discharged from Grafton Hospital revealed that of the total 14 returns to acute care, 11 (79%) underwent surgery at another hospital.

Outlier status is only reported for peer group A-C hospitals that discharged >49 cases with 30 days of follow-up information in the study period.

	Outlier hospital	Number of index hospitalisations	Observed number of returns to acute care	Expected number of returns to acute care	Risk standardised readmission ratio
Hip fracture surgery	Higher than expected RSRR				
	Grafton**	78	14	8.14	1.72
	Nepean	555	85	56.55	1.50
	St George	562	76	57.47	1.32
	Westmead	532	70	53.84	1.30
	Lower than expected RSRR				
	Gosford	818	55	80.92	0.68
	John Hunter	1033	83	106.69	0.78
	Liverpool	476	35	50.07	0.70
Total hip replacement	Higher than expected RSRR				
	Bankstown	166	24	15.46	1.55
	Nepean	94	15	8.91	1.68
	Wagga Wagga	273	48	25.14	1.91
	Wollongong	297	48	29.42	1.63
	Wyong	140	21	12.23	1.72
	Lower than expected RSRR				
	Hornsby	169	3	16.68	0.18
	RPA IRO	634	12	53.74	0.22
Total knee replacement	Higher than expected RSRR				
	Armidale	91	18	10.41	1.73
	Coffs Harbour	451	73	51.82	1.41
	Nepean	205	33	22.74	1.45
	Shoalhaven	195	42	22.61	1.86
	Tamworth	230	40	24.62	1.62
	Wagga Wagga	428	89	48.83	1.82
	Lower than expected RSRR				
	Fairfield	1072	67	116.35	0.58
	Hornsby	284	18	33.10	0.54
	RPA IRO	1079	59	118.15	0.50

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Acknowledgements

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

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

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