Case study 4 — Cholecystectomy (gall bladder surgery)
Hospital costs and outcomes study for NSW Health

Other Industries
July 2010
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1 Introduction and executive summary

NSW Health is currently coordinating a project that ultimately aims to improve clinical practice and efficiency consistently across the NSW hospital system. The project involves 6 components, and is designed to enable development of a methodology that makes better use of available data to compare patient mix, costs, clinical practice and outcomes and which can then be applied across other hospitals to improve performance. (See Box 1.1 for more information.)

NSW Health asked the Independent Pricing and Regulatory Tribunal of NSW (IPART) to conduct a costs and outcomes study that encompasses 3 components of this larger project. The aim of the study was to provide information and analysis that can be used by clinical experts to better understand the variation in clinical practice in NSW hospitals, and the extent to which this variation can lead to differences in hospital costs and clinical outcomes.

IPART’s study involved comparing costs, configurations of care and outcomes in 5 selected NSW hospitals:

- Royal Prince Alfred Hospital (RPAH)
- Royal North Shore Hospital (RNSH)
- John Hunter Hospital (JHH)
- Bankstown-Lidcombe Hospital (BLH), and
- Gosford Hospital (GH).

To do this, we analysed management practices at the hospital-wide level and did detailed case studies of 11 specific clinical areas. As costs, configurations of care and relevant indicators of outcomes vary significantly depending on the condition of the patient and/or the procedure undertaken, these case studies allowed us to compare the hospitals on a more like-with-like basis. This document discusses our findings in one of these 11 clinical areas – cholecystectomy (surgical removal of the gall bladder). (See Box 1.2 for the full list of clinical areas we examined, how they were selected, and how we conducted the case studies.)
Box 1.1 NSW Health Project

IPART's hospital costs and outcomes study is part of a larger, multi-stage project NSW Health is coordinating with the assistance of other organisations. The terms of reference for this project set out 6 components:

1. Audit the quality of current coding and costing data.
2. Analyse differences in costs between 3 principal tertiary referral hospitals and 2 other principal referral hospitals.
3. Describe the different configurations of care that underpin different cost profiles.
4. Analyse available data on differences in adjusted admission rates and clinical outcomes for the 5 selected hospitals.
5. Determine whether variations in configurations of care lead to different clinical outcomes.
6. Identify the extent to which clinical variation exists, with the aim of achieving clinical best practice and maximum efficiency.

The first component is being completed by Health Outcomes International (audit of costing) and Pavilion Health (audit of coding). The results will assist the NSW Department of Health in further developing episode funding, in line with the national agreement by the Council of Australian Governments (COAG) to move to a more nationally consistent approach to activity-based funding. IPART has completed the second, third and fourth components through our hospital costs and outcomes study. The results of this study will be used by clinical experts in completing the fifth and sixth components.

The NSW Health project is part of its response to the findings and recommendations made in the Report of the Special Commission of Inquiry into Acute Care Services by Commissioner Garling.\(^a\)

\(^a\) Flowing from the NSW Government’s response to the Garling Inquiry (Caring Together - The Health Action Plan for NSW (2009)), ‘four pillars’ of clinical improvement have been established – Clinical Excellence Commission (CEC), Agency for Clinical Innovation (ACI), Bureau of Health Information (BHI) and Clinical Education and Training Institute (CETI). IPART’s analysis on costs, clinical practice and outcomes is to be considered by the NSW Department of Health and clinical experts in these agencies to assess whether variations in configurations of care lead to different clinical outcomes and to identify the extent to which clinical variation exists, with the aim of achieving clinical best practice and maximum efficiency.
Box 1.2  IPART’s case studies

To compare costs, configurations of care and outcomes in the 5 study hospitals, we focused on 11 specific conditions or procedures in detail (as well as undertaking a broad, hospital-wide analysis). These conditions/procedures are:

- Hip joint replacement
- Major chest procedures
- Breast surgery
- Cholecystectomy
- Appendicectomy
- Stroke
- Cardiology – stents, pacemakers and defibrillators
- Tracheostomy, or ventilation for greater than 95 hours
- Cataract/lens procedures
- Hysterectomy, and
- Obstetric delivery.

In selecting these conditions/procedures, and the relevant indicators to compare for each, we were advised by a clinical consultant (Dr Paul Tridgell) and a clinical reference group (Professor Bruce Barraclough, Dr Anthony Burrell, Dr Patrick Cregan, Professor Phillip Harris, Professor Clifford Hughes, Professor Brian McLaughan, Professor Peter McClusky, Dr Michael Nicholl, Professor Ron Penny, Professor Carol Pollock and Dr Hunter Watt).

The case studies were selected to provide a range of surgical procedures and a range of medical conditions that met one or more of the following criteria:

- high volumes
- high reported costs
- high variability in reported costs
- apparent differences in clinical practice, or
- a range of models of care.

To conduct the case studies, we visited each of the hospitals and spoke with a range of staff, including clinical, nursing, management, finance, coding and administrative staff. We also collected a range of clinical and financial data from NSW Health, relevant area health services and hospitals. By analysing the data and speaking with clinical experts, we established the most suitable data available for comparing hospitals on a like-with-like basis.

For further information on our methodology and broad findings on costs, outcomes and configurations of care, see our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*. Our detailed findings on the other case study areas can be found in our reports on each area.
1.1 Why did we select cholecystectomy as one of the case studies?

Cholecystectomy was selected as one of the clinical areas for detailed study because it involves:

- high volumes
- large differences in reported costs between hospitals, and
- differences in reported lengths of stay.

1.2 What was the scope of the cholecystectomy case study?

The cholecystectomy case study compared the costs, configurations of care and outcomes related to surgical removal of the gall bladder. See Box 1.3 for a more detailed explanation of a cholecystectomy.

**Box 1.3 What is a cholecystectomy?**

A cholecystectomy is a surgical procedure for the removal of the gall bladder. The gall bladder is a sac attached to the digestive system that contains bile to break down fats.

A cholecystectomy is most commonly undertaken because of cholecystitis, an inflammation of the gall bladder wall. Gallstones usually cause this inflammation by blocking the flow of bile from the gall bladder to the liver. If gallstones are not treated, some patients can end up with pancreatitis. This is a serious disease where the duct at the end of the gall bladder can leak bile and damage the small intestine.

Gallstones are present in about 10% to 15% of the adult western population. Between 1% and 4% become symptomatic (pain, inflammation) each year.

We used diagnostic related groups (DRGs) to define the procedures and identify the data included in the scope of the case study (see Table 1.1).

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1 In 2007/08, 43,777 cholecystectomies were undertaken in Australian hospitals. See Australian Institute of Health and Welfare, AR-DRG Data Cubes, Separation, patient day and average length of stay statistics by Australian Refined Diagnosis Related Group (AR-DRG) Version 5.0/5.1, Australia, 1998-99 to 2007-08 (http://d01.aihw.gov.au/cognos/cgi-bin/ppdscgi.exe?DC=Q&E=/AHS/drgv5_9899-0708_v2).
Introduction and executive summary

Case study 4 – Cholecystectomy (gall bladder surgery)

Table 1.1 DRGs included in the scope of the cholecystectomy case study

<table>
<thead>
<tr>
<th>DRG</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H07A</td>
<td>Open cholecystectomy with closed common duct exploration or with catastrophic complication or comorbidity</td>
</tr>
<tr>
<td>H07B</td>
<td>Open cholecystectomy without closed common duct exploration or without catastrophic complication or comorbidity</td>
</tr>
<tr>
<td>H08A</td>
<td>Laparoscopic cholecystectomy with closed common duct exploration or with catastrophic or severe complication or comorbidity</td>
</tr>
<tr>
<td>H08B</td>
<td>Laparoscopic cholecystectomy without closed common duct exploration or without catastrophic or severe complication or comorbidity</td>
</tr>
</tbody>
</table>

Note: There are clinical criteria for distinguishing between these DRGs, which are based on the Australian Coding Standards.

The DRGs for this case study are divided into the two surgical approaches for performing a cholecystectomy:

- open surgery, which involves an incision into the abdomen below the lower right ribs, or
- laparoscopic surgery, which involves three to four small incisions being made into the abdomen for a camera and instruments to pass through.

Laparoscopic cholecystectomy is the main approach used in Australian hospitals, comprising around 94% of cholecystectomies in 2007/08.2

Unless specified otherwise in this case study, the data we analysed related to the 12 months from 1 July 2008 to 30 June 2009.

1.3 What were the key findings of the cholecystectomy case study?

To compare the costs, configurations of care and outcomes of cholecystectomy procedures at the study hospitals, we collected, analysed and compared data on:

- the number and mix of cholecystectomy patients at each hospital
- the average length of stay for these patients at each hospital
- selected costs or major clinical resources to provide acute inpatient care for these patients at each hospital
- the configurations of care used to provide and manage cholecystectomy patient care at each hospital
- indicators of outcome, safety and quality for cholecystectomies for each hospital.

Our key findings are summarised below.

1.3.1 **Number and mix of patients**

The proportion of emergency admission at the study hospitals varied. It was highest at JHH and lowest at GH and BLH.

We found that it was necessary to separate cholecystectomy cases into planned and emergency admissions to meaningfully compare costs, configurations of care and outcomes between the two groups.

1.3.2 **Average length of stay**

We found that the average length of stay for planned admissions is significantly lower than that for emergency admissions. Further, there is a smaller variation in stays at the study hospitals for planned admissions than for emergency admissions.

In relation to emergency admissions, JHH had the lowest average length of stay and GH had the highest. For planned admissions, BLH had the lowest average length of stay and GH and RNSH had the highest.

The difference in average length of stay for emergency admissions is significantly influenced by a few patients with a length of stay of 20 days or more. If these outliers are excluded, there is only a small difference between stays at RPAH, GH, RNSH and BLH.

1.3.3 **Costs of inpatient care**

To compare the costs related to the case study areas at the study hospitals, we examined the management and use of a selection of clinical resources used directly for patient care in that area. For cholecystectomy, the main clinical resources we examined were nursing staff in wards, imaging, pathology and operating theatre times. We had aimed to also estimate medical staff costs and pharmacy costs for this case study, but were unable to obtain consistent comparisons within the timeframe for this review.\(^3\)

**Cost of nursing staff in wards**

We found that the nursing costs for planned admissions were significantly lower than those for emergency admissions. We also found that average length of stay was the main driver for nursing costs at the study hospitals.

In relation to emergency admissions, JHH had both the lowest average length of stay and nursing costs per acute episode. For planned admissions, the small variation in average length of stay across the study hospitals was reflected in a similarly small variation in nursing costs per acute episode.

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\(^3\) Medical staff costs and pharmacy are discussed in Chapters 9 and 14 of our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals.*
The hospitals use inpatient fractions (IFRACs) to allocate staff time to acute care and other staff responsibilities. We found that nursing costs were highly sensitive to the IFRACs the hospitals apply to them. RNSH used a lower IFRAC than the other study hospitals. When all nursing costs were attributed to inpatient care (ie, IFRACs=1), the nursing costs per day varied even more for emergency admissions at the study hospitals.

Staffing mixes differed at the study hospitals. JHH had the highest proportion of clinical nurse specialists and registered nurses, whereas GH and BLH had a higher proportion of enrolled nurses and assistants in nursing.

**Imaging and pathology costs**

We found that emergency admissions had a much higher use of imaging and pathology services than planned admissions. Further, RNSH generally had higher imaging and pathology costs than the other hospitals.

**Operating theatre times**

While we were unable to estimate operating theatre costs, we did compare the average time between surgery commencing and surgery finishing at the study hospitals. The average operating theatre time for emergency procedures was fairly uniform at about 90 minutes to 100 minutes and it was slightly higher than planned procedures at most hospitals.

There may be a correlation between theatre time and use of fluoroscopy imaging during surgery. The low rate of fluoroscopy use at RPAH may account for its relatively shorter surgical procedure times for planned admissions.

**National Hospital Cost Data Collection**

The National Hospital Cost Data Collection (NHCDC) reports estimates of average hospital costs based on data it collects from hospitals around Australia. In this study, we had access to the study hospitals’ provisional de-identified patient-level data for 2008/09, as well as the overall averages publicly reported by the NHCDC for different hospital groupings in 2007/08. The final NHCDC estimates for study hospitals for 2008/09 became available towards the end of our study. We compared these to the provisional costs and found that some of the costs had changed substantially. Give the limited time available, we used the final costs only where these were substantially different from the provisional costs.

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4 In NSW, these cost estimates are often compiled by area health services, rather than individual hospitals.

We were able to compare study hospitals’ NHCDC estimates with our estimates of nursing, imaging and pathology costs. We used the final NHCDC costs to adjust the provisional pathology costs for GH and RNSH, and for operating theatre costs. We found a greater degree of consistency in the following costs than reflected in the NHCDC:

- nursing costs for planned admissions
- imaging costs for emergency admissions
- pathology costs for both emergency and planned admissions, and
- operating theatre costs.

1.3.4 Configurations of care

We identified the following major differences in the way the study hospitals managed and provided care for cholecystectomy patients:

- the rates of cholecystectomies for emergency admissions
- the use of a dedicated emergency surgical team at JHH
- the use of CT scans for emergency admissions
- the use of fluoroscopy and operative cholangiograms
- the rates of completing cholecystectomies within 24 hours of planned admissions

Rates of cholecystectomies for emergency admissions

There are differences across the study hospitals in the treatment of patients with acute cholecystitis. Clinicians can often choose whether to:

- perform the cholecystectomy during the emergency admission, or
- treat the patient’s symptoms, discharge them and readmit them at a later date as a planned admission to perform the cholecystectomy.

The rate of cholecystectomies from emergency admissions is lowest at GH and highest at JHH. GH may have the lowest rate due to limited access to theatre time.

The different treatment options create difficulties when assessing the efficiency of the cholecystectomy. Normally it is assessed by examining the cost of the acute hospital admission related to the surgery. However, it does not take into account the cost of related admissions. That is, the costs arising from patients, who have been discharged home from an emergency admission and are waiting to have planned surgery, being readmitted to emergency with another acute episode of cholecystitis.

In addition, hospitals that have higher numbers of planned surgeries in favour of emergency surgeries will appear more efficient based on basic casemix measures. However, they may actually be less efficient if prior related emergency admissions are taken into account.
Dedicated emergency surgical team at JHH and use of CT scans for emergency admissions

JHH has a dedicated emergency surgical team with senior surgical staff that provide input early in patient assessments. This results in lower CT usage and may have been a large contributor in the shorter length of stay for emergency admissions at JHH.

Use of fluoroscopy and operative cholangiograms

Another variation in practice for cholecystectomy procedures is whether or not fluoroscopy imaging is used to carry out an operative cholangiogram. There may be a correlation between lower uses of fluoroscopy imaging during surgery and shorter theatre times for planned admissions. However, use of fluoroscopy may reduce certain surgical risks.

Completion of cholecystectomies within 24 hours of planned admission

We found that there were differences in treatment times for the more common, less complicated cholecystectomy DRG H08B. The proportion of these cases completed within 24 hours of planned admission ranged from 71% to 100% among clinicians at the study hospitals.

1.3.5 Outcome, safety and quality indicators

The terms of reference for this study required us to analyse available data on differences in clinical outcomes across the 5 study hospitals. However, we found that few data on indicators of clinical outcomes are collected consistently across hospitals, or on a state-wide (or national) basis. Therefore, we worked with clinical experts to establish a set of outcome, safety and quality indicators that are clinically relevant, and for which we could feasibly obtain data in the timeframe for our study.

While collecting data, we found that the number of deaths, wound infections and unplanned returns to theatre for cholecystectomy patients at the study hospitals were very small. As such, we expanded the scope of the clinical indicators to cover ‘general surgery’, so that the data included both cholecystectomy and appendicectomy patients.

We considered the performance of the study hospitals against the clinical indicators. We found that there were no statistically significant differences between the study hospitals’ risk-adjusted 30-day mortality rates. However, JHH and RPAH had the highest risk-adjusted wound infection rates.

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6 Laparoscopic cholecystectomy without closed common duct exploration or without catastrophic or severe complication or comorbidity.
1.4 What are the key implications of these findings?

Rates of cholecystectomies for emergency admissions

We consider that there is a case for NSW Health to examine whether the difference in acute operative rates for cholelithiasis or cholecystitis has significant quality of care implications.

Some conditions are likely to reoccur if they are not treated acutely. By focusing on the cost of a single acute episode, episode funding may not identify inefficiencies in practice eg, discharge emergencies and have repeat admissions for same condition. Instead, it may be desirable to identify the number of prior repeat admissions and add up cost to get a better handle on cost of alternative approaches.

Dedicated emergency surgical teams

Emergency surgical teams appear to help provide rapid assessment for surgical patients, reducing lengths of stay for emergency cases and reducing CT use. The length of stay of the emergency admissions at JHH was less than the other 4 hospitals.

We consider there is a case for NSW Health to consider the relative costs and benefits of JHH’s dedicated emergency surgical team model for ensuring early diagnosis and treatment of conditions like cholecystectomy and whether it should be more widely applied.

Use of fluoroscopy and operative cholangiograms

We consider that there is a case for NSW Health to consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.

Variation in wound infection rates

There were significant differences between the study hospitals in relation to wound infection rates. These differences should be investigated further by NSW Health and appropriate clinical expert groups.

1.5 List of recommendations

1. That NSW Health and appropriate clinical expert groups note the variation in the proportion of patients with cholelithiasis or cholecystitis who are operated on acutely as emergency admissions.

2. That NSW Health arranges for clinical expert groups to consider whether this variation has significant quality of care implications.
3 That NSW Health notes that costing of cholecystectomy should take into account the costs of prior related emergency department attendances. A similar approach should be adopted for other clinical conditions that are likely to involve multiple prior emergency department attendances.

4 That NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of an emergency surgical services team model for ensuring early diagnosis and treatment of conditions like cholecystectomy and whether it should be more widely applied.

5 That NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.

6 That NSW Health and clinical expert groups review the variation in wound infection rates for cholecystectomy surgery at the study hospitals, and if appropriate, take steps to address the variation.

1.6 What does the rest of this report cover?

The rest of this report discusses the findings of the cholecystectomy case study in more detail:

- Chapter 2 compares the number and mix of cholecystectomy patients at the study hospitals.
- Chapter 3 compares the length of stay for cholecystectomy patients at the study hospitals, and describes the method we used to compare length of stay on a consistent basis.
- Chapter 4 describes how we analysed the costs of cholecystectomy by identifying the main clinical resources used to provide inpatient care, then estimating and comparing the level of each resource used at the study hospitals. It also compares our cost estimates with estimates based on the provisional or final data reported to NSW Health as part of the NHCDC.
- Chapter 5 compares the configurations of care for cholecystectomy patients at the study hospitals and highlights key differences.
- Chapter 6 discusses the indicators of outcome, safety and quality for cholecystectomy we identified as clinically meaningful. It then compares the available data on these indicators across the study hospitals.
- The appendices contain the complete list of recommendations for our hospital costs and outcomes study, a list of indicators with data sources and risk adjustment factors, and the glossary.
2 Number and mix of patients across study hospitals

We identified the total number of cholecystectomy cases at each hospital during the study period, and the proportions of these that were emergency or planned admissions. In addition, we considered the age of patients at the study hospitals.

We found that the number of cholecystectomy patients the study hospitals treated was fairly uniform. However, there was a difference in the mix of emergency and planned admissions at the study hospitals.

The sections below discuss our analysis of patient numbers and mix in more detail.

2.1 Number of cholecystectomy cases at each study hospital

Our data indicates that the 5 study hospitals treated a total of 1,179 cholecystectomy cases during the study period. It also shows that while the number of cases at each hospital was broadly the same, the emergency/planned admission mix differed (see Table 2.1).

Table 2.1 Cholecystectomy cases at study hospitals, DRGs H07A, H07B, H08A, H08B

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases (no.)</td>
<td>280</td>
<td>201</td>
<td>131</td>
<td>294</td>
<td>273</td>
<td>1,179</td>
</tr>
<tr>
<td>Transfers in (%)</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Transfers out (%)</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Emergency admissions (%)</td>
<td>34</td>
<td>16</td>
<td>41</td>
<td>16</td>
<td>51</td>
<td>31</td>
</tr>
<tr>
<td>Planned admissions (%)</td>
<td>65</td>
<td>82</td>
<td>56</td>
<td>79</td>
<td>44</td>
<td>66</td>
</tr>
</tbody>
</table>

**Note:** See Box 2.1 and Box 2.2 for details on how we calculated the number of cases, and identified emergency and planned admissions and transfers. ‘Emergency admissions’, ‘planned admissions’, ‘transfers in’ and ‘transfers out’ are not mutually exclusive categories, so adding together the proportion of patients in these categories will not necessarily equal 100%. For example, some patients may be on the waiting list as a planned admission, but be admitted through the emergency department, and so also be categorised as an emergency admission.

**Source:** HIE inpatient statistics, 2008/09 and IPART analysis.

BLH, RPAH and JHH had similar numbers of cases with 294, 280 and 273, respectively. GH had 201 cases and RNSH had 131 cases.
Box 2.1 provides more detail on how we calculated the number of cases at each hospital.

**Box 2.1  How we calculated the number of cholecystectomy cases**

To calculate the number of cholecystectomy cases at the study hospitals, we:

- used patient episode data for 2008/09
- counted adjoining episodes as part of the same stay (ie, adjoining episodes counted as one case)
- only included patient data where the whole patient stay occurred within 2008/09 (ie, all episodes and adjoining episodes had to start on or after 1 July 2008 and end on or before 30 June 2009 to be counted)
- only included patient data where the first episode in the year in the study hospital was coded as a DRG for a cholecystectomy (ie, episode sequence number had to be 1).

The approach prevented double counting. It excluded cases where the patient was admitted for a different procedure and later reclassified to a cholecystectomy DRG.

**Note** Our approach means that the number of cases we identified will be less than the number of separations in 2008/09.

**2.1.1  Emergency/planned admissions mix**

The proportion of cases that were operated on as emergency admissions varied significantly at each hospital.

JHH had the highest proportion of cases as emergency admissions, with 51%. The next highest proportions were 41% and 34% at RNSH and RPAH, respectively. GH and BLH had similarly low rates at 16%.

Box 2.2 describes the method we used to identify planned and emergency admissions, as well as transfers.
Box 2.2 How we identified emergency and planned admissions and transfers

We used information from the HIE to identify cases that were admitted through the emergency department (emergency admissions), as well as those which were removed from the ‘waiting list’ for surgery at the time of their admission to hospital (planned admissions).

Emergency admissions were identified by linking emergency department attendance data with admitted patient data where the time of arrival and departure in the emergency department matched with the admission time. Note that some of the patients that are transferred in are not included in the emergency figures.

Planned admissions were identified by linking waiting list data with inpatient data where the waiting list removal code was a planned admission and time on the list was more than 1 day.

Due to data quality issues with the transfer in and transfer out fields in the admitted patient data, transfers were calculated using a linkage key developed by the Australian Institute of Health and Welfare.

As discussed in the following chapters, we found significant differences between planned and emergency admissions. Therefore, we have separated the cholecystectomy cases into these subgroups (ie, planned and emergency admissions) in order to meaningfully analyse lengths of stay, costs and configurations of care across the study hospitals.

2.2 Age of patients

Table 2.2 shows the average age of patients who had a cholecystectomy at each of the study hospitals.

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
<td>years</td>
<td></td>
<td>years</td>
<td>years</td>
<td>years</td>
<td>years</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>51</td>
<td>55</td>
<td>51</td>
<td>52</td>
<td>51</td>
</tr>
</tbody>
</table>

Note: Age at date of admission.

Source: HIE inpatient statistics, 2008/09 and IPART analysis.

The average age of patients in all hospitals was 51 years old, ranging from 50 years for RPAH to 55 years for RNSH. The youngest patient was 12 years old and the oldest was 92 years old.
3 Length of stay across study hospitals

We examined the average length of stay of cholecystectomy patients because it is one of the factors that influence the cost of an individual’s hospital care. This is because a large component of this cost is nursing care (and this cost increases with the length of stay). In addition, differences in length of stay can point to differences in casemix or clinical practice between hospitals.

We calculated the average length of stay across all study hospitals for cholecystectomy cases using 3 different measures:

- episode length of stay in study hospital (LOS1)
- total length of stay in study hospital (LOS2)
- total length of stay in study hospital and 2 other hospitals – one transfer in and one transfer out (LOS3).

Box 3.1 provides more detail on these measures. The sections below set out our analysis of length of stay for emergency and planned cholecystectomy cases, with a focus on LOS1 and LOS3.
Box 3.1 The 3 measures of length of stay we used for cholecystectomy patients

1. **Episode length of stay in study hospital (LOS1)**

This is the average number of days a patient stayed in the study hospital for a single acute episode. This measure is often used in NHCDC and DRG benchmarking analyses. We used this measure to enable comparisons to be made between our cost estimates and those included in the NHCDC (discussed in Chapter 4).

2. **Total length of stay in study hospital (LOS2)**

This is the total number of days a patient stayed in the study hospital from admission to discharge. It includes all consecutive episodes including acute, rehabilitation and any other types of care. However, for some conditions/procedures, patients can be:

- transferred to the study hospital from another hospital, and/or
- transferred from the study hospital to another.

LOS2 does not include the length of stay in such other hospitals, so does not provide a consistent basis for comparing average length of stay required to care for certain conditions/procedures.

3. **Total length of stay in study hospital plus up to 2 other hospitals – one transfer in and one transfer out (LOS3)**

The third measure is the total length of stay in the study hospital (ie, LOS2), plus the total length of stay at 2 other hospitals – one ‘transfer in’, and one ‘transfer out’. Ideally all related hospital stays would be linked, but we have only added up to one additional hospital stay at either end of the stay in the study hospital. We used the linkage key developed by the Australian Institute of Health and Welfare (AIHW) for use between all public and private hospitals. This step is not routinely done in hospital comparisons.

We consider that LOS3 is a more consistent basis for comparing average length of stay for certain conditions/procedures because it takes account of differences in hospital:

- administrative practices for reclassifying patients between their acute care and other phases of care (type changes)
- access to rehabilitation facilities (transfers out)
- patterns of referral from other hospitals (transfers in).

### 3.1 Comparing length of stay for emergency and planned cholecystectomy cases

Table 3.1 and Table 3.2 compare the length of stay between the hospitals for emergency admissions (including transfers in) and planned admissions. We found that the average length of stay for planned admissions is significantly lower than that for emergency admissions.
### Table 3.1 Average length of stay for emergency admissions and ‘transfers in’

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS1</td>
<td>6.8</td>
<td>9.4</td>
<td>7.7</td>
<td>7.7</td>
<td>4.7</td>
<td>6.5</td>
</tr>
<tr>
<td>LOS1 (excluding outlier cases with LOS &gt;20)</td>
<td>5.9</td>
<td>7.0</td>
<td>6.8</td>
<td>7.4</td>
<td>4.5</td>
<td>5.8</td>
</tr>
<tr>
<td>LOS3</td>
<td>7.1</td>
<td>10.8</td>
<td>8.8</td>
<td>7.8</td>
<td>6.1</td>
<td>7.4</td>
</tr>
</tbody>
</table>

**Note:** DRG H07A, H07B, H08A and H08B.  
**Source:** HIE inpatient statistics, 2008/09 and IPART analysis.

The average total number of days in hospital (LOS3) for emergency admissions and ‘transfers in’ ranges from 6.1 days at JHH to 10.8 days at GH. JHH has a dedicated emergency surgical team (see section 5.2), which may explain its lower length of stay.

Average length of stay for emergency admissions is significantly influenced by a few patients with a length of stay of 20 days or more. If these outliers are excluded, there is only a small difference between acute stays (LOS1) at RPAH, GH, RNSH and BLH. JHH continues to have the shortest length of stay using this measure.

### Table 3.2 Average length of stay for planned admissions

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS1</td>
<td>1.6</td>
<td>1.9</td>
<td>1.8</td>
<td>1.5</td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td>LOS3</td>
<td>1.5</td>
<td>1.8</td>
<td>1.8</td>
<td>1.3</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**Note:** DRG H07A, H07B, H08A, H08B. In some instances LOS3 will be slightly shorter than LOS1 because LOS1 is calculated using hours on the ward while LOS3 is calculated using days. Therefore, if a patient is admitted in the morning for surgery and discharged early afternoon of the next day, the average length of stay would be 30 hrs or 1.25 days; under LOS3 this would be 1 day and under LOS1 this would be 1.25 days.  
**Source:** HIE inpatient statistics, 2008/09 and IPART analysis.

The average total number of days in hospital for planned admissions ranges from 1.3 days at BLH to 1.8 days at GH and RNSH. As such, there is substantially less variation in length of stay between the hospitals for planned admissions than for emergency admissions and ‘transfers in’.

The study hospitals have different practices for operating on patients who are admitted through the emergency department with cholecystitis. For example, some clinicians prefer to treat a patient’s symptoms, discharge them and readmit them at a later date (ie, as a planned admission) to perform the cholecystectomy. As such, when analysing the stays for cholecystectomies, it is important to also consider the stays for any related admissions for cholecystitis. This issue is discussed in further detail in Chapter 5.
4 Costs of providing inpatient care

To compare the costs of caring for cholecystectomy patients at the study hospitals, we examined the major clinical resources used to provide inpatient care during their ‘acute episode’ (ie, using LOS1). The clinical resources we examined were:

- nursing staff in wards
- imaging
- pathology, and
- operating theatre time.

The sections below discuss our analysis of the estimated costs for each of these resources across the study hospitals. For some resources, they also compare our estimated costs with estimates based on provisional or final data reported to NSW Health by Area Health Services as part of the NHCDC.\(^7\)

Note that given the scope of our task for this study, we were not able to undertake a full bottom-up costing of all the above resource categories. Instead, we used a range of approaches, based on the most reliable and consistent data we could obtain in the time available. The methodologies we used are outlined in the sections below, and discussed in more detail in our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*. Also note that while junior and senior medical staff are a major cost for cholecystectomies, we were not able to compare the use and management of these clinical resources due to the lack of consistent data.

We have separately analysed the costs for emergency and planned admissions. Costs differ between these subgroups because the diagnosis is clear for planned admissions. Further, any tests required before an anaesthetic is given have been done prior to the planned admission.

4.1 Cost of nursing staff in wards

Nursing is one of the largest expenditure areas in hospital budgets and is a significant part of the cost of the acute care of patients having cholecystectomies.

\(^7\) Due to time constraints, we used the final data only where there were substantial differences between the provisional and final data. For this case study we used final NHCDC to adjust the provisional pathology costs for GH and RNSH and for operating theatre costs.
4.1.1 Methodology

To analyse this cost and allow comparisons with the NHCDC, we focused on:

- the cost of nursing staff in wards (ie, excluding those of nursing staff in operating theatres or senior nursing categories that provide area-wide or hospital-wide functions)
- nursing costs for the acute episode only (ie, LOS1).

Our methodology for estimating nursing costs and its limitations are briefly described in Box 4.1 and in more detail in Chapter 8 of our main report. Further, these estimates should be considered in light of the discussion in Chapter 3 on the limitations of using LOS1 relative to LOS3 (the length of stay for the acute episode plus other episodes plus up to one transfer in and one transfer out).

4.1.2 Use of IFRACs

The hospitals use inpatient fractions (IFRACs) to allocate staff time to acute care and other staff responsibilities. We calculated two sets of inpatient nursing costs, the first using the hospitals’ IFRACs and the second setting all IFRACs to 1. We did this because we were concerned that IFRACs may not be consistently applied by the hospitals.

For emergency admissions, BLH has an IFRAC of 1, JHH and RPAH have similar IFRACs of 0.95 and 0.94 respectively, GH has an IFRAC of 0.89, while RNSH has an IFRAC of 0.80. For planned admissions, RPAH has an IFRAC of 1, JHH and BLH have similar IFRACs of 0.98 and 0.97 respectively, GH has an IFRAC of 0.91, while RNSH has an IFRAC of 0.80. These IFRACs may be valid, because ward nursing staff (except at BLH for emergency admissions and RPAH for planned admissions) may spend time on non-inpatient activities (eg, staffing outpatient clinics). However, the purpose of our analysis is to show how sensitive the nursing cost estimates are to IFRACs. IFRACs also underlie the NHCDC estimates of ward costs.

4.1.3 Ward nursing costs for cholecystectomy patients

Average ward nursing costs per acute episode

Table 4.1 contains our estimates of the average ward nursing costs per acute episode for emergency and planned admissions. The last row shows the direct nursing costs from the provisional data for the NHCDC.

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8 IPART, NSW Health costs and outcomes study by IPART for selected NSW hospitals, July 2010.
9 Setting IFRACs to 1 means that we allocated 100% of the nursing time to inpatient care.
In relation to emergency admissions, the average ward nursing cost per acute episode ranges from $1,021 at JHH to $2,051 at BLH using the existing IFRACs. When all nursing costs are attributed to inpatient care (ie, IFRAC=1), it leads to a larger variation in nursing costs across the study hospitals, ranging from $1,073 at JHH to $2,185 at GH. The NHCDC contains an even greater difference in nursing costs between the study hospitals, with direct nursing costs ranging from $1,415 at JHH to $3,066 at GH.

Average ward nursing costs per acute episode are significantly lower for planned admissions when compared to emergency admissions. There is also much less variation in cost between the hospitals. Average costs range from $360 at RNSH to $453 at GH and JHH using the existing IFRACs. With IFRAC=1, the range is from $390 at BLH to $497 at GH. The variation in NHCDC direct nursing costs is much greater than our estimates, ranging from $400 at BLH to $713 at GH.

**Main factors affecting nursing costs**

Our analysis indicates that the average ward nursing cost per acute episode is affected by 4 main factors:

- IFRACs
- acute episode length of stay (ie, LOS1)
- nursing staff-to-patient ratio (ie, nursing hours per patient day)
- nursing staff mix.

IFRACs affect both the nursing costs per episode and the nursing costs per patient day (ie, per day of the acute episode). See Table 4.1 and Table 4.2. Setting IFRACs to 1 increases the costs at all the hospitals (except BLH for emergency admissions and RPAH for planned admissions), but has the biggest impact on RNSH because the IFRACs used at this hospital are the lowest.

We found there is a strong relationship between the second factor, the length of stay, and episode costs. With IFRAC=1, the hospital with the shortest acute length of stay for emergency admissions – JHH with 4.7 days – had the lowest episode nursing costs, while the hospital with the longest acute length of stay for emergency admissions – GH with 9.4 days – had the highest episode nursing costs. Average length of stay was similar for the study hospitals for planned admissions, explaining the smaller variation in costs for these types of admissions.

Along with the acute episode length of stay, we found that the nursing cost per patient day has a strong influence on the acute episode cost. In turn, the staff-to-patient ratio (third factor) and the staff mix (fourth factor) affect the nursing cost per patient day.
In principle, a hospital with a low staff-to-patient ratio is likely to have lower costs per patient day than a hospital with a higher staff-to-patient ratio. However, a lower staff-to-patient ratio can be offset by higher nursing costs per hour if there is a lower proportion of Enrolled Nurses (ENs), Assistants in Nursing (AINs) and student/trainee nurses in the staff mix.

In relation to cholecystectomy cases, our analysis suggests that the nursing costs per patient day depend more on staffing levels than the staff mix (see Table 4.2, Table 4.3 and Table 4.4). For instance, in relation to emergency admissions and assuming IFRACs are set to 1:

- GH and BLH have a similar share of EN, AINs and student/trainee nurses in their staff mix – respectively 28% and 26%. But the nursing cost per patient day is significantly lower at GH than at BLH – respectively $231 and $268. This is because GH had a lower staff-to-patient ratio, providing 6.2 nursing hours per day compared with 7.2 hours at BLH.

- JHH has the lowest proportion of ENs, AINs and student/trainee nurses in its staff mix - 16%. However, it also has the lowest staff-to-patient ratio, and as a consequence the lowest nursing cost per patient day.

For planned admissions, RPAH, GH and RNSH have a lower staff-to-patient ratio than BLH or JHH, and as a consequence have a lower nursing cost per patient day.10

Table 4.1 Ward nursing costs per acute episode, with and without IFRAC

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency admissions and ‘transfers in’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOS1 (days)</td>
<td>6.8</td>
<td>9.4</td>
<td>7.7</td>
<td>7.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Episode nursing cost with IFRAC ($)</td>
<td>1,584</td>
<td>1,944</td>
<td>1,486</td>
<td>2,051</td>
<td>1,021</td>
</tr>
<tr>
<td>IFRAC</td>
<td>0.94</td>
<td>0.89</td>
<td>0.80</td>
<td>1</td>
<td>0.95</td>
</tr>
<tr>
<td>Episode nursing cost ($), IFRAC =1</td>
<td>1,684</td>
<td>2,185</td>
<td>$1,865</td>
<td>2,050</td>
<td>1,073</td>
</tr>
<tr>
<td>NHCDC direct ward costs ($)</td>
<td>1,594</td>
<td>3,066</td>
<td>$1,991</td>
<td>1,999</td>
<td>1,415</td>
</tr>
<tr>
<td><strong>Planned admissions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOS1 (days)</td>
<td>1.6</td>
<td>1.9</td>
<td>1.8</td>
<td>1.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Episode nursing cost with IFRAC ($)</td>
<td>381</td>
<td>453</td>
<td>$360</td>
<td>377</td>
<td>453</td>
</tr>
<tr>
<td>IFRAC</td>
<td>1</td>
<td>0.91</td>
<td>0.8</td>
<td>0.97</td>
<td>0.98</td>
</tr>
<tr>
<td>Episode nursing cost ($), IFRAC =1</td>
<td>381</td>
<td>497</td>
<td>$450</td>
<td>390</td>
<td>462</td>
</tr>
<tr>
<td>NHCDC direct ward costs ($)</td>
<td>532</td>
<td>713</td>
<td>$560</td>
<td>400</td>
<td>709</td>
</tr>
</tbody>
</table>

Note: Episode nursing cost calculated using acute episode LOS measure (LOS1).
Source: IPART analysis from HIE inpatient statistics, 2008/09, payroll data and provisional cost data 2008/09, NHCDC.

10 The nursing categories are explained in Chapter 8 of our main report, NSW Health costs and outcomes study by IPART for selected NSW hospitals.
### Table 4.2  Nursing costs and hours per patient day, with and without IFRAC

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency admissions and ‘transfers in’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing costs per patient day ($)</td>
<td>232</td>
<td>206</td>
<td>193</td>
<td>268</td>
<td>215</td>
</tr>
<tr>
<td>IFRAC=1</td>
<td>247</td>
<td>231</td>
<td>243</td>
<td>268</td>
<td>226</td>
</tr>
<tr>
<td>Nursing hours per patient day</td>
<td>6.7</td>
<td>5.5</td>
<td>5.5</td>
<td>7.2</td>
<td>5.8</td>
</tr>
<tr>
<td>IFRAC=1</td>
<td>7.1</td>
<td>6.2</td>
<td>6.8</td>
<td>7.2</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Planned admissions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing costs per patient day ($)</td>
<td>242</td>
<td>240</td>
<td>202</td>
<td>257</td>
<td>270</td>
</tr>
<tr>
<td>IFRAC=1</td>
<td>242</td>
<td>263</td>
<td>253</td>
<td>267</td>
<td>276</td>
</tr>
<tr>
<td>Nursing hours per patient day</td>
<td>7.5</td>
<td>6.5</td>
<td>5.8</td>
<td>7.8</td>
<td>7.9</td>
</tr>
<tr>
<td>IFRAC=1</td>
<td>7.5</td>
<td>7.2</td>
<td>7.3</td>
<td>8.1</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: HIE inpatient statistics, 2008/09, payroll data and IPART analysis.

### Table 4.3  Proportion of nursing hours by nurse award category, with IFRAC

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency admissions and ‘transfers in’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNS</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>RN</td>
<td>66</td>
<td>67</td>
<td>72</td>
<td>69</td>
<td>73</td>
</tr>
<tr>
<td>EN</td>
<td>13</td>
<td>24</td>
<td>12</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>AIN</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Student/trainee</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EN, AIN &amp; student/trainee</td>
<td>23</td>
<td>28</td>
<td>21</td>
<td>26</td>
<td>16</td>
</tr>
<tr>
<td><strong>Planned admissions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNS</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>RN</td>
<td>72</td>
<td>66</td>
<td>73</td>
<td>66</td>
<td>73</td>
</tr>
<tr>
<td>EN</td>
<td>19</td>
<td>25</td>
<td>14</td>
<td>24</td>
<td>17</td>
</tr>
<tr>
<td>AIN</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Student/trainee</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>EN, AIN &amp; student/trainee</td>
<td>24</td>
<td>27</td>
<td>22</td>
<td>32</td>
<td>19</td>
</tr>
</tbody>
</table>

*a* There is no significant change to these figures with IFRAC=1.

**Note:** CNS = Clinical Nurse Specialist; RN = Registered Nurse; EN = Enrolled Nurse; AIN = Assistant in Nursing. See the Glossary at the end of the Appendices for descriptions of these nursing levels.

Source: HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
| Table 4.4 Nursing costs per hour by award category, with IFRAC<sup>a</sup> |
|----------------|-------|-------|------|------|------|
|                | RPAH  | GH    | RNSH | BLH  | JHH  |
| Emergency admissions and 'transfers in' |       |       |      |      |      |
| All            | 35    | 37    | 35   | 37   | 37   |
| CNS            | 45    | 48    | 46   | 44   | 41   |
| RN             | 36    | 40    | 37   | 40   | 38   |
| EN             | 30    | 29    | 29   | 29   | 29   |
| AIN            | 23    | 23    | 24   | 22   | 22   |
| Student/trainee| 20    | 20    | 21   | 22   | 19   |
| Planned admissions |       |       |      |      |      |
| All            | 32    | 37    | 35   | 33   | 34   |
| CNS            | 46    | 51    | 46   | 42   | 39   |
| RN             | 34    | 39    | 37   | 37   | 36   |
| EN             | 25    | 28    | 27   | 27   | 27   |
| AIN            | 23    | 23    | 23   | 22   | 20   |
| Student/trainee| 19    | 18    | 19   | 20   | 19   |

<sup>a</sup> There is no significant change to these figures with IFRAC=1.

<sup>Note</sup>: CNS = Clinical Nurse Specialist; RN = Registered Nurse; EN = Enrolled Nurse; AIN = Assistant in Nursing. See the Glossary at the end of the Appendices for descriptions of these nursing levels.

<sup>Source</sup>: HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
**Box 4.1  How we estimated nursing costs**

IPART used a model for each hospital to allocate ward nursing costs to each DRG grouping and compare nursing costs.

We calculated ‘nursing hours per patient day’, ‘nursing cost per patient hour’ and ‘nursing cost per acute episode’ for 2008/09 by:

- Mapping the wards in each hospital to cost centres – so we could use these to extract relevant payroll information for each ward.
- Extracting information from the payroll on nursing classification, nursing pay and nursing hours worked for each ward.
- Applying inpatient fractions to our total ward nursing cost – so we only included nursing costs for acute patient care. Note that some hospitals have a fraction of ‘1’ where other hospitals may have fractions like ‘0.95’ for similar wards.
- Allocating ward nursing costs to all patients on the ward, based on their time on the ward and the nursing service weights for their DRG.
- Allocating a cost of nursing care to each patient - for each step of the patient’s stay in acute care. Note that from patient level episode information we attributed a cost to each ward transfer during their ‘acute’ episode.

We then applied our estimate of nursing cost per hour to the average length of the acute episode to obtain an estimate of the ‘nursing cost per episode’. We also calculated costs with IFRAC = 1 for comparison.

**Qualifications**

- For our calculations, we included only direct costs of ordinary hours (excluding leave), penalty rates and overtime, obtained from payroll data.
- The number of ‘nursing hours per patient day’ depends on the occupancy rates of the wards. A higher occupancy rate reduces the hours per patient day but such a change can cause other issues, like outliers or access block.
- The ‘nursing hours per patient day’ is the share of a patient’s use of the nursing staff based on the nursing service weights. These service weights are not perfect and the mix of other patients on the ward may impact on the nursing hours attributed to a patient and hence their cost. The service weights do not take into account the generally higher cost of patients at the start of their hospital stay.
- Some wards have a mix of more acute care with rehabilitation. Fewer nursing hours and lower costs are attributed to the ‘acute’ episode in such wards compared with wards in hospitals that have a greater separation of roles (acute wards separate from rehabilitation).
- Our nursing methodology excludes ‘wards’ like emergency departments where it is particularly difficult to determine the inpatient fraction, but allocated a nursing cost for the time spent in emergency.
- Hospitals with a shorter reported length of stay for the ‘acute’ episode may be expected to have a higher number of nursing hours per day and higher daily nursing costs.
4.2 Imaging costs

Table 4.5 sets out our calculations for the average cost of all imaging tests for cholecystectomy patients during their acute episode. It also sets out the average costs for selected high-cost tests (CT scans/MRIs, ultrasounds and fluoroscopy), as well as the direct and indirect imaging costs from the provisional data for the NHCDC. Our methodology for calculating these costs is explained in Box 4.2.

<table>
<thead>
<tr>
<th>Table 4.5 Average imaging costs for cholecystectomy patients per acute episode</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
</tr>
<tr>
<td>$</td>
</tr>
<tr>
<td><strong>Emergency admissions and ‘transfers in’</strong></td>
</tr>
<tr>
<td>All imaging tests</td>
</tr>
<tr>
<td>CT/MRI</td>
</tr>
<tr>
<td>Ultrasound</td>
</tr>
<tr>
<td>Fluoroscopy</td>
</tr>
<tr>
<td>NHCDC direct and indirect imaging costs</td>
</tr>
<tr>
<td><strong>Planned admissions</strong></td>
</tr>
<tr>
<td>All imaging tests</td>
</tr>
<tr>
<td>CT/MRI</td>
</tr>
<tr>
<td>Ultrasound</td>
</tr>
<tr>
<td>Fluoroscopy</td>
</tr>
<tr>
<td>NHCDC direct and indirect imaging costs</td>
</tr>
</tbody>
</table>

**Source:** IPART analysis using data from hospital imaging services and provisional cost data 2008/09, NHCDC.

Similar to nursing costs, there is a large disparity in resource use between emergency and planned admissions across the hospitals. Imaging costs are significantly higher for emergency admissions than planned ones. The largest difference lies at RNSH, which has an average cost per emergency admission of $532 and an average cost per planned admission of $138.

In relation to emergency admissions, as noted RNSH had the highest imaging costs with $532 (mainly driven by CT/MRI, ultrasound and fluoroscopy costs). However, there was not a great deal of variability among the other hospitals’ imaging costs, ranging from $272 at JHH to $450 at GH. JHH perform significantly fewer CT scans on their emergency admissions.

There was greater variation in imaging costs for planned admissions, ranging from $28 at RPAH to $138 at RNSH. This variability was mainly driven by higher fluoroscopy costs at RNSH.
This range in average imaging costs is smaller than that included in the NHCDC. The NHCDC has imaging costs ranging from $182 at RPAH to $619 at RNSH for emergency admissions, and from $145 at JHH to $262 at RNSH for planned admissions.

**Box 4.2  Our approach to estimating imaging costs**

We did not use a bottom-up costing approach to calculate imaging costs. Instead, we used detailed information from imaging services on the number and type of tests performed, the time and date. We use data for ‘acute’ episodes in 2008/09. As a proxy for cost, we attribute a value based on the Medicare Benefits Schedule (MBS). Each test is valued at 100% of the MBS fee.

More information is included in Chapter 11 of our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*.

We also examined fluoroscopy usage at the study hospitals (Table 4.6). We found there was a difference in clinical practice in the use of fluoroscopy to check for retained gall stones and improve the visualisation of ducts. For example, some surgeons advocated doing this on all patients to prevent subsequent procedures to remove stones.

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroscopy performed</td>
<td>15</td>
<td>167</td>
<td>102</td>
<td>202</td>
<td>247</td>
</tr>
<tr>
<td>None</td>
<td>265</td>
<td>34</td>
<td>29</td>
<td>92</td>
<td>26</td>
</tr>
<tr>
<td>Fluoroscopy rate (%)</td>
<td>5</td>
<td>83</td>
<td>78</td>
<td>69</td>
<td>90</td>
</tr>
</tbody>
</table>

*Source: HIE inpatient statistics, 2008/09 and IPART analysis.*

JHH has the highest rate of fluoroscopy use at 90%, followed by GH at 83%, RNSH at 78% and BLH at 69%. RPAH had a significantly lower rate than the other study hospitals, at 5%.

Clinicians at RPAH noted that while fluoroscopy rates vary among surgeons, those involved with the liver transplant program rarely use fluoroscopy due to their familiarity with the hepatic anatomy. The lower overall fluoroscopy rate at RPAH may contribute to its shorter operating theatre times for planned admissions (see section 4.4).
4.3 Pathology costs

Table 4.7 shows average pathology costs for emergency and planned admissions. Our methodology for calculating these costs is explained in Box 4.3.

| Table 4.7 Average pathology costs for cholecystectomy patients per acute episode |
|---------------------------------|---|--|--|--|--|
|                                 | RPAH | GH | RNSH | BLH | JHH |
| **Emergency admissions and 'transfers in'** |       |     |      |     |     |
| All pathology tests             | 480  | 720 | 717  | 540 | 354 |
| NHCDC direct and indirect pathology costs | 279  | 746 | 617  | 231 | 458 |
| **Planned admissions**          |       |     |      |     |     |
| All pathology tests             | 114  | 84  | 144  | 123 | 131 |
| NHCDC direct and indirect pathology costs | 202  | 100 | 143  | 166 | 216 |

a We adjusted provisional NHCDC costs for GH and RNSH to reflect the change between the provisional and final pathology costs. We used the average increase in pathology costs for all cholecystectomy cases to make the adjustment. The NHCDC costs for these 2 hospitals are therefore estimates only.

Source: IPART analysis using data from hospital pathology services and final cost data 2008/09, NHCDC.

Consistent with our findings for nursing and imaging costs, there is a substantial difference in pathology costs between emergency and planned admissions across the study hospitals. The average tests costs ranged from:

- $354 at JHH to $720 at GH for emergency admissions, and
- $84 at GH to $144 at RNSH for planned admissions.

Pathology costs are much lower at GH than the other hospitals for planned admissions, but this may be due to a charging anomaly (with some costs excluded from anatomical pathology).

The NHCDC costs vary over a wider range than our costs for both emergency admissions ($746 at GH to $231 at BLH) and planned admissions ($216 at JHH to $100 at GH). However, the estimated NHCDC costs for GH and RNSH are roughly consistent with our estimates for both emergency and planned admissions.11

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11 We adjusted provisional NHCDC costs for GH and RNSH to reflect the change between the provisional and final pathology costs. We used the average increase in pathology costs for all cholecystectomy cases to make the adjustment. The NHCDC costs for these 2 hospitals are therefore estimates only.
Box 4.3 Our approach to estimating pathology costs

We did not use a bottom-up costing for pathology. Instead, we attributed a value for pathology tests based on internal billing data between the hospitals and the pathology services. We also used information on the time and date of tests.

Charging arrangements at each hospital are similar, but are not identical. All pathology services base their charges on the Medicare Benefits Schedule.

More information is included in Chapter 12 of our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*.

4.4 Operating theatre times

While we were unable to estimate operating theatre costs, we did compare the average time between surgery commencing and surgery finishing at the study hospitals at the study hospitals (see Table 4.8).

Table 4.8 Average operating theatre time for cholecystectomy patients

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency admissions (mins)</td>
<td>97</td>
<td>89</td>
<td>100</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Planned admissions (mins)</td>
<td>58</td>
<td>93</td>
<td>90</td>
<td>75</td>
<td>95</td>
</tr>
<tr>
<td>NHCDC direct and indirect operating theatre costs ($)</td>
<td>2,539</td>
<td>3,355</td>
<td>2,208</td>
<td>2,612</td>
<td>4,337</td>
</tr>
</tbody>
</table>

Source: IPART analysis using data from hospital operating theatres and final cost data 2008/09, NHCDC.

The theatre time for patients classified as emergency admissions was slightly higher than for planned admissions at most hospitals. We found that the average operating theatre time in emergency was fairly uniform, ranging from almost 90 minutes to 100 minutes.

Although the variation in average theatre time is quite small, the variation in the allocated theatre costs in the NHCDC is relatively large.

There may be a correlation between theatre time and use of fluoroscopy imaging during surgery. The low rate of fluoroscopy use at RPAH – see Table 4.6 – may account for its relatively shorter surgical procedure times for planned admissions.
Configurations of care

The term ‘configurations of care’ refers to the way that hospitals choose to manage and provide patient care, including their clinical practices. The particular configurations of care within a hospital can be influenced by a complex array of factors, including national or state-wide guidelines or protocols, the culture, practices and controls of the individual hospital, the culture and practices of each clinical unit and its leadership and the preferences of each clinician. Differences in the way hospitals manage and provide patient care can also lead to differences in the costs and outcomes of that care.

The section below describes the following major differences we found between the hospitals:

- the rates of cholecystectomies for emergency admissions
- the use of a dedicated emergency surgical team at JHH
- the use of CT scans for emergency admissions
- the use of fluoroscopy and operative cholangiograms
- the rates of completing cholecystectomies within 24 hours of planned admission.

5.1 Rates of cholecystectomies for emergency admissions

When patients present with acute cholecystitis (inflammation of the gall bladder and associated conditions), clinicians can choose either to operate on the patient acutely as an emergency admission, or to treat their symptoms, discharge them and readmit them at a later date, as a planned admission. In general, approximately half of these patients are suitable to receive cholecystectomy surgery within the next 24 hours. Often these patients will be admitted for a number of days.

12 Some patients are not suitable for an immediate operation. As an example, patients that arrive at hospital after having symptoms for a number of days (or wait in hospital for a number of days) may have inflammation and these patients generally need to wait until the inflammation has reduced before the gall bladder is removed.
Our case study analysis suggests there is considerable variation in the percentage of cholecystectomies performed acutely as emergency admissions across the study hospitals (Table 5.1). For example, we found that this percentage was only 16% at GH, compared to close to 50% at RPAH and JHH. (See Box 5.1 for more information on this analysis.) The surgeons at GH indicated that limited access to emergency theatre time prevented them operating on more of the emergency cases.

### Table 5.1 Rate of cholecystectomies for emergency admissions

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of emergency admissions for cholelithiasis or cholecystitis</td>
<td>176</td>
<td>200</td>
<td>170</td>
<td>148</td>
<td>246</td>
</tr>
<tr>
<td>Number of cholecystectomies performed</td>
<td>82</td>
<td>32</td>
<td>50</td>
<td>45</td>
<td>119</td>
</tr>
<tr>
<td>Rate of cholecystectomies for emergency admissions (%)</td>
<td>47</td>
<td>16</td>
<td>29</td>
<td>30</td>
<td>48</td>
</tr>
</tbody>
</table>

**Note:** See Box 5.1 for details on how we compared the rate of surgery for emergency admissions.

**Source:** HIE inpatient statistics, 2008/09 and IPART analysis.

Table 5.1 may understate RNSH’s cholecystectomy rate for emergency admissions. A significant proportion of cholelithiasis/cholecystitis patients who present to RNSH’s emergency department actually have their cholecystectomy performed at the adjoining private hospital (North Shore Private Hospital). These cholecystectomies are not included in Table 5.1.

### Box 5.1 How we compared the rate of surgery for emergency cholecystectomy admissions

- We looked at all the patients with a diagnosis code of K80 (cholelithiasis) and K81 (cholecystitis) who attended emergency departments at the study hospitals during 2008/09.a
- We compared this with the number of cholecystectomy procedures performed in each hospital over the same period (DRGs H07A, H07B, H08A and H08B).
- This comparison is indicative only. Some patients may have had a procedure at another hospital instead of the same hospital at which they had an emergency attendance.

a Patients with an emergency admission with cholelithiasis or cholecystitis are only included in the cholecystectomy DRGs if they have had the procedure.

Based on the above findings, we recommend that NSW Health and appropriate clinical expert groups consider whether the difference in acute operative rates for cholelithiasis or cholecystitis has significant quality of care implications.
Recommendation

1. That NSW Health and appropriate clinical expert groups note the variation in the proportion of patients with cholelithiasis or cholecystitis who are operated on acutely as emergency admissions.

2. That NSW Health arranges for appropriate clinical expert groups to consider whether this variation has significant quality of care implications.

It is important to note that sometimes, patients who have been discharged after an acute episode of cholecystitis and are waiting for planned surgery may be admitted to emergency again with another acute episode. This can be seen in Table 5.2, which shows our analysis of the number of patients who had cholecystectomies at the study hospitals in 2008/09 and who had prior emergency admissions for cholelithiasis or cholecystitis in the 12 months before the date they were admitted for surgery.

<table>
<thead>
<tr>
<th>Table 5.2 Prior emergency admissions for cholecystectomy patients with cholelithiasis or cholecystitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Number of patients with 1 prior emergency admission</td>
</tr>
<tr>
<td>Number of patients with 2 prior emergency admissions</td>
</tr>
<tr>
<td>Number of patients with 3 prior emergency admissions</td>
</tr>
<tr>
<td>Total number of patients with prior emergency admissions</td>
</tr>
<tr>
<td>Total number of emergency admissions for these patients</td>
</tr>
</tbody>
</table>

*Diagnosis codes K80 and K81.

Source: HIE inpatient statistics, 2008/09 and IPART analysis.

We found that 148 of the total of 1,179 cholecystectomy cases at the 5 study hospitals had prior emergency admissions. Some of these patients had multiple emergency admissions, so the total number of prior emergency admissions for cholelithiasis or cholecystitis was 171.

This highlights the limitations of focusing on a single acute episode when costing cholecystectomy. The efficiency of performing a cholecystectomy is normally assessed by examining the cost of the acute hospital admission involving the surgery (ie, with a cholecystectomy DRG). However, this does not take into account the cost of any prior, but related attendance.

In addition, this case study indicates that hospitals with limited access to emergency theatre can have low numbers of emergency admissions and high numbers of planned admissions. Paradoxically, this hospital will appear efficient based on basic casemix measures, but is actually less efficient because patients may have had many related admissions for the same condition.
In light of the above findings, when considering the cost of alternative configurations of care for cholecystectomy, the cost of prior attendances should be reflected in the analysis. A similar approach should be adopted for other clinical conditions that are likely to involve multiple prior attendances.

**Recommendation**

3 That NSW Health notes that costing of cholecystectomy should take into account the costs of prior related emergency department attendances. A similar approach should be adopted for other clinical conditions that are likely to involve multiple prior emergency department attendances.

### 5.2 Dedicated emergency surgical team at JHH

Unlike the other study hospitals, JHH had a dedicated emergency surgical team that included a rostered specialist surgeon to provide care for emergency surgical admissions, such as cholecystectomy cases. JHH also separated planned surgical activity from emergency activity, which can help to simplify the management of theatre access and reduce competition for access.

One of the reasons hospitals choose this configuration of care is that it can assist with early diagnosis of cholecystectomy cases – which can sometimes be difficult to diagnose. Our case study analysis suggests it may reduce the average length of stay for cholecystectomy cases admitted through emergency departments. We found that the average length of stay these cases at JHH was less than at the other study hospitals (see Table 3.1).

In addition, NSW Health considers that this type of dedicated emergency surgical team can lead to a number of benefits, including:

- increased consultant surgeon involvement in management and treatment decisions
- increased surgical registrar supervision with increased learning opportunities for junior surgical staff, and
- improved and standardised patient handover with agreed timing.

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14 A similar model is used at some other hospitals including Nepean.
5.3 Differences in the use of CT for emergency admissions

As discussed in section 4.2, we found that there were differences in the use of CT imaging for emergency admissions. As part of our hospital visits, we asked clinicians about hospital practices and reviewed a sample of clinical notes at each hospital. We found from both the discussions and the review of notes that there were instances where surgical reviews by the registrar would only occur after a CT scan had been performed.\footnote{16}

We found that JHH had a much lower use of CT for emergency admissions than the other hospitals. The dedicated emergency team with senior surgical staff provide input early in the patient assessment, resulting in a lower use of CTs. This may also have contributed to the shorter length of stay for emergency patients at JHH.

That said, RNSH clinicians did not consider that it was necessary to have a dedicated emergency surgical team. Instead, RNSH has daily specialist gastrointestinal cover, with high consultant input. Further, RNSH clinicians thought that the main factor affecting length of stay was difficulty getting access to operating theatres for emergency cases.

We consider there is a case for NSW Health to arrange for appropriate clinical expert groups to consider the relative costs and benefits of JHH’s dedicated emergency surgical team model for ensuring early diagnosis and treatment of conditions like cholecystectomy and whether it should be more widely applied.

Recommendation

4. That NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of an emergency surgical services team model for ensuring early diagnosis and treatment of conditions like cholecystectomy and whether it should be more widely applied.

5.4 Use of fluoroscopy and operative cholangiograms

Another variation in practice for cholecystectomy procedures is whether or not fluoroscopy imaging is used to carry out an operative cholangiogram. Fluoroscopy is a type of imaging that uses low intensity X-rays and dyes. It is used by some surgeons during cholecystectomy to:

- help ensure there are no gallstones left in the patient, which avoids future procedures to remove these stones\footnote{17}, and
- improve visualisation of the ducts, which can reduce mistaken surgical division of a duct.

\footnote{16}{This sometimes led to delays in diagnosis for cholecystectomy.}
\footnote{17}{Sometimes multiple gallstones are present and not all gallstones are removed (eg, gallstones in the biliary tree).}
Some clinicians at the study hospitals considered that patients should routinely have an operative cholangiogram (using fluoroscopy) during their cholecystectomy to reduce these two risks.

As previously discussed in Chapter 4, RPAH had a significantly lower fluoroscopy rate (5%) than the other study hospitals (69% to 90%). Further, we noted that there may be a correlation between lower use of fluoroscopy and shorter operating theatre times for planned admissions. Lower use of fluoroscopy also leads to lower imaging costs.

Data on the requirement for subsequent operations to remove missed retained stones was not available to IPART. If this rate was significant or the issue of mistaken surgical division of a duct was higher in patients that did not have a fluoroscopy, then perhaps all patients should have one.

We consider that there is a case for NSW Health to arrange for appropriate clinical expert groups to consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.

Recommendation

5 That NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.

5.5 Completion of cholecystectomies within 24 hours of planned admission

We found that there were differences in treatment times for the more common, less complicated cholecystectomy DRG H08B. The proportion of these cases completed within 24 hours of planned admission ranged from 71% to 100% among clinicians at the study hospitals.

We note that the NSW Health policy directive indicates that DRG H08B cases should be routinely treated as day only or extended day only admissions (ie, involving a stay of less than 24 hours), unless considered medically unsuitable.

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18 Laparoscopic cholecystectomy without closed common duct exploration or without catastrophic or severe complication or comorbidity.
19 HIE inpatient statistics, 2008/09 and IPART analysis. We only included in our analysis clinicians at study hospitals who treated more than 10 DRG H08B cases during 2008/09.
The variation in treatment times at the study hospitals does not appear to be related to different case loads. Figure 5.1 shows the number of DRG H08B cases completed by each clinician and the proportion of those that were completed within 24 hours of planned admission.

**Figure 5.1 DRG H08B cases completed within 24 hours of planned admission**

Note: We have not identified the treating clinicians for privacy reasons. Further, we have only included in our analysis clinicians who treated more than 10 DRG H08B cases during 2008/09.

Data source: HIE inpatient statistics, 2008/09 and IPART analysis.

Some clinicians with relatively few DRG H08B cases (ie, less than 20) treated 100% of them within 24 hours; whereas other clinicians with similar case loads treated less than 80% of them within this time frame.
6 Outcome, safety and quality indicators

The terms of reference for this study required us to analyse available data on differences in clinical outcomes across the 5 study hospitals. However, we found that few indicators of clinical outcomes were collected consistently across hospitals, or on a state-wide (or national) basis. Therefore, we worked with clinical experts to establish a set of outcome, safety and quality indicators that were clinically relevant, and for which we could feasibly obtain data in the timeframe for our study.

In collecting data for these clinical indicators, we found that the number of deaths, wound infections and unplanned returns to theatre for cholecystectomy patients at the study hospitals were very small. As such, we expanded the scope of the clinical indicators to cover ‘general surgery’, so that the data included both cholecystectomy and appendicectomy patients.

The sections below describe the clinical indicators and consider the performance of the study hospitals against them. We found that there were no statistically significant differences between the study hospitals’ risk-adjusted 30-day mortality rates. However, JHH and RPAH had the highest risk-adjusted wound infection rates.

6.1 How we developed a set of clinical indicators

To identify the indicators we should focus on for this study, we worked with a number of eminent clinicians on our Clinical Reference Group\(^21\) to develop a set of outcome indicators. We also consulted clinicians in study hospitals and sought further advice from clinicians with specific expertise in the fields of interest, as well as other relevant organisations.

Essentially, we aimed to establish a list of indicators that were:

- widely accepted as being clinically appropriate
- likely to be available from NSW hospitals, the NSW Department of Health or other bodies, such as registries, and
- feasible for IPART to collect or calculate.

\(^{21}\) In the early stages of the review, our Clinical Reference Group comprised Professor Bruce Barraclough, Professor Clifford Hughes, Dr Michael Nicholl, Professor Ron Penny and Dr Hunter Watt. A number of other clinicians were consulted as part of this process.
Following this clinical consultation, we established the set of indicators discussed in section 6.3 below. Some of these indicators are not true outcome indicators, but are safety and quality or process indicators. We were not able to obtain data for all of these indicators.

6.2 Analysing indicators and risk-adjusting for patient characteristics

It is important to recognise that hospitals’ performance against many outcome indicators is not simple to interpret and, when considered in isolation, can be misleading. Therefore, this performance needs to be analysed within the appropriate context.

In addition, hospitals treat patients with different mixes of illnesses, which can influence the likelihood of adverse outcomes at the hospitals. To make meaningful and fair comparisons of the performance of the study hospitals on some outcome indicators, the analyses were risk-adjusted for factors outside the control of the hospitals (ie, differences in patient characteristics – see Box 6.1).

Appendix B provides further details for each risk-adjusted indicator provided by NSW Health, including the data sources used, the time period of the data and the adjustment factors applied.
Box 6.1  How data on indicators were risk-adjusted for differences in patient characteristics

To meaningfully compare the performance of the study hospitals on some outcome indicators, the hospitals’ data on these indicators needed to be risk-adjusted to account for differences in patient characteristics that can influence the likelihood of adverse outcomes. In particular, NSW Health adjusted data on mortality and wound infection rates for the following patient characteristics:

- age
- sex
- comorbidity, and
- socio-economic status.

To adjust for comorbidity, NSW Health used the Charlson index. This index simplifies the wide range of comorbidities that may affect patients. It groups clinical conditions together (using ICD 10), and assigns numerical weights (eg, 1, 2, 3) to them, based on the risk of dying associated with the condition. Adding together the numerical weights for a patient’s comorbidities determines the patient’s combined Charlson index score, and therefore the severity of their comorbidities.

To make these adjustments, NSW Health used logistic regression in SAS 9.2. Where there were sufficient numbers, it took repeated measures for the same person into account using multi-level modelling. Where the number of events was too low to allow the above adjustment to be carried out in full, the degree of adjustment was reduced and this was noted for each indicator.

The ABS Index of Relative Socio-Economic Disadvantage (IRSD) was used to estimate socio-economic status. The IRSD was assigned at Local Government Area level and grouped into quintiles from least disadvantaged to most disadvantaged for analysis.


6.3  Clinical indicators for cholecystectomy

We selected 6 indicators for this case study (see Table 6.1). We analysed data from the study hospitals against these clinical indicators, with the results reported below.

The number of deaths, wound infections and unplanned returns to theatre for cholecystectomy patients at the study hospitals were very small. As such, we expanded the scope of these clinical indicators to cover ‘general surgery’. This means that the data includes cholecystectomy patients (DRGs H07A, H07B, H08A and H08B), as well as appendicectomy patients (DRGs G07A and G07B).
Table 6.1  Clinical indicators for cholecystectomy and data availability

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Available?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>30-day mortality rates (risk-adjusted)</td>
<td>Y – data provided by NSW Health (see Appendix B)</td>
</tr>
<tr>
<td>2.</td>
<td>Unplanned return to theatre rates</td>
<td>Y – but indicator not consistently collected to enable meaningful hospital comparisons</td>
</tr>
<tr>
<td>3.</td>
<td>Wound infection rates (risk-adjusted)</td>
<td>Y – data provided by NSW Health (see Appendix B)</td>
</tr>
<tr>
<td>4.</td>
<td>Blood transfusion rates</td>
<td>N – data collected at hospital-wide level but not systematically reported by hospitals for cholecystectomy patients</td>
</tr>
<tr>
<td>5.</td>
<td>Administration of VTE prophylaxis</td>
<td>N – data collected at hospital-wide level for VTE prophylaxis assessment</td>
</tr>
<tr>
<td>6.</td>
<td>Administration of antibiotic prophylaxis</td>
<td>N – data collected at hospital-wide level for antibiotic prophylaxis assessment</td>
</tr>
</tbody>
</table>

6.3.1  30-day mortality rates

NSW Health calculated and provided risk-adjusted data on mortality rates within 30 days of separation for appendicectomy and cholecystectomy (referred to as general surgery), as well as the odds ratios for these rates. Odds ratios are used to highlight the differences in rates between hospitals (see Box 6.3).

NSW Health risk-adjusted each hospital’s mortality data for patient age, sex, comorbidities (using the Charlson index) and socio-economic status using the approach set out in Box 6.1 and using the data set out in Appendix B.

In the 3-year period 2005/06 to 2007/08, there were 16 deaths among 6,662 hospital separations at the 5 hospitals, giving a crude mortality rate of 2.4 per 1,000. There were no statistically significant differences in mortality rates between the 5 hospitals.
Box 6.2 Calculating mortality rates

The NSW Department of Health’s Centre for Epidemiology and Research calculated risk-adjusted odds ratios for mortality for patients treated in each study hospital in the appendicectomy and cholecystectomy case study areas, using the methodology outlined below. We note that the NSW Department of Health does not usually undertake this type of analysis.

Data sources

The analysis for mortality and survival, apart from in-hospital mortality, was carried out using linked records of the NSW Admitted Patient Data Collection (APDC) and NSW Registry of Births, Deaths and Marriages death registration data. The analysis for in-hospital mortality was carried out using linked records of the APDC. In-hospital deaths and deaths from all causes were included for all relevant indicators.

Case-based analysis

As one person may have more than one admission for a specified condition, the analyses were ‘case-based’ where a case represents a hospital admission for a specified condition. This means that, for example, if a person died after 2 hospital admissions for a specified condition and the death occurred within the period specified by the indicator, then the case and therefore the death would be counted twice.

Adjusting for risk and comparing hospitals

Indicators were adjusted for patient age, sex, comorbidity and socio-economic status as described in Box 6.1.

Hospitals that were not significantly different in the adjustment model (at p<0.05) were grouped.
Box 6.3  Risk-adjusted odds ratios

Risk-adjusted odds ratios were calculated for hospitals in order to highlight differences in rates between the hospitals.\textsuperscript{a} The ‘odds ratio’ is the ratio of the odds of an event occurring at one hospital to the odds of it occurring at another hospital.\textsuperscript{b}

If the odds ratio between 2 hospitals is:
\begin{itemize}
  \item 1 – the event is equally likely to occur at both hospitals
  \item >1 – the event is more likely to occur at the first hospital
  \item <1 – the event is less likely to occur at the first hospital.
\end{itemize}

As an example, assume Hospital A has 15 infections and Hospital B has 10 infections, out of 1,000 patients at each hospital. The odds of infection at Hospital A and Hospital B are 15/985 and 10/990 respectively. The odds ratio of infection between Hospital A and Hospital B is $(15/985) / (10/990)$ or 1.51. This odds ratio indicates that the odds of infection at Hospital A are around 50% higher than at Hospital B.

\textsuperscript{a} Odds ratios are widely used in medical literature to examine the effects of other variables on the relationship between two binary variables, using logistic regression (J Bland “The odds ratio”, British Medical Journal, 320, 2000, p 1468; S Simon “Understanding the Odds Ratio and the Relative Risk”, Journal of Andrology, 22, 2001, p 533). The odds ratios were risk-adjusted for patient characteristics using the approach discussed in Box 6.1.

\textsuperscript{b} The ‘odds of an event occurring’ is equal to the probability that the event occurs divided by the probability that it does not occur.

6.3.2  Unplanned return to theatre rates

This indicator measures the rate of unplanned returns to theatre for patients with complications relating to general surgery performed within the previous 72 hours during the same admission. The Australian Institute of Health and Welfare (AIHW) has noted that an unplanned return of a patient to the operating room during the same admission may reflect possible problems in the performance of procedures and/or less than optimal patient management.\textsuperscript{22}

We were unable to compare the study hospitals’ performance in this area, due to problems with the consistency of this indicator. During our hospital visits, we reviewed a sample of clinical notes for patients who appeared from the data to have been readmitted to the same hospital for any reason within 48 hours. In this ‘audit’ of the clinical notes, we found unplanned returns to theatre that had not been reported in the HIE.

There are problems with the data quality for this indicator, as it is difficult to ensure hospitals are capturing data for this indicator in a consistent manner. In particular, there is no State or Commonwealth requirement for hospitals to routinely report unplanned returns to theatre.

- Instead, some hospitals use their own local reports (rather than the HIE data set) to track unplanned returns to theatre for their internal review. Further, while data on this indicator is collected by the Australian Council on Healthcare Standards, this is only for hospitals participating in its programs.  

- This indicator should only pick up those returns to theatre arising from less than optimal care. However, it is often difficult in practice to identify whether patients attending the emergency departments following procedures are actually planned or unplanned returns to theatre. The AIHW has noted that future development work for this indicator includes definitional work around how ‘unplanned returns’ are defined and recorded.

- Even with a more comprehensive definition of ‘unplanned return’, whether a particular incident falls within this definition will still involve some degree of subjective judgment. As such, regular audit of clinical notes may be required to ensure consistency in data collection between hospitals.

### 6.3.3 Wound infection rates

This indicator measures the rate of wound infections within 6 weeks of separation for general surgery. The reliability of this indicator depends on consistent reporting practices and patients re-attending hospital. We note that some infections will not be picked up if treated by a GP.

NSW Health provided information on wound infections for general surgery patients to compare hospital outcomes. It sourced the data from the APDC, included infections reported within the hospital stay and risk-adjusted the data for patient characteristics using the approach discussed in Box 6.1.

We note that the wound infection data in this study does not differentiate between ‘clean’ wounds (ie, sterile wounds) and ‘contaminated’ wounds (ie, wounds already contaminated prior to surgery or surgery into contaminated areas such as the bowel). This means that the study hospitals results need to be interpreted with caution, as their wound infection rates may not be directly comparable.

There were 52 infections among 6,665 hospital separations for the 5 study hospitals, giving an overall crude infection rate of 7.8 per 1,000 (see Table 6.2).

---


Table 6.2  Wound infection within 6 weeks of general surgery, 2005/06 to 2007/08

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Risk-adjusted odds ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>JHH</td>
<td>3.39</td>
<td>1.51-7.64</td>
</tr>
<tr>
<td>RPAH</td>
<td>2.51</td>
<td>1.21-5.19</td>
</tr>
<tr>
<td>GH, RNSH and BLH</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: Wound infection defined as ICD10AM code T81.41. See Box 6.3 for an explanation of the odds ratio. The odds ratio used in this table only compares the odds at the 5 study hospitals. It does not provide an indication of how these study hospitals compare with other hospitals.

Source: Records from the APDC (HOIST), Centre for Epidemiology and Research, NSW Department of Health.

We found that there were no statistically significant differences between GH, RNSH and BLH, so results were grouped for these hospitals. JHH and RPAH had higher odds of wound infections compared to the grouped hospitals.

6.3.4  Blood transfusion rates

This indicator measures the rate of transfusing red blood cells for cholecystectomies where patients have haemoglobin levels in the range 70 g/L to 100 g/L.

According to the Clinical Practice Guidelines on the Appropriate Use of Red Blood Cells25, the decision to transfuse red blood cells should be based on clinical assessment of the patient. Blood component therapy should only be given when the expected benefits to the patient are likely to outweigh the potential hazards.

Table 6.3  Guidelines for appropriate use of red blood cells

<table>
<thead>
<tr>
<th>Haemoglobin level</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 100 g/L</td>
<td>Use of red blood cells is likely to be inappropriate, unless there are specific indications</td>
</tr>
<tr>
<td>70 g/L to 100 g/L</td>
<td>Use of red blood cells may be appropriate</td>
</tr>
<tr>
<td></td>
<td>The decision to transfuse should be supported by the need to relieve clinical signs and symptoms and prevent significant morbidity and mortality</td>
</tr>
<tr>
<td>&lt; 70 g/L</td>
<td>Use of red blood cells is likely to be appropriate</td>
</tr>
<tr>
<td></td>
<td>In some patients who are asymptomatic and/or where specific therapy is available, lower threshold levels may be acceptable</td>
</tr>
</tbody>
</table>


25 The guidelines are a joint initiative of the National Health and Medical Research Council and the Australasian Society of Blood Transfusion, in cooperation with the Commonwealth Department of Health and Aged Care, the Royal Australasian College of Surgeons, the Australian and New Zealand College of Anaesthetists, and other relevant groups. (http://www.anzsbt.org.au/publications/documents/AppRedBloodUse.pdf).
When the haemoglobin level is in the range 70g/L to 100 g/L, the Clinical Practice Guidelines on the Appropriate Use of Red Blood Cells note that clinical judgement about the risk of transfusion is of great importance. Use of red blood cells may be appropriate when:

▼ the patient is undergoing an operative procedure associated with major blood loss
▼ there are clinical signs, symptoms or evidence that the patient has associated impairment in oxygen transport that may be exacerbated by anaemia
▼ to control anaemia-related symptoms in a patient on a chronic transfusion regimen or during marrow suppressive therapy and to maintain the haemoglobin level > 80 g/L.26

The study hospitals collect this data at the hospital-wide level, but do not systematically report it for cholecystectomy patients. Refer to Chapter 16 of our main report for further information.27

6.3.5 Administration of VTE prophylaxis

This indicator measures the proportion of patients who are administered venous thrombo-embolism (VTE) prophylaxis. The AIHW has noted that VTE can cause pain, loss of function and sometimes death. Further, the incidence of VTE is an indicator of the quality of post-operative care, and can reflect inappropriate or inadequate medical and nursing care. VTE invariably prolongs the duration of hospitalisation and requires additional medical intervention.28

The study hospitals do not systematically collect this data at the clinical level. Instead, they conduct hospital-wide audits to see whether VTE prophylaxis assessments are being conducted. Refer to Chapter 16 of our main report for further information.29

6.3.6 Administration of antibiotic prophylaxis

This indicator measures the proportion of patients who are administered antibiotic prophylaxis. Administering an appropriate prophylactic antibiotic at the time of surgery can significantly reduce post-operative infections.

27 IPART, NSW Health costs and outcomes study by IPART for selected NSW hospitals, July 2010.
29 IPART, NSW Health costs and outcomes study by IPART for selected NSW hospitals, July 2010.
The study hospitals do not systematically collect this data at the clinical level. Instead, they conduct hospital-wide audits to see whether antibiotic prophylaxis assessments are being conducted. Refer to Chapter 16 of our main report for further information.30

6.4 Issues for further consideration

There were significant differences between the study hospitals in relation to wound infection rates. These differences should be investigated further by NSW Health and appropriate clinical expert groups.

Recommendation

6 That NSW Health and clinical expert groups review the variation in wound infection rates for cholecystectomy surgery at the study hospitals, and if appropriate, take steps to address the variation.

30 IPART, NSW Health costs and outcomes study by IPART for selected NSW hospitals, July 2010.
Appendices
Outcome, safety and quality indicators

IPART

Case study 4 – Cholecystectomy (gall bladder surgery)
A Full list of recommendations from main report

Consistency of DRG groupings

Our recommendations in this area are mainly aimed at making users of hospital data aware of some of the limitations of using DRG groupings for hospital comparisons in certain clinical areas.

1. That users of hospital cost and outcome data note that DRGs may contain a range of patient types with varying clinical resource requirements, costs of care and expected clinical outcomes. Therefore DRGs may not always provide the optimal basis for comparing costs and outcomes among hospitals.

2. In light of Recommendation 1, that the NSW Department of Health, and other health research bodies at both the state and national level, consider whether DRGs are a suitable basis for determining funding and comparing performance among hospitals (for various different types of hospital activity). Where they are not suitable, continue research to develop better approaches for these areas.

Consistency of patient numbers

Our recommendations on patient numbers are aimed at making users of hospital data aware of differences in patient counting practices and patient datasets between hospitals that can affect hospital comparisons, to improve consistency of patient counting practices between hospitals and lead to better integration of patient datasets.

3. That users of hospital data note that there are differences in practices relating to counting of patients that can affect hospital patient numbers and average cost comparisons eg, counting differences relating to admission status, billing status, location of care and collaborative care arrangements.

4. In light of Recommendation 3, that NSW Health clarifies and standardises administrative procedures including guidelines for recording of non-inpatients of various types, as well as ‘collaborative care’ patients.

5. That NSW Health considers ways of better integrating patient information held locally by hospital clinical units (such as eye clinics and cardiac catheter labs) with the HIE data set.
Consistency of lengths of stay

Our recommendations aim to improve consistency between hospitals on length of stay measures, and to make users of hospital data aware of the limitations of measures based on ‘acute episodes’.

6. That NSW Health monitors hospital practices relating to the classification of episodes into care types and type-changing practices (eg, timing of type changes from acute to rehabilitation care) and provide clear and consistent guidelines to hospitals, so episode measures are more consistent among hospitals.

7. That users of hospital data note that ‘acute episodes’ often only represent a part of a patient’s hospital stay. Therefore, comparisons among hospitals using acute length of stay measures or acute costs may produce misleading results. This is particularly important for conditions that involve both acute and sub-acute care and/or transfers between facilities.

Coding

We have made recommendations aimed at improving the quality of medical records documentation and clinical coding in hospitals to both improve the quality of data for clinical research as well as to more accurately reflect case mix complexity.

8. That NSW Health should continue to improve the quality of medical record documentation and the accuracy and consistency of coding.

9. That hospitals should encourage consistent education on coding and facilitate communication between clinical staff and coders regarding both the coding process and the documentation required to code common clinical conditions, diagnoses or complications, such as AMI, angina and chest pain.

10. Where pathology test information can be readily extracted (eg, Cerner sites), that systems be developed so this information can be used to validate coding and support work on variation in clinical practice and measuring clinical quality.

11. That NSW Health considers undertaking further analysis to identify pathology or imaging tests that can be used to help target audits of coding and support work on variation in clinical practice and measuring clinical quality – such as identifying types of pathology tests that correspond closely with diagnosis coding.
Clinical costing

Our recommendations are aimed at improving the quality and consistency of clinical costing data, and helping to ensure that quality costing data and clinical inputs to the costing process (such as data from prosthesis, pathology and imaging systems) can be used to inform hospital management about resource use, and clinicians about clinical practice.

12 That the NSW Department of Health works with the area health services and hospitals to apply a consistent set of rules for clinical costing covering cost centres and IFRACs so that data are consistent and comparable between the hospitals.

13 That NSW Health regularly audits the accuracy of cost centres and IFRACs used for clinical costing.

14 That NSW Health uses standard clinical data feeds (actual patient data) for clinical costing where this is feasible and useful.

15 That the data used for clinical costing purposes be available to hospitals and clinicians so they can undertake comparative analysis on clinical practices and performance.

Medical staff costs

Given our finding that there was a lack of consistency in the treatment of medical staff costs and the difficulty this created in estimating medical staff costs for our case study areas, we recommend:

16 That further work be undertaken to strengthen the quality and consistency of available information on medical staff costs.

Prosthesis costs

Our recommendations on prosthesis costs are aimed at improving prosthesis purchasing and making cost savings in this area. These should be considered in conjunction with our recommendation that clinical experts should review the appropriateness of clinical variation in prosthesis use and address this variation (see Recommendation 31).

17 That NSW Health notes the variation in prosthesis use among the study hospitals including:
   - drug-eluting stents versus bare metal stents
   - single chamber pacemakers versus dual chamber pacemakers
   - different types of components for hip replacement procedures.

18 That NSW Health notes the range of approaches to prosthesis controls and the variation in prices currently paid for prostheses, including for exactly the same models.
19. That NSW Health facilitates sharing of information on purchase prices for prostheses to assist price negotiations with suppliers.

20. That NSW Health optimises prosthesis cost savings through tenders, supplier price agreements and controlled approaches to prosthesis purchasing, noting that clinical consultation and cooperation is essential as is retaining some flexibility to allow for special orders when clinically indicated.

**Imaging and pathology costs**

Our recommendations are aimed at encouraging better use of imaging and pathology data, and consideration of whether there should be standard treatment of imaging and pathology within clinical costing and whether internal charges should reflect actual costs. These recommendations should be considered in conjunction with our clinical case studies, which include comparisons of imaging use, and Recommendation 31, relating to clinical variation in imaging use for diagnosing appendicitis.

21/25 That NSW Health notes that imaging and pathology data can be used to monitor changes in imaging use and inform clinical practice, and that:

- All hospitals obtain detailed reports from pathology and imaging services on their test ordering patterns, including the number of tests by major test type and the cost of these tests.

- Hospitals routinely provide data to heads of clinical units to help inform them on resource use and provision of care to improve patient outcomes and discuss trends at management meetings – for example, summary reports that include both the number of tests by test type, and the value (or preferably cost) of these tests.

- NSW Health develops reports comparing the use of imaging and pathology tests for clinical groupings and circulates these to area health services and hospitals.

22. That NSW Health considers whether, for clinical costing purposes, it is appropriate for hospitals and area health services to base the value of imaging tests on the MBS rate for these tests and, if so, what standard percentage of this rate is appropriate for use by all hospitals given the actual costs of providing the test.

23. That NSW Health seeks to obtain detailed information from the pathology services on the number and type of tests and the actual cost of undertaking a range of typical tests for future comparisons of pathology costs.

24. That NSW Health addresses issues that prevent the actual costs associated with specific pathology tests and ordering patterns being disclosed by pathology services.

26. That NSW Health considers whether the detailed cost estimates that pathology services prepare as part of the benchmarking pathology project could be used for more accurate pricing between pathology services and hospitals, to enable clinicians to consider the actual cost of their clinical decisions.
Operating theatre costs

Our recommendations in relation to operating theatres aim to facilitate improvements in theatre management arrangements, and the quality and consistency of theatre data.

27 That NSW Health notes the differences in approaches to theatre management among hospitals and consider if there is scope to share information about how the better theatre arrangements are organised.

28 That NSW Health notes the issues regarding theatre data and work with the hospitals to improve the completeness of datasheets and apply a consistent set of rules for recording operating theatre times.

29 That NSW Health considers routine auditing of the quality of data on returns to theatre and considers the best way for achieving accuracy and consistency in this indicator.

Pharmacy costs

As we were not able to undertake a detailed comparison of pharmacy services and costs, our recommendations focus on encouraging further analysis in this area.

30 That NSW Health:

– Notes the wide variation in the proportion of drugs dispensed versus held on imprest across the study hospitals.

– Monitors the value of expired pharmacy stock and compares this among hospitals.

– Considers standardised guidelines for the return of unused medication, principally to ensure patient safety but also to minimise wastage and reduce costs.

– Considers whether antimicrobial stewardship programs should be implemented at the major hospitals where such programs are not currently in place. The purpose of these programs would be to help prevent antimicrobial resistance and reduce costs by preventing inappropriate use of antimicrobials.
Configurations of care – Review of clinical variations during Stages 5 and 6 of the wider NSW Department of Health study

Our case studies identified a number of differences in the way care is provided among study hospitals in specific clinical areas. We recommend that clinical experts consider these clinical differences or clinical issues as part of Stages 5 and 6 of the wider health study. This recommendation should be dealt with in conjunction with Recommendation 36, relating to variation in indicators of safety, quality and outcomes.

31 That NSW Health arranges for appropriate clinical expert groups to consider the following clinical issues identified in our case studies; and that where appropriate, NSW Health and the expert groups take steps to address clinical differences.

- Hip joint replacement:
  - Note that separation of planned and emergency cases may reduce lengths of stay for planned (arthritis) cases.
  - Address the variation in the selection of hip prosthesis components (including press fit, cementless hip stems versus cemented hip stems and ceramic femoral heads versus metal femoral heads) among study hospitals.

- Major chest procedure:
  - Note the different clinical pathways and high day of surgery admission rates for thoracic surgery patients at RPAH compared with other study hospitals.
  - Consider whether aspects of the model of care at RPAH are suitable to be used in other hospitals.

- Breast surgery:
  - Note the early discharge models at RNSH for breast surgery patients having mastectomies and
  - Consider whether such models should be followed more widely in NSW hospitals and the types of patient cases they should be used for (eg, simpler, unilateral cases or younger patients).

- Cholecystectomy:
  - Note the variation in the proportion of patients with cholelithiasis or cholecystitis who are operated on acutely as emergency admissions.
  - Consider whether this variation has significant quality of care implications.
  - Consider the relative costs and benefits of an emergency surgical services team model for ensuring early diagnosis and treatment of conditions like cholecystectomy and whether it should be more widely applied.
  - Note that costing of cholecystectomy should take into account the costs of prior related emergency department attendances. A similar approach should be adopted for other clinical conditions that are likely to involve multiple prior emergency department attendances.
Consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.

**Appendicectomy**

- Note the variation in the use of imaging tests for diagnosing appendicitis.
- Consider establishing standard protocols for diagnosing appendicitis, indicating when it is appropriate to use CT scans, MRIs and ultrasounds.
- As part of establishing standard protocols for diagnosing appendicitis, consider whether CT scans, MRIs and ultrasounds should only be used for certain patient groups (e.g., older patients who are more likely to be suffering from other conditions with symptoms similar to appendicitis).
- Consider the relative costs and benefits of laparoscopic versus open surgery for appendicitis.

**Stroke**

- Consider ways to reduce the proportion of stroke patients coded with a principal diagnosis of 'stroke, not specified as haemorrhage or infarction' (ICD10 code I64).
- Consider developing consistent guidelines for the administration of tPA.
- Consider including tPA administration as a procedure in coding standards.
- Consider ways to improve transfers of suspected stroke patients to stroke units with minimum delay, including consultation with the Ambulance Service and Emergency Departments.
- Investigate whether it is useful and possible to combine Ambulance Service data on response time with hospital patient data to monitor time from call to ambulance to arrival at an appropriate hospital.
- Consider the costs and benefits of providing more rehabilitation care in the home.
- Pursue the collection of the data on outcome indicators from the National Stroke Research Institute.

**Cardiology – Stents, Pacemakers and Defibrillators:**

- Address the variation in the use of drug-eluting stents versus bare metal stents among study hospitals.
- Address the variation in the types of pacemakers used among study hospitals.
- Investigate whether there are differences in treatment procedures, or waiting times between presentation and procedure, for patients who present to hospitals without a 24 hour cardiac catheter laboratory, compared to patients who present to hospitals with a 24 hour cardiac catheter laboratory, and whether any differences in procedure or waiting times have implications for clinical outcomes.
Consider ways of better integrating information held in cardiac catheter laboratories with the HIE data set.

- Tracheostomy or ventilation greater than 95 hours:
  - Note that at BLH, clinicians tend to perform surgical tracheostomies, whereas at the other hospitals, these are usually performed percutaneously.

- Cataract/lens procedure:
  - Assess the costs and benefits of toric lenses and develop guidelines for their use in public hospitals.

- Hysterectomy:
  - That any future studies of hysterectomy compare the costs and outcomes for hysterectomies with the costs and outcomes of other procedures such as endometrial ablation and uterine artery embolisation.

**Improving outcome, safety and quality indicators**

While current Commonwealth and State initiatives will improve outcomes data, we have made recommendations that will assist this process.

32 That NSW Health enhances understanding and use of mortality, survival, unplanned readmission and wound infection indicators and their risk adjustment by:

- continuing to contribute to the development of ACSQHC’s safety and quality standards for these indicators
- refining the methodology used for standardising or risk-adjusting these indicators
- continuing to consult with clinicians regarding the agreed presentation of mortality, survival unplanned readmission and wound infection information
- reporting this information on a more routine and regular basis consistent with ACSQHC data sets.

33 That NSW Health encourages hospitals to put in place systems to facilitate accurate coding of comorbidities and ensures that coding practices are consistent across hospitals.

34 That NSW Health works with ACSQHC to negotiate more streamlined arrangements for access to data held by third parties (such as clinical registries) for clinical analysis, and makes these data available to hospitals and clinicians.

35 That NSW Health explores the possibility of providing outcomes information to clinicians in a more systematic way as an aid to clinical improvement and a key indicator of performance.
Indicators of safety, quality or outcomes, - review of clinical variations during stages 5 and 6 of the wider NSW Department of Health project

We have also made a number of findings relating to variations in indicators of safety, quality or outcomes. Where we have observed apparent differences among hospitals, these should be considered by clinical expert groups in completing stages 5 and 6 of the Department of Health’s wider project. These differences should be considered in conjunction with differences in clinical practice (Recommendation 31).

36 That clinical expert groups consider the following clinical issues; and where appropriate, NSW Health and clinical expert groups take steps to address clinical variations as part of Stages 5 and 6 of the broader NSW Health review:

- Review the variations in outcome, safety and quality indicators among study hospitals, including their:
  - unplanned readmission rates
  - wound infection rates for selected surgical procedures.

- Review the variation in mortality and survival rates for all major chest surgery patients and consider whether to recommend changes to clinical practice or conduct further investigation involving:
  - a larger sample of hospitals, and
  - more detailed analyses for ‘like patients’ (ie, lung cancer, infection-related abscess/pyothorax and collapsed/punctured lung patients).

- Review the variation in the following clinical indicators for hip joint replacement surgery at the study hospitals:
  - wound infection rates
  - unplanned readmission rates.

- Review the variation in wound infection rates for appendicectomy and cholecystectomy surgery at the study hospitals.

- Note the variation in the following clinical indicators relating to obstetric delivery:
  - caesarean section rates for ‘selected primipara’
  - vaginal delivery rates following primary caesarean section
  - caesarean section rates after induction of labour for ‘selected primipara’
  - repeat caesarean section rates
  - significant tear rates

and monitor changes arising from the implementation of the NSW Health policy directive, Maternity – Towards Normal Birth in NSW, to determine whether this policy effectively addresses the variation.
Additional outcome indicators

We made recommendations to consider the costs and benefits of collecting data for the following areas where indicators are not commonly used.

37 That NSW Health considers the costs and benefits of collecting data and monitoring performance against the following indicators:
   - warfarin management
   - visual outcomes for patients undergoing lens procedures.

We also made a recommendation to develop a set of standard indicators for measuring care and/or outcomes in ICUs.

38 That NSW Health undertakes further work to develop a set of standard indicators for measuring care and/or outcomes in ICUs.

Time Out audits

Finally, we made a recommendation to improve consistency in the number of cases audited as part of the Time Out process relative to the number of separations.

39 That NSW Health specifies the number or proportion of patient cases that should be audited as part of the Time Out process.

Next steps - wider application of this study

40 That NSW Health refines and develops useful aspects of this study for application more widely to other hospitals, other health settings and other clinical conditions.
Table B.1 indicates the data sources and risk adjustment factors used for risk-adjusted indicators provided by NSW Health.

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Data Source</th>
<th>Numerator &amp; denominator</th>
<th>Risk-adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30-day mortality rates (post appendicectomy and cholecystectomy surgery)</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 30/9/2008</td>
<td>Numerator-Number of deaths&lt;br&gt;&lt;br&gt;Dominator- Number of cases with the following DRGs: G07A, G07B, H07A, H07B, H08A, H08B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>2</td>
<td>Wound infection rates</td>
<td>APDC 2006-07 to 2008-09</td>
<td>Numerator-Number of cases with a wound infection indicated by the ICD10-AM disease code of T81.41.&lt;br&gt;&lt;br&gt;Dominator- Number of cases with the following DRGs: G07A, G07B, H07A, H07B, H08A, H08B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
</tbody>
</table>

**Note:** APDC - NSW Admitted Patient Data Collection. RBDM - Registry of Births, Deaths and Marriages. A case represents a hospital admission for a specified condition. DRG - Diagnosis Related Group v 5.1. Charlson index (see Box 6.1). Socioeconomic status (see Box 6.1). The linked patient data for appendicectomy and cholecystectomy were combined for the purposes of calculating risk-adjusted 30-day mortality rates and wound infection rates.

**Source:** NSW Health.
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Abb.</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% confidence interval</td>
<td></td>
<td>A statistical term describing a range of values within which we are 95% certain that the true population value lies.</td>
</tr>
<tr>
<td>Activity-based funding</td>
<td>ABF</td>
<td>Funding that is based on the projected amount and type of work of a facility, where standard prices are set for similar work undertaken. This has also been referred to as casemix or episode funding.</td>
</tr>
<tr>
<td>Acute care</td>
<td></td>
<td>Clinical services provided to admitted or non-admitted patients, including managing labour, curing illness or treating injury, performing surgery, relieving symptoms and/or reducing the severity of illness or injury, and performing diagnostic and therapeutic procedures. Most patients have acute or temporary ailments. The average length of stay is relatively short.</td>
</tr>
<tr>
<td>Admission</td>
<td></td>
<td>The process by which a person commences a period of residential care in a health facility.</td>
</tr>
<tr>
<td>Admitted Patient Data Collection</td>
<td>APDC</td>
<td>A database that covers all inpatient separations (discharges, transfers and deaths) from all Public (including Psychiatric), Private, and Repatriation Hospitals, Private Day Procedures Centres and Public Nursing Homes in NSW.</td>
</tr>
<tr>
<td>Agency for Clinical Innovation</td>
<td>ACI</td>
<td>A board-governed statutory health corporation that reports to the NSW Minister for Health and the Director-General of NSW Health.</td>
</tr>
<tr>
<td>Anaemia</td>
<td></td>
<td>A reduced level of haemoglobin, the protein that carries oxygen in the red blood cells. It has many causes, including bleeding (loss of red blood cells), low production of red blood cells, and processes that damage them. It can cause paleness, tiredness and breathlessness.</td>
</tr>
<tr>
<td>Appendicectomy</td>
<td></td>
<td>Surgical excision of the patient’s appendix.</td>
</tr>
<tr>
<td>Assistant In Nursing</td>
<td>AIN</td>
<td>An employee that is not a registered nurse, enrolled nurse or trainee nurse, who assists the Enrolled Nurses and Registered Nurses by providing basic nursing care, working within a plan of care under the supervision and direction of a Registered Nurse.</td>
</tr>
<tr>
<td>Australian Council on Healthcare Standards</td>
<td></td>
<td>An independent organisation dedicated to improving the quality of health care through performance reviews, assessment and accreditation.</td>
</tr>
<tr>
<td>Average length of stay</td>
<td>ALOS</td>
<td>The average number of days each admitted patient stays in hospital. This is calculated by dividing the total number of occupied bed days for the period by the number of actual separations in the period.</td>
</tr>
<tr>
<td>Term</td>
<td>Abb.</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bankstown-Lidcombe Hospital</td>
<td>BLH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Bureau of Health Information</td>
<td>BHI</td>
<td>An independent, board-governed organisation established by the NSW Government to be the leading source of information on the performance of the public health system in NSW.</td>
</tr>
<tr>
<td>Casemix</td>
<td></td>
<td>The range and types of episodes of care of patients (the mix of cases) treated by a hospital. This provides a way of describing and comparing hospitals and other services for planning and managing health care. Casemix classifications put patients into DRGs with similar conditions that use similar health-care resources, so that the activity and cost-efficiency of different hospitals can be compared.</td>
</tr>
<tr>
<td>Casemix funding</td>
<td></td>
<td>See Activity-based funding.</td>
</tr>
<tr>
<td>Cholangiograms</td>
<td></td>
<td>Imaging of the bile duct using x-rays.</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td></td>
<td>Excision of the gall bladder.</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td></td>
<td>Inflammation of the gall bladder, usually caused by infection.</td>
</tr>
<tr>
<td>Cholelithiasis (gallstones)</td>
<td></td>
<td>The presence of gallstones or stone like mass in the gall bladder.</td>
</tr>
<tr>
<td>Clinical Excellence Commission</td>
<td>CEC</td>
<td>A board-governed statutory health corporation with the CEO reporting directly to the NSW Minister for Health. A key role of the Clinical Excellence Commission is building capacity for quality and safety improvement in Health Services.</td>
</tr>
<tr>
<td>Clinical Nurse Specialist</td>
<td>CNS</td>
<td>A Registered Nurse/Midwife who applies a high level of clinical nursing knowledge, experience and skills in providing complex nursing/midwifery care directed towards a specific area of practice, a defined population or defined service area, with minimum direct supervision.</td>
</tr>
<tr>
<td>Comorbidity</td>
<td></td>
<td>When a person has two or more health problems at the same time.</td>
</tr>
<tr>
<td>Computed tomography</td>
<td>CT scan</td>
<td>A non-invasive medical imaging method using X-rays and computer processing.</td>
</tr>
<tr>
<td>Diagnosis Related Group</td>
<td>DRG</td>
<td>A system used to classify hospital admissions into groups with similar clinical conditions (related diagnoses) and similar resource usage (hospital services). There are approximately 500 coding classes. In Australian acute hospitals, Australian refined DRGs are used (AR-DRGs). The classification categorises episodes into groups with similar conditions and similar usage of hospital resources, using information in the hospital morbidity record such as the diagnoses, procedures and demographic characteristics.</td>
</tr>
<tr>
<td>Enrolled Nurse</td>
<td>EN</td>
<td>A person holding an Enrolled Nurse qualification who works under the supervision of a Registered Nurse to provide nursing care for patients in hospitals, nursing and a variety of other health care organisations.</td>
</tr>
<tr>
<td>Episode funding</td>
<td></td>
<td>See Activity-based funding.</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td></td>
<td>An imaging technique that provides real-time moving images of the internal structures of a patient through the use of a fluoroscope.</td>
</tr>
<tr>
<td>Gosford Hospital</td>
<td>GH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Term</td>
<td>Abb.</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Health Information Exchange</td>
<td>HIE</td>
<td>A database maintained by the NSW Department of Health that contains a range of financial, patient and clinical information from hospitals and area health services.</td>
</tr>
<tr>
<td>High dependency unit</td>
<td>HDU</td>
<td>An area or environment in a hospital that provides a higher level of critical care and monitoring than is provided in a general ward, but a lower level of care provided by an intensive-care unit.</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td></td>
<td>Surgical removal of the uterus.</td>
</tr>
<tr>
<td>Independent Pricing and Regulatory Tribunal of NSW</td>
<td>IPART</td>
<td>The independent economic regulator for NSW that is undertaking this hospital study.</td>
</tr>
<tr>
<td>Inpatient fraction</td>
<td>IFRAC</td>
<td>A measure used in casemix costing. The proportion of total (or operating) costs that are attributed to admitted patients.</td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>ICU</td>
<td>An area or environment in a hospital that provides the highest level of critical care and monitoring.</td>
</tr>
<tr>
<td>John Hunter Hospital</td>
<td>JHH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Laparoscopic cholecystectomy</td>
<td></td>
<td>A procedure where several incisions are made to the abdomen to allow the use of trochars and surgical instruments to dissect and remove the gall bladder.</td>
</tr>
<tr>
<td>Length of stay 1 (LOS1)</td>
<td></td>
<td>LOS1 is the episode length of stay in study hospital, ie, from the start of the episode to the end of the episode of care.</td>
</tr>
<tr>
<td>Length of stay 2 (LOS2)</td>
<td></td>
<td>LOS2 is the total length of stay in study hospital, ie, from admission to discharge at the study hospital.</td>
</tr>
<tr>
<td>Length of stay 3 (LOS3)</td>
<td></td>
<td>LOS3 is the total length of stay in study hospital plus up to 2 other hospitals - one transfer in and one transfer out.</td>
</tr>
<tr>
<td>Medical resonance imaging</td>
<td>MRI</td>
<td>A medical imaging technique most commonly used in radiology to visualise detailed internal structures of the body using a magnetic field.</td>
</tr>
<tr>
<td>Medicare Benefits Schedule</td>
<td>MBS</td>
<td>A listing of the Medicare services subsidised by the Australian government.</td>
</tr>
<tr>
<td>National Hospital Cost Data Collection</td>
<td>NHCDC</td>
<td>The NHCDC contains component costs per DRG based on patient-costed and cost-modelled information. The NHCDC enables DRG Cost Weights and average costs for DRGs for acute inpatients to be produced.</td>
</tr>
<tr>
<td>NSW Health</td>
<td></td>
<td>The broad term encompassing operational and other structures including the NSW Department of Health, Area Health Services, the Agency for Clinical Innovation, the Clinical Excellence Commission and a range of clinical taskforces.</td>
</tr>
<tr>
<td>Odds ratio</td>
<td>OR</td>
<td>The odds of an event occurring. This is equal to the probability that the event occurs divided by the probability that it does not occur.</td>
</tr>
<tr>
<td>Open cholecystectomy</td>
<td></td>
<td>The removal of the gall bladder via a large abdominal incision and open surgery.</td>
</tr>
<tr>
<td>Open Surgery</td>
<td></td>
<td>An invasive medical procedure where an incision is required for direct surgical access to the organs.</td>
</tr>
<tr>
<td>Term</td>
<td>Abb.</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Principal referral hospital</td>
<td></td>
<td>Hospital within peer group (principal referral hospitals 1b) classified as an acute hospital, treating 25,000 or more acute casemix weighted separations per annum, with an average cost weight greater than 1 and 1 or fewer specialty services.</td>
</tr>
<tr>
<td>Principal tertiary referral hospital</td>
<td></td>
<td>Hospital within peer group (principal referral hospitals 1a) classified as an acute hospital, treating 25,000 or more acute casemix weighted separations per annum, with an average cost weight greater than 1 and having more than 1 specialty service.</td>
</tr>
<tr>
<td>Prophylaxis</td>
<td></td>
<td>Disease prevention, also called preventive treatment.</td>
</tr>
<tr>
<td>Registered nurse</td>
<td>RN</td>
<td>A qualified nurse who provides care for patients in a variety of healthcare settings. These include public and private hospitals, community and home-based services, nursing homes and industry.</td>
</tr>
<tr>
<td>Royal North Shore Hospital</td>
<td>RNSH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Royal Prince Alfred Hospital</td>
<td>RPAH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td></td>
<td>A surgical procedure to cut an opening into the trachea (windpipe) so that a tube can be inserted into the opening to assist breathing.</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>VTE</td>
<td>The process by which blood clots occur and travel through the veins. It is the collective term for deep vein thrombosis (the formation of a blood clot in one of the deep veins within the body, such as in the leg or pelvis) and pulmonary embolism (condition in which the arteries leading from the heart to the lungs becomes blocked).</td>
</tr>
</tbody>
</table>