NSW Health cost and outcomes study by IPART for selected NSW hospitals

Other Industries
July 2010
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1 Introduction and executive summary

In September 2009, the NSW Department of Health asked the Independent Pricing and Regulatory Tribunal of NSW (IPART) to conduct a hospital costs and outcomes study. This study was part of a larger, multi-stage project the NSW Department of Health was coordinating to assist it in pursuing performance improvements across the state’s hospital system, and preparing for the introduction of activity-based funding. (See Box 1.1.)

Since that time, State and Federal Governments have agreed to implement a National Health and Hospitals Network\(^1\) that will include establishing a national performance framework and determining an ‘efficient price’ for specific hospital services within an activity-based funding model. IPART’s study is equally relevant in this context. In addition, its findings highlight some of the major challenges the body charged with determining the efficient price of hospital services – the Independent Hospital Pricing Authority – will face, particularly data quality and methodological issues.

Our study involved comparing the number and type of patients treated, the costs and configurations of care, and the patient outcomes in 5 NSW principal referral hospitals:

- Royal Prince Alfred Hospital (RPAH)\(^2\)
- Gosford Hospital (GH)
- Royal North Shore Hospital (RNSH)
- Bankstown-Lidcombe Hospital (BLH), and
- John Hunter Hospital (JHH).

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1 With the exception of the Western Australian Government.
2 We have also included the Institute of Rheumatology and Orthopaedics (IRO), a specialised orthopaedic surgery centre attached to RPAH, as part of our consideration of costs, outcomes and in particular, our analysis of the hip joint replacement case study. This facility undertakes the majority of planned hip procedures and shares medical staff and clinical resources with RPAH.
Our primary objective was to produce a body of information and analysis on costs, clinical practice and outcomes that can be used by clinical experts to promote clinical best practice and efficiency. We did this by highlighting variations in the way hospitals manage and provide care, estimating and comparing selected costs and providing data on indicators of clinical outcomes. In addition, we also aimed to:

- develop the basis for a methodology for comparing hospital costs, care and outcomes that can be applied more widely
- gain a better understanding of the current accuracy and consistency of clinical cost estimates and clinical coding, and the reliability of the information provided to the National Hospital Cost Data Collection
- identify ways in which the significant amount of data NSW hospitals currently collect can be better used by the health system, hospitals, clinical units and individual clinicians to improve clinical practice or reduce costs.

This document (Volume 1) is our main report on the costs and outcomes study. It explains how we approached the study and discusses our main findings and recommendations. We have also completed separate reports on the 11 clinical case studies we conducted as part of this study. These reports discuss our approach, findings and recommendations in each case study area in detail. Each case study is designed to stand alone, so this gives rise to some necessary repetition.

1.1 How did we approach the study?

The costs and outcomes study was a relatively complex and difficult task, primarily because hospitals are inherently difficult to compare. They are not like chain businesses, which have standardised services and production processes and virtually identical outputs. Rather, hospitals are complex organisations that produce a range of health services in a complicated environment.

To some extent all hospitals are different. They each have a unique mix of patients, a unique mix of clinical skills and specialisations, and produce a unique mix of outputs, including inpatient care, outpatient care, research and training. In addition, they are only one part of a complex health system, and the range of services they provide can vary, depending on what non-hospital-based health services are available within their area.

This makes it difficult to define and measure their efficiency and directly compare their performance. More specifically, it means that simple comparisons between hospitals are often misleading, or difficult to interpret, because the root cause of apparent differences is often ambiguous. For example, variations in hospitals’ costs may be due to differences in their efficiency, or may reflect differences in the quality care they provide, or the complexity of the cases they treat. Alternatively, they could simply reflect differences in the hospitals’ costing and coding practices. Similarly, variations in outcomes may stem from differences in the quality of care (which may
lead to differences in costs), or differences in the complexity of the cases or the types of patients they treat.

Therefore, we approached the costs and outcomes study acknowledging that the 5 study hospitals were all different. We undertook some hospital-wide analysis, but this was at a relatively high level. We compared the financial management, clinical costing, and clinical coding practices at the study hospitals. We also compared the approaches these hospitals used to manage and control the costs associated with the use of selected clinical resources involved in providing patient care. These resources were nursing staff, medical staff, prostheses, imaging, pathology, pharmacy, and operating theatres.

In addition, we undertook more detailed analysis at the case study level. With advice from a clinical consultant and our Clinical Reference Group (see Box 1.2), we selected 11 specific clinical conditions or procedures as case study areas (see Box 1.3). We defined each area based on a single Diagnostic Related Group (DRG) or several related DRGs. For some case studies, we also divided the area into subgroups (eg, based on principal diagnosis or procedure codes). This approach enabled us to compare similar hospital activities for similar types of patients. Within each area, we sought to compare patient numbers, lengths of stay, costs, configurations of care and outcomes for groups of patients that are likely to have similar clinical resource needs and similar expected outcomes.

Please note that we mainly confined our analysis to direct, acute inpatient care provided at each study hospital, as the most extensive data collections are available for this type of care. For some of our case studies (in particular, obstetrics delivery, cataracts and cardiology) we also examined outpatient or other types of non-inpatient data, because some study hospitals provided some or all of the relevant care in outpatient, community or home settings, or inpatient data sets were incomplete.

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3 We used Australian Refined Diagnostic Related Groups (referred to throughout this report as DRGs). These DRGs are used in all Australian public hospitals to classify acute patient episodes. They also form part of an internationally recognised clinical coding and classification system that is used in several countries.

4 For example patients treated in cardiac catheter labs or procedure rooms were sometimes excluded. This is discussed in Chapter 5.
Box 1.1 NSW Department of Health project

IPART’s hospital costs and outcomes study is part of a larger, multi-stage project the NSW Department of Health is undertaking 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 maximal efficiency.

The first component has been 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 COAG to move to a more nationally consistent approach to activity-based funding. The second, third and fourth components have been completed by IPART through this hospital costs and outcomes study. The results of this study will be used by clinical experts in completing the fifth and sixth components.

In addition, the NSW Department of Health will work with the Agency for Clinical Innovation (ACI), Clinical Excellence Commission (CEC), Bureau of Health Information, and Clinical Education and Training Institute (CETI) to build on and broaden this work to develop methodologies that area health services, individual hospitals and others in the health system can apply to improve performance.
Box 1.2  Our clinical reference group and clinical consultants

Our clinical reference group comprised:

- Professor Bruce Barraclough
- Dr Anthony Burrell
- Dr Patrick Cregan
- Professor Phil Harris
- Professor Clifford Hughes
- Professor Brian McCaughan
- Professor Peter McClusky
- Dr Michael Nicholl
- Professor Ron Penny
- Professor Carol Pollock, and
- Dr Hunter Watt.

Our clinical consultant was Dr Paul Tridgell.

We also consulted clinical groups, including the ACI, the CEC and the National Stroke Research Institute.

IPART sincerely thanks all of these experts, as well as the wide range of clinicians and other staff we spoke to at the study hospitals. We greatly appreciate their time and expertise, which made a significant contribution to the study.

Box 1.3  Clinical case study areas

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

1. Hip joint replacement
2. Major chest procedures
3. Breast surgery
4. Cholecystectomy (gall bladder surgery)
5. Appendicectomy
6. Stroke
7. Cardiology
8. Tracheostomy or ventilation for greater than 95 hours
9. Cataract/lens procedures
10. Hysterectomy
11. Obstetrics delivery.
1.2 How did we obtain comparable data?

One of our main challenges was obtaining consistent or at least comparable data for each hospital. We collected a large volume of data from the NSW Department of Health, area health services, the study hospitals and other organisations (including the hospitals’ imaging and pathology service providers). This included a range of administrative, clinical and financial data related to the patient activity and resource use at each hospital over the period 1 July 2008 to 30 June 2009.

We assessed the quality of the data, and identified where there were inconsistencies in the data for individual hospitals. For example, we spoke to the relevant staff about the way the data was compiled, and audited its accuracy through cross-checking and comparisons between hospitals. In some cases, we reviewed selected clinical notes to assess the consistency of the data and these notes.

In addition, we visited each study hospital and spoke to a range of staff, including hospital executives and managers, doctors, nurses, clinical coders, financial managers, and administrators. During these visits, we obtained an understanding of the hospitals’ administrative, financial and clinical management practices, protocols and standards, methodology for casemix costing, approaches for managing the use and controlling the costs of the selected clinical resources, and clinical practices within our 11 clinical case study areas (configurations of care). We spoke to staff about clinical indicators for safety, quality and outcomes and their collection.

We also obtained information we needed to assist us in estimating nursing costs per patient and medical costs in the case study areas. For example, this included information on ward staffing arrangements, speciality staffing, and the share of staff time spent undertaking direct inpatient care (rather than outpatient clinics or area management responsibilities).

Finally, we used the range of available data and our understanding of any inconsistencies and other shortcomings in these data to create more consistent and therefore more comparable information on the type and number of inpatients provided with acute care at each hospital, their lengths of stay, the associated costs, the configurations of care provided, and the outcomes of this care.

It should be noted that in some instances we were unable to obtain complete or comparable datasets in the timeframe available. We have noted these instances throughout this report and our case study reports, and highlighted the most important gaps in our recommendations and in Chapter 17 on areas for further work.
1.3 How suitable were DRGs as a basis for hospital comparisons?

Studies that compare or benchmark hospital performance often use cost or activity measures based on DRGs as the basis for comparison. DRGs are intended to classify patients into groups with similar clinical conditions and similar resource requirements. Our case study analysis gave us an opportunity to assess whether DRGs are in fact a suitable basis for comparing hospitals’ costs and outcomes.

As noted above, we defined each case study area using a single DRG or several related DRGs. Then, for each area, we assessed whether the DRG(s) provided a reasonable basis for comparing costs and outcomes between hospitals. This involved both data analysis and discussions with clinicians.

We found that in at least 6 of our 11 case study areas, the relevant DRG(s) contained a range of patients with different cost or outcome profiles. These areas were hip joint replacement, cardiology, breast surgery, major chest procedures, stroke, and tracheostomy or ventilation greater than 95 hours. Therefore, for these areas, DRGs did not provide an ideal basis for comparing costs, care and outcomes across the study hospitals.

In 3 of these areas – hip joint replacement, major chest procedures and breast surgery – we were able identify subsets of like patients within the DRGs that provided a more valid basis for comparison. These subsets were based on principal diagnosis codes or procedure codes. For 2 other areas – cardiology and stroke – we found that coding issues played a part in making it more difficult to compare some groups of patients and that improvements in coding practices would facilitate more valid comparisons for some patient groups.

However, in the last of these areas – tracheostomy or ventilation greater than 95 hours – we found that the DRG included such diverse patients with different diagnoses and different clinical procedures that we were not able to identify a better basis for comparison than the DRG without undertaking further analysis.

In addition, we found that in many of the case study areas where DRGs did provide a suitable basis for comparing costs, this basis could be improved in some way – such as by separating planned and emergency cases, or taking into account additional factors.

Given the often strong relationships between hospital costs, outcomes and casemix complexity, these findings indicate that hospital comparisons based solely on DRGs may be misleading. DRGs are not always the most suitable basis for comparing costs, configurations of care and outcomes. Any future methodology for comparing hospital costs and outcomes based on DRGs should involve considering whether these are the best available basis and, if not, interrogating the data to identify a more suitable basis.

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5 DRGs are normally based on clinical conditions or clinical procedures.
1.4 **How comparable were study hospitals’ data on patient numbers and lengths of stay?**

Once we established the most suitable patient groups to use as the basis for comparison in each case study area, we examined data on the number of patients and length of patient stay in these groups for each study hospital. As our starting point, we extracted data on acute inpatient episodes in 2008/09 from the Health Information Exchange (HIE) at the DRG level. We analysed the data to identify anomalies and inconsistencies due to differences in the hospitals’ administrative and other practices.

1.4.1 **Patient numbers**

For patient numbers, we found that not all the patient data was held in the HIE; some was fragmented in multiple locally held datasets (eg, data for cardiac catheter labs or cataract surgery). We also found that the data were not always consistent across hospitals, due to differences in how the hospitals had counted inpatients, both within DRGs and between DRGs. The main inconsistencies arose because:

- the hospitals classified patients differently because they provided the care in different settings (eg, inpatient, outpatient, community and home-based settings)
- the hospitals classified patients differently for charging purposes
- the relevant patients stayed in the hospital for a short time and may not have been formally admitted
- the relevant patient care was shared by more than one hospital under ‘collaborative care’ arrangements or hospital networks.

We adjusted our patient numbers data to account for these differences. Where we identified fragmented patient data or were unable to obtain complete datasets, we have highlighted this in our findings and recommendations.

Our findings on patient numbers have implications for both comparisons of patient outcomes among hospitals and also for the introduction of activity-based funding. In particular, fragmented patient datasets make the collection of patient data for comparisons of outcomes more complex. Also under an activity-based funding model for acute inpatient activity, there is potential for a hospital’s patient classification practices to influence its funding levels.

1.4.2 **Length of stay**

For length of stay, we calculated the average length of stay for each patient group using 3 different measures, and identified the measure that provided the most consistent basis for comparison. The measures included:

- episode length of stay in study hospital (LOS1)
We found that although LOS1 is widely used as a basis for hospital cost comparisons, it was not a consistent basis for comparing the study hospitals for all patient groups. This was because the hospitals had different practices in relation to changing patients’ ‘care type’ codes during their stay (eg, from an acute care episode to a rehabilitation care episode). Therefore, apparent differences in average lengths of stay across hospitals may simply reflect differences in these practices.

For example, stroke patients remain ‘acute’ for far longer at BLH than at any of the other study hospitals because they undergo a significant amount of rehabilitation in the wards, and the hospital only changes their type codes when they are transferred to a rehabilitation ward. This means that they are being treated by medical staff from the ‘rehabilitation’ specialty while still classified as an ‘acute’ patient in the ‘neurology’ or ‘geriatrics’ specialty. Other hospitals reclassify stroke patients to ‘rehabilitation’ far sooner and do not provide much (if any) rehabilitation while they are classified as ‘acute’. During hospital visits, one of the clinical coders commented that, despite efforts by the NSW Department of Health to improve consistency in coding practices, hospitals still tend to “do their own thing”.

We also found that LOS2 was not a consistent basis for comparing the study hospitals, because these hospitals had different patterns of referring patients to other hospitals, and receiving patients referred from other hospitals. (For example, they had different scope to transfer patients to rehabilitation facilities after the acute stage of their care.) Therefore, apparent differences in total lengths of stay may simply reflect differences in hospitals’ volumes of transfers in and out.

Therefore, neither LOS1 nor LOS2 provided a reasonable basis for comparison in case study areas where patients typically have 2 or more consecutive episodes of care, or are often transferred to different hospitals for different episodes of care – such as stroke and hip joint replacement.

We concluded that LOS3 was a more consistent way to compare lengths of stay across hospitals. This measure takes account of inconsistencies in both the hospitals’ practices in relation to changing care types and patterns of transfers. The data required to calculate it can be obtained by using inpatient data in the HIE, and using the linkage key developed by the Australian Institute of Health and Welfare (AIHW) to link inpatient data for consecutive hospital stays. This is not widely done at present.

Ideally, analysis should be patient-centric and analysis should extend across a range of settings, not just hospitals, but GPs and community health as well. The introduction of a unique patient identifier will further improve this capacity.
Our findings suggest that any methodology for comparing hospitals in the future should not use acute episode length of stay to compare clinical groupings where there are typically 2 or more episodes of care or significant numbers of transfers. They also suggest cost estimates based on acute episodes, such as those in the NHCDC, are likely to be of limited value if used to compare hospitals for such clinical groupings. In addition, the NSW Department of Health and hospitals should improve the consistency of hospital practices in relation to care type changes – including by introducing clear guidelines for when a patient’s care type code should be changed from acute to rehabilitation care.

1.5 What were our findings on clinical coding?

Clinical coding is the classification process whereby patients are assigned a DRG and other codes based on information in their medical records about their diagnoses, the procedures they underwent, and various demographic and administrative factors. We undertook limited analysis to assess the accuracy and consistency of the study hospitals’ coding practices. This involved examining de-identified data from RPAH and BLH to check that patients who had had certain pathology tests had been coded in a way that was consistent with the results of these tests. We also reviewed a sample of medical records in relation to selected case studies.

We found that a significant proportion of cases with abnormal pathology results for troponin T, haemoglobin, blood glucose or salt levels had not been coded for acute myocardial infarction (AMI), anaemia, diabetes or hyponatremia.

We acknowledge that an abnormal pathology result does not automatically mean that a patient has a particular diagnosis, particularly in the case of AMI. However, we suggest that some of the cases that were not coded were likely to be patients with diagnoses that could influence DRG complexity. Therefore, RPAH and BLH (and possibly other NSW hospitals) could be understating their casemix complexity.

Our findings suggest that NSW hospitals need to consider their coding accuracy. This is particularly important in light of the introduction of activity-based funding, since coding accuracy will impact on reported casemix complexity and this is likely to have funding implications in a casemix or activity-based funding system. We suggest that hospitals take steps to improve the communication between clinicians and coders in order to better understand the criteria required for coding and the nature of common clinical conditions.
1.6 What were our findings on clinical costing and the National Hospital Cost Data Collection?

Most major Australian public hospitals are required to do clinical costing. This process involves allocating hospital expenditures to specific groups of patients (eg, based on their DRGs) to estimate the costs of providing their hospital care. These estimates are submitted to the National Hospital Cost Data Collection (NHCDC), and reported by the AIHW.

We examined clinical costing practices in the study hospitals as part of our cost analysis, to assess whether these practices were consistent. In addition, for some of the clinical resources we focused on, we were able calculate our own cost estimates using de-identified patient-level data, and then compare them to the cost estimates submitted to the NHCDC. We found that:

- The relevant area health services undertook clinical costing on behalf of the study hospitals, but used different approaches. One principally used ‘top down’ cost allocation using service weights, while the other 2 made use of patient-level data to some extent.
- There were differences between areas in the amount of patient-level data available from the hospitals’ clinical systems. In some instances, these data were not used for clinical costing even when they were available.
- There were also differences between areas in the extent to which hospital finance staff and management understood the clinical costing process undertaken at the area level.
- Generally, the clinical costing process and the outputs from this process were not integrated into the study hospitals’ overall financial management or clinical planning systems. We note that this is markedly different to what occurs in jurisdictions with casemix funding systems.
- The area health services used different charts of accounts and the hospitals used different cost centres and included different items within cost centres. This made the task of comparing costs on a consistent basis much more difficult and time consuming. In some instances, we also found that the cost centres were out of date – for example, wards had changed function, but the cost centres had not always been updated in a timely manner.
- All hospitals applied inpatient fractions (IFRACs) to allocate nursing and medical staff costs to inpatients. However, we are concerned that the hospitals did not apply a consistent approach when calculating these fractions. IFRACs were sometimes out of date.
- Our estimates of average costs per patient indicate there is a higher degree of consistency in these costs across the study hospitals than is suggested by the hospitals’ NHCDC estimates. This is likely to reflect differences in costing methodology across hospitals. However, we understand that the hospitals’ NHCDC estimates for 2008/09 may have been impacted by the implementation of a new clinical costing system in 2007/08 that was still being ‘bedded down’.
Our findings suggest that there is a lack of consistency in clinical costing across hospitals. We consider that the NSW Department of Health needs to take a more proactive role in ensuring a consistent approach to the structure of accounts and clinical costing, and that clinical costing estimates should be audited.

Clinical costing involves a considerable investment of time and resources and therefore it should not be regarded as a pass through of information to the Commonwealth, but should be designed to also be useful to NSW hospital managers and clinicians. We found there is scope to increase the use of actual patient-level costing information (rather than cost modelling) and that quality clinical costing data can be used to provide information relevant for both financial management and clinical comparisons of practice and clinical quality.

1.7 What were our findings on costs?

As noted in section 1.1 above, our cost analysis focused on 7 significant clinical resources used in providing direct inpatient care at the study hospitals – nursing staff, medical staff, prostheses, imaging, pathology, pharmacy and operating theatres. At the hospital level, we examined the use of each resource at each study hospital, and compared the approaches used to manage this use. At the case study level, we estimated the average cost (or value) of the resource on a per patient basis where this was possible. However, we did not do a ‘bottom up’ costing of each resource. We used a range of approaches, based on the best data that was readily available.

1.7.1 Nursing staff costs

Our nursing cost comparisons were based on ‘productive’ hours and pay from hospital payrolls and patient data. At the hospital-wide level, we compared the mix of nurse categories and experience levels at the study hospitals. We also compared the average pay rates for ‘direct care’ nurses7 (for both normal and overtime hours) at these hospitals. In addition, we compared the IFRACs the hospitals use in clinical costing to reflect the share of nursing hours spent on inpatient care versus other duties (such as outpatient care, teaching and administration). We also applied these IFRACs to estimate the number of nursing hours and the costs that were allocated to inpatient care. At the hospital wide-level, we found that:

- There were broad similarities in the mix of nurse categories and experience levels across the study hospitals, but also some differences. Direct care nurse categories made up about 90% of total nursing staff at the hospitals.

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7 These are the nurses who provide most of the direct care to patients: Assistants In Nursing, Trainee Enrolled Nurses, Enrolled Nurses (including Mother Craft Nurses), Registered Nurses, Registered Midwives, Clinical Nurse Specialists, and Clinical Midwife Specialists.
Registered Nurses (RNs) made up the largest nurse category, comprising around 70% of total nursing staff. Approximately half of RNs were RN 8s, the most senior RN category. However, these proportions varied somewhat between the hospitals.

For direct care nurses, the average cost per productive hour\(^8\) was around the same at all of the study hospitals: $36 per hour (including ordinary, overtime and penalty rate costs).

Overtime rate costs ranged from 1.0% of total direct care nursing costs (at BLH) to 3.7% (at GH). Hospitals minimised overtime requirements by maintaining part time and casual staffing pools.

IFRACs had a significant impact on our analysis of nursing costs. We found that the IFRACs used by the study hospitals were inconsistent across hospitals, incomplete and in some instances out of date. In addition, there was no standard approach for determining these fractions. In order to compare nursing costs on a consistent basis IFRACs need to be determined using a consistent approach and accurate.

When the IFRACs provided by each study hospital were applied, the share of direct care nursing hours attributed to inpatient care ranged from 65% to 89%. This variation was partly due to the different range of functions that were included under each hospital’s facility code.

However, the average direct care nursing costs per bed day at the overall hospital level were more or less similar across the study hospitals.

At the case study level, we estimated nursing hours and nursing costs per patient day. We also estimated nursing costs per episode, both with and without applying IFRACs. And we compared our estimates of nursing costs per episode with the provisional estimates of NHCDC direct ward costs per episode for 2008/09. We found that:

The patient’s reported length of stay is a key factor in determining nursing costs per episode. We were only able to estimate this cost for the acute episode length of stay (ie, LOS1), which may represent only one stage of a patient’s total hospital journey. For some of our case studies, this length of stay varied considerably between hospitals, partly due to differences in models of care and partly due to differences in administrative practices relating to ‘type’ changing. This variation led to large differences between our estimates of nursing costs across hospitals, which may have been much less had we been able to estimate these costs for the total patient journey.

Overall, nursing costs were broadly similar. In some case study areas, our estimates of nursing costs per episode varied considerably across hospitals. These differences were largely due to differences in LOS1, but also partly due to differences in the number of nursing hours per patient bed day and (therefore) differences in the nursing costs per patient day.

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\(^8\) That is, excluding leave pay and superannuation.
As discussed in section 1.4.2, measuring the total length of stay (including both before and after the acute episode) provides a more consistent estimate of the length of stay. This suggests LOS3 may be a better measure for comparative purposes, particularly for patient groupings where there are typically 2 or more episodes of care or significant numbers of transfers.

For most of our case studies, the main driver of the cost per patient bed day was the number of nursing hours per patient bed day rather than the average cost per nursing hour (which in turn depended partly on the staff mix).

For most of our case studies, there was more variation in our estimates of total episode nursing costs across hospitals when we applied the hospitals’ IFRACs than when we did not.

The provisional 2008/09 NHCDC estimates of total episode nursing costs contained in each hospital’s cost data files have the hospital’s IFRACs applied and include overhead costs like leave and superannuation. The NHCDC costs were generally higher than our costs (which is expected), but also varied over a significantly wider range than our estimates.

Our findings suggest that at the hospital-wide level, nursing staff structure was broadly similar, although there were some differences in the seniority and mix of nurses and the use of overtime among study hospitals. At the case study level, there were greater differences in nursing seniority between case study areas, reflecting different skill mixes required for different conditions or procedures. Further, the nursing staff structure may influence quality of care, with several studies showing significant links between patient outcomes and the experience of the nurses providing the care.

Our analysis also highlights that the clinical costing methodology (including IFRACs and the length of stay measurement) can have a significant impact on reported nursing costs. We support greater standardisation of clinical costing methods across hospitals.
1.7.2 Medical staff costs

Comparing medical staff costs was considerably more difficult and complex than nursing staff costs, so we were only able to do higher level analyses. We divided medical staff into 2 broad groups - junior medical officers (JMOs) and senior medical staff (including staff specialists employed by the hospitals and visiting medical officers (VMOs) working on a contractual basis).

At the hospital level, we compared the mix of JMOs and staff specialists at the hospitals, and the cost of JMOs, staff specialists and VMOs as a proportion of their total medical staff costs. We also compared the average hourly pay rates for JMOs and staff specialists, and the extent to which overtime hours contributed to JMOs’ total hours worked and pay. In addition, we applied the hospitals’ IFRACs to estimate the proportion of JMOs and staff specialists allocated to inpatient care. We found that:

- There was little variation in the ratio of expenditure on junior to senior medical staff (including VMOs) across the 5 study hospitals.9

- There was also very little variation in the average hourly pay of junior medical officers, (both including and excluding overtime pay), and modest variation in the average hourly pay of staff specialists.

- However, there was significant variation in VMOs costs as a proportion of total medical staff costs across the hospitals. This proportion ranged from 16% at JHH to 41% at GH. There was also significant variation in the way VMOs are paid.

- The study hospitals either paid VMOs an hourly rate per session, or a set fee per service. As there was no information available on the number of hours worked by VMOs on a fee-for-service basis, we could not compare senior medical staff hours, or total medical staff hours across the hospitals.

- The hospitals’ IFRACs were inconsistent between the hospitals, incomplete and sometimes out of date.

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9 Note that in this chapter, RPAH includes IRO unless otherwise stated.
At the clinical specialty level, we did a broad comparison of the number of junior and senior medical staff, and their average hourly pay rates for selected specialties. We also looked at JMO, staff specialist and VMO costs as a proportion of total medical staff costs for selected specialties. We found that:

- It was difficult to compare medical staff costs across hospitals, because of the different ways the hospitals classified specialties and captured the associated costs. Also, doctors’ costs were often allocated to one specialty even though they spent time on other specialties.

- At the hospital level, it may also be misleading to use IFRACs to compare medical staff costs of inpatient care across hospitals at the specialty level. This is because the IFRACs are inconsistent, incomplete and often out of date. Also, comparing the costs of inpatient care can be misleading because this approach does not take account of differences in the complexity of cases within the same specialty.

- There appeared to be greater variability in the numbers of medical staff, overtime hours worked and average hourly pay across the study hospitals at the specialty level than at the hospital level. However, these results need to be interpreted with caution and may be misleading due to differences in the way the hospitals identify their specialties and capture their costs.

- VMOs tended to be more concentrated in some specialties than others at all the study hospitals.

Our analysis of medical staff costs was limited because of inconsistencies in the completeness and consistency of available information on these costs. There were differences among hospitals in relation to the mix in the types of medical appointments; remuneration structures; naming and grouping of specialties; accounting structures; and methodologies used to determine IFRACs for apportioning medical staff time. We consider that further work needs to be undertaken to strengthen the quality and consistency of available information on medical staff costs. For example, more detailed and more consistent information on costs and hours of VMOs, better identification of medical staff time spent with patients and time spent on other functions like training or management.

### 1.7.3 Prosthesis costs

At the hospital level, we compared the approaches to prosthesis purchasing at the study hospitals. At the case study level, we compared the patterns of use and prices paid for 5 selected prosthesis items used in our case study areas. These included coronary stents, pacemakers, and implantable cardioverter and defibrillators (ICDs) (used in cardiology), intraocular lenses (used in cataract/lens procedure), and hip joint prostheses (used in hip joint replacement).
Approach to prosthesis purchasing across study hospitals

We found that the study hospitals’ approaches to prosthesis purchasing varied markedly. At one end of the spectrum, RPAH appeared to have a very structured approach, with threshold pricing at the area health service level, frequent tender processes, tight controls on product choice, and dedicated business resources allocated to negotiate prices and manage the process. At the other end, RNSH appeared to have few controls over what products were purchased and limited resources allocated to collective purchasing negotiations. However, we note that RNSH and NSCCAHS undertook a series of steps to improve prosthesis purchasing during the period of this study, including a new tender process for pacemakers and ICDs and threshold pricing for some of its prosthesis purchases.

In addition, we found that the diversity of clinical conditions and the need for specialist prostheses for some patients means that even with very structured and controlled approaches to purchasing, there still needs to be some flexibility in the system to allow for special orders.

Patterns of use for selected prosthesis items

Each of our 5 selected prosthesis items is available in different types or models, which vary in terms of the materials they are made from, their durability, functionality or other characteristics. We observed substantial variation in the range of prosthesis models purchased by the study hospitals. For some of these items, we also found variation in the types or models most frequently used by the study hospitals. The most notable example was stents, where we found that RNSH used a considerably higher proportion of drug-eluting cardiac stents than the other study hospitals, which more often used the less costly, bare metal cardiac stents.

Other examples related to hip prosthesis components. For instance, we found that JHH most often used ceramic femoral heads, while other study hospitals used more of the less costly, metallic femoral head implants.

Prices paid for selected prosthesis items

We found significant variation in the prices the study hospitals paid for the 5 selected prosthesis items. In many cases this was because the hospitals chose different types or models to one another. But in other cases it was because they paid different prices for the same model. For example, for ICDs, we found that RNSH had paid $5,000 more for a particular model than one of the other study hospitals.

We also found that the study hospitals did not usually share the prices they paid for prosthesis items with other hospitals, often not even with the hospitals within their area. This means that hospital purchasing staff may not be aware that other hospitals are negotiating significantly lower prices than them for the same items.
In addition, we found there tended to be some correlation between a more centralised and controlled approach to purchasing by the hospital or area health service and lower prices paid for prostheses. Further, the hospitals that allocated resources to purchasing tended to benefit from lower prices which outweighed the cost of these resources. The prime example of this is RPAH, which employed a Business Manager in its theatres who negotiated considerable price reductions on the hospital’s procurement and created considerable savings for the hospital.

We also found that in many cases, the study hospitals could achieve significant savings if they had paid lower prices (equivalent to best prices paid by other hospitals) for some of their most frequent prosthesis purchases.

**NHCDC data on average prosthesis cost per patient in selected DRGs**

We found that the study hospitals’ estimates of their 2008/09 average prosthesis cost per patient, as reported to the NHCDC and which were relevant to our selected DRGs, varied widely and appeared to be unreliable. However, estimates of the national public hospital average prosthesis cost per patient for 2007/08 published by the NHCDC (and relevant to our selected DRGs) appeared more reasonable and consistent with our estimates.

Our findings on prosthesis costs suggest that there is scope for the study hospitals to pay lower prices for commonly purchased prosthesis items and for several of the hospitals to adopt more rigorous prostheses management practices. We also suggest that variations in hospitals’ choice of some prosthesis items (such as stents) could have clinical implications and that NSW Health should consider these variations.

**1.7.4 Imaging costs**

At the hospital level, we compared the study hospitals’ protocols for managing the use and costs of imaging. At the case study level, we estimated average imaging costs per patient using data on the number and type of tests and the Medicare Benefit Schedule (MBS) as a proxy for costs. We compared these costs across case studies and hospitals. We also compared these costs with the hospitals’ NHCDC estimates. In addition, we compared the data on imaging tests the study hospitals receive and use, and considered how the health system and hospitals can make better use of available imaging data.
Hospital protocols for managing the use and costs of imaging

We found differences in the study hospitals’ protocols for managing the use and cost of imaging. JHH appeared to have generally sound controls, including a requirement that approval from a senior clinician be obtained before high-cost tests are used (ie, out-of-hours MRIs and CT scans). RNSH’s guidelines appeared likely to increase its imaging use in some cases, and may partly explain the relatively high use of MRI and CT scans for emergency cases at this hospital.

Average imaging costs per patient across case studies and hospitals

Based on our estimates of imaging costs per patient, we found certain conditions or procedures – including stroke, tracheostomy, and cardiology – were associated with much higher imaging costs than others at all the study hospitals. For most conditions, emergency cases also involved higher imaging costs than planned cases.

Within case study areas, we found there was considerable variation in our estimated imaging costs per patient across hospitals. There was also variation between our cost estimates and those included in the NHCDC. The NHCDC estimates for RNSH and GH were the most consistent with our estimates, while those for RPAH and BLH varied the most from our estimates.

Making better use of imaging data

We found that imaging data can be better used to compare and improve clinical practice. For example, these data can be particularly useful for comparing practices for stroke, appendicectomy and cholecystectomy cases. There is scope for the NSW Department of Health, hospitals and bodies such as the CEC to make more use of imaging data for this purpose. Some examples of potentially useful analyses include:

- the time from ambulance call or emergency admission to CT for stroke patients (using the linkage of the ambulance and the imaging systems to provide a more accurate indication of the minimum time since a stroke – which may rule out certain treatments)

- using imaging systems to compare hospitals’ patterns of practice, such as whether ultrasound is routinely used for diagnosing appendicectomy patients in emergency departments, or whether fluoroscopy is routinely used for cholecystectomy surgery.
Imaging data can also be better used to improve the quality of clinical cost estimates. We consider that area health services should use imaging data, and adopt a standard basis for valuing each type of imaging test. For our analysis, we based this value on 100% of the MBS fee for each type of test. However, some other basis could also be used.\textsuperscript{10}

To facilitate better use of imaging data, the format of the data collected at the patient level should be standardised, and this data should be used for a range of uses. Standardising the data would also make comparisons between the hospitals easier, and this would assist clinicians and health managers to better understand variations in cost and practice patterns. The NSW Department of Health may need to review hospitals’ internal charging arrangements and consider whether standard charging arrangements based on actual imaging costs should be applied across the NSW Department of Health.

Our findings on imaging costs suggest that there is variation in the use of imaging among study hospitals for similar conditions as well as differences in the controls used to manage imaging use. Our analysis also indicates that imaging data can be used more effectively. We consider that the format of imaging data should be standardised, so imaging data can be used for a variety of purposes and compared between hospitals.

1.7.5 Pathology costs

For pathology costs, at the hospital level we compared the study hospitals’ protocols for managing the use and costs of pathology tests. At the case study level, we estimated average pathology costs per patient and compared these costs across case studies and hospitals. Our cost estimates used de-identified patient-level internal charges as a proxy for cost. In addition, we considered how the health system and hospitals can make better use of available pathology data.

Hospital protocols for managing the use and costs of pathology tests

We found that the study hospitals used a range of approaches to manage the use of pathology services to control costs and ensure patients have appropriate tests for their condition. All the hospitals had pre-admission test ordering guidelines. JHH’s guidelines appeared to be the most comprehensive and included explicit standards of care. Some also had requirements that specialist approval be obtained before high-cost test were ordered, or certain tests were reordered. Most had electronic systems in place to ensure test ordering protocols were followed.

\textsuperscript{10} At the time of our study, the average costs assigned to imaging tests for internal charging purposes ranged from 120% to 130% of the MBS fee. Using the MBS fee provides a simple and consistent basis for comparing use. However if reliable and consistent cost estimates are available by test type, these could be applied.
Average pathology costs per patient

Within case study areas, we found that average pathology costs per patient varied considerably across the study hospitals. These costs appeared to be highest at RNSH for most of the case study areas. As for imaging, the NHCDC estimates for RNSH and GH were the most consistent with our estimates.

Making better use of pathology data

As section 1.5 discussed, we found that pathology data can potentially be used to assess the accuracy and consistency of hospitals’ medical record coding and coding practices. Hospitals may be able to use similar analysis to more systematically audit the quality of their coding.

We also found that some pathology test results can potentially be used to compare and improve the quality of care. For example, it may be possible to use International Normalised Ratio (INR) level test results to assess whether patients have been administered too much warfarin, and to use sodium or potassium level test results to assess patients’ fluid management.

In addition, it may be possible to use pathology tests to monitor and control pathology costs at the hospital and ward levels. However, for this to occur, the pathology services need to provide hospitals (and hospitals need to provide clinical units) with detailed information on the number of tests they ordered, by test type, and the costs of these tests. In addition, more accurate information on the costs associated with specific tests and the consequences of different test ordering patterns needs to be provided, so clinicians can consider pathology costs in the context of their clinical decision-making.

Our findings suggest that there were differences among study hospitals in the use of pathology tests for similar conditions. There were also differences in the controls used to manage pathology use. Our analysis highlighted how pathology data can be used more effectively, eg, to audit coding quality and potentially to monitor safety and quality in selected areas. We consider that the format of pathology data feeds should be standardised, so that pathology data can be used for a variety of purposes and compared between hospitals.
1.7.6 Operating theatre costs

We found that the study hospitals’ theatre capacity varied widely, as did their theatre management practices. In general, we found that the hospitals that separated planned surgery from emergency surgery (particularly for trauma cases, such as car accidents) had more efficient and effective theatre management. In particular:

- RPAH and JHH both appeared to have sound theatre management practices. Some of these practices could be adopted in other hospitals or hospital networks. Both RPAH and JHH separate planned and emergency surgery. Individual hospitals may not have the theatre capacity to do this, but networks of hospital may.

- GH appeared to have a more difficult management task than BLH (its peer hospital) due to its high emergency caseload, more limited theatre capacity, and because it generally takes the acute trauma cases within its network. In contrast, BLH is not a designated trauma centre, which aids the management of its theatres.

In relation to average operating theatre times, we noted that available theatre data were not always comparable, and there were gaps and inconsistencies in the recorded information. However, in general, we found that average theatre times were similar for many of the like-patient groupings from our case studies. We also identified a range of factors that can influence theatre times and lead to differences in the reported times across hospitals. One example of this was higher average surgery times for cataracts/lens procedures where hospitals were providing medical training.

In relation to the effect of theatre access and theatre management on patient flow, we found that limited theatre availability and inflexible theatre start and finish times can hinder the efficient flow of patients through a hospital, and in some cases influence patient care. Likewise, limited after-hours access to diagnostic tests (such as CT scans) can hinder the efficient flow of patients, particularly for emergency cases.

In relation to the NHCDC, we identified many issues that raise doubts about the quality of the theatre data within this collection, and therefore its usefulness for comparing operating theatre costs across hospitals.

Our findings highlight differences in theatre capacity, but also differences in theatre management practices among study hospitals. We have identified examples of better management practices that should be considered for implementation in other hospitals or hospital networks. Our findings also point to shortcomings in the quality of theatre data and we consider that the NSW Department of Health should establish a standard approach to the measurement of recorded theatre times and undertake audits of the quality of data on returns to theatre.
1.7.7 Pharmacy costs

For pharmacy services, we did not undertake a detailed review of controls or costs. We undertook a limited, high-level review of selected aspects of hospital pharmacy management likely to influence hospital pharmacy costs, patient care and outcomes at the 5 study hospitals.

There are 2 broad ways that medications can be managed and provided to patients in hospital. They can either be ‘dispensed’ or ‘impressed’. Dispensed medications are managed and controlled by the hospital’s pharmacy and allocated (or dispensed) by pharmacists directly to patients. Imprest medications are stored and controlled in or near wards, and normally allocated to patients by nursing staff as required.

We found that the proportion of medications that were dispensed to patients by pharmacists varied markedly across the study hospitals. At RPAH and BLH, 75% to 80% of medications were dispensed. JHH had the lowest proportion of dispensed medication (approximately 20%). We were not able to fully explore the cost or safety implications of this difference, and consider that further investigation of these implications is worthwhile.

Due to this significant variation in dispensing and naming of medications across study hospitals, we were not readily able to estimate patient-level pharmacy costs on a comparable basis across study hospitals.

We found that all the study hospitals had some controls, such as guidelines and policies for the appropriate use of high-cost drugs and antibiotics and audits of medication usage and compliance with guidelines. All study hospitals utilise the State contract for purchasing pharmaceuticals, but since this does not cover all pharmaceutical purchases, hospitals also use a range of other purchasing arrangements. Some of the study hospitals had incentives in place for wards to return unused medication to minimise wastage and reduce costs, though the specific arrangements varied across hospitals.

We found that 4 of the study hospitals participated in the National Antimicrobial Utilisation Surveillance Program (NAUSP), and 3 had active antimicrobial stewardship programs in place. These stewardship programs have been shown to reduce institutional infection rates, as well as morbidity, mortality, and costs.

There are some differences in the number of days of medication the hospitals provided patients upon discharge. These differences are primarily due to the hospitals considerations of drug safety, costs, and also the ease with which the patient is able to collect further medication from a pharmacy outside the hospital once the discharge medication has run out.
Our findings on pharmacy costs are limited because we did not review these in detail. We suggest that a better understanding of arrangements could be obtained by NSW Health through further comparisons of safety controls and patterns of medication use, particularly in light of the wide differences in the proportion of dispensed medications.

1.8 What were our findings on 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 a hospital chooses can be influenced by a complex array of factors, including national or state-wide guidelines or protocols; hospitals’ resources, infrastructure and staff seniority mix; 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. We identified a range of differences in the configurations of care provided at the study hospitals in our case study areas, which may help to explain differences in the costs and outcomes of care across those hospitals. We have identified areas where we believe that NSW Health should arrange for appropriate clinical expert groups to consider, as well as take steps to address, these differences.

1.8.1 Differences in how operating theatre time is managed

The major difference we identified in how operating theatre time is managed was whether or not the hospital separated its planned (or elective) surgery workload from its emergency surgery workload by using dedicated planned surgical centres. The findings of the hip joint replacement case study suggests that separating planned and emergency surgery may reduce patients’ length of stay, particularly those having planned surgery.

1.8.2 Differences in how emergency surgery is managed

We identified 2 main differences in how emergency surgery is managed. The first was that one study hospital’s emergency surgical team included a rostered specialist surgeon to provide care for emergency surgical admissions. Our cholecystectomy case study findings suggest this model may reduce the length of stay for emergency cholecystectomy cases.

The second was that there was considerable variation in the percentage of cholecystectomies performed acutely as emergency admissions across the study hospitals – ranging from 16% to almost 50%. This variation appears to stem from differences in the hospitals’ access to emergency theatre time.
1.8.3 Differences in how planned surgery is managed

We identified several differences relating to the management of planned lung cancer surgery cases (the largest patient grouping in the major chest procedure case study). These included differences in:

- the proportion of cases who had their principal surgical procedure on the day of admission
- the pre-admission processes for these cases
- the use of ICU staff and integration of clinical pathways in thoracic surgery
- the timing of chest drain removal after surgery.

These differences appeared to influence the average length of stay for these cases. We found that the average length of an acute episode (LOS1) for planned lung cancer surgery cases ranged from 7 days at RPAH to 11 days at RNSH. We also noted differences in clinical outcomes. We consider that NSW Health should arrange for appropriate clinical expert groups to note these differences in configurations of care, and consider whether aspects of the model of care at RPAH are suitable to be used in other hospitals.

1.8.4 Differences in the proportion of cases where planned surgery is done as day surgery

In several of our case study areas, we noted marked differences in the proportion of planned surgery cases performed as day surgery or on a 23 hour basis across the study hospitals. For example:

- in relation to stenting procedures, one study hospital performed 15% of stenting procedures as day surgery, whereas all other study hospitals kept these patients in for at least one night, and
- in relation to hysterectomy, one study hospital performed 10% of hysterectomies on a 23 hour basis, whereas the other hospitals had far lower 23 hour surgery rates.

1.8.5 Whether or not registrar training is provided in planned surgery

In our cataract/lens procedure case study, we noted that only one study hospital did not provide training opportunities for junior medical staff (registrars) on planned surgical procedures. This may be the reason why the average length of stay for these procedures at that hospital was significantly shorter than at the other hospitals.

It is important that hospitals that provide training opportunities for junior medical staff are not judged to be ‘less efficient’ than hospitals that don’t simply due to the additional time and resources that training requires. This has implications for activity-based funding.
1.8.6 Differences in how emergency medical cases are managed

We identified a number of differences in the way the study hospitals managed and provided care for stroke patients, including differences in their use of a new clot-dissolving medication (tPA). The effective use of tPA requires early and clear diagnosis of the type of stroke, and this diagnosis is usually based on a CT scan of the brain. In order to receive tPA treatment, patients also need to arrive at a stroke unit with medical staff able to dispense tPA within a given time period.

We found that stroke unit operating hours and staff preferences limited the use of tPA in some instances. Other factors that may cause delays in getting patients to the stroke unit at some hospitals included:

- whether or not the hospital had protocols with NSW Ambulance Service for stroke patients
- how the hospital’s emergency department and stroke units worked together, and
- how busy the emergency department is and road congestion in the surrounding area.

NSW Health should consider ways to improve transfers of suspected stroke patients to stroke units with minimum delay, including consultation with Ambulance Service and Emergency Departments. In addition, NSW Health should arrange for appropriate clinical expert groups to consider developing consistent guidelines for the administration of tPA. Hospitals should also code tPA administration as a procedure so that the rates of administration and the outcomes can be more accurately measured.

1.8.7 Differences in how discharge support and home-based post-surgery care is provided

We found significant variation in the discharge support policies and post-surgical care models of study hospitals regarding mastectomy patients (one of the main patient subgroups in the breast surgery case study). This reflected the hospitals’ different approaches for managing patients’ post-surgical drains, and using home-care models such as APAC\textsuperscript{11} services and other community care options in this process. The different approaches appear to result in variations in the length of stay and costs for this patient subgroup across the hospitals.

NSW Health should arrange for appropriate clinical expert groups to note the early discharge models 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).

\textsuperscript{11} Acute and Post Acute Care.
1.8.8 Differences in how discharge support and home-based obstetric care is provided

All study hospitals provided a variety of birthing options and had some form of early discharge program with support, while one hospital provided a home birthing option. We found differences in the early discharge programs, including in the timeframes for patients leaving hospital.

1.8.9 Differences in how selection of prostheses is managed and the types of prostheses most frequently used

As section 1.7.3 discussed, we found there were differences in the types of prostheses selected in each hospital as well as in the hospital management practices relating to prostheses selection. We also found that there was substantial variation in the types of products selected by particular hospitals and by individual clinicians.

In our case studies, we identified variations in:

- the use of drug-eluting stents versus bare metal stents (cardiology case study)
- the types of pacemakers and ICDs used (cardiology case study)
- the types of hip prosthesis components used (including press fit, cementless hip stems versus cemented hip stems and ceramic femoral heads versus metal femoral heads) (hip joint replacement case study), and
- the use of toric lenses (cataract/lens procedure case study).

NSW Health should note these variations.

1.8.10 Differences in the use of imaging in diagnosing emergency surgery cases

There is no definitive test for diagnosing appendicitis, and this diagnosis is sometimes difficult because of similar symptoms caused by other illnesses. Therefore, not surprisingly, we found that different clinicians and hospitals used different approaches for this diagnosis. The main difference was in the reliance placed on imaging at different hospitals (see also section 1.7.4). This could lead to patients experiencing longer delays to treatment at some hospitals than is necessary, as well as those hospitals incurring higher diagnostic costs.

We think there is a case for NSW Health and appropriate clinical expert groups to note the variation in the use of imaging tests for diagnosing appendicitis and for NSW Health to arrange for appropriate clinical expert groups to consider establishing standard protocols for diagnosing appendicitis, indicating when it is appropriate to use CT scans, MRIs and ultrasounds.
1.8.11 Differences in how surgery is performed

We found 3 major differences in how surgery is performed, in the cholecystectomy, appendicectomy and tracheostomy case studies.

Cholecystectomy case study

We found variation in surgical practice between the hospitals relating to the use of fluoroscopy imaging during cholecystectomy procedures (operative cholangiograms). This imaging test is used in some hospitals but not all. Some clinicians indicated that the test can help ensure there are no gallstones left in the patient, which avoids future procedures to remove these stones, and improve visualisation of the ducts, which can reduce mistaken surgical division of a duct. We did not have data that indicated the frequency of retained gallstones or of duct injuries. We did find that there may be a correlation between lower use of fluoroscopy and shorter operating theatre times for planned admissions and that lower use of fluoroscopy leads to lower imaging costs.

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

Appendicectomy case study

There are 2 major types of appendicectomy surgery – laparoscopic and open surgery. We found considerable variation in rates of laparoscopic surgery across the study hospitals, which ranged from 41% to 94%. Patients who underwent laparoscopic surgery had lower average length of stays than those who underwent open surgery. However, the cost of equipment used in surgery was higher for these cases.

NSW Health should arrange for appropriate clinical expert groups to consider the relative costs and benefits of laparoscopic versus open surgery for appendicitis.

Tracheostomy case study

We found that the procedure performed for tracheostomy differed among study hospitals. Tracheostomies at BLH tended to be performed by cardiothoracic surgeons in operating theatres, while at other hospitals they were performed percutaneously by ICU clinicians.

1.9 What were our findings on outcome, safety and quality indicators?

While there are a number of safety and quality indicators being collected locally, at the State level and through clinical registries, there are few clinically agreed outcome indicators. As such, we found that data on only a few 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. These indicators included mortality and survival rates; unplanned hospital readmission rates; unplanned return to theatre rates; wound infection rates; blood transfusion rates; compliance with requirements to assess patients for antibiotic and venous thromboembolism (VTE) prophylaxis, and patient experience of care.

We found that many outcome indicators, such as mortality, survival, unplanned readmission and wound infection rates, are more meaningful when set, measured and monitored at the clinical procedure/condition level, rather than the hospital-wide level. As for cost comparisons, this allows for the comparison of ‘like’ patient groups who could be expected to have similar risks and outcomes (ie, groups based on the DRGs or subgroups within DRGs, as our case study groupings were). Where possible, we collected and compared data on the key outcome indicators at both the case study and hospital level.

When comparing hospitals’ performance against many outcome indicators, it is important to recognise that this needs to be analysed within the appropriate context, and can be misleading when considered in isolation. Therefore, this performance needs to be analysed within the appropriate context.

In addition, hospitals treat patients with different mixes of illnesses, and the degree to which a patient is ill 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 such as patient age, sex, comorbidity and socio-economic status, and where relevant, hospital transfers. We also carried out additional risk-adjustment for some of the cardiology indicators, by excluding admissions where death occurred on the day of admission and admissions resulting from a transfer from another hospital.

1.9.1 Variations in study hospitals’ performance against key outcomes indicators

We found:

▼ Differences in risk-adjusted mortality and survival rates for major chest procedure patients, noting the methodology for measuring mortality continues to be discussed nationally and internationally.

▼ Differences in risk-adjusted unplanned readmission rates (to any public hospital) at the hospital-wide level. At the case study level, we found no statistically significant differences in unplanned readmission rates for hip joint replacement for arthritis patients at the main study hospitals. However, the readmission rate for such patients treated at the Institute of Rheumatology and Orthopaedics (IRO) was substantially lower than those for the other study hospitals.
• Differences in risk-adjusted wound infection rates in some case study areas and at the hospital-wide level, noting that these rates include both ‘clean’ wounds (ie, sterile wounds) and ‘contaminated’ wounds (ie, wounds already contaminated prior to surgery or surgery into contaminated areas such as the bowel).

• Differences in the blood transfusion rates at the hospital level, and that patients admitted through emergency departments were more likely to receive blood transfusions than non-emergency admissions. One hospital (GH) had significantly higher blood transfusion rates for patients with higher haemoglobin levels (80-89 g/L and 90-99 g/L) than other hospitals, for both emergency and non-emergency admissions.

• Audits indicate similar levels of compliance with the requirement to conduct antibiotic and VTE prophylaxis assessments, which exceeded 95% in the last quarter measured (February 2010). However, the data for this indicator needs review to ensure similar proportions of records are audited. We also consider that these indicators would be enhanced if there was agreement on patient risk status and treatment so that data on the appropriate administration of prophylaxis should also be collected and monitored.

• Differences in the proportion of overnight and day only inpatients surveyed who rated their overall care experience as excellent. For overnight patients, this proportion was highest at RPAH (39%) and GH (33%), and lowest at RNSH and BLH (each with 25%). For day only patients, there was a smaller range between the study hospitals, with the proportion highest at RPAH (37%) and lowest at RNSH (33%).

We were not able to compare the study hospitals’ unplanned returns to theatre rates due to problems with the definition of this indicator and consistency of the data.

1.9.2 Actions NSW can take to improve outcomes data and to prepare for a national performance reporting regime

We encountered several issues when collecting data for the hospital-wide and clinical level outcome indicators. Some data sets proved to be unreliable or were not collected consistently across study hospitals. In addition, there were several indicators for which data was either unavailable or was unable to be provided within the timeframe for our study. This was particularly the case for many of the clinical level indicators.
We note that the NSW Department of Health and the CEC have taken several steps to improve outcomes monitoring and reporting. In addition, the Commonwealth and the States are working to introduce national hospital performance reporting that will include national safety and quality indicators. While these initiatives will improve outcomes data, NSW Health can further improve these data and prepare for the introduction of this reporting regime by:

- continuing to contribute to the national debate on the best methodology for risk adjusting or standardising key outcome indicators, particularly mortality, survival, unplanned readmission and wound infection rates
- encouraging consistent coding of comorbidities, so that coding of comorbidities is more reliable
- facilitating ready access to outcomes data collected and held by third parties (such as the Australian Council on Healthcare Standards, the National Stroke Research Institute and clinical registries)
- disseminating outcomes information to hospital management and clinicians on a regular basis
- supporting data collection with appropriate resources.

1.9.3 Matters related to outcomes that should be considered in completing stages 5 and 6 of NSW Health’s wider review

Based on our analysis of the study hospitals’ performance against the key outcome indicators and the additional outcome indicators, we identified a range of matters NSW Health and clinical expert groups should consider in completing stages 5 and 6 of NSW Health’s wider review. These matters include:

- the areas where there were significant differences in the study hospitals’ performance against outcome indicators, outlined in section 1.9.1 above
- the costs and benefits of collecting data for areas where indicators are not commonly used, including warfarin management and visual outcomes for patients undergoing cataract/lens procedures
- developing a set of standard indicators for measuring care and/or outcomes in ICUs.

1.10 Next steps and areas for further work

As noted above, this hospital costs and outcomes study was just one part of a wider NSW Health project. The main focus of IPART’s work was on collecting and compiling comparable information on costs, configurations of care and outcomes and making observations on differences in clinical practice. The next 2 steps will involve clinical experts considering our findings, to determine whether variations in clinical practice or variations in clinical outcomes warrant further research or investigation or further action. In addition, given the limited timeframe and budget for the study,
we had to be pragmatic in defining the scope and deciding on the approach and methodologies we would use to complete this task. In some instances, we were unable to fully explore important issues.

Given these circumstances, our study should be regarded as a preliminary body of work, and a fairly wide range of matters raised by the study will need to be developed further by others. To facilitate this, the NSW Department of Health and our Clinical Reference Group asked us to indicate the areas where we consider further work is required, plus areas where we encountered problems obtaining consistent data, and issues relevant for Federal-State reform.

We consider the key next steps are to:

- **Complete NSW Health’s wider project.** NSW Health should consider our recommendations in the context of other priority areas and other health reforms taking place. Some of our recommendations may be already underway or planned as part of these reforms. However, others will not be and it is important that these be prioritised, and that decisions be made about which health organisation(s) will have responsibility for implementing each recommendation, and the resources and timeframe required for implementation. There should be a timely completion of stages 5 and 6 of NSW Health’s wider project, in which clinical experts will review our analysis and observations on variations in configurations of care and performance against outcome indicators with the aim of determining whether variations in configurations of care lead to different clinical outcomes, and promoting best clinical practice and maximum efficiency.

- **Improve the quality and reliability of outcomes data.** This step involves improving NSW Health’s understanding of and ability to model and interpret risk-adjusted mortality rates, and facilitating ready access to outcome information collected and maintained by third parties. This is important to facilitate clinical improvement as well as improve performance measurement.

- **Resolve other data quality issues.** This involves addressing the other data problems we encountered in conducting this study – such as problems with the completeness and consistency of selected patient numbers and datasets; the use of episodes for hospital comparisons and consistency in lengths of stay and costs; the quality of selected patient data and hospitals’ operating theatre data; and medical records and clinical coding.

- **Complete NSW Health’s data improvement program.** We note that a range of steps are being undertaken to address shortcomings in NSW Health’s current data management environment in the short, medium and longer term. We strongly support these measures.

- **Pursue opportunities for cost savings and better cost management,** particularly those our study identified in the management controls and purchasing arrangements for prostheses, and the use of imaging and pathology diagnostic services.
Consider further analysis of medical costs and pharmacy costs. In both these areas, we were unable to undertake detailed analysis due to time and data constraints. We consider both warrant further work. In relation to medical costs, this would include NSW Health obtaining more detailed and more consistent information on all medical staff costs (including VMOs) and the allocation of staff time between patient care and other activities. In relation to pharmacy costs, there is scope to compare costs and benefits of different pharmacy service provision models, in terms of cost, stock wastage and safety.

Improve the quality of clinical costing estimates, by taking steps to standardise data collection and formatting across hospitals. Some of the key areas where greater standardisation is required are hospitals’ chart of accounts and pathology and imaging charging data. As part of this process, clinical costing data should be put in a form suitable for multiple uses, including by hospital management and clinicians.

Consider extensions to the scope of the costs and outcomes study – potentially to include additional hospitals (including smaller or regional hospitals or private hospitals); other types of hospital care and other clinical conditions or procedures; and other care settings.

Investigate equity of access to health services. We did not explore this significant aspect of health care as part of this study, although we observed differences in waiting periods for surgery at different hospitals, delays for patients transferring to larger hospitals, and variations in access to rehabilitation and other services. We consider any further reviews should investigate the issue of equity of access.

1.11 List of recommendations

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 casemix 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 prostheses 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).

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.

1.12 Structure of this report

The rest of this report describes our study and how we conducted it, and discusses our findings and recommendations in detail. It is structured as follows:

- Chapter 2 sets out the scope of the study and explains our approach for conducting it.
- Chapter 3 discusses the 5 hospitals included in the study, and provides a broad comparison of their patient activity, casemix complexity and degree for specialisation.
- Chapter 4 sets out the DRGs and other patient groupings included in each of our case studies, and discusses our findings on whether DRGs are a reasonable basis for comparing hospital costs and outcomes.
- Chapter 5 provides our analysis on patient numbers and length of stay, and discusses how we obtain consistent data for each study hospital.
Chapter 6 focuses on clinical coding, and explains our analysis and findings on the accuracy and consistency of the study hospitals’ current coding practices.

Chapter 7 discusses clinical costing, including the consistency of the approaches for this costing at the study hospitals and the likely reliability of the costing data they provide for the National Hospital Cost Data Collection.

Chapters 8 to 14 focus on our analysis and findings on the costs associated with the selected clinical resources – ward nursing staff, medical staff, prostheses, imaging, pathology, operating theatres and pharmacy. For each resource, they explain what analyses we did and the methodologies we used, and discuss our findings and recommendations.

Chapter 15 discusses our analysis and findings on configurations of care.

Chapter 16 discusses our findings on safety, quality and outcome indicators.

Chapter 17 discusses suggested next steps and areas for further analysis by NSW Health.

The appendices provide further detail on some aspects of our study, including our case studies (see Appendix A). In addition, separate reports provide a more detailed discussion of our approach, findings and recommendations in the individual case study areas.

**Box 1.4 Hospital codes for study hospitals and how we have listed hospitals in this report**

Throughout this report and the case study reports, the study hospitals are generally listed in the order of their alpha-numeric hospital codes. These codes, which are used in the HIE, are as follows:

A208 = RPAH
A239 = IRO for hip replacement case study
B202 = GH
B218 = RNSH
D227 = BLH
Q230 = JHH
The task defined by the terms of reference for this study was a relatively broad and complex one. It required us to analyse and compare costs, configurations of care and outcomes across 5 hospitals. Given the limited timeframe and budget for the study, we had to be pragmatic in defining the scope and deciding on the approach and methodologies we would use to complete this task. The sections below provide a broad overview of the scope and approach we used and discuss the key elements in more detail.

2.1 Overview of scope and approach

In line with the terms of reference, the study’s scope included 5 principal referral hospitals, 3 of which were tertiary referral hospitals. The 3 tertiary referral hospitals were Royal Prince Alfred Hospital (RPAH), Royal North Shore Hospital (RNSH) and John Hunter Hospital (JHH). The other 2 principal referral hospitals were Bankstown-Lidcombe Hospital (BLH) and Gosford Hospital (GH).

In conducting the study, we recognised that these 5 hospitals have different functions and serve different populations. As Chapter 3 discusses, they also vary in terms of their patient numbers, casemix complexity, role and functions. Nevertheless, we were able to make meaningful comparisons by focusing on ‘like’ patients and activities at the hospitals (discussed further below).

To make our task more manageable, we chose to limit the scope of the study to acute inpatient care at the study hospitals. We selected this area of care because extensive data collections are currently available for it and the data tends to be more reliable and consistent than for outpatient activity. In addition, hospitals have been required to cost inpatient care for some time as part of the National Hospital Cost...
Study scope and IPART approach

Data Collection (NHCDC).\textsuperscript{14} It also will be included in the new Commonwealth-State activity-based hospital funding arrangements.\textsuperscript{15}

To identify differences in costs and outcomes across the hospitals, and analyse how differences in their hospital management or configurations of care influenced costs, we approached the study from 2 main perspectives:

\textbullet \hspace{1em} \textbf{First, we took a hospital-wide view.} We analysed available data to provide a high-level picture of the similarities and differences in the costs of inpatient care at the hospitals, and to explore the factors that may help to explain the differences. More specifically, we focused on 7 key clinical resources used to provide direct patient care - patient care nursing staff, medical staff, prostheses, imaging, pathology, pharmacy and theatre use. For nursing staff and medical staff costs, we compared aspects of staffing at the hospitals. For other costs we identified and compared the approaches used to manage the use of the resource and control the costs associated with this use at the study hospitals. We also compared the hospitals’ different approaches to managing some of these clinical resources – prostheses, imaging, pathology, pharmacy and theatre use.

\textbullet \hspace{1em} \textbf{Second, we took a clinical case study view.} We selected 11 clinical areas (defined by diagnostic related group (DRG) codes) to analyse in more detail. In some cases, we ‘drilled within the DRGs’ and subdivided the clinical area (eg, based on principal diagnosis codes). This allowed us to examine and compare the study hospitals’ costs and configurations of care for groups of comparable or ‘like’ patients and activities. Where the necessary data was readily available, we estimated the average cost (or value) of the key clinical resources per patient for each hospital. We then compared this cost across the hospitals, and identified the factors that may explain significant differences. In some cases, we also compared our cost estimates to those included in the NHCDC, to assess the likely level of accuracy and reliability of the NSW data in this collection.

At both the hospital and case study levels, we aimed to identify areas where the differences in hospital management, clinical practice or costs were likely to provide opportunities to improve hospital performance. We also aimed to identify and demonstrate the ways in which current available data could be better used – for example, to reduce hospital costs, improve clinical practice or improve the accuracy and reliability of hospital costing and coding. In addition, we gathered available

\textsuperscript{14} National Hospital Cost Data Collection (NHCDC) is a collection for public and private hospitals that contains component costs for DRGs based on patient-costed and cost-modelled information. The NHCDC is designed to enable DRG cost weights and average costs for DRGs for acute inpatients to be produced. See: http://www.health.gov.au/internet/main/publishing.nsf/Content/health-casemix-data-collections-NHCDC-HIRMs.

data on patient outcomes (and other indicators of safety and quality), and where possible, analysed and compared outcomes across the hospitals.

Throughout the study, we were advised by a clinical consultant and we also consulted on key issues with a Clinical Reference Group.

As noted above, the limited timeframe for the study meant we could not attempt to provide a comprehensive or all-encompassing review of costs, outcomes or configurations of care at each of the 5 hospitals. Nevertheless, we consider that our approach has allowed us to provide a rich body of data that can be used in a range of beneficial ways. For example, it can allow similar clinical units to share information on costs, configurations of care and outcomes. In addition, it can enable clinical experts to assess best practice and make decisions about the relative costs and benefits of alternative treatments.

2.2 How did we conduct the study?

We conducted the study between September 2009 and July 2010, using the following 5-stage process:

1. Consulted with our Clinical Reference Group and clinical experts to select the case study areas, determine the focus for each of these areas, and agree on appropriate clinical indicators of outcomes, safety or quality.

2. Collected data from a range of sources (including NSW Health and hospitals, as well as hospital pathology and imaging services). Initial analysis of these data helped inform the next stage of the process.

3. Visited each study hospital and consulted with hospital staff, including management, finance staff, doctors, nurses, coders and administrators. During this stage, we met with clinical staff from each case study area and discussed a wide range of issues. These included the unique aspects of clinical practice or patient mix in the case study area, how clinical and nursing care is provided, and whether outcome indicators are collected. We also met with management, finance and other staff from hospitals and area health services to discuss hospital management and finance practices. We collected hospital-level outcome, safety and quality indicators and discussed the coordination of quality indicator collection. We also reviewed a small sample of clinical notes to compare clinical coding practices and aspects of clinical practice.
4. Undertook further data analysis and modelling at the case study and hospital-wide levels. For the case studies, we established the most reasonable basis for comparing hospitals based on the data available and the advice we received during our hospital visits. Using this data and advice, we calculated consistent case numbers and consistent lengths of stay and extracted relevant information on each of the 7 selected clinical resources from clinical systems. Where the necessary data was readily available, we estimated the average per-patient cost associated with the clinical resource. At the hospital-wide level, we compared the approaches the hospitals used to manage the use of the resource, and control the associated costs. We consulted with staff in hospitals to check aspects of cost data and cost models.

5. Referred our analysis and findings to our Clinical Reference Group for clinical review. We have incorporated the comments from their review into our reports.

### 2.3 How did we select the case study areas?

In selecting our case study areas, we aimed to include a range surgical and medical procedures and medical conditions that met one or more of the following criteria:

- Were relatively common (i.e., represented high volume of hospital cases)
- Involved high reported costs per patient
- Involved highly variable reported costs per patient
- Appeared to involve variations in clinical practice, or
- Appeared to involve a range of models of care.

In setting these criteria, and making our selection, we were advised by a clinical consultant (Dr Paul Tridgell), and by our Clinical Reference Group (see Box 1.2).

The areas we chose, how we defined them, and our findings on a suitable basis for comparing hospitals are discussed in Chapter 4.

### 2.4 How did we obtain comparable data?

As the Productivity Commission found in its recent review of public and private hospitals, although a lot of hospital data is collected and published, these data “are limited by inconsistent collection methods and missing information”\(^\text{16}\). As a result, the published data collections are not very useful for comparing hospital costs on a like-with-like basis, or assisting clinical experts assess the relative benefits and costs of different clinical practices.

To overcome this problem, we collected a large volume of data from NSW Health, area health services, the study hospitals and other organisations. This included a range of administrative, clinical and financial data related to the patient activity and costs (or resource use) at each hospital during 2008/09.

We then assessed the quality of the data, and identified where there were inconsistencies in the data for individual hospitals by:

- asking a range of staff in NSW Health, the area health services and hospitals about the way the data is compiled
- undertaking relatively straightforward auditing of the accuracy of the reported data using cross-checking and comparisons between hospitals
- in some cases, reviewing selected clinical notes to assess the consistency of the data and the clinical notes.

In addition, we visited each of the study hospitals and spoke to a range of staff (including hospital executives and managers, doctors, nurses, clinical coders, financial managers, and administrators). During these visits, we collected supplementary information on each hospital’s:

- administrative, financial and clinical management practices
- methodology for casemix costing
- approaches for managing the use and controlling the costs of the 7 selected clinical resources
- clinical practices within our 11 clinical case study areas (configurations of care).

We also obtained information we needed to assist us in estimating the costs per patient in the case study areas. For example, this included information on ward staffing arrangements, speciality staffing, and the share of staff time spent undertaking direct inpatient care (rather than outpatient clinics or area management responsibilities).

We then used the range of available data and our understanding of their inconsistencies and other shortcomings to create more consistent information on the type and number of inpatients provided with care at each hospital, their length of stay, the associated costs, the configurations of care provided, and the outcomes of this care. Our findings on the consistency of the available data on patient numbers and type and length of stay are discussed in Chapter 5.
2.5 How did we compare costs?

Our cost analysis focused on direct costs of acute inpatient care. We compared the management and use of a selection of ‘direct cost’ areas. These areas are essentially clinical resources used directly for patient care, including:

- nursing staff
- medical staff
- prostheses
- imaging
- pathology
- operating theatre use, and
- pharmacy.

For each of these clinical resources, we examined the use of these resources and, where possible, their estimated cost at the hospital level. We also compared the approaches in managing the use of each resource, and identified major differences between the study hospitals. In addition, we estimated the average cost (or value) of the resource per patient for each of our case study areas where this was possible. However, we do not necessarily use a ‘bottom up’ approach for estimating this cost – rather we used different approaches for each resource, based on the best data that was readily available.

The analysis we did for each resource is summarised in Table 2.1. The approaches and methodologies we used are described in Chapters 8 to 13, which discuss our cost analysis in detail.

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17 ‘Direct costs’ is a term used in NSW Health’s Program and Product Data Collection Standards, 2008/09.
<table>
<thead>
<tr>
<th>Hospital level cost analysis</th>
<th>Hospital level – management approach</th>
<th>Case study level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing staff, See Chapter 8</td>
<td>Compare: number of total nursing staff; number of direct care nursing staff; share of direct nursing time allocated to inpatients; average hourly pay for direct care nurses; average direct care nursing hours and costs per bed day.</td>
<td>Use model to allocate nursing costs to patients for their acute episode for most case studies. For model, use 2008/09 data on nursing hours and pay, patient time in hospital during their acute episode, their time in each ward, a ‘mapping’ of cost centres and wards, nursing service cost weights and IFRACs.</td>
</tr>
<tr>
<td>Medical Staff, See Chapter 9</td>
<td>Compare: use of VMOs and extent to which these are paid on sessional vs fee-for-service basis; use of overtime hours; average hourly pay for JMOs and SMOs; total pay for JMOs, SMOs and VMOs.</td>
<td>Unable to reliably estimate for case studies in timeframe for review.</td>
</tr>
<tr>
<td>Prosthesis costs, See Chapter 10</td>
<td>Compare purchase prices for selected commonly used prostheses eg, hip prosthesis components, stents, pacemakers, defibrillators, leads and lenses.</td>
<td>Compare purchase price for prostheses for following case studies: Hip replacement, Cataracts, Cardiology.</td>
</tr>
<tr>
<td>Imaging, See Chapter 11</td>
<td>Compare management approach in each hospital.</td>
<td>Use data from imaging data system and Medicare Benefits Schedule to provide value of imaging tests.</td>
</tr>
<tr>
<td>Pathology, See Chapter 12</td>
<td>Use pathology charges from pathology service to hospitals as an indication of value of pathology tests.</td>
<td>Use pathology charges from pathology service to hospitals as proxy value of pathology tests.</td>
</tr>
<tr>
<td>Theatre time, See Chapter 13</td>
<td>Compare management approach in each hospital. Note data quality issues.</td>
<td>Use theatre data systems to estimate surgery time for relevant case studies.</td>
</tr>
<tr>
<td>Pharmacy, See Chapter 14</td>
<td>Compare management approach in each hospital.</td>
<td></td>
</tr>
</tbody>
</table>
2.5.1 How did we consider configurations of care

Configuration of care refers to the way that patient services are provided. IPART obtained information about configurations of care by talking to staff in each hospital as well as clinicians from other hospitals, our Clinical Reference Group, and other clinical research bodies.

As part of the hospital visits, IPART spoke to a range of staff to get a comprehensive view of how services are actually delivered. We spoke to staff, including: medical, nursing, coders, administrative staff and hospital management.

We considered configurations of care by:

- Obtaining an understanding of the way that the hospitals were managed, structured, controlled and organised. We did this by talking to a range of staff in the hospital as part of the hospital visits. We asked questions about how important clinical resources were managed, including theatres, imaging, radiology, pathology and pharmacy.

- Obtaining an understanding of configurations of care for the 11 DRG Groupings by visiting the hospitals and talking to relevant doctors and nurses about the way that they delivered care to patients. We also asked questions about the factors that influenced the delivery of care, such as: hospital staffing, out of hours staffing, access to theatres, access to services such as: radiology, pathology, pharmacy, rehabilitation services.

2.5.2 How did we consider outcomes

At the early stages of our review, we consulted with and were guided by a Clinical Reference Group which came up with draft list of clinical indicators. This was further refined following consultation with clinical experts for each clinical case study grouping.

Where outcome indicators are not readily available, other indicators of safety and quality have been used.

Given the timetable for the review, IPART has used indicators that are already collected and readily available or can be compiled from existing datasets or source material.

IPART requested selected outcome information from hospitals as part of the hospital visits. We also requested information from NSW Health and clinical data managers or research bodies.
While the purpose of this study is to compare costs, configurations of care and outcomes at 5 hospitals, it is important to recognise that comparing hospitals is difficult, and therefore simple comparisons can be misleading. Hospitals are not like chain businesses, which have standardised services and production processes and virtually identical outputs. For those types of businesses, it is relatively easy to define and measure their efficiency and directly compare their performance.

Hospitals are complex organisations that produce a range of services in a complicated environment. To a certain extent, all hospitals are different – they each have a unique mix of patients and medical/nursing staff, and produce a unique mix of outputs, including inpatient care, outpatient care, research and training. In addition, they are only one part of a complex health system. The range of services they provide can vary, depending on what non-hospital-based health services are available within their area or the organisational, and on the accounting ‘boundaries’ placed around the hospital relative to ‘area-wide’ activities.\(^{18}\)

These characteristics make it difficult to compare hospitals’ performance because they mean that the root cause of apparent differences is often ambiguous. For example, differences between hospitals’ costs or outcomes may be due to differences in the quality of care they provide, or they may simply reflect differences in the services they provide or the types of patients they treat.

Although various classification systems are used in Australia to facilitate hospital comparisons, these systems have their limitations. For example, at the hospital level, peer hospital groupings are used to compare similar-sized hospitals with similar roles and functions. But these groupings are broad and do not take into account important differences, such as the hospitals’ areas of specialisation, and the differences in patients attending these specialised centres, such as socioeconomic differences from area to area.

\(^{18}\) For example, is ‘hospital in the home’ treated as part of the hospital or as part of area-wide activities.
At the patient level, patients are grouped into diagnostic related groups (DRGs), which are designed to group patients with similar resourcing requirements. However, DRGs do not necessarily include uniform groups of patients with the same level of case complexity, or the same likely outcomes. Our case studies provide examples of why it is important to take account of differences within DRGs when comparing costs, configurations of care and outcomes. For example:

- RPAH specialises in acute trauma surgery and has a specialised orthopaedic facility. In the hip joint replacement case study, we found that RPAH attracted a higher proportion of the more complex hip replacement cases – such as those for patients with secondary cancer in the hip joint, or infections in the hip joint requiring revisions. These cases are associated with higher costs and higher lengths of stay.

- RNSH specialises in spinal surgery. In our tracheostomy case study, we found that RNSH had more patients with serious spinal cord injuries with very long lengths of stay.

- JHH cares for a higher proportion of patients who live in regional or remote areas where there were fewer support services once a patient is discharged and this may affect how long it retains patients in the hospital.

- BLH and GH are likely to treat a higher proportion of patients who delay health care, either due to difficulty in accessing health care services (for GH) or because of factors associated with people from non-English speaking backgrounds (for BLH). This may affect the outcomes of hospital care. These issues are discussed further below.

Given these circumstances, we approached this study acknowledging that the 5 study hospitals we had to compare were all different and designed the study to take account of the differences. Most importantly, we used clinical case studies as the main basis for comparing patient numbers, costs, configurations of care and outcomes across the hospitals.

As Chapter 2 discussed, we sought advice from clinical experts and analysed available data to identify groups of reasonably similar hospital activities and, within these, identify groups of patients who were likely to have required similar care and so could be expected to have similar clinical costs and outcomes. While we defined the case study areas using DRG codes, where necessary and useful we also drilled within DRGs to identify subgroups of similar patients. This approach enabled us to make more meaningful comparisons across hospitals.

The sections below provide an overview of the 5 study hospitals, including their roles and functions and their patient activity and casemix complexity.
3.1 Overview of study hospitals’ role and functions

Three of the study hospitals – RPAH, RNSH and JHH – are classified in the hospital peer grouping ‘A1a’, while the other 2 – GH and BLH – are both classified in the hospital peer grouping ‘A1b’. But, despite these similar classifications, each hospital has slightly different roles and functions within NSW and its region. In addition, each hospital services a different local population with different health needs.

3.1.1 Royal Prince Alfred Hospital

RPAH is a principal referral hospital and is one of the largest and busiest hospitals in the state, with a major teaching role. It is located in Camperdown in Sydney’s Inner West and is a principal referral hospital in the Sydney South West Area Health Service (SSWAHS). RPAH acts as a state-wide centre for a number of high-cost clinical areas, including liver transplant and dialysis, major trauma and complex epilepsy. It has a co-located orthopaedic surgery centre – the Institute of Rheumatology and Orthopaedics (IRO) – with which it works closely.

The Inner West area has a high population density and high traffic congestion. RPAH is located within a short distance of a number of other principal referral hospitals, including St Vincent’s and Prince of Wales Hospital.

3.1.2 Gosford Hospital

GH is a principal referral hospital within the Northern Sydney Central Coast Area Health Service (NSCCAHS) along with RNSH. It is located in Gosford on the Central Coast of NSW, and is the major provider of acute hospital services within this region. It also acts as a regional trauma service.

The Central Coast is geographically separated from the major metropolitan area of Sydney and is characterised by a population comprising both young families and older retirees. It is an area of high average population growth.

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19 Peer grouping is used by the NSW Department of Health and the AIHW to group hospitals into similar categories based on the number of case weight separations, speciality services offered, regional role and functions. ‘A1a’ are Principal Tertiary Referral Hospitals, Group 1 and A1b are Principal Referral Hospitals, Group 2.
20 The SSWAHS provides care for over 1.34 million people and covers a geographical area of approximately 6,380 square kilometres within metropolitan Sydney. Sydney South West Area Health Service remains the most culturally diverse health area in Australia, with approximately 40% of the population speaking a language other than English at home.
21 The NSCCAHS provides care for over 1.1 million people, covering an area of over 2,500 square kilometres and spanning 13 Local Government Areas.
The Central Coast area is reported to have a shortfall in primary and other health care services relative to the state-wide average. The NSW Health Survey Program 2005-2007 reported that 17.2% of people in the Central Coast Division of GPs had difficulties in accessing health care when needing it, compared to the NSW rate of 14.4%. Access to primary health care services is one factor that can impact on hospital demand and hospital outcomes.

### 3.1.3 Royal North Shore Hospital

RNSH is one of the largest hospitals in the state and has a major teaching role. It is located at St Leonards on Sydney’s North Shore and is a principal referral hospital within the Northern Sydney Central Coast Area Health Service (NSCCAHS). It acts as a state-wide centre for a number of high-cost clinical areas, including acute spinal cord injury and severe burn injury.

The North Shore area has a slightly older demographic group than the state-wide average.

### 3.1.4 Bankstown-Lidcombe Hospital

BLH is a principal referral hospital within the SSWAHS (along with RPAH). It serves Sydney’s South West and operates on a networked basis with a number of hospitals in the area. It has a sub-speciality in upper-gastrointestinal surgery.

BLH services a slightly older demographic than the other hospitals and also has many patients from non-English speaking backgrounds. In the 2006 Australian Census, 39% of the population of Bankstown Local Government Area reported being born outside of Australia and 54% spoke a language other than English at home. This is higher than across Sydney overall where 34% of residents were born overseas and 31% speak a language other than English at home.

Elsewhere, people from non-English speaking backgrounds have been associated with poorer health care outcomes despite lower disease rates. NSW Health advised that this may reflect that people from non-English speaking backgrounds delay access to health care to a point where their disease is more progressed. This may lead to an increased rate of adverse outcomes following hospitalisation.

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24 For instance, the prevalence of diagnosed asthma in Australia is lower among people from non-English speaking backgrounds, however the rate of admission to intensive care and mortality due to asthma is higher. Source: Asthma in Australia 2005. Australian Centre for Asthma Monitoring 2005. AIHW Asthma Series 2. AIHW cat. no. ACM 6. Canberra: AIHW, http://www.asthmamonitoring.org/asthma_aust05_html/Index.htm.
3.1.5  **John Hunter Hospital**

JHH is a principal referral hospital within the Hunter New England Area Health service (HNEAHS). It is a major teaching hospital and serves a mix of metropolitan (principally Newcastle) and regional and rural areas. JHH provides speciality services in major trauma and renal transplant. Due to its trauma role and its regional role, it receives a high proportion of transfers in from other hospitals.

3.2  **Broad comparison of study hospitals’ patient activity and casemix**

To provide a broad indication of the study hospitals’ relative size and activity levels, Table 3.1 and Figure 3.1 compare their data on patient activity indicators. Please note that the data has not been adjusted to reflect any differences in the counting practices of the hospitals. We consider that the reported numbers of outpatient occasions of services are unlikely to be comparable, due to inconsistencies in these practices. The data on separations are also occasionally subject to inconsistencies due to counting differences, for example whether hospitals treat patients with the same condition as inpatients or outpatients; or whether hospitals provide some of the care in community or home settings rather than in hospital. The hospitals’ patient counting practices are discussed further in Chapter 5 on patient numbers and lengths of stay.

### Table 3.1  Patient activity at study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Acute casemix weighted separations</th>
<th>Inpatient bed days</th>
<th>Outpatient occasions of service</th>
<th>Emergency Department UDAG weighted attendances</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>79,925</td>
<td>232,160</td>
<td>540,244</td>
<td>64,339</td>
</tr>
<tr>
<td>IRO</td>
<td>5,032</td>
<td>18,664</td>
<td>14,498</td>
<td>0</td>
</tr>
<tr>
<td>GH</td>
<td>44,594</td>
<td>150,832</td>
<td>459,986</td>
<td>52,263</td>
</tr>
<tr>
<td>RNSH</td>
<td>60,767</td>
<td>181,340</td>
<td>855,156</td>
<td>55,999</td>
</tr>
<tr>
<td>BLH</td>
<td>32,106</td>
<td>125,373</td>
<td>393,677</td>
<td>45,274</td>
</tr>
<tr>
<td>JHH</td>
<td>76,137</td>
<td>230,070</td>
<td>515,290</td>
<td>63,435</td>
</tr>
</tbody>
</table>

*a* Inpatients only, excluding unqualified neonates (newborn babies that do not require hospitalisation).

*b* UDAG means Urgency, Disposition (admitted, not admitted, did not wait) and Age Group. These weights were used for the 2009/10 and 2010/11 Episode Funding target measures for ED.

**Sources:** NSW Department of Health, Health System Quality, Performance and Innovation Division and IPART analysis of HIE patient data.

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25 The HNEAHS is the only area health service with a major metropolitan centre (Newcastle/Lake Macquarie) as well as a mix of several large regional centres and many smaller rural centres and remote communities within its borders. The HNEAHS covers a geographical area of over 130,000 square kilometres, and over 20% of the State’s Aboriginal population lives in the HNEAHS catchment area.
Figure 3.1  Reported inpatient and outpatient activity measures for study hospitals, 2008/09

- **Acute casemix weighted separations (a)**
  - RPAH
  - IRO
  - GH
  - RNSH
  - BLH
  - JHH

- **Inpatient bed days**
  - RPAH
  - IRO
  - GH
  - RNSH
  - BLH
  - JHH

- **Outpatient occasions of service**
  - RPAH
  - IRO
  - GH
  - RNSH
  - BLH
  - JHH

- **Emergency Department UDAG weighted attendances (b)**
  - RPAH
  - IRO
  - GH
  - RNSH
  - BLH
  - JHH

---

- **Inpatients only, excluding unqualified neonates (newborn babies that do not require hospitalisation).**

- **UDAG** means Urgency, Disposition (admitted, not admitted, did not wait) and Age Group. These weights were used for the 2009/10 and 2010/11 Episode Funding target measures for ED.

**Sources:** NSW Department of Health, Health System Quality, Performance and Innovation Division and IPART analysis of HIE patient data.

Similarly, Table 3.2 provides a broad indication of the hospitals’ relative casemix complexity and degree of specialisation. Please note that our study found that there were differences in the study hospitals’ coding and counting practices that will affect the comparability of these numbers.

More directly comparable numbers for our case studies are included in Chapter 5 on patient numbers and lengths of stay.
Table 3.2  DRG complexity and specialisation of study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Number of distinct DRGs&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Separations in DRGs with a casemix weight of over 4</th>
<th>Casemix weighted separations in DRGs with a cost weight of over 4</th>
<th>Specialty services provided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>RPAH</td>
<td>584</td>
<td>6</td>
<td>41</td>
<td>Bone marrow transplant, cochlear implant, complex epilepsy, liver transplant, major trauma, extra-corporeal membrane oxygenation (ECMO) retrieval, NICU Level 5</td>
</tr>
<tr>
<td>IRO</td>
<td>na</td>
<td>24</td>
<td>53</td>
<td>Orthopaedic surgery centre</td>
</tr>
<tr>
<td>GH</td>
<td>483</td>
<td>4</td>
<td>28</td>
<td>Bone marrow transplant, regional trauma services</td>
</tr>
<tr>
<td>RNSH</td>
<td>544</td>
<td>6</td>
<td>41</td>
<td>Bone marrow transplant, acute spinal cord injury, severe burn injury, major trauma, renal transplant, NICU level 5</td>
</tr>
<tr>
<td>BLH</td>
<td>416</td>
<td>4</td>
<td>25</td>
<td>Major trauma, renal transplant</td>
</tr>
<tr>
<td>JHH</td>
<td>582</td>
<td>5</td>
<td>39</td>
<td>Major trauma, renal transplant</td>
</tr>
</tbody>
</table>

<sup>a</sup> Number of distinct DRGs for 2007/08.

**Note:** Case weighting of over 4 implies that the average cost of care for patients in this DRG is 4 times higher than an average case.

**Sources:** Health Policy Analysis, NSW Department of Health Review of Peer Hospital Groups, Draft Final Report, 2009, p 51 and NSW Department of Health.

Table 3.3 compares the hospitals in terms of the percentage of patients who are transferred in from another hospital, the size of their intensive care units (ICUs), and the role delineation of their ICUs and Emergency Departments (EDs). Role delineation is used by NSW Health as part of its service planning process and is also used in peer grouping processes to differentiate hospital services based on their capacity and degree of specialisation.²⁶

### Table 3.3 Transfers in, ICU and emergency, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>% of acute transfers in</th>
<th>ICU role delineation</th>
<th>ICU beds</th>
<th>ED role delineation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>3</td>
<td>6</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>IRO</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GH</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>RNSH</td>
<td>7</td>
<td>6</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>BLH</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>JHH</td>
<td>6</td>
<td>6</td>
<td>17</td>
<td>6</td>
</tr>
</tbody>
</table>

*a Number of beds refers to available beds (staffed and equipped for immediate use) as per Critical Care Resource Management System as at 19 February 2010.

4 Our case studies, DRGs and patient groupings

As previous chapters have discussed, in light of the differences in the 5 study hospitals’ roles, functions and casemixes, we used a series of clinical case studies to make like-with-like comparisons across the hospitals. We initially defined each case study area using DRG classifications, since these are part of an established classification system that is intended to group like patients with like clinical resource requirements. However, we also analysed available administrative, clinical and cost data for the patients within the relevant DRG(s) for each case study area, to check that they contained groups of comparable patients or comparable procedures and thus provided a suitable basis for these comparisons. This analysis was not only relevant for our study – it provided useful information for developing a methodology for comparing hospitals in the future.

The section below provides an overview of our findings on the suitability of DRG(s) as a basis for comparing hospitals. The following sections discuss our case study areas, how we selected them and how the case study areas fit within the DRG classification system. The final section explains our assessment of the suitability of the DRG(s) to compare costs, configurations of care and outcomes in each case study area, and our decisions on the best basis for these comparisons available for this study in each area.

4.1 Summary of findings on DRGs

In at least 6 of our 11 case study areas, we found that the relevant DRG(s) did not provide an ideal basis for comparing costs, care and outcomes across the study hospitals because they contained a diverse range of patients with different cost or outcome profiles:

- In 3 of these areas – hip joint replacement, major chest procedures and breast surgery – we were able identify subsets of like patients within the DRGs that provided a more valid basis for comparison. These subsets were based on principal diagnosis codes and/or procedure codes.
For another 2 areas – cardiology and stroke – we found that coding issues played a part in making it more difficult to compare some groups of patients.

For one area – tracheostomy and ventilation greater than 95 hours – we found that the DRG included such diverse patients with different diagnoses and different clinical procedures that we were not able to identify subgroups of similar patients with sufficient case numbers to make comparisons on any other basis than the DRG without undertaking further analysis.

We also found that in many of the case study areas where DRGs did provide a suitable basis for comparing costs, this basis could be improved in some way – such as by separating planned and emergency cases, or taking into account additional factors.

The lessons from this analysis for any future methodology for comparing hospital performance are that:

- DRGs are not always the best basis for comparing costs, care and outcomes for acute hospital activity.
- When selecting a basis for comparing groups of patients, it is useful to drill within the DRGs and to consider whether diagnosis codes, procedure codes or other factors provide a more suitable basis. For example, these factors might include patient characteristics (such as age, co-morbidities or mortality rates) or clinical needs (such as length of stay, imaging and pathology costs).
- Broad comparisons between hospitals based on DRG data alone will reflect patient differences as well as differences in efficiency and clinical practice.

### 4.2 Case study areas and how we selected them

We analysed the following 11 case study areas:

- Hip joint replacement
- Major chest procedures
- Breast surgery
- Cholecystectomy
- Appendicectomy
- Stroke
- Cardiology

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27 We found in the cardiology case study that coding distinctions between Acute Myocardial Infarction (AMI), chest pain and angina were sometimes inconsistent (see Chapter 6 on clinical coding). We found in the stroke case study that for approximately 25% of patients where the cause of the stroke was unknown (ie, coding did not identify if they had a haemorrhagic stroke or an ischaemic stroke or these 2 types of strokes involve different treatment options). Also there is no procedure code for administration of tPA as a stroke treatment.
- Tracheostomy or ventilation for greater than 95 hours
- Hysterectomy
- Cataract/lens procedures
- Obstetrics delivery.

In selecting these areas, we aimed to provide a range surgical procedures and medical conditions that met one or more of the following criteria:

- were relatively common (ie, represented a high volume of hospital cases)
- involved high reported costs per patient
- involved highly variable reported costs per patient
- appeared to involve variations in clinical practice, or
- appeared to involve a range of models of care.

To assist us in this, we sought advice from a clinical consultant (Dr Paul Tridgell) and our Clinical Reference Group (Professor Bruce Barraclough, Dr Tony Burrell, Dr Patrick Cregan, Professor Phil Harris, Professor Clifford Hughes, Professor Brian McCaughan, Professor Peter McClusky, Dr Michael Nicholl, Professor Ron Penny, Professor Carol Pollock, and Dr Hunter Watt).

We originally chose two additional areas – renal dialysis (haemodialysis) and infections and antibiotic management – but did not proceed due to time constraints. Our Clinical Reference Group also suggested we consider selecting a number of additional areas, including chemotherapy, asthma and a paediatric area. We did not proceed with these potential case studies because the scope of the project was already extensive. Given the timeframe for the study, we considered that it was prudent to demonstrate a useful analytical approach before undertaking any additional case studies.

Table 4.1 summarises the key characteristics of each case study area, and how they meet the selection criteria listed above.
Our case studies, DRGs and patient groupings

NSW Health costs and outcomes study by IPART for selected NSW hospitals

Table 4.1 Key characteristics of our case study areas

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
<th>Reported costs</th>
<th>Variability in reported costs at study hospitals</th>
<th>Apparent differences in clinical practice or models of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip joint replacement</td>
<td>medium</td>
<td>high</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Major chest procedure</td>
<td>low</td>
<td>high</td>
<td>medium</td>
<td>yes</td>
</tr>
<tr>
<td>Breast surgery</td>
<td>medium</td>
<td>medium</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>high acute surgery</td>
<td>medium</td>
<td>high</td>
<td>Yes</td>
</tr>
<tr>
<td>Appendicectomy</td>
<td>high acute surgery</td>
<td>medium</td>
<td>very high</td>
<td>yes</td>
</tr>
<tr>
<td>Stroke</td>
<td>high acute</td>
<td>high</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Cardiology</td>
<td>varies by DRG and condition, very high in total</td>
<td>high</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Tracheostomy or ventilation &gt; 95 hours</td>
<td>low</td>
<td>very high</td>
<td>medium</td>
<td>yes</td>
</tr>
<tr>
<td>Cataract/lens procedure</td>
<td>high</td>
<td>low</td>
<td>very high</td>
<td>no</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>medium</td>
<td>medium</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Obstetrics delivery</td>
<td>high</td>
<td>low/medium</td>
<td>na</td>
<td>yes</td>
</tr>
</tbody>
</table>


For each case study area (or major patient grouping within these areas), Figure 4.1 shows the number of separations (all hospitals) and the average total cost per episode (all public hospitals) in Australia as reported in the NHCDC for 2007/08. Data obtained from AIHW National Hospital Morbidity Database. Note that the cost per tracheostomy episode ($92,274) is too large to be displayed in the figure.

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28 2007/08 is the latest year available for national numbers. Data obtained from AIHW National Hospital Morbidity Database. (http://d01.aihw.gov.au/cognos/cgi-bin/ppdscgi.exe?DC=Q&E=/AHS/drgv5_9899-0708_v2)

29 Total cost includes direct and overhead costs.

Figure 4.1  Number of separations and NHCDC cost per episode for public hospitals in Australia, 2007/08

Figure 4.2 shows the average total cost per episode (all public hospitals as reported in the NHCDC 2007/08) and the ratio of the highest to the lowest cost per episode among the 5 study hospitals (based on provisional data reported for the NHCDC for 2008/09). This ratio, which ranges from 1.3 (for tracheostomy) and 2.4 (for cataract surgery), indicates the variation in the reported cost per episode across hospitals. It is interesting to note this variation is reasonably high for some fairly standard procedures (eg, cataract surgery and hysterectomy).31

Chapter 7 will discuss the variation in reported costs can reflect differences in the hospitals’ costing methodology as well as actual cost differences.

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31 The final 2008/09 NHCDC estimates for study hospitals became available towards the end of our study. We compared these to the provisional estimates and found that the total costs had changed substantially (by more than 12%) only for our appendicectomy case study. We therefore excluded appendicectomy from this analysis.
NSW Health costs and outcomes study by IPART for selected NSW hospitals

**Figure 4.2** NHCDC average cost per episode for public hospitals in Australia and variability in cost per episode for the 5 study hospitals based on provisional NHCDC estimates for 2008/09

- **Cost variability is measured as the ratio of the highest to the lowest cost for the 5 study hospitals using 2008/09 provisional NHCDC estimates 2008/09. We have excluded some clinical groupings due to significant outpatient activity. We excluded appendicectomy because the final NHCDC estimates varied significantly from the provisional estimates for some study hospitals.**
- **Stroke excludes DRG B70D (died or transferred in less than 5 days).**
- **Tracheostomy or ventilation exceeding 95 hours. The cost per episode is too high to be shown on the chart ($92,274).**

**Data source:** NHCDC, round 12 (2007/08); provisional 2008/09 estimates for study hospitals; NHCDC and IPART analysis.

Some of the variation in reported cost per episode is likely to be due to differences in the episode length of stay, which in turn may reflect differences in the casemix, clinical practice and/or configurations of care, but can also reflect hospital administrative practices relating to type changes. However, as Figure 4.3 shows, for some of the clinical groupings, such as breast surgery, cataract/lens procedure and hysterectomy, the ratio between the longest and the shortest length of stay (the blue dot) is significantly smaller than the ratio between the highest and the lowest cost (the blue bar).
As Chapter 2 discussed, we limited the scope of the study to inpatient care. However, in the obstetric delivery area, part (or all) of the care may be provided on an outpatient basis. Therefore, for this case study, we also include outpatient data. For this case study, we were unable to undertake detailed patient or cost analysis in the time available, and had to focus mainly on models of care and available outcome indicators.

Similarly, in cataract/lens procedure and cardiology areas a significant number of patients were treated as privately referred non inpatients and were not counted as inpatients. This limited the completeness of our dataset for these study areas.

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Note: We excluded appendicectomy because the final NHCDC estimates varied significantly from the provisional estimates for some hospitals.

Data source: HIE inpatient statistics; 2008/09, Study hospitals’ provisional estimates 2008/09; NHCDC and IPART analysis.

Cost variability is measured as the ratio of the highest to the lowest cost using provisional 2008/09 NHCDC estimates. Length of stay variability is measured as the ratio of the longest episode length of stay to the shortest episode length of stay.

Stroke excludes DRG B70D (died or transferred in less than 5 days).

Tracheostomy or ventilation exceeding 95 hours.

Our case studies, DRGs and patient groupings

Our nursing cost analysis uses a methodology that relies on inpatient data.
4.3 Case study areas relationship with the DRG classification system

Australian public hospitals classify acute patient episodes using Australian Refined Diagnostic Related Groups (referred to throughout this report as DRGs). These DRGs also form part of an internationally recognised clinical coding and classification system that is used in several countries. DRGs are intended to classify patient episodes into groups with similar clinical conditions (related diagnoses) and with similar hospital resource use.

As noted above, we initially defined our case study areas based on one DRG, or a number of related DRGs. Table 4.2 shows how these areas fit within the DRG system. It lists the Major Diagnostic Categories (MDCs) used in the DRG classification system, the DRG ranges covered by each MDC and the DRGs that relate to our case studies. Box 4.1 provides more information on the DRG system and how DRGs are allocated. This issue is also discussed further in Chapter 6 on clinical coding.

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33 The grouping system is known as the International Classification of Diseases and related health conditions of the World Health Organisation. The current version used in Australian public hospitals for admitted patients is the International Classification of Diseases, 10th revision, Australian modification or ICD-10-AM. DRGs group patients based on diseases, procedures and other criteria.
Box 4.1 The DRG classification system and how DRGs are assigned

DRGs are assigned to patient episodes based on clinical conditions, clinical procedures or patient demographics. In Australia, the DRG classification system that is commonly used is the AR-DRG system, or Australian Refined DRG system.

The AR-DRG classification is broadly based on:

- an initial separation based on body systems, and
- a further separation based on medical, surgical and other procedures.

Patient episodes are generally assigned to one of 23 Major Diagnostic Categories (MDCs) and to one of over 600 individual DRGs. The process for deciding on the final DRG to be assigned to a patient’s episode of care can be complex and ultimately depends on a hierarchy of procedures, medical conditions and other factors that differentiate processes of care.

The 23 MDCs are mostly defined by body system or disease type, and correspond with a particular medical speciality. In general, episodes are assigned to an MDC on the basis of the principal diagnosis.

Once an episode has been linked to an MDC, it is assigned to a surgical or medical DRG within the MDC. This DRG is assigned primarily on the basis of the procedure codes (for surgical activity) or the diagnosis codes (for medical activity). However, this is not always the case. Some episodes involve procedures that are particularly resource intensive. These episodes may be assigned to a Pre-MDC category (in the DRG range A01Z-A41Z), irrespective of the MDC assigned on the basis of principal diagnosis. An example of this is the DRG for tracheostomy and ventilation greater than 95 hours, DRG A06Z.

When more than one DRG is associated with several closely-related procedures or diagnoses, other variables, such as the patient’s age, complications or co-morbidities, and the mode of separation from hospital, are also used to assign DRGs. For example, several of our case studies include DRGs ending in an A, B, C or Z. DRGs with the ending ‘A’ are the most complex cases ‘with catastrophic or severe co-morbidities or complications’. DRGs with the ending ‘B’ or ‘C’ are usually less complex cases indicating the patient has fewer co-morbidities or complications. The ending ‘Z’ indicates that this is a single DRG and there is no DRG distinction based on complexity.

Where there are several related principal procedures, the one with the highest resource intensity is generally allocated.

Box 4.2 Other clinical classification systems

DRGs are one of several classification systems. A number of other clinical classification systems are used for different purposes e.g. population health analyses or health funding systems.

For example,

The **Adjusted Clinical Groups (ACG) System** from John Hopkins University is used for hospital casemix funding and population health assessments in the United States. This system applies a disease-based risk weighting and takes into account common co-morbidities.

### Table 4.2 Major Diagnostic Categories and DRG ranges and our case studies and relevant DRG ranges

<table>
<thead>
<tr>
<th>MDC</th>
<th>MDC Description</th>
<th>DRG range</th>
<th>Case studies</th>
<th>Case study DRGs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre MDC</td>
<td>Major procedures where the principal diagnosis may be associated with any MDC</td>
<td>A01Z-A41Z</td>
<td>Tracheostomy and ventilation&gt;95 hours</td>
<td>A067Z</td>
</tr>
<tr>
<td>1</td>
<td>Diseases and disorders of the nervous system</td>
<td>B01Z-B81B</td>
<td>Stroke</td>
<td>B70A, B70B, B70C, B70D</td>
</tr>
<tr>
<td>2</td>
<td>Diseases and disorders of the eye</td>
<td>C01Z-C63B</td>
<td>Cataracts/ lens procedure</td>
<td>C16A, C16B</td>
</tr>
<tr>
<td>3</td>
<td>Diseases and disorders of the ear, nose, mouth and throat</td>
<td>D01Z- D67Z</td>
<td>Major chest procedure</td>
<td>E01A, E01B</td>
</tr>
<tr>
<td>4</td>
<td>Diseases and disorders of the respiratory system</td>
<td>E01A-E75C</td>
<td>Cardiology</td>
<td>F10Z, F15Z, F16Z, F41A, F41B, F42A, F42B, F60A, F60B, F60C, F742</td>
</tr>
<tr>
<td>5</td>
<td>Diseases and disorders of the circulatory system</td>
<td>F01Z-F75C</td>
<td>(includes) Pacemaker or defibrillator insertion or replacement</td>
<td>F01A, F01B, F02Z, F12Z, F17Z,</td>
</tr>
<tr>
<td>6</td>
<td>Diseases and disorders of the digestive system</td>
<td>G01A- G70B</td>
<td>Appendicectomy</td>
<td>G07A, G07B</td>
</tr>
<tr>
<td>7</td>
<td>Diseases and disorders of the hepatobiliary system and pancreas</td>
<td>H01A-H64B</td>
<td>Cholecystectomy</td>
<td>H07A, H07B, H08A, H08B</td>
</tr>
<tr>
<td>8</td>
<td>Diseases and disorders of the musculoskeletal system and connective tissue</td>
<td>I01Z-I76C</td>
<td>Hip joint replacement</td>
<td>I03A, I03B, I03C</td>
</tr>
<tr>
<td>9</td>
<td>Diseases and disorders of the skin, subcutaneous tissue and breast</td>
<td>J01Z-J67B</td>
<td>Breast surgery</td>
<td>J06A, J06B, J07A, J07B, J63Z</td>
</tr>
<tr>
<td>10</td>
<td>Endocrine, nutritional and metabolic diseases and disorders</td>
<td>K01Z-K64B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Diseases and disorders of the kidney and urinary tract</td>
<td>L01A-L67C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Diseases and disorders of the male reproductive system</td>
<td>M01Z-M64Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDC</td>
<td>MDC Description</td>
<td>DRG range</td>
<td>Case studies</td>
<td>Case study DRGs</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>----------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>13</td>
<td>Diseases and disorders of the female reproductive system</td>
<td>N01Z-N62B</td>
<td>Hysterectomy</td>
<td>N04Z</td>
</tr>
<tr>
<td>14</td>
<td>Pregnancy, childbirth and the puerperium</td>
<td>O01A-O65B</td>
<td>Obstetrics delivery</td>
<td>01A, 01B, 02A, 02B, 02C</td>
</tr>
<tr>
<td>15</td>
<td>Newborns and other neonates</td>
<td>P01Z-P67D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Diseases and disorders of the blood and blood forming organs and immunological disorders</td>
<td>Q01Z-Q62B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Neoplastic disorders (haematological and solid neoplasms)</td>
<td>R01A-R64Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Infectious and parasitic diseases</td>
<td>S60Z-T64B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Mental diseases and disorders</td>
<td>U40Z-U68Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Alcohol/drug use and alcohol/drug induced organic mental disorders</td>
<td>V60Z-V64Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Injuries, poisoning and toxic effects of drugs</td>
<td>W01Z-X64B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Burns</td>
<td>Y01Z-Y62B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Factors influencing health status and other contacts with health services</td>
<td>Z01A-Z65Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error DRG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DRG Errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error DRG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Blank cells reflect that the MDC and associated DRGs were not part of IPART’s case studies.
4.4 Assessment of suitability of DRGs as basis for comparison in case studies

In each case study area, we assessed whether the DRG(s) related to that area provided a sound basis for comparing study hospitals by checking whether in fact they included patients with similar conditions and clinical resource requirements. We wanted to be confident that differences in length of stay, costs and outcomes related to differences in clinical practices, rather than differences between patients or differences in coding practice between hospitals.  

This assessment involved analysing available patient, administrative and other data and consulting with clinical experts. (See Box 4.3 for more detail.) We found for 6 of our case study areas, the DRGs were not an ideal basis for comparing costs and outcomes. These were:

- hip joint replacement
- major chest procedure
- breast surgery
- cardiology
- stroke, and
- tracheostomy or ventilation greater than 95 hours.

For hip joint replacement, major chest procedure and breast surgery, we identified subgroups of like patients within the DRGs that provided a better basis for comparing costs and outcomes. These subgroups were defined by principal diagnosis codes or principal procedure codes. For example, for hip joint replacement there are 3 DRGs – I03A, I03B or I03C, and the A, B and C indicate the degree of complexity. Our analysis indicated that there was more similarity in the lengths of stay and costs of patients with the same principal diagnosis code (eg, arthritis, fracture, secondary cancer, etc) than those with the same DRG. In addition, it indicated that it would also be better to separate patients by their principal procedure code (ie, primary or revision).

For cardiology, we distinguished between patients that had been coded with an AMI, Angina or Chest Pain as well as using DRGs. However, we found that clinical coding practices were not always accurate in relation to AMI and may not have been consistent in relation to AMI, Angina and Chest Pain between hospitals.

For stroke, we found that it would be better to also separate patients by whether they had an ischaemic or haemorrhagic stroke, but we were unable to do this because the diagnosis coding for a large proportion of cases did not indicate the type of stroke.

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34 Coding is discussed further in Chapter 6.
35 Further information is included in cardiology and interventional cardiology case study.
For tracheostomy and ventilation greater than 95 hours, we found that the DRG included a diverse range of patients.\(^{36}\) This DRG tends to be assigned to all patients who have had a tracheostomy or required ventilation for more than 95 hours while in intensive care units or high dependency units, regardless of their underlying condition.\(^{37}\) In our 5 study hospitals, we found that patients assigned this DRG had 390 different principal diagnosis codes. We were not able to identify subgroups of similar patients within the DRG with sufficient numbers to make valid comparisons. Therefore, we had no alternative other than to use the DRG. However, we emphasise that we do not consider it to be an ideal basis for comparing costs and outcomes across hospitals.

In some of the case study areas where we found that the DRGs did provide a reasonable basis for comparison, we also identified ways in which this basis could be improved. For example, for appendicectomy and cholecystectomy, we found that it would be better to also separate planned and emergency surgery cases. For obstetrics delivery and hysterectomy, we found it would be better to also separate cases by the type of delivery or the type of hysterectomy.

Table 4.3 provides an overview of our assessment of the 11 case study areas and indicates whether we found that DRGs were a reasonable basis for comparing costs or if we identified a better basis for comparing costs and outcomes. Where we did not find that the DRGs were reasonable, the table lists the patient sub-groupings that we identified as a better basis and therefore used for our case study analysis.

**Recommendations**

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.

\(^{36}\) A tracheostomy is a surgical procedure to cut an opening into the trachea (windpipe) so that a tube can be inserted into the opening to assist breathing. A tracheostomy may be temporary or permanent, depending on its purpose. There are a variety of reasons why a tracheostomy may be performed: in emergencies where there are blockages to airways above the trachea, before surgery to the throat or mouth so the patient can breathe after the surgery or to make the prolonged use of ventilators more comfortable and safe.

\(^{37}\) As Box 4.1 explained, this is because this care is particularly resource intensive.
Box 4.3 How we assessed if DRGs were suitable to compare costs, configurations of care and outcomes

For each of our case studies, we used a range of approaches to assess whether DRGs were suitable for comparing hospital costs, care and outcomes.

We examined the available patient data and administrative data from the HIE, as well as patient-level data on pathology costs and imaging use from hospitals. Using this data we examined the degree of variability between patients, within DRGs and within the same DRGs in different hospitals, using:

- length of stay
- transfers
- age of patients
- ICU hours, and
- diagnostic testing costs.

Where there was a high degree of variability, we ‘drilled’ into the DRG to examine the patterns for patients based on their emergency and planned admissions, diagnosis codes and procedure codes. We did this to assess if these provided more consistent results than DRGs or DRGs alone.

Our analysis was informed by discussions with clinicians, nurses, coders and allied health staff in hospitals, as well as our Clinical Reference Group. This consultation helped us to understand our case study groupings, our case study DRGs and the procedures, diagnoses and patient demographics underlying them.

We also assessed if there were major differences in coding practice. We did this by comparing the average number of diagnosis codes within given DRGs in different hospitals, and, for some case studies, by reviewing samples of patient notes in each hospital to help assess if consistent coding practices were used in different hospitals (see Chapter 6 on clinical coding for further information on our analysis of coding practice).

Based on this analysis we drew conclusions on whether DRGs provided the best way to group patients to compare length of stay, cost and outcomes.
### Table 4.3 Case study groupings and significant subgroups identified through IPART's analysis

<table>
<thead>
<tr>
<th>Case study</th>
<th>Original DRG grouping</th>
<th>Was DRG a reasonable basis for comparing costs and outcomes?</th>
<th>Did we identify a better basis for comparing costs and outcomes?</th>
<th>Important subgroups following analysis</th>
<th>Subgroups identified using</th>
<th>Comment</th>
<th>Number of patients in 2008/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract/lens procedure</td>
<td>C16A Overnight</td>
<td>Yes</td>
<td>No</td>
<td>▼ C16A Overnight</td>
<td>DRG</td>
<td>Small number</td>
<td>2,988</td>
</tr>
<tr>
<td></td>
<td>C16B Same day</td>
<td></td>
<td></td>
<td>▼ C16B Same day</td>
<td>DRG</td>
<td>Main sub group</td>
<td></td>
</tr>
<tr>
<td>Hip joint replacement</td>
<td>I03A, I03B and I03C</td>
<td>No</td>
<td>Yes - Use principal diagnosis and principal procedure</td>
<td>▼ Arthritis</td>
<td>Principal diagnosis</td>
<td>Main sub group</td>
<td>1,158</td>
</tr>
<tr>
<td>Major chest procedure</td>
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<td>Principal diagnosis</td>
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<td>485</td>
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<td></td>
<td>▼ Pneumothorax</td>
<td>Principal diagnosis</td>
<td>Small number</td>
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<td></td>
<td></td>
<td></td>
<td>▼ Pyothorax,</td>
<td>Principal diagnosis</td>
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<td>▼ Revision</td>
<td>Principal procedure</td>
<td>Small number</td>
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<td>Obstetrics delivery</td>
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<td>Yes</td>
<td>Yes - Add type of delivery</td>
<td>▼ Vaginal delivery</td>
<td>DRG</td>
<td>Note - 'unqualified' babies excluded</td>
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<td>(Caesarean section)</td>
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<td>O02A, O02B, O02C</td>
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<td>(Vaginal delivery)</td>
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<td>Note - 'unqualified' babies excluded</td>
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<tr>
<td>Stroke</td>
<td>B70A, B70B, B70C and B70D</td>
<td>Best available</td>
<td>Yes - It would be desirable to separate</td>
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<td>DRG</td>
<td>Omit B70D (Stroke, died or</td>
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<td>Case study</td>
<td>Original DRG grouping</td>
<td>Was DRG a reasonable basis for comparing costs and outcomes?</td>
<td>Did we identify a better basis for comparing costs and outcomes?</td>
<td>Important sub groups following analysis</td>
<td>Subgroups identified using</td>
<td>Comment</td>
<td>Number of patients in 2008/09</td>
</tr>
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</table>
| Cardiology | F10Z, F15Z, F16Z, F41A, F41B, F42A, F42B, F60A, F60B, F60C, | No | Yes by using procedure codes (eg, stenting) and diagnosis codes (eg, AMI, Angina) and DRG Chest Pain. | • DRG B70B  
• DRG B70C | Principal diagnosis  
Main sub group | transferred <5 days) for cost analysis | 5,412 |
| Pacemaker/Defibrillator | F01A, F01B, F02Z, F12Z, F17Z | Yes | Yes - by emergency and planned | • Emergency  
• Planned | DRG | Large number of patients that are privately referred non-inpatient and not counted | 1,087 |
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<thead>
<tr>
<th>Case study</th>
<th>Original DRG grouping</th>
<th>Was DRG a reasonable basis for comparing costs and outcomes?</th>
<th>Did we identify a better basis for comparing costs and outcomes?</th>
<th>Important sub groups following analysis</th>
<th>Subgroups identified using</th>
<th>Comment</th>
<th>Number of patients in 2008/09</th>
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<td>Separate emergency and planned cases</td>
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<td></td>
<td>▼ G07A ‘Without CC’</td>
<td>▼ Match with emergency dataset</td>
<td>▼ Match with removal from waiting list</td>
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<td></td>
<td></td>
<td>▼ Emergency</td>
<td>Match with emergency dataset</td>
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<td></td>
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<td>Match with emergency dataset</td>
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<td>▼ Planned</td>
<td>Match with removal</td>
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<td>▼ Lesion excision – non malignant cases</td>
<td>Principal procedure</td>
<td>Main sub group</td>
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<td>▼ Mastectomies</td>
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<td></td>
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<td></td>
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<td>Principal procedure</td>
<td>Small numbers</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>▼ Other breast surgery</td>
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<td>Was DRG a reasonable basis for comparing costs and outcomes?</td>
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<td>Important sub groups following analysis</td>
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<td>Comment</td>
<td>Number of patients in 2008/09</td>
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<tr>
<td>Tracheostomy or Ventilation &gt; 95hrs</td>
<td>A06Z</td>
<td>No</td>
<td>A very mixed group. Requires further analysis.</td>
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<td>Very diverse diagnosis codes</td>
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<td>Hysterectomy</td>
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<td>Yes – Use type of hysterectomy – vaginal or abdominal</td>
<td>▼ One mixed group</td>
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<td>609</td>
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</table>
5 Patient numbers and lengths of stay

Once we established the most suitable patient groups to use as the basis for comparison in each case study area (see Chapter 4), we examined data on the number of patients in these groups for each study hospital over 2008/09. We also examined data on the lengths of patient stay in these groups. As both these factors have a strong influence on a hospital’s costs, it was important to ensure that patient numbers were counted in a consistent way, and that length of stay was defined and calculated in consistently across the hospitals.

As our starting point, we extracted data for each hospital on acute inpatient episodes in 2008/09 from the Health Information Exchange (HIE) at the DRG level. We analysed the data to identify anomalies and inconsistencies due to differences in the hospitals’ administrative and other practices. Then we re-calculated the patient numbers to correct for these differences and provide a more consistent basis for comparison. We re-calculated average length of stay using 3 different measures, and identified the measure that provided the most consistent basis for comparison. The measures included:

- ▼ Episode length of stay in study hospital (LOS1)
- ▼ Total length of stay in study hospital (LOS2), and
- ▼ Total length of stay in study hospitals plus up to 2 other hospitals – one transfer in and one transfer out (LOS3).

The section below summarises our main findings on the consistency of inpatient episode data within the HIE, and the implications for the introduction of episode or casemix funding. The subsequent sections discuss how we calculated patient numbers and average length of stay, and provide the results of these calculations. Box 5.1 explains what is meant by an ‘episode’ of care.
5.1 Summary of findings on patient numbers and lengths of stay

5.1.1 Patient numbers

We found that the inpatient data in the HIE for each hospital were not always complete or consistent due to differences in how the study hospitals had counted inpatients, both within DRGs and between DRGs. This has led to fragmentation of patient datasets in some instances. Some of the main inconsistencies arose because:

- **The hospitals classified patients differently because they provided part or all of the care in different settings.** For example, in some of the case study areas, some hospitals provided all the relevant care in an inpatient setting and classified all this care as inpatient activity. However, other hospitals provided some of the relevant care in outpatient and/or community health settings, or in the patient’s home, and classified this as outpatient occasions of service. This meant that for these hospitals, the inpatient data in the HIE did not include all the patients they treated during the study period. This issue particularly affected our obstetrics delivery case study.

- **The hospitals classified patients differently for charging purposes.** For example, some hospitals classified the relevant patients as inpatients whereas others classified them as privately referred inpatients. Again, this meant that the inpatient data in the HIE did not include all the relevant patients. In some instances, hospitals’ patient datasets had become fragmented and patient datasets were held locally by particular clinical units, rather than being included in the HIE. This particularly affected our cardiology and cataracts/lens replacement case studies. For example, in relation to the cardiology case study, we were unable to readily access patient level data from the 24 hour cardiac catheter laboratories.

- **The relevant patients stayed in the hospital for a short time and may not have been formally admitted.** This may have been because the patients were discharged shortly after arrival (eg, in emergency departments and maternity units), or died shortly after arrival (eg, stroke patients). In some cases, these patients were counted as inpatients, and in others they were not.

- **The relevant patient care was shared by more than one hospital under ‘collaborative care’ arrangements or hospital networks.** We found some instances in the cardiology area where patients receiving pacemakers were counted as inpatients at more than one hospital at the same time. This related to a collaborative care arrangement where patients received pacemakers at one hospital on behalf of another hospital.

We adjusted our patient numbers and patient mix data to account for these differences. In addition, for our obstetric delivery case study, where there were large numbers of outpatient occasions of service, we have used both inpatient and outpatient data in our discussion.

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38 This anomaly in practice has subsequently been rectified.
Some of our findings on patient numbers have implications for the introduction of episode or activity-based funding in NSW. For example, hospitals will need to ensure that all patient activity is captured and reported and this may require consolidation of locally held patient datasets in the HIE. In addition, the differences in hospitals’ classification practices suggest that under an activity-based funding model for acute inpatient activity, there is potential for a hospital’s patient classification practices to influence its funding levels.

Recommendations

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.

5.1.2 Lengths of stay

We found that inpatient data on episode length of stay (LOS1) – which relates to a single episode of acute care – was not a consistent basis for comparing the study hospitals. This was because the hospitals had different practices in relation to changing patients’ ‘care type’ codes during their stay (eg, from an acute care episode to a rehabilitation care episode). Therefore, apparent differences in average lengths of stay across hospitals may simply reflect differences in when they change these codes.

We also found that inpatient data on total length of stay at the study hospital (LOS2) – which relates to all consecutive episodes/care types – was not a consistent basis. The hospitals had different patterns of referring patients to other hospitals, and receiving patients referred from other hospitals. (For example, they had different scope to transfer patients to rehabilitation facilities for some of their care.) Therefore, apparent differences in total lengths of stay may simply reflect differences in hospitals’ volumes of transfers in and out.

These findings particularly affected the case study areas where patients typically have 2 or more consecutive episodes of care, or where patients are often transferred to different hospitals for different episodes of care – such as stroke and hip joint replacement.
In our view, a more consistent way to compare lengths of stay was to use the total length of stay in the study hospital plus the total length of stay in up to 2 other hospitals – one transfer in and one transfer out (LOS3). This measure takes account of inconsistencies in both the hospitals’ practices in relation to changing care types and patterns of transfers. The data required to calculate it can be obtained by using inpatient data in the HIE, and the linkage key developed by the Australian Institute of Health and Welfare (AIHW).

The main implications of these findings are that:

- NSW hospitals/NSW Health should improve the consistency of hospital practices in relation to care type changes – including by introducing clear guidelines for when a patient’s care type code should be changed from acute to rehabilitation care.

- Episode length of stay should not be used to compare clinical groupings where there are typically 2 or more episodes of care or significant numbers of transfers.

- Cost estimates based on acute episodes, such as those in the NHCDC, are likely to be of limited value where they are used to compare hospitals for clinical groupings where there are typically 2 or more episodes of care or significant numbers of transfers.

- A more consistent measure of length of stay can be obtained by using the AIHW linkage key to link patients’ related episodes across hospitals.

5.2 Our analysis of patient numbers

For all inpatients, the hospital records administrative information at various stages of their stay about the patient, the nature of their care (e.g., the type of care they are receiving, such as acute care or rehabilitation care), their treating doctor and their location (e.g., which ward they are staying in). A summary of this information is stored in the HIE maintained by NSW Health. The HIE also contains financial information relating to the hospital, as well as some data from its clinical information systems.

We found that for some clinical areas, patient data was not included in the HIE.

We extracted de-identified administrative information from the HIE to calculate the number of patient cases in each of our case study patient groupings and subgroupings for each study hospital during 2008/09. In particular:

- We defined a patient case as an acute episode of care. Where a patient had a series of consecutive episodes of care for the same DRG, the patient was counted once.

39 Ideally, analysis should be patient-centric and analysis should extend across a range of settings, not just hospitals, but GPs and community health as well. The introduction of a unique patient identifier will make this type of analysis more feasible, providing better insights into patient care.
We excluded patient cases where the episode (or series of consecutive episodes) started before 1 July 2008 or ended after 30 June 2009. For this reason, our case numbers will differ slightly from separation numbers from the HIE.

Table 5.1 includes our patient case numbers for each case study area.

### Box 5.1 What is an ‘episode’ of care?

An episode of care is as a phase of treatment for an admitted patient. It may correspond to a patient’s entire hospital stay, or the hospital stay may be divided into separate episodes of different types of care – such as acute, rehabilitation or palliative care.

We used episodes of acute care as the basis of our analysis because this is the basis used for clinical costing for the NHCDC, and we wanted to be able to compare our cost estimates with those in this collection. In addition, episode-based indicators are often used for hospital benchmarking:

- episode numbers are used as an indicator of hospital activity
- costs per acute episode are used as an indicator of cost efficiency, and
- episode lengths of stay are also used as an indicator of hospital efficiency.

We found that acute episodes are not a particularly reliable basis on which to compare hospital activity, costs or length of stay because an acute episode represents only a component of the care provided to a patient. Acute episodes are also affected by the way a hospital conducts ‘type changes’ and transfers of patients into or out of a hospital.

### Table 5.1 IPART’s patient case numbers for each case study grouping and relevant DRGs, 2008/09

<table>
<thead>
<tr>
<th>Case study</th>
<th>DRG</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>Hip replacements</td>
<td>I03A</td>
<td>13</td>
<td>13</td>
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### Case study

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**Note:** We excluded patient cases where the episode (or series of consecutive episodes) started before 1 July 2008 or ended after 30 June 2009. For this reason, our case numbers will differ slightly from separation numbers from the HIE.

**Source:** NSW Health HIE data and IPART analysis.
5.3 Our analysis of lengths of stay

We examined the average length of stay as part of our analysis 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 as well as some other costs 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 each case study using 3 different measures:

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

LOS 1 is the length of stay for a single acute episode, and is the measure often used in the NHCDC and DRG benchmarking analyses. We used this measure so we could compare our cost estimates and those included in the NHCDC (discussed in Chapter 7). However, we found that it does not always provide a consistent basis for comparing lengths of stay or costs, due to differences in the study hospitals’ administrative practices in relation to classifying patients’ ‘care type’ during their stay.

For example, care types include acute care, rehabilitation care, palliative care and other types of care (see Box 5.2 for more information). In some cases, a patient’s care type can change during their stay – for instance when they moved from the acute to the rehabilitation stage of care. We found that some study hospitals tended to change patients’ care type codes more frequently than others, or changed them at different clinical points within the patients’ care. Therefore, apparent differences in LOS1 across hospitals may simply reflect differences in their administrative practices.

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40 Several other costs are related to length of stay eg pharmacy, pathology and hotel services (food, linen).

41 In a few instances LOS2 will be slightly shorter than LOS1 because LOS1 is calculated using hours on the ward while LOS2 (and LOS3) is calculated using days. Therefore if patients are admitted in the morning for surgery and discharged the next day early afternoon the average LOS will be say 30 hrs or 1.25 days: under LOS2 this would be 1 day and under LOS1 this would be 1.25 days.
LOS2 is the total stay from admission to discharge at the study hospital, including all consecutive episodes/types of care (ie, acute, rehabilitation and other). We found that although this measure is not affected by differences in hospital administrative practices, it still does not always provide a consistent basis for comparison. This is because it does not take account of the fact that patients can be:

- transferred to a study hospital from another hospital (eg, patients with more specialised care requirements, such as those with cancers or fractures with other trauma following serious accidents, may be referred to a hospital better able to meet those requirements), and/or

- transferred from the study hospital to another (eg, they may be referred to specialised rehabilitation facility).

Therefore, apparent differences in LOS2 across hospitals may simply reflect differences in their relative ability to transfer patients to alternative facilities for rehabilitation or palliative care (eg, due to the location of such facilities) or differences in the extent to which patients are referred to them (eg, due to areas of specialisation).

LOS3 is the total length of stay in the study hospital (ie, LOS2), plus the total length of stay at up to 2 other hospitals – one ‘transfer in’, and one ‘transfer out’. We consider that this measure is the most consistent basis for comparing average length of stay because it takes account of differences in hospitals’:

- administrative practices in relation to changing patients’ care type code
- access to rehabilitation facilities (transfers out)
- patterns of referral from other hospitals (transfers in).

Ideally, we consider that all of a patients’ related hospital stays should be linked, but for this study we 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 AIHW for use between all public and private hospitals. This step is not routinely done in hospital comparisons.

Table 5.2 compares our findings on the average length of stay using LOS1, LOS2 and LOS3 for each case study area and each hospital.
Box 5.2  Type changes

Consistent with approved practice, hospital stays can be administratively split, or ‘fragmented’, into a number of episodes reflecting changes in the type of care provided. The episode types used in the HIE are:

1. Hospital Boarder
2. Acute Care
3. Rehabilitation Care
4. Palliative Care
5. Maintenance Care
6. Newborn Care
7. Other Admitted Patient Care
8. Geriatric Evaluation and Management
9. Psycho-geriatric
10. Organ Procurement.

For example, an elderly patient with a stroke may typically have two or more episodes – an ‘acute’ episode, a ‘rehabilitation’ episode and, perhaps, a ‘psycho-geriatric’ episode for a patient with confusion or dementia.

Hospital practices relating to episode type changes differ. For example, for stroke patients some hospitals do the type change from ‘acute care’ to ‘rehabilitation care’ when the patient is ready for rehabilitation, while others do the type change only when the patient physically moves to a rehabilitation ward or facility.

Recommendations

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.
## Table 5.2 Comparisons of length of stay – DRGs and subgroups

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<td>3.1</td>
<td>6.1</td>
</tr>
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<td>F60B</td>
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<tr>
<td>F74Z</td>
<td>2.3</td>
<td>2.4</td>
<td>2.4</td>
<td>1.2</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>AMI</td>
<td>4.7</td>
<td>4.8</td>
<td>6.9</td>
<td>4.4</td>
<td>4.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Angina/Chest Pain</td>
<td>1.8</td>
<td>2.0</td>
<td>2.6</td>
<td>2.1</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Others</td>
<td>3.2</td>
<td>3.4</td>
<td>5.1</td>
<td>3.4</td>
<td>3.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Pacemaker/Defibrillator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F01A</td>
<td>8.3</td>
<td>8.4</td>
<td>11.5</td>
<td>11.2</td>
<td>11.2</td>
<td>17.2</td>
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<tr>
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<td>4.3</td>
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<td>3.9</td>
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<td>F17Z</td>
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<td>1.0</td>
<td>1.0</td>
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<td>1.0</td>
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<td>1.0</td>
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<td>Tracheostomy or Ventilation &gt; 95hrs</td>
<td>A06Z</td>
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<td>37.1</td>
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<tr>
<td>Case study</td>
<td>Sub groups</td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
<td>BLH</td>
<td>JHH</td>
</tr>
<tr>
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<td>----</td>
<td>------</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>LOS1</td>
<td>LOS2</td>
<td>LOS3</td>
<td>LOS1</td>
<td>LOS2</td>
</tr>
<tr>
<td>Cataracts</td>
<td>C16A</td>
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<td>1.1</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
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<tr>
<td></td>
<td>C16B</td>
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<td>1.0</td>
<td>1.0</td>
<td>0.2</td>
<td>1.0</td>
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<tr>
<td>Hysterectomy</td>
<td>N04Z</td>
<td>4.6</td>
<td>4.5</td>
<td>4.5</td>
<td>3.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Obstetric</td>
<td>Caesarean delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>delivery</td>
<td>O01A</td>
<td>9.9</td>
<td>9.8</td>
<td>10.2</td>
<td>7.1</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>O01B</td>
<td>6.5</td>
<td>6.4</td>
<td>6.5</td>
<td>4.7</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>O01C</td>
<td>4.7</td>
<td>4.6</td>
<td>4.6</td>
<td>3.5</td>
<td>3.3</td>
</tr>
<tr>
<td>Vaginal delivery</td>
<td>O02A</td>
<td>4.7</td>
<td>4.6</td>
<td>4.6</td>
<td>3.8</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>O02B</td>
<td>4.0</td>
<td>3.9</td>
<td>3.9</td>
<td>2.7</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>O60A</td>
<td>5.3</td>
<td>5.2</td>
<td>5.2</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
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<td>3.2</td>
<td>3.3</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>O60C</td>
<td>2.3</td>
<td>2.2</td>
<td>2.2</td>
<td>1.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Note: Numbers in blue font indicate low case numbers and so LOS values should be interpreted with care. In a few instances LOS2 will be slightly shorter than LOS1 because LOS 1 is calculated using hours on the ward while LOS2 (and LOS3) is calculated using days. Therefore if patients are admitted in the morning for surgery and discharged the next day in the early afternoon, the average LOS will be say 30 hours or 1.25 days: under LOS2 this would be 1 day and under LOS1 this would be 1.25 days.

Source: NSW Health HIE data and IPART analysis.
Clinical coding (coding) is the classification process whereby patients are assigned a DRG and other codes based on information in their medical records about their diagnoses, the procedures they underwent and various demographic and administrative factors. It is important that both the codes and the medical records on which they are based are accurate and consistent for a variety of reasons including patient safety, reliability of research and consistency of funding (see Box 6.1).

As Chapter 1 noted, NSW Health has recently undertaken an audit of the quality and consistency of current coding data, as part of the larger project it is coordinating. However, we also assessed the accuracy and consistency of the study hospitals’ coding practices as part of our study. In particular, we obtained de-identified patient-level data and compared the results of selected pathology tests with the diagnosis codes included in the patients’ medical records to assess whether those codes were consistent with the test results and consistent across hospitals. For example, we examined the test results for:

- troponin T levels to assess coding for acute myocardial infarction
- haemoglobin levels to assess coding for anaemia
- glucose levels to assess coding for diabetes
- sodium levels to assess coding for hyponatremia.

The troponin comparison related directly to our cardiology case study and for this comparison we also reviewed a small sample of medical records in each hospital to assess medical documentation. The other comparisons were not directly related to our case studies, but did provide insights into coding practice.

We were only able to obtain the data needed for this analysis from RPAH and BLH, so it was limited to these 2 hospitals. However, it is possible that our findings apply more widely.

42 DRGs (or diagnostic related groups) are used to classify patient cases into groups with similar clinical conditions (related diagnoses) and with similar hospital resource use. See Chapter 4 for more information.

43 See Box 1.1, which explains that IPART’s costs and outcomes study forms part of a larger project that NSW Health is conducting, and that this project also includes an audit of current coding and costing data. The audit of coding was undertaken by Pavilion Health and was aimed at informing NSW Health on the implementation of episode based funding.
Given the importance of coding accuracy for both clinical analysis and for helping to determine funding levels in a casemix system, we believe that this is an important area for attention.

The section below summarises our main findings on the accuracy and consistency of coding. The subsequent sections discuss what coding is and how it is conducted, then describe our analysis and findings in more detail. Box 6.1 outlines why the accuracy and consistency of coding is important.

### 6.1 Summary of our main findings on the accuracy and consistency of coding

Based on our examination of the pathology test results and diagnosis coding of RPAH and BLH patients, we found that a significant proportion of cases with abnormal pathology results for troponin T, haemoglobin, blood glucose or salt levels had not been coded for acute myocardial infarction (AMI), anaemia, diabetes or hyponatremia. We acknowledge that an abnormal pathology result does not automatically mean that a patient has a particular diagnosis, however, we suggest that some of the cases that were not coded were likely to be patients with diagnoses that could influence DRG complexity. It is possible that these hospitals (and other NSW hospitals) are understating their casemix complexity. This would have funding implications in a federal casemix funding system.

We suggest that:

- NSW Health should continue to improve the quality of medical record documentation and the accuracy and consistency of coding.
- Hospitals should further encourage education on coding and facilitate communication between clinical staff and coders regarding the coding process and the documentation required to code common clinical conditions, diagnoses or complications.
- Hospitals that have patient-level pathology data available should consider using this data to audit coding quality for selected conditions.

### 6.2 What is coding and how is it conducted?

As noted above, clinical coding is the process whereby all hospital patients are assigned various codes that determine their DRG. Coding involves a system of translating medical description of disease, injuries and procedures into pre-defined alpha-numerical codes for all admitted (inpatient) hospital patients. Coding is often undertaken after a patient has been discharged from hospital. The process used to allocate a specific DRG to a patient can be complex.
Clinical coders, employed (or engaged) by the hospitals, use information recorded in a patient’s medical record (paper and/or electronic format) by medical and other clinical staff to assign codes for diagnoses, procedures and complications for the patient. The codes assigned by a clinical coder are then fed into a computer program (commonly known as a ‘Grouper’) that assigns the DRG. The grouper applies algorithms that determines the patient’s DRG based on their diagnosis, procedure and complication codes assigned by the clinical coder and other factors, such as the patient’s characteristics (eg, age) and administrative data relating to their stay (eg, their method of discharge). Clinical coders add the appropriate codes and DRG to the patient’s medical record.

For the coding to be accurate and consistent both within and across hospitals, it is necessary that:

- coders work consistently, in accordance with the coding standards
- clinical staff provide clear and accurate documentation that meets the coding standards
- medical staff use consistent criteria to decide if a patient has a particular diagnosis
- hospitals use consistent administrative practices in relation to patient administrative data.

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44 The patient’s discharge summary is a particularly important source of information for coders, though other information in the medical record is also reviewed.

45 Coders allocate these codes in line with clinical coding standards. There are 2 key coding classification systems: the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10_AM) for diagnoses and the Australian Classification of Health Interventions (ACHI) for procedures. The classification edition current during the 2008/09 period was the 6th Edition. For the purpose of this study, the term DRG is synonymous with AR-DRG 5.2.
Box 6.1 Why is the accuracy and consistency of coding important?

Patient records are used by medical, nursing and other staff to help with patients’ diagnosis, assessment and monitoring while they are in hospital. Therefore, the accuracy and clarity of these records is critical for patient safety. Diagnosis codes and DRGs are usually assigned after a patient has been discharged from hospital, so it is possible that some hospital staff regard them as unimportant for patient care.

However, it is important that DRGs and other clinical codes included in patient records are accurate and consistent with these records, and that hospitals assign these codes to patients in a consistent way. There are 3 main reasons for this:

▼ First, DRGs are often used in conducting clinical research and assessing clinical practice. For example, researchers use DRGs to identify groups of like patients to compare clinical outcomes, such as mortality rates. If a hospital’s coding is not accurate, this research may not be as helpful as it could be.

▼ Second, DRGs are often used in calculating the workload of a hospital and complexity of that workload. Hospital activity can be compared and funded on this basis – for example, using an episode-based or casemix funding system. If a hospital’s coding is not accurate, it may not receive appropriate levels of funding.

▼ Third, DRGs are often used in comparing the efficiency of hospitals. Unless the hospitals’ coding practices are consistent and accurate, the comparisons will be misleading, or difficult to interpret.

### 6.3 Our analysis of the consistency and accuracy of coding at study hospitals

One way to assess the quality of coding data is to conduct a coding audit. However, such audits focus on the finished medical record and examine whether the codes included in this record are consistent with the information in the record, and with coding standards. They do not consider issues such as whether the medical records clearly document the diagnoses of the patient, or whether clinicians are using similar criteria to determine whether certain diagnoses are documented. To help us examine these broader issues, we compared de-identified patients’ pathology test results with these patients’ diagnosis coding, to check that they had been coded in a way consistent with their test results. As noted above, we examined the results of tests on patients’:

▼ troponin T levels to assess coding for acute myocardial infarction
▼ haemoglobin levels to assess coding for anaemia
▼ glucose levels to assess coding for diabetes, and
▼ sodium levels to assess coding for hyponatremia.
In addition, in the case of the troponin T comparison, we also reviewed a small sample of medical records in each hospital to check whether there were other clinical indications of an AMI and to assess whether there was adequate medical documentation to enable coders to code a diagnosis of AMI.

### 6.3.1 Troponin T levels and coding for acute myocardial infarction (AMI)

Troponin T is a protein that is present in the blood when heart muscle damage has taken place. Clinicians typically order troponin T level tests when patients present with chest pain as part of the diagnostic process for an AMI (heart attack). Clinicians consider the troponin test results in conjunction with ECG\(^{46}\) results and other factors such as the nature of the patient’s pain and their medical history, to help determine whether they have had an AMI.

An elevated troponin T test result does not necessarily mean that a patient has had an AMI, since high troponin levels may also indicate the patient has had an AMI in the recent past, or that their heart tissue has been damaged through coronary angioplasty (e.g., stenting), or several other diseases (like myocarditis, congestive heart failure or renal failure).\(^{47}\)

Clinicians advised that a troponin result of over 0.02 µg/L would be considered to be elevated, however as the troponin level increases above 1.0 µg/L, it is much more likely to be caused by ischaemia\(^{48}\) than by other conditions.\(^{49}\)

Table 6.1 compares the number and percentage of patients RPAH and BLH coded as having an AMI for a range of troponin T results. It indicates BLH coded higher proportions of patients with troponin T levels over 0.2 µg/L as having an AMI. This may reflect patient mix, but might also suggest that the hospitals were using slightly different troponin level thresholds for determining whether a patient should be coded as having an AMI or it may indicate the quality of coding at each hospital.

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\(^{46}\) Electrocardiography uses electrical signals from the heart to help detect heart damage or heart rhythm irregularities. It is used to help diagnose AMIs.


\(^{48}\) Ischaemia is a lack of oxygen to an organ (in this case the heart) usually due to a blockage in an artery.

\(^{49}\) Source: Professor Phil Harris, RPAH.
Table 6.1 Number and percentage of cardiology patients coded as having an AMI, by their troponin T level test results, 2008/09

<table>
<thead>
<tr>
<th>Troponin T level in blood μg/L</th>
<th>Coded as having an AMI</th>
<th>0.02-0.05</th>
<th>0.06-0.10</th>
<th>0.1-0.2</th>
<th>0.2-1.0</th>
<th>&gt;1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>No</td>
<td>1107</td>
<td>429</td>
<td>245</td>
<td>237</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>67</td>
<td>58</td>
<td>95</td>
<td>238</td>
<td>312</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>6</td>
<td>12</td>
<td>28</td>
<td>50</td>
<td>84</td>
</tr>
<tr>
<td>BLH</td>
<td>No</td>
<td>667</td>
<td>212</td>
<td>97</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>34</td>
<td>30</td>
<td>41</td>
<td>123</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>5</td>
<td>12</td>
<td>30</td>
<td>58</td>
<td>87</td>
</tr>
</tbody>
</table>

Note: Pathology test level results were only available for RPAH and BLH.

Source: Pathology test results from study hospitals, 2008/09 data.

Review of sample of clinical notes for patients with high troponin results

In order to further assess coding practice in light of the clinical documentation, we identified cases in the cardiology case study area where patients had high troponin T levels tests but had not been coded with an AMI. We examined their medical records to see if these included documentation of other factors that might explain the high troponin result.

We found that some of these patients were coded correctly, as their notes indicated they had conditions or recent coronary procedures that can give a high test result without having an AMI. However, we found other patients who did not have other explanations for a high troponin result and appeared to have been coded incorrectly. In most of these incorrectly coded cases, the incorrect coding appeared to be due to a lack of clear clinical documentation. In particular, if a clinician wrote the term ‘AMI’, it would almost always be coded as an AMI. However, we found examples of other cases where the clinician used terms such as ‘chest pain’, ‘radiating chest pain’ but did not clearly state that the patient had an ‘AMI’. We were advised by coders that these cases could not be coded as an AMI. In a few cases, the notes and discharge summary indicated that the patient had a heart attack, but used an alternative abbreviated term, such as ‘STEMI’ and ‘NSTEMI’. Some of these cases had not been coded as an AMI.

We found there were gaps in understanding between clinicians and coders in relation to coding requirements. We were advised by clinical coders that they needed clear clinical documentation of a recent ie, acute, myocardial infarction and that the use of the term ‘chest pain’ did not allow an AMI to be coded. We found differing views about the use of the terms NSTMI or STEMI. A cardiologist pointed out that:

A large effort has gone into teaching and training clinical staff to think of myocardial infarctions in terms of STEMIs and NSTEMIs because of the different immediate intervention that each receives.....it is apparent that.... coders need to be educated that they should code STEMIs and NSTEMIs as AMIs.
This difference between clinical teaching and coding practice highlights the need for coders and medical staff to discuss common conditions and the key descriptors required for coding and to amend coding standards if required.

We also suggest that hospitals or their cardiology departments could routinely use a targeted audit approach (based on pathology results) to assess their coding and the quality of discharge summaries by medical staff and this could improve the accuracy and consistency of their coding.

The following examples relate to diagnoses that may impact on the DRG coding assigned to a patient. We did not review clinical notes relating to these cases, but have simply compared pathology results with assigned diagnosis codes.

### 6.3.2 Sodium levels and coding for hyponatremia

Hyponatremia is a low concentration of sodium ions in the blood. In some clinical areas, this condition can increase the complexity of the patient’s case and affect the DRG a patient is placed in. One marker of hyponatremia is the sodium concentration in the patient’s blood.

We examined patient data, and used a sodium level of 120 or below as the threshold for when patients should have been coded for hyponatremia. This is a significant level that would normally warrant being recorded in the patient’s clinical notes and thus should have been coded.

Table 6.2 shows the number and percentage of patients at RPAH and BLH coded for hyponatremia for a range of sodium level results. It indicates that only 71% of patients with very critical hyponatremia (<=120) at RPAH were coded for this condition, and only 64% of such patients at BLH were coded. As you would expect, it also shows that percentage of patients coded for hyponatremia at both hospitals declined as their sodium levels rose towards the normal level (above 134). However, 3 patients with a very high level of sodium (above 156) were coded as having hyponatremia, when in fact this level would normally warrant them being coded for hypernatremia, or high concentration of sodium in the blood.
Table 6.2 Number and percentage of patients coded for hyponatremia, by their sodium level test results, 2008/09

<table>
<thead>
<tr>
<th>Sodium concentration in blood</th>
<th>Coded for hyponatremia</th>
<th>120 or below</th>
<th>121-125</th>
<th>126-130</th>
<th>131-134</th>
<th>156 or above</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>No</td>
<td>25</td>
<td>238</td>
<td>1150</td>
<td>3218</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>61</td>
<td>125</td>
<td>116</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>71</td>
<td>34</td>
<td>9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BLH</td>
<td>No</td>
<td>16</td>
<td>135</td>
<td>526</td>
<td>1560</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>28</td>
<td>63</td>
<td>40</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>64</td>
<td>32</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: (Sodium >=156) are patients with hypernatremia that have been coded as having hyponatremia.

Source: Pathology test results from study hospitals, 2008/09 data.

The variations in the percentages of patients coded for hyponatremia at the hospitals suggest they may be using different clinical thresholds to determine whether patients should be coded for hyponatremia.

### 6.3.3 Haemoglobin levels and coding for anaemia

Anaemia occurs when a patient has a low number of red blood cells, which can be due to a large number of clinical causes. It is measured using a haemoglobin test. The level at which it becomes an issue and so should be documented in a patient’s clinical notes may vary. Even significant levels of anaemia may not be documented or coded, which could potentially affect the DRG the patient is assigned to.

We examined patient pathology data, and used a haemoglobin level of 79 or below as the threshold for when they should have been coded for anaemia. This is a significant level of anaemia that would normally warrant being recorded in the patient’s clinical notes and thus should have been coded. As there are many different ICD10 diagnosis codes that can include anaemia, we considered that patients coded with any code that included the word ‘anaemia’ had been correctly coded.

Table 6.3 compares the number and percentage of patients with haemoglobin levels of 79 or below at RPAH and BLH who were coded for anaemia. It suggests that only 62% of these patients at RPAH and 60% at BLH were correctly coded. The difference in the percentage at each hospital was small but may suggest they were using slightly different thresholds for determining when a patient should be coded as having anaemia.
Table 6.3  Number and percentage of patients with haemoglobin levels of 79 or less at RPAH and BLH coded as having anaemia, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Coded as having anaemia</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>No</td>
<td>798</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1318</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>62</td>
</tr>
<tr>
<td>BLH</td>
<td>No</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>384</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Anaemia coded is any ICD10 code descriptor that included the word anaemia.
Source: Pathology test results from study hospitals, 2008/09 data.

6.3.4 Glucose levels and coding for diabetes

Diabetes is formally tested using a fasting blood glucose test and frequently initially diagnosed in a patient using a glucose tolerance test. Patients admitted to hospital frequently have a random blood glucose test. A very high result may mean that the patient is diabetic, or that their blood glucose levels have been affected by hospital-administered sugar.

We looked at patients in all our case study areas who had been given a random blood glucose test. We considered that those whose test results indicated they had a blood glucose level of 16 or more should have been coded for diabetes. This is a very high level of blood glucose that would normally warrant being treated, and thus should have been coded.50

As Table 6.4 shows, we found that only 70% of patients who had a blood glucose level of 18 or higher were coded as having diabetes at BLH, while 76% were coded at RPAH.

Table 6.4  Number and percentage of patients with random blood glucose levels of 16 or more at RPAH and BLH coded as having diabetes, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Coded as having diabetes</th>
<th>Blood glucose of 16-18</th>
<th>Blood glucose of 18+</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>No</td>
<td>130</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>231</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>64</td>
<td>76</td>
</tr>
<tr>
<td>BLH</td>
<td>No</td>
<td>62</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>83</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>57</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: Pathology test results from study hospitals, 2008/09 data.

50 We were advised by RPAH that a random blood glucose level of greater than 11 is used by endocrinologists as evidence that a patient has diabetes. We note that some pathology results may be invalid due to contamination, but certainly not all the cases that were not coded.
Recommendations

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 involves allocating hospital expenditures to specific groups of patients (eg, based on their DRGs) to estimate the costs of providing hospital care to these patients. Most major Australian public hospitals are required to do clinical costing as part of national hospital data collections, such as the National Hospital Cost Data Collection (NHDC)\textsuperscript{51} or other Commonwealth datasets.

Clinical cost estimates are also used as an integral part of activity-based funding systems (such as casemix funding in Victoria or South Australia). In states such as Victoria or South Australia, data collection, data quality and IT systems have been established over many years to collect activity-based casemix cost estimates.

NSW has not historically used an activity-based or casemix funding system and so has not had the same focus on the systems used to support clinical costing or the accuracy of clinical costing information at the DRG level. However, NSW Health has started to move towards an activity-based ‘episode funding model’ and is further developing episode funding in line with the national agreement by COAG to move to a more nationally consistent approach to activity-based funding.\textsuperscript{52} These types of funding arrangements rely on accurate measures of patient activity and an understanding of costs, usually at the DRG level.

As Chapter 1 noted, the NSW Department of Health undertook an audit of the quality and consistency of NSW hospitals’ current costing data, as part of the larger project it is coordinating.\textsuperscript{53} We also examined clinical costing practices by relevant area health services and our 5 study hospitals as part of our cost analysis.\textsuperscript{54}

\textsuperscript{51} This collection is used to determine ‘case weights’ for DRGs.

\textsuperscript{52} Episode-based funding is the term used for NSW’s casemix funding system. More detail is provided at the end of this chapter.

\textsuperscript{53} See Box 1.1, which explains that IPART’s costs and outcomes study forms part of a larger project that NSW Health is conducting, and that this project also includes an audit of current clinical costing data. The audit of clinical costing was undertaken by Health Outcomes International.

\textsuperscript{54} Clinical costing is generally undertaken or coordinated by area health services, rather than hospitals.
As part of our hospital visits, we broadly examined the structure of each hospital’s chart of accounts and cost centres. We asked a range of hospital and area health service staff about their clinical costing process, the clinical data that feed into this process and the cost centres relevant to our study areas. For some of the clinical resources we focused on, we were able calculate our own cost estimates using patient-level data and compare them to the cost estimates the hospitals submitted to the NHCDC. We identified several ways to make the output of NSW hospitals’ clinical costing more useful in the future – both as a hospital management tool, and as a rich source of data for clinicians and clinical units.

The sections below provide an overview of the initiatives being implemented in NSW as part of episode-based funding and summarise our main findings on clinical costing, which were based on our observations of the approaches used in study hospitals to compile 2008/09 NHCDC estimates. We then discuss our analysis and findings in more detail and set out our recommendations for improving the quality, consistency and usefulness of clinical costing data in the future. Box 7.1 provides an overview of clinical costing and the NHCDC.
Box 7.1 Overview of clinical costing and the NHDC

As noted above, most major Australian public hospitals are required to do clinical costing, and submit the resulting cost estimates to the NHDC. Clinical costing involves estimating the costs of providing care to specific groups of patients (eg, based on their DRGs). This is a complex process that may involve a combination of:

- ‘top down’ costing, where a cost bucket is allocated to patients using a series of allocation statistics – such as ‘service weights’ or
- ‘bottom up’ costing in which the costs of each service provided to an individual patient are measured or estimated to obtain the total cost of treating that patient.

These approaches are not mutually exclusive. Some resources cannot be allocated using a ‘bottom up’ approach, for example administrative and cleaning services. And the ‘bottom up’ approach still requires a certain amount of allocation, for example of nursing time. Hospitals are best able to use the ‘bottom up’ approach where their clinical systems are able to identify patients, and these systems are linked to their costing system. Where this is not the case, hospitals generally rely heavily on service weights to allocate costs.

The basic building blocks for clinical costing are:

- Clinical data systems that are able to identify patients and are linked to the costing system. For our study hospitals, we found that patient-level data were available from pathology systems, imaging systems, theatre prostheses systems, theatre consumables and theatre time.
- General ledger chart of accounts, cost codes and account codes.
- Patient administrative systems for allocating patient time.
- Inpatient fractions used to allocate staff time to inpatient and other activities.
- Service weights used to help allocate resources to patients.

If clinical costing data are of high quality, they can be used for a range of purposes such as measuring and comparing costs, and developing hospital and health system policies.

NSW Health has been producing clinical cost estimates at the DRG level for all Peer Group C2 and above hospitals for more than a decade. Clinical cost estimates are compiled by NSW hospitals for the NHDC and are reported to the Commonwealth Government. They are published by NSW Department of Health at the hospital level in the ‘Yellow Book’ and by the AIHW and Commonwealth Government in various publications and databases.

The NHDC produces national cost weights for Australian Refined Diagnosis Related Groups (AR-DRGs) and other statistics relevant to health service costing and planning. Although they are not intended for this purpose, NHDC costs are also sometimes referred to when comparing hospital efficiency, particularly between jurisdictions. This can be a problem because the NHDC methodology is not appropriate for this purpose.¹

¹ For example, see Kathy Eagar, The cost of public hospitals – which State or Territory is the most efficient?, ABF Information Series No. 4, University of Wollongong March 2010.
7.1 Summary of main findings on clinical costing, episode funding and the NHDC

Our analysis was undertaken in 2009/10, based on our observations of the approaches used by area health services to derive the 2008/09 NHDC estimates for study hospitals. These estimates were prepared during a time of significant changes to clinical costing in NSW, with the recent implementation of a new clinical costing system and the introduction of episode-based funding as a funding tool. Our findings will help the NSW Department of Health, area health services and hospitals to identify areas for refinement, but we acknowledge that a number of steps are already being taken to improve costing systems and methodologies.

For the 2008/09 estimates, we found that:

- The relevant area health services undertook clinical costing on behalf of the study hospitals, but used different approaches. One area health service principally used ‘top-down’ costing using service weights, while the other 2 made use of patient-level costing to some extent.

- There were differences between areas in the amount of patient-level data available from the hospitals’ clinical systems. In some instances, these data were not used for clinical costing even when they were available.

- There were also differences in the extent to which hospital finance staff and management understood the clinical costing process undertaken at the area level.

- Generally, the clinical costing process and the outputs from this process were not integrated into the study hospitals’ overall financial management or clinical planning systems. We note that this is markedly different to what occurs in jurisdictions with casemix funding systems.

- The area health services used different charts of accounts and the hospitals used different cost centres and included different items within cost centres. This made the task of comparing costs on a consistent basis much more difficult and time consuming. In some instances, we also found that the cost centres were out of date – for example, wards had changed function, the cost centres had not always been updated in a timely manner, which made the cost estimates unreliable.

- All hospitals applied inpatient fractions (IFRACs) to allocate nursing and medical staff costs to inpatients. However, we are concerned that the hospitals did not apply a consistent approach when calculating these. IFRACs were also sometimes out of date.

- Our estimates of average costs per patient indicate there is a higher degree of consistency in these costs across the study hospitals than is suggested by the NHDC estimates. This is likely to partly reflect differences in costing methodology across hospitals.

- Due to differences in costing methodologies among hospitals, we would caution against simplistic comparisons of DRG-level cost estimates between hospitals.
7.2 Recent state-wide reforms relevant to clinical costing

The 2008/09 NHCDC estimates were prepared during a period of adjustment and high demands on clinical costing staff. A number of state-wide changes relevant to clinical costing were underway at the time, including:

- application of a relatively new state-wide clinical costing system, which was being ‘bedded down’ during the period of the study
- the introduction of episode funding as a funding tool for the first time.

Both of these changes meant that clinical costing in NSW hospitals was occurring in an environment of change. We expect that the quality of the clinical cost estimates will improve over time as costing systems and linking feeder systems are ‘bedded-down’ and activity-based funding is established.

7.2.1 Introduction of episode or activity-based funding in NSW

Episode funding is the NSW Health label for activity-based funding (ABF). Work on episode funding has been underway in NSW Health since the early 2000’s. Prior to 2009/10, episode funding was not used by the NSW Department of Health on a state-wide basis as a funding or budget-setting tool, but instead was used by some area health services to assist with cost comparisons between hospitals in the same peer group. For the 2009/10 financial year, the episode funding model was used for the first time to determine the activity-related component of the recurrent budgets for selected public hospitals in NSW. A number of initiatives were underway during the period of our study to implement episode-based funding eg, the use of a new state-wide costing system (see Box 7.2). This work is occurring in parallel with a national move towards ABF (see Box 7.3).

Box 7.2 State-wide rollout of Power Performance Manager

In 2008, NSW Health started implementing a state-wide clinical costing system (PPM) that had been customised for NSW public hospitals. One of its principal aims was to achieve greater consistency and a more standard approach to clinical costing across NSW public hospitals and area health services. As part of this, an aim was to increase the use of ‘bottom up’ patient level clinical costing approaches and reduce the reliance on service weights. It was recognised at the time that the diverse, customised ‘feeder systems’ that had been developed by different area health services over a number of years to suit local circumstances represented a legacy that would require significant additional investment to address, and that this would not be achieved quickly. NSW Health is still working on this issue.

Source: NSW Department of Health.
Box 7.3 National activity-based funding initiatives

NSW Health is participating, along with all other state and territory health departments, in the implementation of the National Implementation Plan developed under the Activity-Based Funding National Partnership Agreement (NPA). NSW Health has developed its own Implementation Plan based on the National Plan. The NPA and Implementation Plans are aimed at fulfilling a COAG commitment by all jurisdictions to move to a more nationally consistent approach to ABF. Under this NPA, multi-jurisdictional work is proceeding on developing common or consistent approaches to patient classification, coding and clinical costing in relation to each of eight separate work-streams: acute admitted, ED, subacute, outpatients, mental health, community-based services, teaching training and research and CSOs.

The agreement reached by COAG (with the exception of WA) in April 2010 to sign the National Health and Hospitals Network Agreement provides for an acceleration of the ABF NPA National Implementation Plan, to enable the Commonwealth to use an ABF model to fund 60% of the “efficient price” of each public hospital service provided to public patients. This COAG Agreement further underscores the importance of ensuring that public hospitals in NSW are adopting robust and consistent practices in relation to both clinical coding and clinical costing.

Source: NSW Department of Health.

7.3 Approaches to clinical costing by study hospitals

Clinical costing in NSW is mainly undertaken by area health services on behalf of hospitals. For the 2008/09 estimates, the area health services used a range of approaches to clinical costing with different levels of sophistication:

- The Sydney South West Area Health Service (SSWAHS), which includes RPAH and BLH, mainly used a ‘top down’ approach using service weights and made very little use of the patient-level data available from the hospitals’ clinical systems.

- The North Sydney Central Coast Area Health Service (NSCCAHS), which includes GH and RNSH, and the Hunter New England Area Health Service (HNEAHS), which includes JHH, made greater use of patient-level data.

- All 3 area health services relied on service weights to allocate medical and nursing staff costs to patient groups.
We found that a reasonably wide range of patient-level data was available for clinical costing from the study hospitals’ pathology systems, imaging systems and various theatre systems, including prostheses systems, theatre consumables and theatre time. However, as noted above, in some instances, the available data were not used in clinical costing. Table 7.1 show the ‘feeder’ systems that were used to some extent by area health services in clinical costing.55

Table 7.1 Clinical feeder systems used in clinical costing

<table>
<thead>
<tr>
<th></th>
<th>SSWAHS</th>
<th>NSCCAHS</th>
<th>HNEAHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathology</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Imaging</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Operating theatres</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Pharmacy</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prostheses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Interventional radiology</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


There were also differences in the extent to which the hospitals’ management and finance staff understood the clinical costing process that their area health service undertook on their behalf. In general, staff at JHH, GH and RNSH appeared to have a better understanding of clinical costing than staff at RPAH or BLH.

In addition, the clinical costing process and the outputs from this process were generally not integrated into the hospitals’ overall financial management or clinical planning systems. JHH appeared to have the most integrated approach to clinical costing.

We note that NSW introduced a new clinical costing system, the Power Performance Manager (PPM), in all area health services during 2008/09 within a 12 month period (for the 2007/08 estimates). In order to implement the system in the short time frame, the area health services mainly used service weights and basic overhead statistics to allocate costs for 2007/08. During 2009/10 there was some further development of clinical feeder integration.56 However, we expect that the process of clinical feeder integration will take time as there was little uniformity in feeder systems across the different area health services.

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55 The term ‘feeder system’ refers to hospital IT systems or datasets that include data that can be used within clinical costing to show resource use for each patient episode e.g., the imaging system will include information on the type of test, the pharmacy system will have information on the drugs that were dispensed.

7.4 Chart of accounts, cost codes and account codes

We found that in the 2008/09 financial year, SSWAHS was not using the same chart of accounts as the other area health services and this made comparisons between the hospitals more complicated. We also found that there were differences in the structure of the hospitals’ financial accounts or complexities within the accounts that made the separation of hospital patient costs from other costs more complex.

For several of the study hospitals, area health service functions or costs were included in the accounts of the hospital. For example, the accounts for GH included a number of overhead costs for the NSCCAHS or for other hospitals on the Central Coast. In addition, expenditures by the study hospital were included in accounts of another hospital (eg, expenditures on renal services by BLH were included in the accounts for Liverpool Hospital).

Most of the study hospitals had not clearly separated staff time spent on area responsibilities from staff time spent on hospital activities. Most hospitals used program fractions (including inpatient fractions, or IFRACs) to adjust for this effect, but the processes used to set these fractions were not always rigorous or consistent across area health services (see section 7.5 below).

In addition, the study hospitals did not use the same cost centres for the same activities and items. While there was a NSW standard chart of accounts that specified account names and set a range of cost centres for area health services, there were no ‘rules’ about what expenditures cost centres should contain. Consequently, there was little consistency between hospitals about what was included even in cost centres with the same name. For example, there were no rules about whether medical staff should be allocated to wards or clinical departments, or where JMO overtime should be allocated. As a consequence, for example, JHH included both nursing and medical staff costs in the same cost centres while the other hospitals included medical staff costs in other cost centres. We also found that in some instances, cost centres mappings were out of date. For example, we found several instances where the functions of wards had changed, but cost centres and IFRACs had remained the same.

We understand that NSW Health and the area health services are moving towards the use of a consistent chart of accounts, and we support this direction.
Inpatient fractions or IFRACs are used in cost modelling to allocate nursing and medical staff time and pay to inpatient activities. We found that there was wide variation in the IFRACs applied by the hospitals for similar clinical activities, and that these IFRACs generally exacerbated differences between hospitals’ nursing staff costs (see Box 7.4 and Chapters 8 and 9 on nursing staff and medical staff costs respectively).

We also found that the processes for setting IFRACs were not always well understood by hospital staff and were inconsistent. In some instances they appeared to be set for medical staff but applied to the whole cost centre, which may include nursing staff. Based on our hospital visits, it appeared that there were differences between the hospitals relating to the importance placed on ‘getting the IFRACs right’ and on the rigour of the methodology used to establish IFRACs.

We found that without undertaking a substantial quality assurance or auditing process, it was difficult to disentangle valid inpatient fractions from invalid ones.

**Box 7.4 Examples of variations in nursing costs with and without IFRACs from our case studies**

For our clinical case studies we estimated direct ward nursing staff costs both with and without IFRACs. We did this because we found a wide variation in IFRACs between the study hospitals for similar clinical conditions. For most of our case studies, we found that the nursing costs were more consistent across the hospitals when all IFRACs were set to 1 than when the hospitals’ IFRACs were used.

For example, we calculated nursing cost per bed day and found that the difference between the highest and lowest cost hospital varied as follows:

- For appendicectomy without complications (DRG G07B), the difference was $51 with the hospitals’ IFRACs and $16 with IFRACs = 1.
- For hip joint replacement due to a fracture, the difference was $80 with the hospitals’ IFRACs and $31 with IFRACs = 1.
- For breast surgery (mastectomy) the difference was $45 with the hospitals’ IFRACs and $126 with IFRACs = 1.
- For hysterectomy (DRG N04Z), the difference was $56 with the hospitals’ IFRACs and $72 with IFRACs = 1.

IFRACs for nursing staff are discussed in more detail in Chapter 8 and IFRACs for medical staff are discussed in Chapter 9.

57 As explained in Chapter 9, we were unable to calculate medical staff costs for our case studies.
Given the wide variation in IFRACs for similar activities, we consider that NSW Health take steps to improve the accuracy and consistency of IFRACs across NSW hospitals. We understand that some of ‘fractioning’ will be automated within the new PPM system once the necessary patient data are included in the clinical costing process.

Recommendations

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.

7.6 Better use of costing data

Clinical costing takes time and resources and should not be regarded as a pass through of information to the Commonwealth Government. We suggest that a more standardised approach, using clinical inputs such as data from prosthesis, pathology and imaging systems, can help to inform hospital management about resource use, and clinicians about clinical practice. This issue is further discussed in Chapters 11 and 12 on imaging and pathology.

Recommendation

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.

7.7 Comparison of our cost estimates and NHCDC estimates

The next section includes comparisons of study hospitals’ cost estimates for the NHCDC, for certain types of costs (referred to as cost buckets) with our estimates.

7.7.1 How we compared NHCDC cost estimates and our cost estimates

We obtained provisional patient-level cost estimates for 2008/09 from the NSW Department of Health that it was preparing to submit to the NHCDC. This included detailed information for the costs attributed to patients for a range of cost types. We were able to use these data to regroup patient cost estimates using our selected patient subgroups for each case study.
The final NHCDC data for 2008/09 became available towards the end of our study. We compared these to the provisional data and found that the pathology, prosthesis and operating theatre cost categories had changed substantially for some hospitals. Given the limited time frame for our study, we did not redo all of our analysis for these cost categories based on the final costs. Our approach to this issue differed depending on whether the case study used DRG groupings or subgroups based on diagnosis codes or procedure codes:

- for case studies based on DRG groupings (eg, appendicectomy, cataracts and hysterectomy) we used the final NHCDC data for pathology, prosthesis and operating theatre costs

- for case studies based on diagnosis or procedure subgroupings (eg, hip joint replacement, major chest surgery or breast surgery) we used the provisional NHCDC data, but adjusted the costs to reflect the changes between the provisional and final data.  

We then assessed the hospitals’ cost estimates for the NHCDC in light of the information we had available about these patient groupings and our own cost estimates for ward nursing staff, diagnostic tests (pathology and imaging), prostheses, and theatre use. We also examined the hospitals’ NHCDC estimates related to our case study areas to identify any anomalies (such as prostheses costs for procedures that did not use prostheses).

We compared the hospitals’ NHCDC estimates for certain types of costs (referred to as cost buckets) with our cost estimates. The NHCDC cost buckets often were not directly comparable with our costs estimates, however, the comparison with our data highlighted issues with the reasonableness of some estimates and with the use of the data for hospital comparisons.

7.7.2 Reasons for the differences between our costs and the NHCDC costs

There are 2 reasons why our estimated costs differed from the hospitals’ NHCDC estimates.

First, our cost categories were not exactly the same as those of the NHCDC cost buckets and we generally estimated our costs differently to area health services. Box 7.5 explains the differences in approach between the NHCDC estimates and our approach.

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58 For each clinical condition, we used the weighted average change for the relevant DRGs to make the adjustment.
As explained in Box 7.1, the costs we investigated can be allocated by a ‘bottom up’ approach using patient level data or a ‘top-down’ approach using service weights. We used individual patient data for pathology, imaging and theatre time, and allocated direct ward nursing costs to patients based on time spent in the wards and other parts of the hospital. As discussed in section 7.3 above, this differed from the methods used by SSWAHS in particular, which used service weights to allocate costs in all these categories. Both HNEAHS and NSCCAHS used direct patient data to allocate some costs (see Table 7.1).

Our costing methodology is explained in some detail in the individual cost chapters later in this report.

The remainder of this section provides some examples of our costs compared with the NHCDC costs from our case studies.
Box 7.5 Comparing NHCDC and our cost categories

Direct ward costs and ward nursing staff costs

Our ward nursing staff costs are a subset of the NHCDC’s direct ward costs.

The NHCDC’s direct ward costs include the salaries and wages of nursing staff and other non-
medical staff as well as medical supplies. They exclude Allied Health staff, prostheses, drugs,
diagnostic tests, and depreciation costs.¹

Our ward nursing costs include only salaries and wages for ‘direct care’ nursing staff for time
actually worked (i.e., payment for normal and overtime hours including penalty rates). We
defined ‘direct care’ nurses to include CNSs, RNs, ENs, AINs and student nurses (see Chapter 8
on nursing costs).

Differences: Our costs exclude leave pay and superannuation for direct care nurses; salaries and
wages for all other ward staff (e.g., nurse managers and medical supplies).

Pathology

The NHCDCs costs include “all salaries, wages, VMO payments and goods and services costs in
pathology cost centres (where in-house services exist), or charges relating to pathology tests”.²

We attributed a value for pathology tests based on internal billing data between the hospitals
and the pathology services. Our methodology is explained in Chapter 12.

Differences: The NHCDC costs can be based on costs or charges. Our cost estimates use the
latter approach and are based on internal charges (which are based on MBS). Also, the NHCDC
costs include Blood bank costs whereas we calculated costs for blood use separately.

Imaging

The NHCDCs costs include “all salaries, wages, VMO payments and goods and services costs in
imaging cost centres (where in-house services exist), or charges relating to imaging tests”.²

We used detailed information from imaging services on the number and type of tests
performed. As a proxy for cost, we attribute a value based on 100% of the Medicare Benefits
Schedule (MBS). Our methodology is explained in Chapter 11.

Differences: The NHCDC costs can be based on costs or charges. Our cost estimates use the
latter approach and are based on the number of tests performed and a standard charge per
test.

Prostheses

The NHCDCs costs include “all cost associated with inpatient prostheses”.²

We did not have complete information on the hospitals’ volumes of prosthesis purchases.
Instead, we compared hospitals on the basis of their purchases, with a particular focus on their
most frequent purchases. Our methodology is explained in Chapter 10.

Differences: The NH CDC costs are based on the average costs of all actual purchases, whereas
our costs compare prices for the most frequently purchased items only.

¹ NSW Health, Product costing standards V1.0, Reporting requirements V1.0, 2008/09.
7.7.3 NHCDC direct ward costs compared with our ward nursing costs

We compared our ward nursing costs per episode with the hospitals’ NHCDC direct ward cost estimates, and found our estimates indicated a higher degree of consistency in these costs across the study hospitals than was suggested by the NHCDC estimates. This is illustrated in Figure 7.1, which compares our costs per acute episode (both with the hospitals’ IFRACs and with all IFRACs set to 1) with the provisional 2008/09 NHCDC cost estimates from our case studies.59

Figure 7.1 NHCDC direct ward costs compared with our ward nursing costs (with IFRAC and without IFRACs) ($ per episode)

Note: We did not estimate ward nursing costs for RPAH for hysterectomy because the ward moved during the year and the costs were therefore unreliable.

Data source: IPART analysis from HIE inpatient statistics, 2008/09, payroll data and provisional cost data 2008/09, NHCDC.

59 We estimated direct ward nursing costs both with and without IFRACs because of the previously mentioned wide variations we found for IFRACs for similar clinical conditions.
We also found that the NHCDC estimates were usually higher than our cost estimates (as expected). However, this was not always the case, for example for hysterectomy at JHH.

### 7.7.4 NHCDC pathology costs compared with our costs

Like ward nursing costs, we compared our pathology cost estimates with the hospitals’ NHCDC pathology cost estimates. Again, we found our estimates indicated a higher degree of consistency in these costs across the study hospitals than was suggested by the hospitals’ NHCDC cost estimates for many clinical conditions. Comparing hospitals, we found that the NHCDC cost estimates from RNSH and GH were fairly consistent with our estimates for most case studies, while the NHCDC costs from JHH were consistently higher than our estimates. The NHCDC costs from RPAH and BLH varied the most from our estimates, probably due to the cost allocation methods used by SSWAHS. Figure 7.2 illustrates these findings for selected case studies, and further details are provided in Chapter 12.
We also found that the NHCDC estimates for RPAH and BLH included significant pathology costs for patients undergoing cataract surgery, even though this procedure very seldom involves pathology tests (Figure 7.3). As previously noted, these hospitals are in the SSWAHS and their cost modelling was done using ‘top down’ cost allocation. This result for cataract surgery is one of the anomalies of this methodology.
Figure 7.3 Comparison of NHCDC and our pathology costs for cataract surgery ($ per episode)

Cataract surgery - lens procedures (DRGs C16A & C16B)

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

7.7.5 NHCDC imaging costs compared with our costs

We also compared our imaging costs with the hospitals’ NHCDC imaging cost estimates using provisional NHCDC data. Again, we found our estimates generally indicated a higher degree of consistency in these costs across the study hospitals than was suggested by the hospitals’ NHCDC estimates. Comparing hospitals, we found that the NHCDC estimates for RNSH and GH were the most consistent with our estimates, while the NHCDC estimates for JHH were consistently higher than our estimates. The NHCDC estimates for RPAH and BLH varied the most from our estimates, again probably due to the cost allocation methods used by SSWAHS. (See Figure 7.4. Further details are provided in Chapter 11.)

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60 There was very little difference in imaging costs between the provisional and final NHCDC data for our case studies.
Like for pathology, we found that the NHCDC estimates for RPAH and BLH included significant imaging costs for procedures that very seldom involve imaging. To illustrate this, Figure 7.5 shows the reported costs for cataract surgery and vaginal delivery. Again, this result is a consequence of the cost allocation methodology used by SSWAHS.
**Figure 7.5  Comparison of NHCDC and our imaging costs for cataract surgery and vaginal delivery ($ per episode)**

![Graph showing comparison of costs for cataract surgery and vaginal delivery](image)

**Data source:** IPART analysis using data from hospital imaging services and provisional cost data 2008/09 for the NHCDC.

7.7.6 **NHCDC prosthesis costs compared with our costs**

As explained in Chapter 10, our prosthesis costs were not directly comparable with the NHCDC estimates because we based our cost estimates on the most frequently purchased items at each study hospital rather than the average cost. However, our analysis did allow us to compare the variability of the final NHCDC estimates with the variability of the prices paid for prostheses at the study hospitals. We found that there was considerably less variation in the prices paid for the most frequently purchased items than in the reported NHCDC costs. Figure 7.6 illustrates this for stents and lenses.
Figure 7.6 Prices of most frequently purchased items and NHCDC costs – stents and lenses ($ per episode)

Stents - price of most frequent purchase

Stents - cost reported to NHCDC

Lenses - price of most frequent purchase

Lenses - cost reported to NHCDC

Data source: Study hospitals’ purchasing databases and final cost data for the NHCDC, 2008/09. All frequent purchases and prices were checked by study hospitals.

We also found that the hospitals’ NHCDC estimates included fairly substantial prostheses costs for conditions or procedures that do not make use of them, such as cholecystectomy, appendicectomy, major chest procedures and hysterectomy. This applies mainly to RPAH, BLH and JHH. These are shown in Figure 7.7.
### Figure 7.7  NHCDC prostheses costs for selected clinical conditions ($ per episode)

**Hysterectomy - DRG N04Z**

- RPAH: 1,200
- GH: 1,000
- RNSH: 800
- BLH: 600
- JHH: 400

**Appendicectomy - DRG G07B**

- RPAH: 600
- GH: 500
- RNSH: 400
- BLH: 300
- JHH: 200

**Cholesystectomy - DRG H08B**

- RPAH: 1,200
- GH: 1,000
- RNSH: 800
- BLH: 600
- JHH: 400

**Major chest procedures - DRG E01A**

- RPAH: 1,200
- GH: 1,000
- RNSH: 800
- BLH: 600
- JHH: 400

*Data source:* Final cost data from area health services for NHCDC, 2008/09.

### 7.8 Operating theatre costs and time

We cannot directly compare our analysis of operating theatre times with the data for the NHCDC for operating theatre costs, because the NHCDC estimates include items that are not related to time spent in surgery (such as goods and services and some anaesthetic department costs). However, to the extent that there is some relationship between time spent in surgery and operating theatre costs, the ranking of hospitals by cost using NHCDC data were sometimes difficult to understand in the light of our analysis of operating theatre times. Figure 7.8 compares operating theatre times with the hospitals’ NHCDC operating theatre costs for selected procedures. For example, NHCDC operating theatre costs for cataract surgery are

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about the same at RNSH and GH, while our analysis indicates that each procedure takes (on average) nearly twice as long at RNSH than at GH.62

Looking at hip joint replacement surgery, there was relatively little variation in operating theatre time but a large variation in reported costs. For example, theatre time for hip joint replacement for patients with arthritis varied by 18 minutes (or 18%) while the NHCDC theatre cost bucket varied by $1,990 (or 104%). We note that it is possible that these differences may reflect theatre staffing differences, but should not reflect clinical staff cost differences, since these should be included in another cost bucket.

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62 Note that this does not reflect medical staff costs. The difference could reflect some staff or equipment cost differences, but would also reflect clinical costing differences.
Figure 7.8  Operating theatre time and NHCDC operating theatre costs

Note: We used the final NHCDC costs for the DRG based conditions (cataract and hysterectomy). For the hip surgery we used the provisional NHCDC data, but adjusted the values to reflect the changes between the provisional and final data (using the weighted average change for all hip surgery DRGs).

Data source: IPART analysis using data from hospital operating theatres and NHCDC cost data, 2008/09.
7.9 Is the NHCDC valid for comparing hospitals or comparing hospital efficiency between jurisdictions?

Based on our study hospitals, we found that DRG level cost estimates were not always reliable and the range of cost estimates between hospitals partly reflected differences in costing methodology. Our examination of study hospitals indicated that there was a wide range of approaches used to undertake clinical costing and a strong reliance on allocating costs using ‘service weights’, rather than using available patient level clinical data. Our detailed comparisons of cost buckets would indicate that clinical cost estimates at the DRG level are certainly not comparable between NSW hospitals at present.

The issues with reported DRG level clinical cost estimates for NSW hospitals were not surprising, since:

- the data were not previously used for funding purposes
- NSW was in a transitional phase in relation to clinical costing and costing systems, and
- there were competing demands for the time of staff preparing cost estimates.

If we consider differences between jurisdictions, we would expect to see differences in the reliability of NHCDC estimates in different states, depending on whether this data has been used as part of their funding systems.

There is clearly less incentive to ‘get casemix numbers right’ when they are not used for funding. Victoria and South Australia have used a casemix funding model for acute services for over a decade and have focused on these casemix costs and their audit as part of this funding system. For all of these reasons, we would caution against simplistic comparisons of DRG-level cost estimates between hospitals in different jurisdictions.
8 | Nursing staff costs

Nursing staff costs are one of the largest expenditure items for hospitals (together with medical staff costs), and even relatively small differences in average nursing costs can have significant impacts on total hospital expenditure. In considering these costs, it is important to take account of the mix of nurses of different categories and levels of experience, and nurse-to-patient ratios. The mix will depend on a number of factors including the range of services that are provided by the hospital, and the hospital’s area health service role. Furthermore, the staff-to-patient ratios, and the mix of nursing categories and experience levels may affect patient outcomes. Some research on ICU nursing indicates that higher nurse-to-patient ratios may be associated with improved patient outcomes. Other research suggests that the proportion of RNs on a ward is more critical to patient outcomes than the hours of nursing care provided.

The primary focus of our study was on the direct costs associated with the provision of inpatient care. For our analysis of nursing costs, we therefore focussed only on direct costs for productive work (excluding for example leave pay and superannuation). We also focussed primarily on ‘direct care nurses’, which are the nurses who provide most of the direct care to patients. These nurse categories are described in Box 8.1, and account for 88% of the total productive work supplied by all nurses employed at the 5 study hospitals. The remaining 12% is supplied by expert/specialist nurses and nurse managers who provide less direct patient care. These ‘indirect care’ nurse categories are described in Box 8.2.

Using payroll data from the Health Information Exchange (HIE) system rather than hospitals’ General Ledgers, we compared the mix of nurse categories and experience levels at the study hospitals. We also compared the average pay rates for direct care nurses (for both normal and overtime hours) at these hospitals.

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65 IRO is included in RPAH unless otherwise stated.
Nursing staff employed against a cost centre may spend part of their time attending outpatient clinics or performing other duties (eg, teaching or administration) that are not directly related to inpatient care. To take account of this, we discussed and applied the inpatient fractions (IFRACs) which the hospitals estimate in order to allocate nursing time between inpatient and other duties.

While this chapter gives an overview of productive hours and costs of nursing staff at the overall hospital level, the clinical case studies provide detailed nursing cost estimates. The approach to these nursing cost estimates is described in Box 8.4. The final section of this chapter provides a brief summary of some of the results from the clinical case studies.

### 8.1 Summary of findings on nursing costs

At the overall hospital wide level, we found:

- There were broad similarities in the mix of nurse categories and experience levels across the study hospitals, but also some differences. Direct care nurse categories made up about 90% of total productive nursing staff at the hospitals.

- RNs made up the largest productive nurse category, comprising over 70% of total productive nursing staff. Approximately half of these RNs were RN 8s, the most senior of RN categories. However, these proportions varied somewhat between the hospitals.

- For direct care nurses, the average cost per productive hour was around the same at all of the study hospitals, at approximately $36 per hour (including ordinary time, overtime and penalty rate costs).

- Overtime rate costs ranged from 1.0% of total direct care nursing costs at BLH, to 3.7% at GH. Hospitals minimised overtime requirements by maintaining part time and casual staffing pools.

- IFRACs had a significant impact on the analysis of nursing costs, and it is crucial to ensure that these are accurate for future hospital comparisons. We found inconsistencies between IFRACs and hospitals that can only be explained by the absence of a standard approach to determining the appropriate ratios.

- Based on the IFRACs provided by the hospitals, the share of direct care nursing hours that was attributed to inpatient care (as opposed to outpatient care, administrative duties, teaching, etc) ranged from 65% to 89%. This variation was partly due to the different range of functions that are included under each hospital’s facility code.

- After applying the hospitals’ IFRACs, average direct care nursing costs per bed day at the overall hospital level were more or less similar across the study hospitals.
At the clinical condition level, we found:

- The patient’s length of stay is a critical factor in determining the total episode nursing cost per patient. We only estimated the cost for the acute episode (ie, for the length of stay for the acute episode). For some of our case studies, this length of stay varied considerably between hospitals, partly due to differences in models of care and partly due to differences in counting practices. This variation led to large differences between our estimates of nursing costs across hospitals, which may have been much less significant had we been able to estimate these costs for the total patient journey.

- As Chapter 5 discussed, measuring the total length of stay (including both before and after the acute episode) provides a more consistent estimate of the length of stay. This suggests LOS3 may be a better measure for comparative purposes, particularly for patient groupings where there are typically 2 or more episodes of care or significant numbers of transfers (such as those in our stroke and hip joint replacement case studies).

- For some case studies, our estimates of total episode nursing costs based on LOS1 varied considerably across hospitals. These differences were largely due to differences in LOS1, but were also partly due to differences in the number of nursing hours per patient bed day and (therefore) differences in the nursing costs per patient day.

- For most of our case studies, the main driver of the cost per patient bed day was the number of nursing hours per patient bed day rather than the average cost per nursing hour (which in turn depended partly on the staff mix).

- For most of our case studies, there was less variation in our estimates of total episode nursing costs across hospitals when we applied a uniform IFRAC of 1 than when we used the hospitals’ IFRACs.

- The provisional 2008/09 NHCDC total episode nursing cost estimates contained in each hospital’s cost data files have the hospitals’ IFRACs applied and include overhead costs like leave and superannuation. The NHCDC costs were generally higher than our costs (which is expected), but also varied over a significantly wider range than our estimates.

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66 We did not undertake our nursing cost estimation for stays in other hospitals, for example where a patient is transferred to another facility for rehabilitation after the acute episode at a study hospital.
Box 8.1 Direct care nurse categories

For this report, ‘direct care nurses’ include the following nurse categories:

- Assistants In Nursing
- Trainee Enrolled Nurses
- Enrolled Nurses (including Mother Craft Nurses)
- Registered Nurses/Registered Midwives
- Clinical Nurse Specialists/Clinical Midwife Specialists.

An Assistant In Nursing (AIN) 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. The AINs’ role is limited to activities appropriate to their level of knowledge and skill, corresponding to their education and experience. AINs may be employed with or without a qualification. They are often undergraduate students of Nursing, or holders of a Level III Certificate of the Australian Qualifications Framework (AQF) using the national competency standards from the Community Services or Health Training Packages depending on the sector.a

An Enrolled Nurse (EN) is a nurse that has completed a Certificate/Diploma in Nursing, and “may provide patient care in all relatively stable nursing situations and assist the registered nurse with patient care in less stable nursing situations”.b

A Trainee Enrolled Nurse (TEN) is someone who is training to become an EN in a facility approved by the Nurses and Midwives Board NSW for enrolled nurse education, and is involved in full time paid work and structured training which may be on or off the job.c

A Registered Nurse (RN) has completed a Bachelor/Master (or equivalent) of Nursing and is licensed to practice as an RN by the Nurses and Midwives Board.d Similarly, a Registered Midwife (RM) has completed a Bachelor or Graduate Diploma (or equivalent) of Midwifery, and is licensed to practice as an RM by the Nurses and Midwives Board. RNs and RMs are licensed to practice without supervision, and assumes accountability and responsibility for their own actions. Their responsibilities include the coordination, organisation, provision and evaluation of evidence-based nursing care.e

A Clinical Nurse Specialist/Clinical Midwife Specialist (CNS/CMS) is an RN/RM 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. To become a CNS/CMS, the nurse needs to meet a minimum requirement of post registration experience and/or qualifications.f

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Box 8.2 Indirect care nurse categories

Indirect care nurse categories include:

- Nurse Practitioners/Midwife Practitioners
- Clinical Nurse Consultants/Clinical Midwife Consultants
- Clinical Nurse Educators/Clinical Midwife Educators
- Nurse Educators/Midwife Educators
- Nurse Managers/Midwife Managers
- Nursing Unit Managers/Midwifery Unit Managers.

A Nurse or Midwife Practitioner (NP/MP) is an RN/RM who is qualified and authorised to function autonomously and collaboratively in an advanced and extended clinical role.a

A Clinical Nurse or Clinical Midwife Consultant (CNC/CMC) is an RN/RM who meets a minimum requirement of post registration experience and who has approved post registration nursing/midwifery qualifications and experience relevant to his/her field.b The role involves the organisation and delivery of specialist consultant service.c

A Clinical Nurse or Clinical Midwife Educator (CNE/CME) is an RN/RM who holds relevant clinical or education post registration qualifications and/or experience. The CNE/CME is required to deliver and evaluate clinical education programs at the ward/unit level.d

A Nurse/Midwife Educator (NE/ME) is an RN/RM who holds post registration nursing/midwifery clinical or education qualifications relevant to the clinical area in which he/she is appointed. An NE/ME is responsible for the development and delivery of nursing education.d

A Nurse Manager (NM) is an RN/RM who is accountable at an advanced practice level for the provision of human and material resources either supporting a division or a specific patient/client area or systems or service.a

A Nurse Unit Manager (NUM) is an RN/RM who is accountable at an advanced practice level for the coordination of clinical practice and the provision of human and material resources in a specific patient/client area.a

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a ANMC (2006) National Competency Standards for the Nurse Practitioner
8.2 How differences between hospitals affect nursing requirements

As Chapter 3 discussed, the 5 hospitals differ in the terms of the functions that are included in their facility codes, their regional roles and the specialised services they provide. These differences, as well as differences in hospital practice that influence the length of stay, have an impact on the nursing staff requirements of the hospitals. These differences mean that simple measures - for example nursing costs or nursing hours per patient bed day - cannot be used to compare hospital ‘efficiency’, even if the costs associated with inpatient care could be accurately identified.

This section discusses three important reasons why the nursing staff requirements differ between the 5 study hospitals.

Functions included in the hospital facility codes

When we looked at the medical and nurse staffing costs for the hospital as a whole, we included all the cost centres that were attached to the hospital’s facility code. However, the services attached to the facility codes differ considerably between the hospitals. Even some similar services may be associated with the hospital facility code at one hospital, but be linked to a separate facility code at other hospitals. Examples of such services include ambulatory care services, hospital in the home services, and area-wide services.

The share of total nurse and medical staff that provide inpatient services rather than other services will be affected by these hospital boundary definitions. For example, a hospital with many outpatient services associated with the hospital facility code will have a smaller share of staff providing inpatient services compared with hospitals where such services are attached to separate facility codes.

Differences in casemix and types of wards

There is significant variation across wards in a hospital in the types of nursing staff required. To an important extent this reflects the mix of clinical skills required to care for some patients compared with others. For example, in intensive care units (ICUs) all nurses are registered nurses (RNs) or clinical nurse specialists (CNSs). Rehabilitation wards, on the other hand, use high proportions of enrolled nurses (ENs) and assistants in nursing (AINs).

At the hospital level, this means that differences in the casemix (and therefore the types of wards) will have a significant impact on nursing staff requirements.

Differences in configurations of care that affect the length of stay

The amount and type of nursing care a patient requires changes during their admission to hospital. Typically, patients require the most nursing care at the start of their admission and this reduces as the patient’s condition improves. Additional work is also required on the day of admission and day of discharge.
At the department or hospital level, this means that configurations of care and clinical practices that affect the length of stay will have an impact on nursing costs. For example, a hospital that discharges patients home earlier will have a higher proportion of higher cost days. At this hospital, the nursing cost per patient day will be higher even though total nursing costs for the episode (or hospital) stay may be lower. Whether the episode cost is higher or lower will depend on the net effect of the higher daily nursing costs and the shorter length of stay.

Nursing cost analysis frequently assumes that all days are of equal cost. However, this is inaccurate, and the changing needs of the patient should be considered when comparing the performance of clinical departments or hospitals.

### 8.3 Mix of nurse categories and experience levels across the study hospitals

To compare the mix of nurse categories and experience levels at the study hospitals, we obtained 2008/09 payroll data from the HIE system. We extracted the hours worked, ordinary pay, overtime pay and penalties for the different nursing categories described in Box 8.1 and Box 8.2 above.

We focussed only on direct costs for productive work. We excluded costs like leave, superannuation and indexation of leave liability because the hospitals account for some of these costs in different ways, and because they may reflect past liabilities rather than current operational costs. We also used payroll data from the HIE system as the source of costs, rather than the hospitals’ General Ledgers, because account codes in the General Ledgers differ between hospitals. Also, payroll data provides information on the exact salary grading, and this detail is not available in the General Ledger.

To translate the hours worked into more meaningful information, we converted the hours worked into productive Full Time Equivalents (FTEs)\(^{67}\). We found that there are broad similarities in the mix of nurse categories and experience levels across the hospitals, but also some differences.

\(^{67}\) We used the following formula to convert hours worked into FTEs: \((\text{Total number of working hours including overtime}) / \left( \frac{\text{(average number of working hours per week, or 38) x (average number of weeks in a year, or 52.2)}}{\text{}} \right)\).
8.3.1 Mix of nurse categories at the hospital level

Table 8.1 shows the total number of productive FTE nursing staff in each nursing category at the study hospitals. It includes all nursing categories for which payroll data for 2008/09 exists in the HIE, and separates the direct and indirect care nurse categories. Table 8.2 shows the relative mix in percentage terms. Please note that the hospitals’ IFRACs have not been applied any of these figures, so the number of direct care nurse FTEs in this table is not equivalent to the number of nurse FTEs providing direct inpatient care. (IFRACs are discussed in section 8.5 below).

These tables show that at all the study hospitals, direct care nurses comprise the majority of the nursing staff, and RNs is by far the largest category among these nurses. The relative mix of RNs and other direct care nurse categories is important because:

- The more experienced and qualified RNs (and CNSs) earn higher rates of pay than the other direct care nurse categories. However, a more experienced staff member may mean that fewer nursing hours are required per patient stay.
- These more experienced nurses have more expertise, so the mix influences patient outcomes. Several studies have shown that there is a significant link between patient outcomes and the experience of the nurses providing the care. In particular, studies have shown that the proportion of RNs on a ward is more critical to patient outcomes than the hours of nursing care provided.\(^{68}\)

The net effect on treatment costs of the higher cost per nursing hour for more senior nurses, versus fewer nursing hours per day and/or shorter length of stay, depends upon the extent to which these factors offset each other.

Table 8.1 includes the total number of patient bed days in 2008/09 for each of the study hospitals, in order to provide a rough indication of the relative workload at the hospitals. However, it is important to bear in mind that bed days relate to inpatients only, and inpatient care represent only part of the hospitals’ activities. And as discussed in section 8.2, hospitals differ in the proportion of their activities that relate to inpatient care.

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### Table 8.1 Total number of salaried nursing staff and patient bed days, 2008/09

<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>Direct care nurses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AINs and TENs</td>
<td>59</td>
<td>18</td>
<td>49</td>
<td>36</td>
<td>23</td>
</tr>
<tr>
<td>ENs (incl MCFNs)</td>
<td>109</td>
<td>112</td>
<td>74</td>
<td>83</td>
<td>119</td>
</tr>
<tr>
<td>RNs</td>
<td>800</td>
<td>438</td>
<td>700</td>
<td>314</td>
<td>727</td>
</tr>
<tr>
<td>CNSs</td>
<td>20</td>
<td>11</td>
<td>15</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td><strong>Subtotal direct care nurses</strong></td>
<td>987</td>
<td>580</td>
<td>838</td>
<td>437</td>
<td>882</td>
</tr>
<tr>
<td><strong>Indirect care nurses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NMSs</td>
<td>18</td>
<td>8</td>
<td>17</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>NUMs</td>
<td>48</td>
<td>26</td>
<td>37</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>NEs (incl CNEs)</td>
<td>14</td>
<td>13</td>
<td>20</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>NPs</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CNCs</td>
<td>54</td>
<td>22</td>
<td>31</td>
<td>8</td>
<td>52</td>
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<tr>
<td><strong>Subtotal indirect care nurses</strong></td>
<td>137</td>
<td>69</td>
<td>106</td>
<td>43</td>
<td>135</td>
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<tr>
<td><strong>Total nursing staff</strong></td>
<td>1,124</td>
<td>649</td>
<td>944</td>
<td>479</td>
<td>1,017</td>
</tr>
<tr>
<td><strong>Total bed days</strong></td>
<td>250,824</td>
<td>150,832</td>
<td>181,340</td>
<td>125,373</td>
<td>230,070</td>
</tr>
</tbody>
</table>

*Note:* Numbers may not add up due to rounding.

*Source:* 2008/09 HIE payroll data and IPART analysis.

### Table 8.2 Relative percentage mix of salaried nursing staff, 2008/09

<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>Direct care nurses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AINs and TENs</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>ENs (incl MCFNs)</td>
<td>10</td>
<td>17</td>
<td>8</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>RNs</td>
<td>71</td>
<td>67</td>
<td>74</td>
<td>66</td>
<td>71</td>
</tr>
<tr>
<td>CNSs</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Subtotal direct care nurses</strong></td>
<td>88</td>
<td>89</td>
<td>89</td>
<td>91</td>
<td>87</td>
</tr>
<tr>
<td><strong>Indirect care nurses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NMSs</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>NUMs</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>NEs (incl CNEs)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>NPs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CNCs</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>5</td>
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<tr>
<td><strong>Subtotal indirect care nurses</strong></td>
<td>12</td>
<td>11</td>
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<tr>
<td><strong>Total nursing staff</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note:* Numbers may not add up due to rounding.

*Source:* 2008/09 HIE payroll data and IPART analysis.
8.3.2 Mix of experience levels among RNs at the hospital level

In addition to the relative mix of RNs and other direct care nurse categories, the mix of experience levels among the RNs can have an important influence on costs and patient outcomes. RNs are classified according to the number of years of experience they have – from RN 1 for those in their first year as an RN, to RN 8 for those in their eighth or later year. A high proportion of RN 8s may reflect nursing staff requirements, but may also reflect difficulty recruiting younger staff.

Figure 8.1 shows the mix of direct care nurse categories at the study hospitals, with RNs broken down by their level of experience. It indicates that RN 8s is the largest category of direct care nurses at all the study hospitals. As a proportion of all direct care nurses, RN 8s range from 37% at RPAH to 46% at JHH.

**Figure 8.1 Mix of experience levels among direct care nurses, 2008/09**

![Figure 8.1](image)

*Data source: 2008/09 HIE payroll data and IPART analysis.*

Figure 8.2 shows the mix of RNs by their level of experience. It indicates that RN 8s comprise between 46% of all RNs at RPAH and 63% at BLH.
8.4 Average pay rates for direct care nurses across study hospitals

Again using the HIE payroll data, we compared the average pay rates for direct care nurses in the study hospitals. Figure 8.3 shows that, despite differences in the mix of nurse categories and experience, the average hourly pay for normal hours (including penalties), overtime hours, and total hours were very similar for all of the study hospitals.
As would be expected, the average hourly pay rate for overtime hours was considerably higher than for normal hours. However, this had little impact on the total average hourly pay rate. As Figure 8.3 shows, the average total hourly pay was no more than a dollar higher than the average hourly pay for normal hours at each of the study hospitals. This reflects the fact that overtime hours represented only 1.4% of direct care nurses’ total hours across the study hospitals.

Overtime for nursing staff is different to that for medical staff. Hospitals minimise overtime nursing requirements by maintaining part time and casual staffing pools. Overtime in nursing is frequently linked to the need for a senior or specialist role related to a more senior nursing category. In contrast, only junior medical officers (JMOs) work overtime hours, and this is part of their normal working week to provide medical staffing out of normal working hours. (See Chapter 9.)

BLH had the smallest share of overtime direct care nursing hours, with 0.7% of total direct care nursing hours being paid at overtime rates. GH had the highest share, with 2.5% of total direct care nursing hours being paid at overtime rates. Overtime pay ranged from 1.0% of total direct care nurse pay at BLH, to 3.7% at GH. The slightly higher proportion overtime hours at GH may be attributed to the absence of a nursing agency on the Central Coast, which means that overtime or extension of part time hours are often GH’s only options. Rostering practices also affect the number of overtime hours at the hospital.

As expected, we also found that the most junior direct care nurses (AINs, TENs, ENs and RN 1s) worked proportionately less overtime than the more senior nurses (RN 2s – 8s and CNSs) at all the hospitals.

Although not significantly impacting the average hourly direct care nursing costs for the hospitals overall, overtime nursing costs may be a significant component of patient costs for certain specialties and procedures. Further, given that nursing costs make up a large proportion of hospital costs, even relatively small differences in average nursing costs can have significant impacts on total hospital expenditure. Therefore, a focus on effective management of nursing costs is warranted.

### 8.5 The proportion of direct care nursing costs allocated to inpatients using IFRACs

Not all nursing staff time is spent on inpatient care. Nurses also spend time in emergency departments, in outpatient clinics and on home visits. In addition they participate in training and research, and undertake administrative duties. To keep account of the share of nursing hours spent on inpatient care versus other duties, the hospitals estimate IFRACs for each relevant cost centre. We applied these IFRACs to estimate the number of nursing hours and the costs that should be allocated to inpatient care. Our approach is outlined in Box 8.3 below.

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69 Feedback from GH in response to draft report, provided May 2010.
Box 8.3 How we allocated direct care nursing costs to inpatients

To calculate the nursing hours and pay associated with direct inpatient nursing care, we obtained a list of IFRACs for the relevant cost centres from each hospital. We then multiplied the total nursing hours and pay associated with each cost centre by the corresponding IFRAC.

The hospitals did not supply IFRACs for some cost centres that recorded nursing hours and pay. However, these cost-centre descriptions suggested they do not pertain to inpatient care and we therefore assumed that an IFRAC of zero was appropriate.

In principle, applying the appropriate IFRAC to the number of direct care nursing hours (or payroll costs) associated with each cost centre will provide the direct care nursing hours (or payroll costs) devoted to inpatient care. However, we identified a number of issues associated with IFRACs that make their use potentially misleading in comparing hospitals:

- There was no standard approach to determining IFRACs. Some hospitals performed annual reviews of their IFRACs, while others did not. In either case, the reported IFRACs were often arrived at through ‘guessimation’ by a staff member who knows the cost-centre/ward well, such as the relevant division manager. In many cases, these ‘guessimations’ are probably more or less accurate. However, when considering the wide variation in IFRACs across the hospitals for some cost-centres that appear to be providing largely similar services, we believe that some of the reported IFRACs may not be reliable. In view of the large impact these IFRACs have on our estimates (as demonstrated in section 8.6 below), more consistent and robust methods of arriving at the IFRACs would be preferable.

- Cost-centres at some hospitals included both nurses and other staff like junior medical officers (JMOs). The JMOs may spend a much smaller proportion of their time on inpatient care, for example due to outpatient clinic duties. But the IFRAC provided by the hospital for the cost-centre was an average that applies to all staff in that cost-centre. Applying these IFRACs to direct care nursing costs only is therefore misleading.

- Some hospitals’ IFRACs were out of date and needed to be updated.

Table 8.3 illustrates the differences between the hospitals’ IFRACs. The table shows the weighted average IFRACs for a selection of the clinical groups from our case studies. Comparing hospitals, our analysis shows that the weighted average IFRACs at RNSH were lower than at the other hospitals in almost all cases (range 0.56 to 0.8). GH’s IFRACs were also frequently lower (range 0.62 to 0.95) than those at RPAH (range 0.88 to 1), JHH (range 0.76 to 1) and BLH (range 0.97 to 1). Comparing clinical conditions, the IFRACs associated with hip joint replacement (for patients with

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70 Medical staff is discussed in the next chapter.
arthritis) varied from 0.62 at GH to 1 at RPAH and JHH, while the IFRACs associated with appendicectomy (without complications) varied from 0.77 at RNSH to 1 at BLH.

Table 8.3 Weighted Average IFRACs for Direct Care Nursing for selected clinical conditions or procedures

<table>
<thead>
<tr>
<th>Clinical Condition</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>0.99</td>
<td>0.70</td>
<td>0.80</td>
<td>1.00</td>
<td>0.96</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>1.00</td>
<td>0.62</td>
<td>0.80</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>0.97</td>
<td>na</td>
<td>0.80</td>
<td>na</td>
<td>0.96</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung (Pneumothorax)</td>
<td>0.95</td>
<td>na</td>
<td>0.76</td>
<td>na</td>
<td>0.95</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>0.91</td>
<td>0.94</td>
<td>0.70</td>
<td>0.99</td>
<td>na</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>0.94</td>
<td>0.89</td>
<td>0.80</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>1.00</td>
<td>0.91</td>
<td>0.80</td>
<td>0.97</td>
<td>0.98</td>
</tr>
<tr>
<td>Appendicectomy – Without severe complications (DRG G07B)</td>
<td>0.97</td>
<td>0.93</td>
<td>0.77</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td>Stroke – excluding most complex (DRGs B70B &amp; B70C)</td>
<td>0.90</td>
<td>0.90</td>
<td>0.77</td>
<td>1.00</td>
<td>0.90</td>
</tr>
<tr>
<td>Cardiology - Without pacemakers</td>
<td>0.88</td>
<td>0.93</td>
<td>0.56</td>
<td>1.00</td>
<td>0.76</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>0.99</td>
<td>0.76</td>
<td>0.72</td>
<td>1.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>na*</td>
<td>0.94</td>
<td>0.79</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Range for these clinical conditions</td>
<td>0.88-1.00</td>
<td>0.62-0.95</td>
<td>0.56-0.80</td>
<td>0.97-1.00</td>
<td>0.76-1.00</td>
</tr>
</tbody>
</table>

* We excluded RPAH from our cost analysis because the gynaecology ward moved during the year, making the costs unreliable.

Source: Hospital IFRACs and IPART analysis.

The result from applying the hospitals’ IFRACs to the productive direct care nursing FTEs at the hospital level is shown in Figure 8.4. This figure shows that out of the total productive direct care nursing FTEs at the study hospitals (as shown in Table 8.1), the share allocated to inpatient care ranged from 65% at RNSH to 89% at BLH.

The differences in the share of total productive direct care nursing hours that were allocated to inpatients are probably due mainly to differences in the extent to which non-inpatient services were included in the hospitals’ facility codes. But they also depend on the accuracy of the IFRACs provided by the hospitals.
Figure 8.4  Proportion of productive direct care nursing FTEs allocated to inpatients based on each hospital’s IFRACs, 2008/09

Note: Cost-centres with no reported IFRAC have been given an IFRAC of zero.
Data source: 2008/09 HIE payroll data and IPART analysis.

Figure 8.5 shows the average number of productive direct care nursing hours per bed-day before and after applying the hospitals’ IFRACs. There was significantly greater variation in nursing hours per patient bed-day when the IFRACs were not applied than when the IFRACs were applied. This is as expected, since bed days only account for the time inpatients spend in the hospitals, while the hospitals also provide varying degrees of outpatient services. Without IFRACs the average number of nursing hours per bed day varied between 6.9 at BLH and 9.2 at RNSH. After applying the IFRACs, the average number of nursing hours per bed day was less variable across the study hospitals, and varied between 5.7 at JHH and 6.2 at BLH.

71 Not applying IFRACs is equivalent to setting all the IFRACs equal to one, and therefore allocating all direct care nursing hours to inpatients.
We also looked at the average direct care nursing cost per patient bed day both with and without the application of IFRACs (Figure 8.6). As with hours per bed day, we found that the average nursing costs per bed day allocated to inpatient care were more or less similar for all the hospitals after the IFRACs were applied.

**Figure 8.5** Average productive direct care nursing hours per patient bed day with and without the application of IFRACs

**Data source:** 2008/09 HIE payroll data and IPART analysis.

Figure 8.5 and Figure 8.6 show that applying the IFRACs had a significant impact on the nursing hours and costs. This highlights the importance of ensuring that IFRACs are accurate.

**Figure 8.6** Average productive direct care nursing cost per patient bed day with and without the application of IFRACs

**Data source:** 2008/09 HIE payroll data and IPART analysis.
As discussed in section 8.2, it is important to remember that even if the IFRACs were accurate, the average number of inpatient care nursing hours or cost per bed day would not reflect the relative ‘efficiency’ of inpatient care at the 5 hospitals. The ‘required’ hours per bed day will vary across the hospitals, depending on factors such as each hospital’s casemix, the qualifications and experience of the nursing staff and hospital practices that affect the length of stay.

Moreover, the focus of much cost analysis (and the NHCDC costs) is the cost per acute episode rather than per patient bed day. As our clinical case studies show, the total nursing cost for an episode depends not only on the hours of nursing care that the patient receives each day, but also on the patient’s length of stay for the episode of care. Our case studies show that although the average number of nursing hours per patient bed day (and therefore the cost) can vary quite significantly between hospitals, it is the variation in length of stay that is more likely to cause the large divergence in total nursing cost for an episode. And as discussed in section 8.2, a higher number of nursing hours per patient day may be associated with a shorter length of stay. The net effect on the total nursing costs for treatment of the patient depends on the extent to which these factors offset each other. Section 8.6 below provides an overview of the findings from our clinical case studies.

### 8.6 Direct care nursing costs for selected clinical conditions

A major part of this review was to analyse the costs of treating like-with-like patients by identifying a set of similar clinical conditions across the study hospitals, and we included direct care nursing costs in this cost analysis. Given the potential issues affecting the accuracy of the IFRACs provided by the hospitals (as discussed above), we did these calculations both with applying the hospitals’ IFRACs and with setting the IFRACs to 1. An overview of the methodology we used to estimate the nursing costs for these case studies is described in Box 8.4.

Table 8.4, Table 8.5 and Table 8.6 summarise the results from selected case studies, both with and without the application of IFRACs. Table 8.4 provides information that is not affected by the application IFRACs, namely the number of episodes and hospitals included in the analysis, the range of costs per nursing hour and the length of stay. Table 8.5 and Table 8.6 summarise our estimates of nursing hours and nursing costs per patient day, and nursing costs per episode, both with the hospitals’ IFRACs and with IFRACs equal to 1. The tables also show the provisional NHCDC direct ward costs per episode for 2008/09 (ranges only). Please note that these tables exclude the estimates for hospitals which had fewer than 20 episodes in 2008/09. The nursing costs for each hospital are shown in Appendix B.

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72 We excluded a number of groups due to low case volumes, a very short length of stay or other difficulties identifying nursing costs. The main exclusions are listed in Appendix B, Table B.2. Further details are provided in the individual case studies.

73 We subsequently obtained the final NHCDC ward costs, but found only small differences between the provisional and final costs. Due to time constraints, we did not update our analysis using the final NHCDC costs, but have based these on the provisional estimates.
Box 8.4 How we estimated nursing costs

IPART used a model for each hospital to allocate direct care 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 direct care 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 patients’ 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 all IFRACs set to 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.
Table 8.4 shows 2 measures of the length of stay because, as discussed in Chapter 5, we found that the episode length of stay may not be measured in a consistent way across hospitals because:

- the hospitals have different practices for changing the ‘care type’ of patient episodes (‘type changes’ are explained in Box 5.2), and
- the hospitals have different proportions of patients that were transferred to them from other hospitals, or from them to other hospitals or rehabilitation facilities.

### Table 8.4  Case volume, cost per hour and length of stay for selected clinical groups

<table>
<thead>
<tr>
<th>Clinical Group</th>
<th>Number of Episodes</th>
<th>Cost per Nursing Hour</th>
<th>Length of Stay 1</th>
<th>Length of Stay 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>379</td>
<td>34 – 37</td>
<td>10.3 – 13.5</td>
<td>21.4 – 23.6</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>530</td>
<td>35 – 37</td>
<td>7.1 – 8.1</td>
<td>7.4 – 12.0</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>250</td>
<td>36 – 36</td>
<td>6.9 – 10.7</td>
<td>7.5 – 16.2</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>64</td>
<td>36 – 37</td>
<td>7.0 – 10.5</td>
<td>8.9 – 13.6</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>187</td>
<td>32 – 37</td>
<td>3.8 – 5.6</td>
<td>4.7 – 18.5</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>390</td>
<td>35 – 37</td>
<td>4.7 – 9.4</td>
<td>6.1 – 10.8</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>772</td>
<td>32 – 37</td>
<td>1.5 – 1.9</td>
<td>1.3 – 1.8</td>
</tr>
<tr>
<td>Appendicectomy – Without severe complications (DRG G07B)</td>
<td>1,084</td>
<td>35 – 37</td>
<td>2.4 – 3.0</td>
<td>2.4 – 3.1</td>
</tr>
<tr>
<td>Stroke – excluding most complex (DRGs B70B &amp; B70C)</td>
<td>995</td>
<td>34 – 36</td>
<td>7.0 – 9.9</td>
<td>12.4 – 14.1</td>
</tr>
<tr>
<td>Cardiology– Without pacemakers</td>
<td>7,925</td>
<td>35 – 39</td>
<td>2.3 – 3.2</td>
<td>3.5 – 5.4</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>841</td>
<td>39 – 41</td>
<td>23.8 – 32.1</td>
<td>33.2 – 43.2</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>409</td>
<td>34 – 39</td>
<td>3.6 – 4.5</td>
<td>3.4 – 4.5</td>
</tr>
</tbody>
</table>

**Notes:**

- a When hospitals had fewer than 20 episodes, these have been excluded.
- b Nursing cost per hour remains largely then same whether estimated with the hospitals’ IFRACs or with IFRACs set to 1. The only difference is for cardiology, where the lower value for hourly nursing cost when the IFRACs are set to 1 is $36 as opposed to $35 when applying the hospitals’ IFRACs.
- c RPAH and IRO are combined as one hospital.
- d Only RPAH, RNSH and JHH provide major chest procedures, and only RPAH and JHH had more than 20 episodes of collapsed or punctured lung in 2008/09.
- e JHH is excluded due to a case volume of less than 20.
- f We excluded RPAH because the gynaecology ward moved during the year, making the costs unreliable.

**Source:** HIE Inpatient statistics, 2008/09, payroll data and IPART analysis.
We calculated 3 comparative measures of length of stay:

- **LOS1**: The length of stay for the acute episode
- **LOS2**: The length of stay in the study hospital
- **LOS3**: The length of stay in the study hospital, plus the length of one previous adjoining hospital stay (transfer in) and one subsequent adjoining stay in a hospital (transfer out).

Table 8.4 shows that the differences between LOS1 and LOS3 can be considerable. Firstly, this suggests there can be significant stages in a patient journey which are not costed when considering only LOS1. Moreover, in some cases, LOS3 is more consistent across the hospitals, which may suggest that costing the duration as measured by LOS3 would be more appropriate for cost comparison. Unfortunately, the task of estimating patient costs using LOS3 is very difficult and time consuming, primarily due to difficulties in obtaining the necessary cost data, and matching these to patients across the hospitals. For this reason, and to allow comparisons between our estimates and the NHCDC costs, we based our cost estimates on LOS1.

In order to improve the comparability of cost estimates based on LOS measures, it would be beneficial to promote the highest possible degree of consistency of ‘type changing’ practices between the hospitals. There may be practical difficulties that will prevent complete consistency in type-changing practices. These include differences in the way the hospitals are organised, and often also difficulties relating to deciding when to type-change, such as when a patient is waiting for a bed at a rehabilitation facility. However, regular monitoring and reporting could help to identify systematic differences in type-changing practices that may warrant further investigation, and which could allow for improvements in consistency between hospitals.

Our case study analysis, summarised in Table 8.5 and Table 8.6, shows that nursing costs and nursing hours per patient bed day varied significantly between the study hospitals. For example, when IFRACs were applied the nursing hours per patient bed day varied from 4.1 to 6.6 hours for hip joint replacement (due to fracture) and from 5.7 to 7.0 hours for appendicectomy (without complications). Nursing cost per patient bed day showed similar levels of variation. For most of our cases we found that the main driver of the nursing cost per patient bed day was the number of nursing hours per patient bed day, rather than the average cost per nursing hour (and therefore the staff mix). Variations in the number of nursing hours per patient bed day may reflect differences in ward occupancy rates and/or possibly staff shortages.

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74 The staff mix will affect the average cost per nursing hours because the hourly rate for more senior nurse categories, such as RNs and CNSs, is higher than that for more junior staff such as ENs and AINs.
The costs per episode varied between hospitals due to both differences in the nursing cost per patient bed day and, often more importantly, differences in the acute episode length of stay. For example, when IFRACs were all set to 1 the cost per episode for hip joint replacement (for patients with fractures) varied from $2,175 to $2,962 (ie, by $787) and the episode length of stay varied from 10.3 to 13.5 days. In contrast, the variation was only $116 for planned cholesystectomies where the episode length of stay varied by less than 0.5 days.

For the majority of our clinical groups, setting all IFRACs to 1 reduced the differences between hospitals in the total episode costs. This is most easily seen in Table 8.6, which shows the difference between the highest and the lowest values from Table 8.5. For example, the difference between the highest and the lowest episode cost for hip joint replacement (fracture) was $1,197 when the hospitals' IFRACs were used, and this fell to $788 when all IFRACs were set to 1. Similarly, the difference for appendicectomy (without complications) was $224 when the hospitals' IFRACs were used and this fell to $124 when all IFRACs were set to 1. However for some of our clinical groups, setting the IFRACs to 1 increased the difference between the highest and the lowest episode costs, and this occurred for major chest procedures (both lung cancer and collapsed or punctured lung) and cholecystectomy (both planned and emergency).

Table 8.5 also shows the provisional 2008/09 NHCDC estimates of direct ward costs, and Table 8.6 shows the difference between the highest and the lowest cost for the hospitals included in our analysis. These estimates were made on the basis of the hospital's IFRACs, and include indirect costs that were not included in the IPART study such as leave pay and superannuation (see Chapter 7 on clinical costing). The NHCDC costs were generally higher than our costs (which is expected), but also varied over a significantly wider range than our estimates.
Table 8.5 Variation in nursing hours and costs for episodes of care with and without IFRACs – ranges for study hospitals, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>With IFRACs</th>
<th>IFRACs = 1</th>
<th>Nursing hours per bed day</th>
<th>Nursing cost per bed day</th>
<th>Total episode nursing cost based on LOS1</th>
<th>NHCDC cost per episode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With IFRACs</td>
<td>IFRACs = 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip joint replacement – Fractures</td>
<td>4.1 – 6.6</td>
<td>5.4 – 6.7</td>
<td>147 – 227</td>
<td>198 – 230</td>
<td>1,731 – 2,928</td>
<td>2,175 – 2,962</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>3.6 – 6.1</td>
<td>4.8 – 6.2</td>
<td>132 – 214</td>
<td>167 – 216</td>
<td>969 – 1,530</td>
<td>1,248 – 1,613</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.6 – 9.5</td>
<td>6.8 – 9.7</td>
<td>238 – 342</td>
<td>247 – 352</td>
<td>2,087 – 2,650</td>
<td>2,171 – 3,311</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.4 – 7.2</td>
<td>5.6 – 7.6</td>
<td>192 – 261</td>
<td>202 – 275</td>
<td>1,816 – 2,017</td>
<td>1,916 – 2,122</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.6 – 6.4</td>
<td>4.9 – 9.2</td>
<td>169 – 214</td>
<td>181 – 306</td>
<td>654 – 1,125</td>
<td>698 – 1,164</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>5.5 – 7.2</td>
<td>6.1 – 7.2</td>
<td>193 – 268</td>
<td>226 – 268</td>
<td>1,021 – 2,051</td>
<td>1,073 – 2,185</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>5.7 – 7.0</td>
<td>6.5 – 7.3</td>
<td>197 – 248</td>
<td>239 – 255</td>
<td>469 – 693</td>
<td>594 – 718</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>4.9 – 6.7</td>
<td>5.5 – 7.5</td>
<td>167 – 243</td>
<td>185 – 271</td>
<td>1,168 – 2,026</td>
<td>1,298 – 2,079</td>
</tr>
<tr>
<td>Tracheostomy /Ventilation &gt; 95 hours</td>
<td>8.1 – 14.2</td>
<td>10.7 – 14.4</td>
<td>323 – 565</td>
<td>427 – 569</td>
<td>8,995 – 14,999</td>
<td>11,879 – 14,998</td>
</tr>
<tr>
<td>Hysterectomy&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5.2 – 7.5</td>
<td>5.2 – 7.9</td>
<td>201 – 256</td>
<td>201 – 273</td>
<td>807 – 1,002</td>
<td>895 – 1,019</td>
</tr>
</tbody>
</table>

<sup>a</sup> See case studies for more detailed information.
<sup>b</sup> When hospitals had fewer than 20 episodes, these have been excluded. RPAH and RIO have been combined as one hospital.
<sup>c</sup> Only RPAH, RNSH and JHH provide major chest procedures, and only RPAH and JHH had more than 20 episodes of collapsed or punctured lung in 2008/09.
<sup>d</sup> JHH is excluded due to a case volume of less than 20.
<sup>e</sup> RPAH is excluded because the gynaecology ward moved during the year, making the costs unreliable.

**Source:** HIE Inpatient statistics, 2008/09, payroll data and IPART analysis.
<table>
<thead>
<tr>
<th></th>
<th>Nursing hours per bed day</th>
<th>Nursing cost per bed day</th>
<th>Total episode nursing cost based on LOS1</th>
<th>NHCDC cost per episode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With IFRACs</td>
<td>IFRACs = 1</td>
<td>With IFRACs</td>
<td>IFRACs = 1</td>
</tr>
<tr>
<td></td>
<td>hours</td>
<td>hours</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Hip joint replacement – Fractures</td>
<td>2.6</td>
<td>2.5</td>
<td>2.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>2.5</td>
<td>2.4</td>
<td>2.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.9</td>
<td>2.9</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.9</td>
<td>2.0</td>
<td>1.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.8</td>
<td>4.3</td>
<td>1.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>1.8</td>
<td>1.1</td>
<td>1.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>2.0</td>
<td>1.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>1.3</td>
<td>0.9</td>
<td>1.3</td>
<td>0.9</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>1.7</td>
<td>2.0</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Cardiology–Without pacemakers</td>
<td>2.7</td>
<td>3.6</td>
<td>2.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>6.2</td>
<td>3.7</td>
<td>6.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Hysterectomy&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.3</td>
<td>2.6</td>
<td>2.3</td>
<td>2.6</td>
</tr>
</tbody>
</table>

<sup>a</sup> Hospitals with fewer than 20 cases have been excluded. RPAH and IRO have been combined as one hospital.

<sup>b</sup> Only RPAH, RNSH and JHH provide major chest procedures, and only RPAH and JHH had more than 20 episodes of collapsed for punctured lung in 2008/09.

<sup>c</sup> JHH is excluded due to a case volume of less than 20.

<sup>d</sup> RPAH is excluded because the gynaecology ward moved during the year, making the costs unreliable.

**Source:** HIE Inpatient statistics, 2008/09, payroll data and IPART analysis.
When examining the detailed comparative tables provided in Appendix B, the following observations can be made:

▼ GH had the highest average episode length of stay (LOS1) more frequently than the other study hospitals. This might be partly due to differences in type changing practices or transfer patterns. For example, GH confirmed during our hospital visits that they had recently reviewed ‘type changes’ for stroke patients and had begun to record ‘type changes’ to rehabilitation earlier in the patient’s stay in hospital.

▼ When IFRACs were all set to 1, JHH had the lowest nursing cost per patient day, the lowest number of nursing hours per patient day and the lowest episode cost more frequently than the other study hospitals.

▼ RNSH generally has the lowest IFRACs, and setting all IFRACs to 1 affected RNSH’s costs the most. When the hospitals’ IFRACs were used, RNSH’s costs per patient bed day (and number of nursing hours per patient bed day) were near the low end of the range and were frequently the lowest. But with all IFRACs set to 1, RNSH’s costs were more likely to be near the top of the range. (The hospitals’ IFRACs are shown in Table 8.3.)

▼ RPAH had the highest nursing cost (and number of nursing hours) per patient day more frequently than the other study hospitals, both when applying the hospitals IFRACs and when setting the IFRACs to 1. But this did not translate into a higher cost per episode at this hospital because of the generally shorter episode length of stay at this hospital.

▼ When IFRACs were all set to 1, GH and RNSH had the highest cost per episode more frequently than the other study hospitals. But when the hospitals’ IFRACs were used, BLH most frequently had the highest cost per episode.

For detailed analysis of the cost components for each of the clinical conditions/procedures above, please consult the individual case studies.
Like nursing staff costs, medical staff\textsuperscript{75} costs are one of the largest cost items for hospitals. While we would have liked to do the same analyses for these costs as we did for nursing staff costs, we found that this was significantly more difficult and complex for medical staff, particularly for senior medical staff and particularly at the case study level. Therefore, given the limited timeframe for our study, we were only able to do higher level analyses of these costs at the hospital and broad clinical specialty levels.

For these analyses, we divided medical staff into 2 broad groups - junior medical officers (JMOs) and senior medical staff (such as staff specialists employed by the hospitals and visiting medical officers (VMOs) who work on a contractual basis). Box 9.1 describes the staff categories we included in each group.

At the hospital level, we compared the mix of JMOs and staff specialists employed at the study hospitals, and the cost of JMOs, staff specialists and VMOs as a proportion of total medical staff costs. We also compared the average hourly pay rates for JMOs and staff specialists, and the extent to which overtime hours contributed to JMOs’ total hours worked and pay. In addition, to better understand and compare the proportion of medical staff costs allocated to direct inpatient care, we applied the hospitals’ own ‘inpatient fractions’ (IFRACs) to their JMO and staff specialist numbers.

At the clinical specialty level, we did a broad comparison of the number of junior and senior medical staff, and their average hourly pay rates for selected specialties. We also looked at JMO, staff specialist and VMO costs as a proportion of total medical staff costs for selected specialties.

The sections below summarise our overall findings on medical staff costs at the hospital and specialty levels and explain why comparing these costs was difficult. The subsequent sections discuss our findings in more detail. Box 9.2 outlines our approach for calculating medical staff numbers and costs.

\textsuperscript{75} The term ‘medical staff’ in this chapter refers to doctors or doctors in training. These can be either employees (junior medical staff and staff specialists), or contractors – (visiting medical officers (VMOs)).
9.1 Summary of findings on medical staff costs

At the hospital level, we found that:

- There was little variation in the ratio of expenditure on junior to senior medical staff (including VMOs) across the 5 study hospitals.\(^76\)
- There was also very little variation in the average hourly pay of JMOs, (both including and excluding overtime pay), and modest variation in the average hourly pay of staff specialists.
- There was significant variation in VMO costs as a proportion of total medical staff costs across the hospitals. This proportion ranged from 16% at JHH to 41% at GH. There was also significant variation in the way VMOs are paid. But the extent to which a hospital’s medical staff costs are affected by its use of VMOs rather than staff specialists is unclear.
- The study hospitals either paid VMOs an hourly rate per session, or a set fee per service. As there was no information available on the number of hours worked by VMOs on a fee-for-service basis, we could not compare senior medical staff hours, or total medical staff hours across the hospitals.
- A hospital’s medical staff costs may not accurately reflect the time worked by medical staff at that hospital, particularly for senior medical staff. One reason for this is that costs may be allocated to one hospital even though clinicians spend some of their time at another hospital. Another reason is that research fellows who work at a hospital may not be included in the hospital’s medical staff costs.
- The hospitals’ inpatient fractions (IFRACs) do not provide a reliable basis for comparing the costs of inpatient care costs across hospitals because the IFRACs are inconsistent between the hospitals, incomplete and sometimes old. But even if we had reliable IFRACs, comparing the average cost of inpatient care would be misleading because it does not take into account other important factors such as the differences in the casemix across the hospitals.

At the clinical specialty level, we found that:

- It was difficult to compare medical staff costs across hospitals, because of the different ways the hospitals classified specialties and captured the associated costs. Also, doctors’ costs were often allocated to one specialty even though they spent time on other specialties.
- Like at the hospital level, it may be misleading to use IFRACs to compare medical staff costs on inpatient care across hospitals at the specialty level. This is because the IFRACs are inconsistent, incomplete and sometimes old. Also, comparing the costs of inpatient care can be misleading because this approach does not take account of differences in the complexity of cases within the same specialty.

\(^76\) Note that in this chapter, RPAH includes IRO unless otherwise stated.
There appears to be greater variability in the numbers of medical staff, overtime hours worked and average hourly pay across the study hospitals at the specialty level than at the hospital level. However, these results need to be interpreted with caution and may be misleading due to differences in the way the hospitals identify their specialties and capture their costs.

VMOs tended to be more concentrated in some specialties than others at all the hospitals.
Box 9.1  Junior medical officers and senior medical officers

Junior medical officers (JMOs) are employees of the hospital, and range from new medical graduates who are entering training programs to experienced medical staff who may have worked in hospitals for many years. There are a large number of different award classifications for JMOs, the most common of which are:

- Interns
- Resident Medical Officers
- Registrars
- Career Medical Officers (CMOs).

In general terms, a doctor is categorised as a JMO when serving in the hospital before obtaining full registration (Intern), through registration (Resident) and while acquiring experience and higher qualifications (Resident then Registrar). A CMO is an experienced practitioner in a particular area who has chosen to work as a CMO. A JMO may become a Staff Specialist once he/she has had sufficient experience and specialist training, and has been formally recognised as a specialist by the relevant industry body.

Senior medical officers include:

- Staff specialists – which include Specialists, Senior Specialists and Post Graduate Fellows
- Visiting Medical Officers (VMOs)
- Clinical Academics.

Specialists and senior specialists are employees of the hospital, but have the right to perform a certain amount of private practice. This amount is determined by the annual ‘level agreement’ (Levels 1 to 5) between the hospital and specialist. Level 1 provides a high guaranteed salary, but allows no additional income from private practice. However, Level 1 specialists are required to perform a certain amount of private practice for which the income is retained by the hospital. Levels 2-4 provide a higher guaranteed minimum salary than level 1, with private practice income retained by the specialist increasing with the levels. Level 5 provides the lowest guaranteed minimum salary, but permits the highest amount of private practice income for the specialist.

Post graduate fellows have attained their specialist qualification but have not yet been appointed as a specialist/senior specialist.

VMOs are specialists who work on a contractual basis with the hospital. VMOs are remunerated on either a ‘sessional’ or a ‘fee-for-service’ basis. Sessional remuneration consists of an hourly rate paid for the duration of a VMO’s rostered ‘session’ in the hospital. Fee-for-service is a flat fee paid to the VMO for each unit of service provided – eg, a set amount per cataract procedure.

Clinical academics can also perform duties at a hospital, but may not be employees of the hospital or be paid by the hospital.
9 Medical staff costs

9.2 Why comparing senior medical staff costs across hospitals was difficult

We found comparing senior medical staff costs across hospitals to be more difficult and complex than other costs. One reason for this is the complexity of medical employment and contracting arrangements for senior medical staff. For example:

- Senior doctors in public hospitals often share their time between care of inpatients and other activities – including care of outpatients, management responsibilities (at the area health service, hospital or clinical unit level), research, and teaching and supervising junior medical staff who are in training.

- Senior doctors may work in multiple hospitals and be paid by one hospital. For example, doctors may work at both GH and Wyong Hospital but have all their costs allocated to GH.\(^{77}\) (Note that this may also apply to junior medical staff.)

- Senior doctors often share their time between their work for public hospitals and their private work (either in the hospital or in their private rooms).\(^{78}\)

- Clinical academics or post-graduate fellows can perform duties at a hospital, but may not be employees of the hospital or be paid by the hospital.

These complex arrangements mean it would have been very time-consuming to work out how much senior medical staff time should be allocated to inpatient care at a particular hospital.

Another reason was the incompleteness of the data available on senior medical staff costs. As Box 9.1 discussed, some senior medical staff are VMOs who work for hospitals on a contractual basis. Some of the study hospitals pay VMOs on a fee-for-service basis, and no data on the number of VMO hours worked on this basis was available. This meant we could not estimate the number of VMO FTEs or calculate VMOs’ average hourly pay at each hospital.

9.3 Why comparing medical staff costs at the clinical case study level was difficult

We also found comparing junior and senior medical staff costs at the clinical case study level to be more difficult than ward nursing costs because:

- Medical staff spend a smaller proportion of their time on inpatient care than ward nursing staff, but we could not allocate their time on a consistent basis across the hospitals. One of the main reasons for this was that the IFRACs for medical staff were inconsistently applied across the hospitals.

\(^{77}\) Again, IFRACs are supposed to capture this but are not always reliable.

\(^{78}\) IFRACs are supposed to capture this but, as discussed, these are not always reliable.
In principle, medical staff costs can be allocated to patients on the basis of specialties. However, some of the specialties covered a very wide range of conditions and this made it very difficult to allocate medical staff time to a particular clinical condition. The ‘obstetrics/gynaecology’ specialty is a good example of this, because it covers both childbirth and procedures such as hysterectomy. The ‘geriatrics’ specialty is another example, because it includes patients with a wide range of clinical conditions.

Hospitals classified specialties and captured the associated costs differently, and we did not have sufficient information to adjust for these differences.

This meant that we could not reliably allocate medical staff hours or pay to patients being treated for specific clinical conditions, and had to focus on broader clinical specialty areas instead. Even then, we found there were a number of problems with the data which meant we were only able to make broad comparisons – such as medical staff numbers by specialty – rather than compare average hours and pay per patient bed day as we did for nursing staff costs. The problems associated with the IFRACs are discussed in section 9.6, and the problems associated with comparing specialties are discussed in section 9.7.

Box 9.2 How we estimated total medical staff numbers and costs, and allocated these to clinical specialties

As for nursing costs, we used 2008/09 payroll data from the Area Health Service payroll system (contained in the HIE) to calculate the number of JMOs and staff specialists employed at each study hospital, and the payment costs associated with these staff.

Using data on productive hours only (i.e. excluding leave etc.), we estimated the total number of FTEs of these staff using the Award Code associated with each payment. Then we identified the number in each JMO and staff specialist category defined by the Award Profile and described in Box 9.1.

We allocated these staff numbers and payment costs to clinical specialties, using maps of cost centres to specialties provided by the hospitals.

To calculate VMO hours worked and payment costs, we obtained 2008/09 information from VMoney, which is the payment system for VMOs. For VMOs paid on a sessional basis, VMoney includes data on hours worked and payment costs. However, for VMOs paid on a fee-for-service basis it provides payment costs only. Therefore, we had no information on hours worked by fee-for-service VMOs.

VMoney groups data by clinical specialty. However, the specialty groupings used did not always match the specialties in the cost centre maps for salaried staff provided by the hospitals. This meant we had to exclude some data from our analysis (as discussed in section 9.7 below).

a Note that we excluded dentistry from our analysis.

Patients are admitted under an attending physician and assigned to a specialty.
9.4 Mix of junior and senior medical staff across study hospitals

We compared the number of JMOs and staff specialists at the study hospitals, and the mix of seniority levels within these groups, as described in Box 9.2. However, we weren’t able to directly compare the number of VMOs because, as noted in this box, the available data did not include the number of VMO hours paid on a fee-for-service basis. Instead, we compared the payment costs associated with JMOs, staff specialists and VMOs as a proportion of total medical staff costs across the hospitals.

We found that the share of JMO payment costs was broadly similar at all the hospitals, although there were some differences in mix of staff specialists and VMOs, and in the levels of seniority within the JMO and staff specialist categories.

9.4.1 Mix of JMOs, staff specialists and VMOs at the hospital level

Table 9.1 shows our estimate of the total number of full time equivalent (FTE) JMOs and staff specialists employed at each study hospital, based on productive hours only. It indicates that JMO FTEs as a proportion of total FTEs varied from 68% to 87%.

Table 9.1 Total number of salaried JMOs, staff specialists and patient bed days, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH(^a)</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FTEs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMOs</td>
<td>365</td>
<td>164</td>
<td>290</td>
<td>155</td>
<td>304</td>
</tr>
<tr>
<td>Staff specialists</td>
<td>120</td>
<td>24</td>
<td>112</td>
<td>30</td>
<td>144</td>
</tr>
<tr>
<td>Total</td>
<td>485</td>
<td>188</td>
<td>402</td>
<td>185</td>
<td>448</td>
</tr>
<tr>
<td>JMOs as % total</td>
<td>75</td>
<td>87</td>
<td>72</td>
<td>84</td>
<td>68</td>
</tr>
<tr>
<td>Total bed days</td>
<td>250,824</td>
<td>150,832</td>
<td>181,340</td>
<td>125,373</td>
<td>230,070</td>
</tr>
</tbody>
</table>

\(^a\) RPAH including the Institute of Rheumatology and Orthopaedics.

**Note:** Totals may not add due to rounding.

**Source:** IPART analysis of HIE payroll and patient data.

However, this variation appears to be mainly due to differences in the extent to which each hospital used VMOs rather than staff specialists to provide specialist services. This can be seen in Figure 9.1, which shows the costs associated with payments to JMOs, staff specialists and VMOs as proportions of the total medical staff payment costs at each hospital. It indicates that when VMOs were taken into account, junior medical staff accounted for around half of the total medical staff costs at all hospitals.

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80 “Productive hours” refers to the time spent by staff on performing work which is part of their duties. “Non-productive hours” includes time on leave for which staff receive payment (eg, sick leave, vacation and maternity/paternity leave).
Figure 9.1 JMO, staff specialist and VMO pay as a proportion of total medical staff pay costs, 2008/09

![Bar chart showing the percentages of JMO, staff specialist, and VMO pay as a proportion of total medical staff pay costs for different hospitals.

- RPAH (a): 19% JMO, 25% staff specialists, 18% VMO sessional payments, 11% VMO fee for service.
- GH: 48% JMO, 42% staff specialists, 11% VMO sessional payments, 10% VMO fee for service.
- RNSH: 52% JMO, 44% staff specialists, 11% VMO sessional payments, 5% VMO fee for service.
- BLH: 50% JMO, 45% staff specialists, 15% VMO sessional payments, 5% VMO fee for service.
- JHH: 49% JMO, 43% staff specialists, 15% VMO sessional payments, 5% VMO fee for service.

Data source: IPART analysis of HIE payroll data and Vmoney.

Figure 9.1 also shows that VMOs provided a larger share of specialist services at GH and BLH than at the other hospitals. For example, VMO payments accounted for 41% at GH and 35% at BLH, compared with only 16% to 19% at the other hospitals. During our hospital visits, staff at BLH indicated that the smaller or more remote hospitals tend to have trouble attracting staff specialists, and therefore rely more on VMOs than the larger teaching hospitals. GH and BLH also paid a significant proportion of their VMO costs on a fee-for-service basis, while the other hospitals paid virtually all these costs on a sessional basis.

The extent to which a hospital’s medical staff costs are affected by its use of VMOs rather than staff specialists is unclear. On the one hand, the hourly rate for VMOs paid on a sessional basis is in the order of $200, which is significantly higher than the staff specialist hourly rate of less than $80 (excluding rights of private practice income). But on the other hand, staff specialists have generous leave entitlements and can spend time on research or education, whereas VMOs are paid for the time they spend on patient care only.

Note that Table 9.1 above shows the total number of patient bed days in 2008/09 as a rough indication of the workload at each hospital. However, it would be highly misleading to use a simple measure such as the average number of FTEs per bed day, or staff cost per bed day, to compare the hospitals’ relative medical staff costs. As discussed elsewhere in this report, comparing costs on a like-with-like basis is a complex task, and using average FTEs or total pay per bed day grossly oversimplifies this. For example, a hospital’s number of bed days per medical FTE will vary depending on how many outpatients it treats, the complexity of its casemix, the size of its emergency department and its teaching load.
9.4.2 Mix of seniority levels among JMOs and staff specialists

Figure 9.2 shows the mix of JMO categories at each study hospital. It shows that at most of these hospitals, there were similar proportions of interns and CMOs, but variations in the proportions of residents and registrars. For example, at GH the proportion of JMOs that were registrars was 41%, while at RPAH, this proportion was 59%.

![Figure 9.2 Seniority profile of JMOs by category, 2008/09](image)

Figure 9.3 shows the mix of staff specialist categories at each study hospital. It indicates there was a degree of variation in this mix across the hospitals. For example, a higher proportion of staff specialists at GH and BLH were senior specialists than at the other hospitals, possibly reflecting the difficulties these smaller hospitals face in attracting younger staff specialists. In addition, a higher proportion of staff specialists at JHH were post graduate fellows. At the other hospitals there may have been post graduate fellows who were working at the hospital, but who did not appear on the medical staff payroll. For example, at GH post graduate fellows are recorded as ‘goods and services’ to the University of Newcastle. Similarly, research fellows may be paid through a research centre.

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81 Where there were hours recorded for agency and part-time MOs, these have been grouped together with CMOs. These two categories account for less than 0.5% of total JMO FTEs.

82 The Area Health Services may fund research though different cost centres to the hospital centres.
Figure 9.3 Seniority profile of staff specialists by category, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Specialists</th>
<th>Senior Specialists</th>
<th>Post Graduate Fellows</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH (a)</td>
<td>37%</td>
<td>60%</td>
<td>3%</td>
</tr>
<tr>
<td>GH</td>
<td>31%</td>
<td>69%</td>
<td>0%</td>
</tr>
<tr>
<td>RNSH</td>
<td>37%</td>
<td>61%</td>
<td>2%</td>
</tr>
<tr>
<td>BLH</td>
<td>32%</td>
<td>66%</td>
<td>4%</td>
</tr>
<tr>
<td>JHH</td>
<td>36%</td>
<td>50%</td>
<td>14%</td>
</tr>
</tbody>
</table>

*Data source: IPART analysis of HIE payroll data.*

9.5 Average pay rates for JMOs and staff specialists across study hospitals

Again using payroll data, we compared the average pay rates for JMOs and staff specialists employed at the study hospitals (Figure 9.4). For JMOs, we found that despite the variation in the mix of seniority levels among these staff, average hourly pay rates were very similar across all hospitals. This pay varied from $43 to $44 (excluding overtime) and $48 to $49 (including overtime). For staff specialists, we found slightly more variation in average hourly pay across hospitals, which probably reflected differences in the mix of seniority levels among these staff as well as different ‘levels of agreement’ with respect to the amount of private practice permitted (see Box 9.1).
For JMOs, we also looked at the average hourly pay rate for normal hours (including penalties), overtime hours and total hours (Figure 9.5). As would be expected, the average hourly rate for overtime hours (around $72) was significantly higher than the average hourly rate for normal hours (around $43). Therefore, it follows that the more overtime hours JMOs work relative to normal hours, the higher their average total hourly rate.
We looked at overtime as a proportion of JMOs’ total hours worked and total pay (Figure 9.6). We found some variation in overtime as a share of total hours worked, which ranged from 21% at GH to 16% at JHH. We found similar variation in overtime as a share of total pay – from 30% at GH and RNSH to 25% at JHH. This share was also higher than that of total hours worked, due to the higher average hourly pay rate for overtime.

Figure 9.6 Overtime as a proportion of JMOs’ total hours worked and total pay, 2008/09

However, despite these variations in overtime as a proportion of JMOs’ hours and pay, we found that overtime increased JMOs’ total average hourly pay by between $5 and $6 at all the hospitals (see Figure 9.5). This suggests that JMO overtime is an issue of similar magnitude to each of the study hospitals.

Note that there is no overtime rate for staff specialists or VMOs.

9.6 Proportion of medical staff costs allocated to inpatient care using IFRACs

Like nursing staff, medical staff do not spend all their time on inpatient care – they also spend time in emergency departments, and on outpatient care, teaching, research and administrative duties. Also, both senior and junior medical staff may spend time at other hospitals even though their costs are recorded at one hospital. Therefore, as for nursing staff, the hospitals keep account of medical staff time spent on inpatient care by calculating and applying ‘inpatient fractions’ (IFRACs) for each relevant cost centre.
To get an indication of the medical staff costs allocated to inpatient care, we looked at the study hospitals’ JMO and staff specialist numbers after applying the relevant IFRACs. However, it’s important to note that these IFRACs suffer from similar problems as the nursing IFRACs, which means they are difficult and potentially misleading to use for this purpose. In addition, medical staff spend less of their time than nursing staff on inpatient activities so that inaccurate IFRACs are more of a problem for medical staff costs. In particular, we found that:

- As discussed in Chapter 8 in relation to nursing costs, there was no standard approach to determining IFRACs. Some hospitals performed annual reviews of their IFRACs, while others did not. In either case, the reported IFRACs were often arrived at through ‘guesstimation’ by a staff member who knows the cost centre well, such as the relevant division manager. In many cases, these ‘guesstimations’ are probably about accurate. However, given the wide variation in IFRACs across the hospitals for some cost centres that appear to be providing largely similar services, we believe that some of the reported IFRACs may not be reliable.

- Different hospitals define their cost centres differently. For example, some include some medical and nursing costs in combined cost centres, while others include all medical costs in separate cost centres. Since medical and nursing staff spend different proportions of their time on inpatient activities, combining them in a single cost centres makes it very difficult to allocate either medical or nursing staff costs to inpatient activities.

- None of the hospitals calculate IFRACs for cost centres that provide hospital-wide (eg, administrative) services, but they differ in terms of the types of costs they record as hospital-wide services.

- There are some cost-centres that do not have IFRACs. While most of these appear to be administrative or outpatient related cost-centres without inpatient activity, others may have inpatient activity associated with them. Without IFRACs, medical staff costs associated with these cost centres were not counted.

- Some IFRACs were old and needed to be updated.

To illustrate this point, Table 9.2 shows the study hospitals’ IFRACs for the cost centres (or wards) that were mainly used for the clinical specialties we focused on for our case studies. The table also shows the number of cost centres associated with each specialty. Box 9.3 provides a sample of cost centre and IFRAC data, which illustrates both the wide range of IFRACs for similar specialties and the different ways the hospitals define their cost centres.
### Table 9.2  IFRAC and number of cost centres for selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Speciality</th>
<th>IFRAC</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>IFRAC</td>
<td>0.00</td>
<td>0.80</td>
<td>0.53</td>
<td>0.76</td>
<td>0.05</td>
</tr>
<tr>
<td>Cardiology</td>
<td>IFRAC</td>
<td>0.50</td>
<td>0.18</td>
<td>0.30</td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td>Neurology</td>
<td>IFRAC</td>
<td>0.30</td>
<td>0.63</td>
<td>0.40</td>
<td>0.90</td>
<td>0.47</td>
</tr>
<tr>
<td>Cardiothoracic</td>
<td>IFRAC</td>
<td>0.82</td>
<td>na</td>
<td>0.40</td>
<td>na</td>
<td>0.95</td>
</tr>
<tr>
<td>Surgery</td>
<td>IFRAC</td>
<td>0.20</td>
<td>0.80</td>
<td>0.45</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>General surgery</td>
<td>IFRAC</td>
<td>na</td>
<td>0.37</td>
<td>0.78</td>
<td>0.00</td>
<td>0.45</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>IFRAC</td>
<td>0.58</td>
<td>0.49</td>
<td>0.30</td>
<td>1.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: One cardiology cost centre at GH has an IFRAC of 18%, but only 55% of this is allocated to GH. This is because staff specialists work at multiple facilities but are costed to a single cost centre.

Source: IPART analysis of information provided by the study hospitals.

### Box 9.3  Sample of cost centre codes and IFRACs

<table>
<thead>
<tr>
<th>General Surgery</th>
<th>No Cost Centre</th>
<th>IFRAC</th>
<th>#/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A208</td>
<td>268190</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>B202</td>
<td>268980</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>B218</td>
<td>256920</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>256928</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>258560</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>D227</td>
<td>256311</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>D230</td>
<td>354879</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>554680</td>
<td>0.96</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obstetrics/Gynaecology</th>
<th>No Cost Centre</th>
<th>IFRAC</th>
<th>#/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A208</td>
<td>23111</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>B202</td>
<td>23232</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>B218</td>
<td>256800</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>256807</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>256815</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>256819</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>D227</td>
<td>256464</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>D230</td>
<td>554822</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>554856</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ophthalmology</th>
<th>No Cost Centre</th>
<th>IFRAC</th>
<th>#/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A208</td>
<td>22371</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>B202</td>
<td>268061</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>B218</td>
<td>258748</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>D227</td>
<td>250015</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>D230</td>
<td>554681</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>554838</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>
Figure 9.7 shows the hospitals’ JMO and staff specialist FTEs after IFRACs were applied as a proportion of these FTEs before IFRACs were applied. It indicates that based on IFRACs, only 39% of FTEs were allocated to inpatient care at RNSH, compared to 76% at the BLH. Some of the differences between the hospitals may be explained by the amount of outpatient care they provide. However, the differences between the hospitals are also likely to reflect problems with the IFRACs.

**Figure 9.7 Proportion of JMO and staff specialist FTEs allocated to inpatient care based on each hospital’s IFRACs, 2008/09**

![Proportion of JMO and staff specialist FTEs allocated to inpatient care](image)

- **RPAH (a)**
- **GH**
- **RNSH**
- **BLH**
- **JHH**

*Source: IPART analysis of HIE payroll and patient data.*

To provide a very rough indication of JMO time per patient bed day, we calculated the number of JMOs per bed day both before and after applying IFRACs. Figure 9.8 shows the number of JMO FTEs per 1000 bed days before and after applying IFRACs for each study hospital. The ‘true’ number of FTEs per 1000 bed days probably lies somewhere between the number before and after applying IFRACs. Note that the application of IFRACs changes the ranking of the hospitals. For example, RNSH had the highest number of FTEs per 1000 bed days before applying IFRACs, but BLH had the highest after applying IFRACs.

As for nursing costs, it is important to stress that even if we had accurate IFRACs the number of JMO FTEs per 1000 bed days (after applying IFRACs) would not show the relative cost of inpatient care at the 5 hospitals. The ‘required’ hours per bed day would vary across the hospitals, depending on factors such as the hospital’s casemix, and the qualifications and experience of its medical staff. A hospital with a more complex casemix would require more medical hours per patient bed day and/or better qualified medical staff, increasing the average cost per bed day.

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83 We cannot do the same analysis for senior medical officers (SMOs) because we do not have the necessary data for VMOs.
9.7 Broad comparison of medical staff numbers and average hourly pay rates at the specialty level

As section 9.2 discussed, for several reasons we could not reliably allocate medical staff hours or pay to patients being treated for specific clinical conditions. This meant we could not compare medical staff costs at the case study level, as we did for other major hospital cost items. Instead, we tried to compare these costs at the broader clinical specialty level. However, even at this level, we found a number of problems with the data which meant it would be misleading to compare average medical staff hours and pay per patient bed day, as we did for nursing staff costs.

The first problem was that we could not reliably calculate the proportion of medical staff costs that should be allocated to inpatient care, because of the difficulties associated with IFRACs (as discussed above).

The second problem was that we could not always identify medical staff costs by specialty on a comparable basis, for the following reasons:

- The specialty classifications used by the study hospitals differed, which meant that direct comparisons between hospitals were frequently not possible. For example, BLH did not use a ‘general medicine’ specialty whereas the other study hospitals did. At GH, intensive and critical care units were also mapped to ‘general medicine’ rather than the treating doctors’ specialties. Similarly, at RPAH ‘breast surgery’ was a unique specialty while the other hospitals included breast surgery in the ‘general surgery’ specialty. RPAH did not have a ‘general surgery’ specialty, and at the four study hospitals that had a division for ‘general surgery’, the types of surgery that fell under this division varied.
The specialty classifications used for VMO time were not always the same as those used for salaried staff (eg, JMOs and staff specialists). For example, the VMO specialties used at all study hospitals include ‘general medicine’ and ‘general surgery’, but as noted above, BLH does not use the ‘general medicine’ specialty for salaried staff and RPAH did not use the ‘general surgery’ specialty.

Patients with the same condition can be treated under different specialties. For example, while some stroke patients are treated under ‘neurology’, some may be treated under ‘geriatrics’ and the balance differs between the hospitals.

In some cases, all of a JMO or staff specialist’s time may be allocated to one specialty, even though he/she spends time on other specialties. For example, during our hospital visits, RPAH indicated that it estimates that registrars allocated to ophthalmology spend about 33% of their time on ophthalmology inpatients and 20% on inpatients in other specialties. GH noted that JMOs’ costs were allocated to their ‘home’ division, regardless of whether they work elsewhere at times.

Some hospitals (eg, RPAH) record the costs of relieving junior medical staff in a central cost centre while others allocated out the costs to the various cost centres for medical staff.

Casemixes within specialties differ between hospitals, with significant implications for medical staff costs. For example, our case study analysis on cholecystectomy (which hospitals would allocate to the ‘general surgery’ or ‘gastrointestinal surgery’ specialty) shows that emergency cases require significantly more care than planned cases. Therefore, the high proportion of emergency admissions for cholecystectomy at JHH compared with GH and BLH, for example, has a large impact on the average cost of treating this condition at the 3 hospitals (see Case Study 4 – Cholecystectomy).

As previously discussed in Chapter 5, the way hospitals ‘type change’ patients and measure episode length also differ. For example, stroke patients remain ‘acute’ for far longer at BLH than at any of the other hospitals because they undergo a significant amount of rehabilitation in the wards and type changes occur only when they are transferred to a rehabilitation ward. This means that they are being treated by medical staff from the ‘rehabilitation’ specialty while still coded as an ‘acute’ patient in the ‘neurology’ or ‘geriatrics’ specialty. Other hospitals reclassify stroke patients to ‘rehabilitation’ far sooner.

Given these problems, we limited our analysis to comparing the staff mix and average hourly pay for selected specialties. This analysis provides some indication of the relative contribution of different specialties to the study hospitals’ medical staff costs, and identifies common trends and obvious differences at the specialty level. However, the results should still be interpreted with caution.

84 Hospital stays can be administratively split, or ‘fragmented’, into a number of episodes reflecting changes in the type of care provided.
9.7.1 Number of JMO and staff specialist FTEs by specialty

Table 9.3 and Table 9.4 show the number of JMO and staff specialist FTEs allocated to selected specialties at each study hospital. The specialties were chosen because they broadly correspond to the clinical conditions that we analysed in the case studies. The tables also show total FTEs, as a rough indication of the relative size of each hospital.

In addition to highlighting how the specialty classifications used by the hospitals vary (discussed above), Table 9.3 provides an indication of the differences in the casemix at the various hospitals. For example, it shows that the obstetrics/gynaecology specialty is larger at RPAH than the other hospitals, while the orthopaedics specialty is larger at JHH.

Table 9.3 JMO FTEs allocated to selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast surgery</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardiology</td>
<td>13.2</td>
<td>8.5</td>
<td>10.8</td>
<td>5.2</td>
<td>8.0</td>
</tr>
<tr>
<td>Cardiothoracic surgery</td>
<td>11.7</td>
<td>-</td>
<td>7.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gastrointestinal surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.2</td>
<td>-</td>
</tr>
<tr>
<td>General surgery</td>
<td>-</td>
<td>12.0</td>
<td>15.2</td>
<td>17.3</td>
<td>22.7</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>6.3</td>
<td>6.6</td>
<td>8.6</td>
<td>15.4</td>
<td>-</td>
</tr>
<tr>
<td>Neurology</td>
<td>3.8</td>
<td>5.3</td>
<td>6.1</td>
<td>1.9</td>
<td>5.4</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>26.5</td>
<td>10.9</td>
<td>12.9</td>
<td>6.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>2.3</td>
<td>-</td>
<td>3.3</td>
<td>1.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>12.9</td>
<td>10.1</td>
<td>13.7</td>
<td>6.5</td>
<td>27.5</td>
</tr>
<tr>
<td><strong>Total FTEs (selected specialties)</strong></td>
<td>79.6</td>
<td>53.4</td>
<td>78.0</td>
<td>55.9</td>
<td>77.0</td>
</tr>
<tr>
<td><strong>Total FTEs (whole hospital)</strong></td>
<td>365.2</td>
<td>163.7</td>
<td>289.8</td>
<td>155.1</td>
<td>303.8</td>
</tr>
</tbody>
</table>

* RPAH including the Institute of Rheumatology and Orthopaedics.

Source: IPART analysis of HIE payroll data.

Table 9.4 shows how some clinical specialties tended to be principally VMOs, rather than staff specialists. For example, there were no staff specialist FTEs for ophthalmology, and few staff specialist FTEs for orthopaedics. On the other hand, there were JMOs allocated to these specialties. In contrast, the majority of cardiology and obstetrics/gynaecology senior staff were staff specialists. The table also indicates that GH and BLH use fewer staff specialists than the larger teaching hospitals. As discussed in section 9.4 above, these smaller hospitals rely more on VMOs for specialist services than the other study hospitals.
Table 9.4  Staff specialist FTEs allocated to selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RPAH*</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast surgery</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardiology</td>
<td>5.1</td>
<td>2.0</td>
<td>5.6</td>
<td>1.7</td>
<td>8.9</td>
</tr>
<tr>
<td>Cardiothoracic surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gastrointestinal surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General surgery</td>
<td>-</td>
<td>0.4</td>
<td>2.4</td>
<td>-</td>
<td>5.2</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>2.9</td>
<td>-</td>
<td>6.4</td>
<td>6.3</td>
<td>-</td>
</tr>
<tr>
<td>Neurology</td>
<td>4.4</td>
<td>-</td>
<td>3.1</td>
<td>-</td>
<td>7.4</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>7.8</td>
<td>1.7</td>
<td>4.6</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total FTEs (selected specialties)</td>
<td>20.6</td>
<td>4.1</td>
<td>23.0</td>
<td>8.7</td>
<td>25.3</td>
</tr>
<tr>
<td>Total FTEs (whole hospital)</td>
<td>119.6</td>
<td>24.0</td>
<td>111.8</td>
<td>29.5</td>
<td>143.9</td>
</tr>
</tbody>
</table>

*a RPAH including the Institute of Rheumatology and Orthopaedics.

Source: IPART analysis of HIE payroll data.

9.7.2  Average hourly pay for JMOs and staff specialists by specialty

Table 9.5 shows JMOs’ average hourly pay rate for normal hours (including penalties) for selected specialties and at the hospital level. It suggests that there is more variability in the average hourly rates between hospitals at the specialty level than at the hospital level. However, some of this variability may be due to the way specialties are coded and how JMO time is allocated. Therefore, this table should be interpreted with caution.

Table 9.5  JMOs’ average hourly pay rate for normal hours worked (including penalties) for selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RPAH*</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast surgery</td>
<td>34</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardiology</td>
<td>40</td>
<td>40</td>
<td>39</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Cardiothoracic surgery</td>
<td>41</td>
<td>-</td>
<td>43</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gastrointestinal surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>General surgery</td>
<td>-</td>
<td>37</td>
<td>38</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>38</td>
<td>37</td>
<td>34</td>
<td>43</td>
<td>-</td>
</tr>
<tr>
<td>Neurology</td>
<td>41</td>
<td>35</td>
<td>37</td>
<td>34</td>
<td>41</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>44</td>
<td>44</td>
<td>45</td>
<td>41</td>
<td>45</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>45</td>
<td>-</td>
<td>44</td>
<td>44</td>
<td>40</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>43</td>
<td>39</td>
<td>36</td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td>Average at hospital level</td>
<td>43</td>
<td>43</td>
<td>43</td>
<td>43</td>
<td>44</td>
</tr>
</tbody>
</table>

*a RPAH including the Institute of Rheumatology and Orthopaedics.

Source: IPART analysis of HIE payroll data.
Table 9.6 shows the additional hourly pay for JMOs due to overtime hours worked by specialty. Again, it suggests that there is more variability in JMO costs due to overtime pay at the specialty level than at the hospital level. It also suggests that overtime may be more common in some specialties than others across all the hospitals. For example, all the hospitals paid an additional $9 to $12 per hour for overtime in orthopaedics, compared with no more than $3 in geriatrics.

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RPAH*</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast surgery</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardiology</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Cardiothoracic surgery</td>
<td>12</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gastrointestinal surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>General surgery</td>
<td>-</td>
<td>9</td>
<td>8</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Neurology</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>11</td>
<td>12</td>
<td>10</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

*RPAH including the Institute of Rheumatology and Orthopaedics.

Source: IPART analysis of HIE payroll data.

Table 9.7 shows staff specialists’ average hourly pay rates for selected specialties and at the hospital level for each study hospital. As for JMOs, the data suggest that there is more variability in these rates between hospitals at the specialty level than at the hospital level, but the data should be interpreted with caution.
Table 9.7  Staff specialist average hourly pay rates for selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast surgery</td>
<td>61</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardiology</td>
<td>60</td>
<td>64</td>
<td>62</td>
<td>78</td>
<td>64</td>
</tr>
<tr>
<td>Cardiothoracic surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gastrointestinal surgery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General surgery</td>
<td>-</td>
<td>75</td>
<td>77</td>
<td>-</td>
<td>71</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>74</td>
<td>-</td>
<td>80</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>Neurology</td>
<td>73</td>
<td>-</td>
<td>79</td>
<td>-</td>
<td>76</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology</td>
<td>75</td>
<td>81</td>
<td>79</td>
<td>82</td>
<td>69</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>-</td>
<td>71</td>
<td>80</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Average at the hospital level</td>
<td>73</td>
<td>78</td>
<td>73</td>
<td>74</td>
<td>75</td>
</tr>
</tbody>
</table>

*RPAH includes the Institute of Rheumatology and Orthopaedics.*

**Source:** IPART analysis of HIE payroll data.

### 9.7.3 JMO, staff specialist and VMO costs as a proportion of medical staff costs for selected specialties

As section 9.4.1 discussed, JMO salary costs accounted for about half of all medical staff costs at each of the study hospitals, while the proportions of staff specialist and VMO costs varied, depending on the extent to which the hospitals used VMOs.

Table 9.8 shows the shares of JMO, staff specialist and VMO costs for selected specialties. Please note that this table should be interpreted with caution, given the problems associated with allocating medical officers to specialties, as discussed above. In particular, note that the specialist categories for VMOs and salaried staff do not always coincide. We have excluded data for the specialties where VMO and salaried staff categories clearly did not match, such as general surgery at RPAH. However, we were not able to fully adjust for other differences, due to a lack of information.

This table suggests that the extent to which JMO, staff specialist and VMO costs contribute to the total medical staff costs of the selected specialties varies significantly between specialties. For example, JMO costs as a proportion of total medical staff costs vary from between 68% (of obstetrics/gynaecology costs at BLH) to 0% (of ophthalmology costs at GH). VMO costs as a proportion of total medical staff costs vary from 100% (of ophthalmology costs at GH) to 0% (of geriatrics costs at RPAH).

Table 9.8 also confirms that VMOs are more commonly used in some specialties than others. For example, VMO costs account for between 35% and 100% of all
ophthalmology medical staff costs, compared to between 0% and 9% of all geriatrics medical staff costs at the study hospitals.

Table 9.8  JMO, staff specialist and VMO costs as a proportion of total costs for selected specialties, 2008/09

<table>
<thead>
<tr>
<th>Specialty</th>
<th>JMO</th>
<th>Staff specialist</th>
<th>VMO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
</tr>
<tr>
<td>Cardiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>60</td>
<td>62</td>
<td>43</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>29</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>VMO</td>
<td>12(^b)</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td>Cardiothoracic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>50</td>
<td>na</td>
<td>55</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>0</td>
<td>na</td>
<td>0</td>
</tr>
<tr>
<td>VMO</td>
<td>50</td>
<td>na</td>
<td>45</td>
</tr>
<tr>
<td>General surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>na</td>
<td>53</td>
<td>61</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>na</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>VMO</td>
<td>na</td>
<td>44</td>
<td>24</td>
</tr>
<tr>
<td>Geriatrics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>53</td>
<td>na</td>
<td>36</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>47</td>
<td>na</td>
<td>60</td>
</tr>
<tr>
<td>VMO</td>
<td>0</td>
<td>na</td>
<td>4</td>
</tr>
<tr>
<td>Neurology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>33</td>
<td>56</td>
<td>42</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>60</td>
<td>0</td>
<td>43</td>
</tr>
<tr>
<td>VMO</td>
<td>7</td>
<td>44</td>
<td>15</td>
</tr>
<tr>
<td>Obstetrics/Gynaecology(^c)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>56</td>
<td>47</td>
<td>56</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>25</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>VMO</td>
<td>19</td>
<td>42</td>
<td>14(^d)</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>63</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VMO</td>
<td>37</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JMO</td>
<td>66</td>
<td>37</td>
<td>65</td>
</tr>
<tr>
<td>Staff specialist</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>VMO</td>
<td>34</td>
<td>63</td>
<td>27</td>
</tr>
</tbody>
</table>

\(^a\) RPAH includes the Institute of Rheumatology and Orthopaedics.
\(^b\) Includes paediatric cardiology VMO costs.
\(^c\) Includes gynaecology oncology.
\(^d\) Includes obstetric and gynaecological ultrasound.

**Note:** For many specialties the staff profile could not be calculated because of differences in the way the specialties are defined for salaried staff and VMOs.

**Note:** Numbers may not add up due to rounding.

**Source:** IPART analysis of HIE payroll and VMoney data.

Recommendation

16   That further work be undertaken to strengthen the quality and consistency of available information on medical staff costs.
When a prosthesis is required in treating a public patient in a public hospital, the treating doctor determines what type of prosthesis is used, and the cost of this prosthesis is incurred by the hospital. Overall, prosthesis costs represent a small proportion of a hospital’s total budget.\textsuperscript{85} However, prostheses can represent a significant proportion of expenditure on individual patients.\textsuperscript{86}

To understand the extent to which prosthesis costs per patient for the same clinical procedure vary across hospitals and the reasons for this variation, we examined the study hospitals’ approaches to purchasing prostheses. We also undertook more detailed analysis of 5 prostheses used in our case study areas: coronary stents, pacemakers, implantable cardioverter defibrillators, lenses and hip joint prostheses.

Each of these items is available in a variety of types or models, which vary in terms of the materials they are made of, and their durability, functionality or other characteristics. For each item, we compared the study hospitals’ use of the different types of the item, and the range of prices they paid for it (including for identical models of the item). We also compared the prices the study hospitals paid for their most frequently purchased model of the item. In addition, we calculated the annual savings they could have made had they bought their most frequently purchased model at the lowest price paid for that model by any of the study hospitals.\textsuperscript{87}

Finally, we considered the implications of our findings for the hospitals’ approaches to prosthesis purchasing, and compared our findings on common prices paid for prostheses items with average costs reported to the NHCDC.


\textsuperscript{86} For example, the average Australian public hospital prostheses cost for cases coded under DRG F15Z (Percutaneous coronary interventions without an acute myocardial infarction (or heart attack) when stents are used), represented the highest cost element of hospitals’ care (22% of direct costs), according to the AIHW in its National Hospital Cost Data Collection, Cost Report Round 12 (2007-2008, September 2009, pp 16 and 17 (http://www.health.gov.au/internet/main/publishing.nsf/Content/0BF59B7DB88A427FCA25769001FCD3D/$File/3_WebR12CWNatEst.pdf).

\textsuperscript{87} Given that we had incomplete information regarding the volumes of purchases of various prosthesis items by the hospitals, for these estimates of potential savings we assumed that all purchases of a particular type of prosthesis (eg, bare metal or drug-eluting stent) were the most frequently purchased type or model in 2008/09. See section 1.2 for more detail.
The section below summarises our findings on prosthesis costs. The subsequent sections explain the approach we used to analyse prosthesis costs, then discuss in more detail our findings on each prosthesis, the implications of these findings for prosthesis purchasing, and our comparison of common prosthesis purchase prices with average costs in the NHCDC.

### 10.1 Summary of findings on prosthesis costs

At the hospital level, we found that:

- The study hospitals’ approaches to prosthesis purchasing varied markedly. At one end of the spectrum, RPAH had a very structured approach, with threshold pricing at the area health service level, frequent tender processes, tight controls on product choice, and dedicated business resources allocated to negotiate prices and manage the process. At the other end, RNSH appeared to have few controls over what products were purchased and limited resources allocated to collective purchasing negotiations. We note that during the period of this study, NSCCAHS improved its prosthesis purchasing approach and guidelines.

- The diversity of clinical conditions and the need for specialist prostheses for some patients mean that even with very structured and controlled approaches to purchasing, hospitals need some flexibility to allow for special orders.

At the prosthesis item level, we found:

- Substantial variation in the range of prosthesis models purchased by the study hospitals.

- For some items, variation in the types or models most frequently used by the study hospitals. For example, RNSH used a considerably higher proportion of the more costly drug-eluting cardiac stents than the other study hospitals. We have recommended that this variation in usage be noted by NSW Health.

- Significant variation in the prices paid for the same item. Often this was because the hospitals purchased different types or models of the item, but also because they paid different prices for the same model. For example, for ICDs, we found that RNSH had paid $5,000 more than one of the other study hospitals for a particular model.

- The study hospitals did not usually share the prices they paid for prosthesis items with other hospitals, often not even with the hospitals within their area. This means hospital purchasing staff may not be aware that other hospitals are negotiating significantly lower prices for the same items.

---

88 However, we note that RNSH is currently developing a new tender process for pacemakers and ICDs and aims to introduce more controls on its prosthesis purchases.
There was some correlation between a more centralised and controlled approach to purchasing by the hospital or area health service and lower prices paid for prostheses. Further, hospitals that allocated resources to purchasing tended to benefit from lower prices which outweighed the cost of these resources. For example, RPAH employed a business manager in its theatres who negotiated considerable price reductions on the hospital’s procurement and created considerable savings for the hospital.

In many cases, the study hospitals could achieve significant savings if they had paid lower prices (equivalent to best prices paid by other hospitals) for some of their most frequent prosthesis purchases.

The main implications of our findings on prosthesis costs are that more organised approaches to purchasing by hospitals or areas, and some consistent controls on clinicians’ choices, would lead to significant savings on frequently purchased prostheses. There may also be a case for some prostheses to be purchased at the state level.

Our comparison of the study hospitals’ provisional estimates of their 2008/09 average prosthesis cost per patient, as prepared for the NHCDC, varied widely and appeared to be unreliable. However, estimates of the national public hospital average prosthesis cost per patient for 2007/08 published by the NHCDC appeared more reasonable and consistent with our estimates.

10.2 How we analysed prosthesis costs

As patient-level prostheses data were not available for all study hospitals, we analysed prosthesis costs using purchasing data from the hospitals. For some hospitals (eg, RNSH), these data were predominantly based on information extracted directly from their purchasing database. For others (eg, RPAH), we largely relied on advice from the hospitals regarding the types of prostheses they purchased and the prices they paid for them. This approach enabled us to compare the range of prostheses purchased by the hospitals and the prices they paid (although we did not know the relative proportions of all prostheses items purchased). Please note that

89 We examined NHCDC prosthesis costs related to our case study areas only.
90 NSW hospitals have traditionally modelled their prosthesis costs and have not directly calculated them from patient-level expenditure data. With the shift towards episode funding, more hospitals are collecting data on prosthesis expenditure at the patient level. Both RNSH and GH have implemented IT systems that collect this data and the Northern Sydney Central Coast Area Health Service (NSCCAHS) aims to use them as feeds into clinical costing in the future. However, as yet, RPAH, BLH and JHH do not have systems with this capability.
our analysis included purchasing data related to public patients only, not private patients.91

We selected 5 prostheses used in the case study areas of cardiology, cataract procedures and hip replacements (see Table 2.1). We then analysed the purchasing data from the study hospitals using the approach outlined in Box 10.1. This analysis focused on identifying the factors which explain much of the cost variation between the hospitals: their purchasing approaches, their controls on prosthesis choice, the ranges of prostheses they purchased and the direct price differentials between the prosthesis items they purchased.

### Table 10.1 Selected prostheses and case study areas in which they are used

<table>
<thead>
<tr>
<th>Prosthesis item</th>
<th>Case study area</th>
<th>DRG</th>
<th>DRG description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary stent</td>
<td>Cardiology</td>
<td>F10Z</td>
<td>Percutaneous coronary intervention w AMI*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F15Z</td>
<td>Percutaneous coronary intervention w/o AMI w stent implantation</td>
</tr>
<tr>
<td>Pacemaker and lead</td>
<td>As above</td>
<td>F12Z</td>
<td>Cardiac pacemaker implantation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F17Z</td>
<td>Cardiac pacemaker replacement</td>
</tr>
<tr>
<td>Implantable cardioverter-defibrillator (ICD) and lead</td>
<td>As above</td>
<td>F01A</td>
<td>Implantation or replacement of AICD total system w cs cc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F01B</td>
<td>Implantation or replacement of AICD total system w/o cs cc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F02Z</td>
<td>AICD component implantation/replacement</td>
</tr>
<tr>
<td>Intraocular lens</td>
<td>Cataract/lens procedure</td>
<td>C16A</td>
<td>Lens procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C16B</td>
<td>Lens procedures, same day</td>
</tr>
<tr>
<td>Hip joint prostheses componentsb:</td>
<td>Hip joint replacement</td>
<td>I03A</td>
<td>Hip revision w cs cc</td>
</tr>
<tr>
<td>• Acetabular shell</td>
<td></td>
<td>I03B</td>
<td>Hip replacement w cs cc or hip revision w/o cs cc</td>
</tr>
<tr>
<td>• Liner/insert</td>
<td></td>
<td>I03C</td>
<td>Hip replacement w/o cs cc</td>
</tr>
<tr>
<td>• Femoral head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hip stem</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only some cases in DRG F10Z require stents.

b Our analysis relates to separate components rather than a complete prosthesis.

**Note:** “w” = with; “w/o” = without; “cs cc” = catastrophic or severe comorbidities and complications.

**Source:** AR-DRG Version 5.1, IPART analysis.

91 However, we did note that private patients in the study hospitals frequently receive more expensive prosthesis items than public patients. The Productivity Commission estimated that in 2007/08, the average prosthesis cost per casemix-adjusted separation for their selected DRG group was $790 in public hospitals and $1,514 in private hospitals (Source: Productivity Commission, Public and Private Hospitals Research Report, December 2009, p 107). This appears to be due to more expensive types of prostheses being used for private patients, as well as higher prices being charged for exactly the same models.
We acknowledge that we were not able to examine all the factors that affect a hospital’s prosthesis costs. For example, we did not analyse the impact of the study hospitals’ casemixes (which can influence the types of prostheses they use, because different types and combinations of prostheses may be better suited to some patients than others, depending on their age and diagnosis). We recognize that our findings on the differences between the study hospitals’ purchases may in part reflect variations in their patient mix.

In addition, we note that the hospitals may receive additional benefits for certain prosthesis prices (such as offsetting price reductions on other items and additional services included by the supplier free of charge) which have not been included in our analysis.
Box 10.1 How we analysed prosthesis costs for our selected case study procedures

For each prosthesis, we examined as many of each study hospital’s purchases (including supplier, model and price paid) as possible in 2008/09. Then we compared:

- the relative use of different types of the item across study hospitals
- the prices paid for the item, including for the same or similar models of the item, across hospitals
- the prices paid for each hospital’s most frequently purchased model of the item.

Given that we did not have complete information on the hospitals’ volumes of prosthesis purchases, we asked hospitals to check which particular type of prosthesis they purchased most frequently in 2008/09.

We also:

- ranked the study hospitals in terms of the prices paid for directly comparable types/models of the item
- calculated the percentage differences between the prices paid by the hospitals for their most frequently purchased models of the item and the lowest price paid for that same model by a study hospital
- estimated the potential annual savings available to each hospital if it used only its most frequently purchased model of the item in 2008/09 and purchased this model at the lowest price paid for that same model by any study hospital (as per the previous calculation).

To rank the study hospitals, we used data on each model purchased by more than one study hospital. For each of these models, we ranked the hospitals as either paying the lowest price, second lowest, third lowest or fourth lowest, depending on the relative prices they paid. If 2 or more hospitals paid the same price, we gave them the same ranking (except where one hospital had purchased the item on behalf of the other(s) - in this case, only the purchasing hospital was included in the analysis). If only one hospital had purchased a particular model, this model was excluded from the analysis.

We cannot be sure that all item purchases and prices were included in this process. For example, some may have been omitted because they were called something other than the particular item name we searched for in the hospitals’ purchasing databases (eg, something other than stent or ICD). In addition, as noted above, others were omitted because only one hospital purchased a particular model. However, we are confident that most purchases were included in the analysis, and that the results provide a useful indication of which study hospitals are paying more or less than others for the selected prosthesis.

Note that for hip procedures, a number of individual components of hip prostheses are used (eg, stems, liners, femoral heads etc) and not just one prosthesis. Therefore, we estimated the total prosthesis costs of a hip joint replacement by summing the prices paid for the total hip joint prostheses purchased most frequently by each hospital. Also note that in analysing hip prosthesis costs at RPAH we included data from IRO, because IRO treats most of RPAH’s planned hip joint replacement cases.

For example, consider if one hospital purchased Item X more than any other hip stem and purchased it for $2,500, while another study hospital purchased it for $1,873. The first hospital could potentially save $627 or 25% on every purchase of that item. This could translate to a total of $82,137 in annual savings based on a volume of 131 cases that would require hip stems.
10.3 Approach to prosthesis purchasing across study hospitals

Through our hospital visits, we collected information on each study hospital’s approach to prosthesis purchasing, including the extent to which they used price agreements with suppliers and imposed controls on the types or models of a specific item clinicians select from.

We identified some key similarities in their approaches. For example, they all bought most prostheses on consignment, and they all used the Oracle purchasing database to record and manage their prosthesis purchases. This database enabled them to track and monitor all their purchases (and also allowed us to examine their prosthesis purchasing based on actual transactions in 2008/09). However, overall, we found that these approaches varied significantly. Some were very structured and tightly controlled and others had few controls in place.

Table 10.2 provides a summary of the hospitals’ approaches to prosthesis purchasing which are discussed in more detail in the sections below.

<table>
<thead>
<tr>
<th>Purchasing approach</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area tender process</td>
<td>Yes – for cardiothoracic and interventional cardiac items eg, pacemakers, ICDs and leads</td>
<td>Yes – for pacemakers, defibrillators &amp; heart failure devices. Tender launched in May 2010 (responses are waiting to be evaluated)</td>
<td>Yes – for pacemakers, defibrillators &amp; heart failure devices. Tender launched in May 2010 (responses are waiting to be evaluated)</td>
<td>Yes – for cardiothoracic &amp; interventional cardiac items eg, pacemakers ICDs and leads</td>
<td>No - but has hospital price agreement processes (eg, for pacemakers, ICDs and leads)</td>
</tr>
<tr>
<td>Threshold pricing policy</td>
<td>Yes – for orthopaedic items</td>
<td>No - but had price agreements with suppliers</td>
<td>No</td>
<td>Yes – for orthopaedic items</td>
<td>No - but has price agreements with suppliers</td>
</tr>
<tr>
<td>Product review approval process</td>
<td>Yes</td>
<td>Yes</td>
<td>No - but is being developed</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dedicated business managers for purchasing</td>
<td>Yes – in operating theatres; otherwise NUMs</td>
<td>Dedicated hospital CNC Logistics with NUMs</td>
<td>No – mainly NUMs</td>
<td>No - mainly NUMs</td>
<td>No – mainly NUMs; but service/finance managers have cost delegations.</td>
</tr>
</tbody>
</table>

Source: IPART visits to study hospitals, November to December 2009.
10.3.1 Royal Prince Alfred Hospital and Bankstown-Lidcombe Hospital

Of the 5 study hospitals, RPAH (including IRO)\(^\text{92}\) and BLH appeared to have a more centralised and controlled approach to prosthesis purchasing, which reflected the Sydney South West Area Health Service’s (SSWAHS’s) area-wide approach and policies.

Each hospital in the SSWAHS area is ultimately responsible for their purchases. However, area contracts are negotiated centrally, and in many cases, the hospitals pay the area contract price for items that have been put to tender. For example, these items include cardiothoracic and interventional cardiac items like heart valves, pacemakers, defibrillators and leads.\(^\text{93}\)

For prostheses not put to tender, the hospitals each have an approved inventory list and doctors are only able to choose items on these lists. Doctors are able to propose new items to be added to the inventory list, but for this to happen, the product needs to be approved by the hospital’s New Products Committees. These committees include clinicians, nurses and radiologists within the hospitals. All proposed new products are subject to a product trial first and the supplier is required to provide this free of charge. The price for the new product has to be no higher than the existing price paid, unless there is clinical justification.

Orthopaedic prostheses are not put to tender, but there is an agreed threshold price list and clinicians are required to seek approval for items that cost more than the threshold level. This process resulted from the SSWAHS’s threshold pricing project, which was first conducted across the area in 2007 to contain expenditure on orthopaedic prostheses, while increasing efficiency and maintaining the quality of patient care. SSWAHS advised us that the project had reduced the individual unit costs of orthopaedic prostheses and overall expenditure on prostheses at the hospitals in its area. For example, it estimated that the project resulted in:

- a 13% reduction in the average cost of knee prostheses
- a 5% reduction in the average cost of hip prostheses
- projected annual savings in orthopaedic prosthesis purchases of $1.2 million
- projected annual savings in lower hip prosthesis purchases of $364,000.\(^\text{94}\)

\(^{92}\) The Institute of Rheumatology and Orthopaedics (IRO) is relevant to the hip prostheses costs and associated purchasing policies in our analysis only. While RPAH handles emergency hip replacement cases, the IRO undertakes the majority of its planned hip surgeries. Management of orthopaedic surgery, including purchasing, is closely linked between RPAH and IRO. Apart from hip prostheses, other prosthesis costs for RPAH refer only to RPAH’s patients.

\(^{93}\) Under the current tender, 80% of pacemakers must come from Supplier 3, while 40% of defibrillators must come from Supplier 7 and Supplier 1. Source: IPART visits to study hospitals, November to December 2009.

However, SSWAHS noted that although it encouraged ongoing application of threshold pricing through regular stakeholder meetings, audits and reporting,\textsuperscript{95} compliance averaged 57% for hip prosthesis purchases across the area. Therefore, improved compliance is likely to lead to further reductions in costs.

RPAH also has a business manager on its operating theatre staff whose role is to manage purchasing and negotiate prices for prostheses and other consumables not put to tender. The hospital indicated that it has found that an appropriately experienced person in this role can achieve substantial savings for the hospital. It further noted that it benefits from its larger size in price negotiations. At BLH and RPAH’s non-theatre units, the purchasing and price negotiation role is usually performed by NUMs, who may not have expertise in contract negotiation.

\subsection*{10.3.2 Royal North Shore Hospital and Gosford Hospital}

Of the 5 hospitals, RNSH appeared to have the least centralised approach to prosthesis purchasing. It had limited controls on the selection of prosthesis types and models that could be purchased, which appeared to be largely determined by clinician preference. GH also had a less centralised approach than RPAH and BLH.

Both RNSH and GH are part of the North Shore Central Coast Area Health Service (NSCCAHS). At the time of this study, the NSCCAHS did not have an area-level tender process for cardiothoracic and interventional cardiac prosthesis items. Instead, RNSH indicated it had initiated a hospital level tender process for pacemakers and ICDs and aimed to achieve savings of around $180,000 on these items. However towards the end of our study, we were informed by NSCCAHS that RNSH’s hospital level tender did not go ahead. Instead an area-wide tender for pacemakers, defibrillators and heart failure devices was launched in May 2010 and responses are waiting to be evaluated.

RNSH also indicated it was in the process of introducing more controls on the selection of prosthesis types and models. It expected that this would involve the selection of prostheses being subject to peer review. The hospital had also started to implement some controls at the departmental level – focusing first on the vascular, spinal and cardiac surgery departments, given the particular high costs of prostheses (and grafts in the case of vascular surgery) in these areas. For example, it had introduced a new requirement that spinal prosthesis purchases be reported (by type and surgeon) to the Clinical Director to monitor expenditure.

At GH, the selection of prosthesis types and models was controlled using an inventory list of clinician-approved products. If a surgeon’s selected prosthesis was on this list, the product could be purchased without further approval. Approval for new products requires a business case and a trial of the product, which is reviewed by the Theatre Manager, tabled at the Perioperative Management Committee, with

final sign off from divisional management. Trial and evaluation must be undertaken before any final approval is obtained.96

In addition, at both RNSH and GH, all proposals to purchase new technology prosthesis items must be approved by the area-wide Technical Committee, and this process involves research into the product and its benefits.

GH advised that sharing of prosthesis price information occurs within the Area Health Service, with contracts discussed at the Perioperative Nurse Managers group.

We note that GH could potentially benefit from increased area-level price negotiation, given it is a smaller hospital than RPAH, RNSH and JHH and so has less bargaining power.

10.3.3 John Hunter Hospital

JHH has a less centralised approach to purchasing at the area level, reflecting the approach and policies of the Hunter New England Area Health Service (HNEAHS). However, it negotiates and enters into price agreements for almost all of its prosthesis purchases. It indicated that it preferred to seek price reductions through price agreements rather than formal tender processes because it believes tenders are too price-driven when other factors are important (for example, pacemaker battery life). Nevertheless, we found it had tight controls around the selection of prosthesis types and models and a culture of price scrutiny.

JHH staff indicated that the hospital benefits from its size in price negotiations and at times, it uses this size to negotiate lower prices for supply to smaller hospitals in its area, such as Tamworth Hospital (which like JHH, also has a catheter lab and so uses similar items). Staff felt that there could be an opportunity for more strategic bulk purchasing or tender processes at the area level, and potentially more support from NSW Health Support in these processes.

Like RPAH and BLH, JHH had tight controls for approving new prosthesis products proposed for purchase. Surgeons wanting to purchase new or more advanced prostheses were required to make a formal written request to the Clinical Governance Committee. To be approved, the product had to be trialled (with the supplier providing the product at no cost) and be priced at no more than the currently purchased equivalent item.

JHH also had tight controls over meetings with medical supply company representatives. These representatives were able to meet with surgeons during set times only. Business rules applied during these meetings, and surgeons had very open conversations with representatives about any proposed price increases. The

96 In relation to pacemaker selection at GH, the new clinical equipment process requires submission of a proposal to the Area Clinical Product Manager supported by the Department of Cardiology and the Division of Medicine, Central Coast Health Service.
finance staff reported that they have gained surgeon support for this tight process because the resulting savings are injected back into emergency surgery.

In addition, at the time of our hospital visit, JHH was in the process of introducing some clinical and price criteria for prosthesis purchases which incorporated a systematic and higher level of scrutiny. For example, if surgeons want to use a partial prosthesis, the new criteria would require them to gain consensus across surgical teams on which product should be used for consistency purposes. In such cases, the hospital would ask the surgeons to check with all companies that they are willing to change parts for compatibility with a new preferred product if required.

In orthopaedics, some unwritten protocols have developed over time concerning which types of hip prostheses are most suitable for certain categories of patients (eg, based on their age and lifestyle factors). Around 5 years ago, JHH reviewed the choices of orthopaedic prosthesis types taking into account alternative perspectives offered by visiting surgeons from Brisbane. As a result, it made some changes in its usage patterns. For example, surgeons at JHH indicated that they had previously used a lot more of the relatively expensive ceramic prostheses. However, they are now more conservative about using these products (eg, these products are generally not used on patients over 80 years of age).

At the time of our visits, JHH monitored its prosthesis purchases using Oracle and other theatre databases. However, it indicated that it planned to introduce a CSD tracking system in the next 6 months to better monitor prosthesis use.

10.4 Patterns of use and prices paid for coronary stents

Coronary or cardiac stents are used in cardiac surgery. They are artificial support devices placed in the coronary artery after treatment for coronary artery disease. The stent is usually a stainless steel mesh tube that comes in various sizes to match the size of the artery. It stays in the artery permanently, holds it open, improves blood flow to the heart muscle and relieves symptoms (usually chest pain). Within a few weeks, the inside lining of the artery grows over the metal surface of the stent.97

The insertion of stents is a fairly common procedure, and is undertaken in 70% of coronary angioplasty procedures.98 However, BLH does not perform these procedures so was omitted from our analysis.

10.4.1 Types of stent

There are 2 major types of coronary stents:

1. **Bare metal stents**, which are made of thin stainless steel or cobalt chromium alloy wire, without a coating.

2. **Drug-eluting stents**, which have a coating that slowly releases a drug to block cell proliferation. The aim of the drug release is to prevent fibrosis that, together with clots (thrombus), could otherwise block the stented artery, a process called restenosis.99

Drug-eluting stents tend to be about 3 times as expensive as the bare metal stents.100 Clinical opinions about the appropriate stent selection for different patients differ, and in recent years, risks associated with drug-eluting stents have been identified.101 The risks arise because patients treated with this type of stent must take ongoing medication. In response to the differing opinions, the GMCT Cardiac Coordinating Committee established guidelines for NSW public hospitals on the selection of patients for drug-eluting stents. These guidelines recommend that drug-eluting stents be considered for patients with the following conditions/circumstances:

- diabetes
- lesions greater than 18mm in length
- vessels less than 2.5mm in diameter
- in-stent restenosis
- bifurcation or ostial lesions.102

In the committee’s view, application of these recommendations would result in the use of drug-eluting stents in up to 30% to 40% of all cases where stents are used.103

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100 Study hospitals’ 2008/09 purchasing data.


10.4.2 Relative use of each type of stent at the study hospitals

We examined the proportion of drug-eluting stents used at the study hospitals in 2008/09 and found that for 3 of these hospitals, it was broadly in line with the 30% to 40% proportion expected when the guidelines are applied:

- RPAH – 20%
- GH – 35%
- JHH – 27%, 104

RPAH indicated that it used an algorithm based on lesion length, vessel size and whether the patient is diabetic to determine the type of stent to use (thus reflecting clinical guidelines). Its rate of restenosis was less than 10%. It also advised us that Concord Hospital also used this algorithm and had a similar restenosis rate.

However, we found that RNSH used a much higher proportion of drug-eluting stents than the other hospitals (70%). 105 The hospital indicated that this was because its clinicians consider that drug-eluting stents offer better results to patients.

Given the significant differences in practice in relation to drug-eluting stent use among the hospitals and the impact this may have on patient outcomes and costs, we recommend that this variation should be noted by NSW Health (Recommendation 17).

10.4.3 Prices paid for stents by the study hospitals

Both bare metal stents and drug-eluting stents are available from a wide range of suppliers. Overall, JHH used the greatest range of suppliers for stents, followed by RNSH, while RPAH used the fewest suppliers.

We also found that the prices the hospitals paid for both types of stent varied to some degree. Prices paid for bare metal stents ranged from around $400 to $800, while those for drug-eluting stents usually ranged from around $1,950 to $2,400.

In addition, we found many examples where the price paid for the same model of stent varied across hospitals. This can be seen in Appendix C (Table C1), which compares the prices paid by the hospitals for a sample of specific models of bare metal and drug-eluting stents.

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104 RPAH, GH and JHH stent usage data, 2008/09.
105 RNSH stent usage data, 2008/09.
10.4.4 Rankings of study hospitals based on prices paid for comparable stents

We used the ranking process described in Box 10.1 to provide a broad indication of whether the study hospitals tended to pay relatively high or low prices for the same products. We found that RPAH tended to pay the lowest price for comparable stents among the study hospitals. It paid the lowest price for 83% of the comparable stents it purchased in 2008/09. In comparison, GH paid the lowest price for 60% of the comparable stents it purchased, while JHH paid the lowest price for 33% and RNSH paid the lowest price for 20%.

To provide some specific examples, we noted that:

- The difference between the highest and lowest price paid for the same stent model across hospitals was $395 for bare metal stents and $450 for drug-eluting stents.
- RNSH paid the lowest price for its most frequently purchased bare metal stent model ($525 for Stent C), followed by RPAH ($650 for Stent E). In comparison, JHH and GH paid $800 for their most frequently purchased bare metal stent (Stent A).
- For drug-eluting stents, RPAH tended to pay the lowest prices – including $1,950 for its most frequently purchased model (Stent J). RNSH tended to pay the highest prices – including $2,400 for its most frequently purchased model (Stent G). GH and JHH paid $2,100 for their most frequently purchased models (Stent H and Stent G respectively).

Figure 10.1 compares the prices paid by the study hospitals for their most frequently purchased stent model of each type.

Figure 10.1 Prices paid by study hospitals for their most frequently purchased models of stent, 2008/09 ($)

Data source: Study hospitals’ purchasing databases. All frequent purchases and prices were checked by study hospitals.
10.4.5 Estimated potential annual savings from paying lowest price for most frequently purchased stents

We undertook a scenario analysis to estimate the hypothetical savings each of the hospitals could make if it purchased its most frequently purchased model of each type of stent at the lowest price paid by any study hospital for the same model.\textsuperscript{106} For each hospital, the estimated savings for each type of stent is equal to:

\begin{itemize}
\item the difference between the price it paid for its most frequently purchased model and the lowest price paid for this model among the hospitals, multiplied by
\item the estimated volume of that type of stent it used in 2008/09.
\end{itemize}

To estimate the volumes of stents it used, we took the total number of relevant patient cases in DRG F15Z\textsuperscript{107} and multiplied this by the percentage of bare metal or drug-eluting stents used by the hospital (based on its advice).

The analysis indicated that:

\begin{itemize}
\item JHH, RPAH and GH could not save anything, since they all purchased their most frequent purchased stent models at the lowest prices paid among the study hospitals.
\item RNSH could save 14\% on bare metal stents (for a hypothetical annual saving of $4,185) and 13\% on drug-eluting stents (for a hypothetical annual saving of $39,060). In aggregate, the hypothetical annual saving is $43,245.
\end{itemize}

Note that this analysis provides only a broad indication of the magnitude of savings available to each hospital, as we have assumed that all the stents used were the most frequently purchased model (and we know that this is not the case). More or less savings could be available, depending on the range and relative prices of the stent models the hospitals actually use and any change in the mix of stents used. Therefore, the estimated savings should be considered together with the findings on hospitals’ rankings to determine how the hospitals perform more generally on prices across different models (see section 10.4.4 above).

\textsuperscript{106} It was not possible to calculate scenarios on all purchased items since the share of each device used in the relevant DRG episodes could not be determined with any accuracy given the incomplete nature of the purchasing information.

\textsuperscript{107} DRG F15Z includes percutaneous coronary interventions without AMI and with stent implantations. Note our estimated volume excludes the stents that were used in treating cases in other DRGs where coronary stents are sometimes used, such as F10Z - percutaneous coronary intervention with AMI.
10.5 Patterns of use and prices paid for pacemakers

Prosthesis pacemakers are medical devices that use electrical impulses to regulate the beating of the heart. Their primary purpose is to maintain an adequate heart rate, either because the heart’s own pacemaker is not fast enough, or there is a block in the heart’s electrical conduction system. They are connected to the heart with leads, which are often purchased separately.

BLH does not undertake pacemaker procedures, so was omitted from our analysis.

10.5.1 Types of pacemaker

There are 3 main types of pacemaker – single chamber, dual chamber and biventricular. Each type comes in a range of models which can differ in a variety of ways, including in their electrical functionality. For example, they may be demand, fixed-rate or rate-responsive models. The degree of functionality required can vary, according to the patient’s condition and circumstances. The biventricular type tends to be used to treat chronic heart failure because it ensures that both ventricles contract together.

Clinical opinions differ on whether the newer dual chamber pacemakers are better than the single-chamber versions. Many physicians consider that dual chamber pacemakers are preferable for most patients (except for those with irregular heart rhythms (ie, chronic atrial fibrillation)). In terms of price, the dual chamber device usually costs around 50% more than the single chamber device (though the prices can vary considerably depending on type and functionality).

Leads by different suppliers are often fairly generic and compatible with different models of pacemakers.

10.5.2 Relative use of each type of pacemaker at the study hospitals

At RPAH, GH and RNSH, we found around 80% of the pacemakers used in 2008/09 were the single chamber device, while the other 20% were the dual chamber device (and only a small number were biventricular). At JHH, 51% were single chamber and 46% were dual chamber (with the remaining 3% being biventricular). It is not clear why the rate of single versus dual chambers at JHH is so different to the other hospitals. It may be due to a different patient mix or a stronger clinical preference for single chamber pacemakers at JHH.

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110 Study hospitals’ 2008/09 purchasing information.
111 Note that BLH did not purchase any pacemakers so was not included in this analysis.
During our hospital visits, clinicians at the different hospitals emphasised the importance of a range of factors (other than type and price) in choosing pacemaker models. Those at JHH indicated that for them, the battery life of the generator was one of the most important factors. At RNSH, clinicians noted that the associated service level provided by the suppliers was also very important (e.g., company representative being available at 2 am for an emergency).

At RPAH, clinicians emphasised that the surgeon’s familiarity with the pacemaker model and leads used can be more important than the actual model because negative outcomes such as dislodgement are more likely to arise from lack of familiarity than model choice. They also noted that while it was not unreasonable for the hospital to indicate what lead should be used in most cases, there should be some flexibility in this choice to accommodate a surgeon’s familiarities.

### 10.5.3 Prices paid for pacemakers and leads at the study hospitals

To compare the prices paid for pacemakers, we focused on the single chamber and dual chamber devices. (The study hospitals purchased so few biventricular pacemakers that we did not have enough information to enable price comparisons of this type.)

We found that these hospitals purchased most of their pacemakers from 4 main suppliers. RPAH tended to use the widest range of suppliers, followed by GH. RNSH used the fewest suppliers, which may indicate that the hospital was using the suppliers it entered into contracts with 5 years ago.

Prices paid for single chamber pacemakers tended to range from around $1,000 to $2,000 (though they could be as much as $4,000 to $6,000 for the more expensive models of single chamber pacemakers). Prices for dual chamber pacemakers tended to range from around $1,800 to $3,000 (although again, they could be much more for a few more expensive models). Although we did not compare prices for biventricular pacemakers, we note that the cheapest of this type that we identified on the hospitals’ databases was $7,200.

Appendix C (Table C2) compares the prices the hospitals paid for a sample of specific models of single chamber and dual chamber pacemakers. Figure 10.2 compares the prices they paid for their most frequently purchased model of each type of pacemaker and lead. These comparisons indicate that:

- The variation between the highest and lowest price paid for the same pacemaker model was more than $1,000.
- RPAH (which paid the SSWAHS area contract price for pacemakers) paid the lowest price for its most frequently purchased model of each type of pacemaker ($1,100 for the single chamber model and $1,850 for the dual chamber model).
- JHH also paid relatively low prices for its most frequently purchased model of each type ($1,500 for the single chamber and $2,050 for the dual chamber).
GH and RNSH paid relatively high prices for their most frequently purchased models of each type of pacemaker:

- GH paid $1,950 for the single chamber model and $2,800 for the dual chamber model.
- RNSH paid $2,300 for the single chamber and $2,900 for the dual chamber. This dual chamber model was the same as RPAH’s most frequently purchased dual chamber model, but RNSH paid more than $1000 more per pacemaker than RPAH.

However, the relativity between the hospitals was reversed for leads. Both RNSH and JHH paid the lowest price for their most frequently purchased model of lead (both $450). GH and RPAH also most frequently purchased this model. However, GH paid $475, and RPAH (which paid the area contract price) paid $500 – the highest price paid for leads among the study hospitals.

**Figure 10.2 Prices paid by study hospitals for their most frequently purchased models of pacemaker and lead, 2008/09 ($)**

![Bar chart showing prices for pacemaker and lead models](chart.png)

Data source: Study hospitals’ purchasing databases. All frequent purchases and prices were checked by study hospitals.

### 10.5.4 Rankings of study hospitals based on prices paid for comparable pacemakers and leads

We used the ranking process described in Box 10.1 to provide a broad indication of whether the study hospitals tended to pay relatively high or low prices for the same products. We found that JHH tended to pay the lowest price for comparable pacemakers and leads. It paid the lowest price among the study hospitals for 86% of the comparable pacemakers and leads it purchased in 2008/09. RPAH also paid relatively low prices — it paid the lowest price for 63% of the comparable pacemakers and leads it purchased.
In comparison, RNSH paid the lowest price for 46% of the comparable pacemaker and leads it purchased, and GH paid the lowest price for just 10% of comparable products. However, GH paid the second lowest price for 75% of the comparable pacemakers it purchased.

10.5.5 Estimated potential annual savings from paying lowest price for most frequently purchased pacemakers and leads

We undertook a similar scenario analysis as we did for stents to provide a broad indication of the savings available to each hospital by negotiating better prices for pacemakers and leads. For each hospital, we estimated the annual potential savings it could make if it purchased its most frequent purchased model of single chamber pacemaker, dual chamber pacemaker and lead in 2008/09 at the lowest price paid among the study hospitals for these models. For each hospital, the estimated saving for each product is equal to:

- the difference between the price it paid for its most frequently purchased model and the lowest price paid for this same model among the study hospitals, multiplied by
- the estimated volume of cases in which each type of pacemaker and leads were required in 2008/09.

To estimate the required volume for each type of pacemaker, we took the hospital’s total number of cases in the pacemaker DRGs (F12Z and F17Z)\(^{112}\) and applied the percentages of single chamber and dual chamber pacemakers it used (based on its advice).\(^{113}\) This analysis indicated that:

- JHH could not save anything, since it paid the lowest price for its most frequently purchased model of single chamber pacemaker, dual chamber pacemaker and lead.
- RPAH could not save anything on either type of pacemaker, since it paid the lowest price for its most frequently purchased model of each type. However, it could save 10% on leads (for a hypothetical annual saving of $8,950).
- GH could save 23% on single chamber pacemakers (for a hypothetical annual saving of $4,059), 25% on dual chamber pacemakers (for a hypothetical annual saving of $22,386), and 5% on leads (for a hypothetical annual saving of $1,025). This equals a total annual hypothetical saving of $27,470.

\(^{112}\) DRGs F12Z and F17Z include cardiac pacemaker implantations and cardiac pacemaker replacements.

\(^{113}\) As for stents, this means that our estimate of potential savings assumes that all pacemakers used are the most frequently purchased model. Therefore, our findings on potential savings should be considered together with how well the study hospitals ranked in terms of price comparisons across different model choices (section 10.8.3).
RNSH could achieve the most significant savings. It could save 15% on single chamber pacemakers (for a hypothetical annual saving of $15,680) and 36% on dual chamber pacemakers (for a hypothetical annual saving of $188,160), totalling $203,840. However, it could not save anything on leads.

We note that during our hospital visits, clinicians at RNSH indicated that their estimates show that the hospital could save around $180,000 as a result of its planned tender process for pacemakers and ICDs.114

10.6 Patterns of use and prices paid for implantable cardioverter defibrillators (ICDs)

Implantable cardioverter defibrillators (ICDs) are similar to pacemakers but are used to treat the more serious cardiology cases. They comprise a generator (which houses a battery and a tiny computer) and one or more leads.

Neither BLH nor GH performs ICD implantation procedures, so these hospitals were omitted from our analysis.

10.6.1 Types of ICD

Like pacemakers, ICDs come in 3 main types – single chamber, dual chamber and biventricular. The most appropriate type depends on the nature of the patient’s condition; however, the biventricular type is specifically used for patients with heart failure.

Research indicates there is little difference in the complication and mortality rates of patients who receive single chamber ICDs versus dual chamber ICDs115

In terms of purchase price, a single chamber ICD costs less than a dual chamber ICD. However, patients who are given a single chamber ICD because they do not have a clinical need for a dual chamber ICD at that time may need a dual chamber device at a later date if their condition deteriorates. The cost involved in upgrading their single chamber ICD would offset any savings made by initially selecting the cheaper single chamber type. Some research suggests that the least-costly strategy for most patient populations receiving ICD is to use dual chamber ICDs initially and thus reduce the potential need for future upgrades.116

114 IPART visit to RNSH, December 2009.
10.6.2 Prices paid for ICDs by the study hospitals

ICDs are usually purchased as a complete system (including both the generator and leads), so we have focused our price comparisons on complete systems. As with pacemakers, we were only able to compare the prices paid for 2 of the main types of ICD – the single chamber and dual chamber types – as there was insufficient purchasing data available on the biventricular type to make comparisons. In addition, the study hospitals made fewer purchases of directly comparable ICDs than they did of other prosthesis items, which meant we could only compare prices paid for a limited number of models (based on model name and product code rather than by feature or other functionality).

We found that the study hospitals purchased most of their ICDs from 4 main companies. There was considerable variation in the prices they paid for both single chamber and dual chamber ICDs, including significant variation in for the prices paid for the same model. Appendix C (Table C.3) lists the prices the hospitals paid for a sample of specific models.

Our main observations based on this sample were that:

- For single chamber ICDs, JHH paid $11,500 and RPAH paid between $11,000 and $14,000. However, RNSH paid significantly more – between $14,000 and $17,500.
- For dual chamber ICDs, JHH paid from $15,200 to $16,500 and RPAH paid from $13,095 to $18,000. Again, RNSH paid more – from $15,000 to $21,000.

Figure 10.3 compares the prices the hospitals paid for their most frequently purchased ICD model. It shows that RNSH paid higher prices for its most frequently purchased single chamber ICD ($15,900) and for its most frequently purchased dual chamber model ($21,000).
10.6.3 Rankings of study hospitals based on prices paid for comparable ICDs

As we did for stents and pacemakers, we ranked the hospitals using the process outlined in Box 10.1. We found that JHH paid the lowest price for all of the comparable ICDs it purchased, and RPAH paid the lowest price for 70% of the comparable ICDs it purchased. In contrast, RNSH paid the lowest price for only 15% of the comparable ICDs it purchased.

These findings indicate that when RNSH purchased ICDs directly comparable to those purchased by other study hospitals, it generally paid higher prices. However, please note that the study hospitals made much fewer purchases of comparable ICDs than of the other prosthesis items we examined, and therefore these findings on ICDs should be interpreted with caution.

10.6.4 Estimated potential annual savings from paying lowest price for most frequently purchased ICDs

As for stents and pacemakers, we used scenario analysis to estimate the potential annual savings available to each hospital if they had negotiated better prices for ICDs. For each hospital, the estimated saving is equal to:

- the difference between the price it paid for its most frequently purchased model of each type of ICD and the lowest price paid for this same model among the study hospitals, multiplied by
- the estimated volume of each type of ICD it required in 2008/09.
To estimate the volume for each type of ICD required by each hospital, we took its total number of cases in the relevant DRGs (F01A and F01B).\(^{117}\) Because we did not have reliable data on percentages of single chamber and dual chamber ICDs the hospitals used, we applied the percentages of single and dual chamber pacemakers the hospitals used (discussed in section 10.5.2 above). We acknowledge that these percentages may not be the same for ICDs, and may overestimate the proportion of dual chamber ICDs used.

This analysis indicated that:
- JHH and RPAH could not save anything, since they both paid the lowest price for their most frequently purchased model of single chamber and dual chamber ICD.
- RNSH could save 31\% on single chamber ICDs (for a hypothetical annual saving of $127,400) and 24\% on dual chamber ICDs on (for a hypothetical annual saving of $520,000). This is equal to a total potential annual saving of $647,400 on ICDs.

The size of RNSH’s potential saving stems from the finding that it paid around $5,000 more per ICD for its most frequently purchased model of each type of ICD than one of the other study hospitals. Again, we acknowledge that the total estimated savings may not be accurate, due to the same issues we noted in relation to stents and pacemakers,\(^{118}\) and due to the potential inaccuracy of our assumptions on the relative use of single and dual chamber ICDs.

### 10.7 Patterns of use and prices paid for intraocular lenses

In cataract surgery, an intraocular lens (IOL) is usually implanted into the eye to replace the existing lens which has been clouded over by a cataract. In general, this prosthesis consists of a small plastic lens with plastic side struts, called haptics, to hold the lens in place within the capsular bag inside the eye.\(^{119}\)

#### 10.7.1 Types of lenses

Lenses differ in terms of the material they are made from. Most IOLs fitted today are either acrylic or silicone (both of which are flexible). Some are still made of polymethylmethacrylate (PMMA), but this inflexible type has largely been superseded.

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\(^{117}\) DRGs F01A and F01B include implantation or replacement of AICD systems.

\(^{118}\) This is a hypothetical estimate of potential savings only. It assumes that all ICDs used are the most frequently purchased model. We know this is not true and that more or less savings may be achieved on other models purchased.

\(^{119}\) Niper Ahmedabad, Medical Devices Sector Analysis for Department of Pharmaceuticals, 8 May 2009.
Lenses also differ in terms of how they correct vision. The most common type are fixed monofocal lenses, which are matched to the patient’s distance vision. Other types include:

- **multifocal IOLs**, which provide the patient with multiple-focused vision at far and reading distance
- **toric IOLs**, which correct for specific vision problems such as astigmatism.\(^{120}\)

Of these, toric lenses tend to be used the most sparingly. For example, RPAH staff advised that the hospital uses around 3 toric lenses per month in total.\(^{121}\) Box 10.2 provides more information on these 3 types of lenses.

Ophthalmologists’ preferences for a particular type of lens are based on the ease of use in surgery, patient needs and quality issues (such as if the lens has a higher or lower risk of the patient requiring a laser capsulotomy).\(^{122}\)

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**Box 10.2 Main types of IOL in terms of vision-correction capability**

**Monofocal or traditional IOLs**

These are rigid lenses that provide clear vision at only one distance. Individuals with these types of lenses are required to wear external lenses for clear vision at other distances.

**Multifocal IOLs**

Multifocal IOLs have the ability to correct visions at all distances and come in 3 main types:

- **Multifocal refractive IOLs**, which are designed with several optical zones on the intraocular lens. These zones provide various focal points, allowing for an improvement in distance, intermediate, and near vision.

- **Multifocal apodized diffractive multifocal IOLs**, which have gradual diffractive steps on the intraocular lens implant that create a smooth transition between focal points. They also bend incoming light to the multiple focal points to increase vision in various lighting situations.

- **Multifocal accommodative IOLs**, which are designed to be flexible like a natural lens, changing shape as the distance of an object to the eye changes.

**Toric IOLs**

These lenses have a surface which is a combination of a sphere and a cylinder. They are used to correct specific vision problems, such as astigmatism.


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\(^{120}\) Allaboutvision.com (http://www.allaboutvision.com/conditions/iols.htm).

\(^{121}\) IPART visit to RPAH, December 2009.

\(^{122}\) Laser capsulotomy is a non-invasive procedure performed on the eye to remove the cloudiness that develops on the posterior capsule of the lens of the eye after extraction of a cataract (http://www.answers.com/topic/laser-posterior-capsulotomy).
10.7.2 Relative use of different types of lens at the study hospitals

The study hospitals purchased many more lenses than any of the other prosthesis items we examined, given the significant number of DRG episodes of cataract surgery. In terms of the types used, we found that the most frequently purchased types were acrylic monofocal lenses and silicone multifocal lenses. JHH and BLH purchased a higher proportion of silicone multifocal lenses than the other study hospitals.

10.7.3 Prices paid for lenses by the study hospitals

We found that the study hospitals used 3 companies to source the majority of the lenses they purchased, although a handful of other companies were also used. The prices they paid per lens were much lower than prices for the other prosthesis items we examined, and so the price variations we identified were also lower:123

- For both of the most frequently purchased types of lens – the acrylic monofocal and the silicone multifocal lens – the price paid by each hospital varied from $180 to $220.

- For the less frequently purchased, more sophisticated toric lens, the price paid was around $450.

Appendix C (Table C.4) compares the prices the hospitals paid for a sample of specific lens models (identified by product number and supplier). Our main observations in relation to this sample were that:

- The prices the hospitals paid for the same model of lens (both for the acrylic and silicone type) varied by $20 or less per lens.

- JHH paid the lowest prices for both acrylic and silicone lenses ($180 and $190, respectively).

- RPAH and BLH appeared to be the only hospitals to purchase the PMMA lenses. RPAH paid $140 to $156 for this type of lens, while BLH paid $220.

Figure 10.4 compares the prices the hospitals paid for their most frequently purchased model of lens (including all types). It shows that these prices varied by $30 per lens. They ranged from $190 (paid by JHH) to $220 (paid by RPAH and BLH).

123 For same-day cataract procedures where costs are low overall, the lens costs are around 13% of total costs, excluding overheads and depreciation.
### 10.7.4 Rankings of study hospitals based on prices paid for comparable lenses

We used the same approach to rank the hospitals in terms of the prices they paid for directly comparable lenses as we did for other prosthesis items. This analysis indicated that:

- **JHH** paid the lowest prices for 100% of the comparable lenses it purchased.
- **GH** paid the lowest price for 33% of the comparable lenses it purchased, and **RPAH** paid the lowest price for 25%.
- **RNSH** did not pay the lowest price for any of the comparable lenses it purchased, but paid second lowest price for 100% of these lenses.
- **BLH** did not pay the lowest price for any of the comparable lenses it purchased, and paid the highest price for 25% of these lenses.

### 10.7.5 Estimated potential annual savings from paying lowest price for most frequently purchased lenses

As for the other prosthesis items, we used scenario analysis to estimate the hypothetical annual savings available to each hospital if they had negotiated better prices for lenses. For each hospital, the estimated saving is equal to the difference between the price it paid for its most frequently purchased model of lens and the lowest price for that model, multiplied by the estimated volume of lenses it required in 2008/09. We calculated this volume of lenses by summing the total number of cases in the cataract surgery DRGs in that year (C16A and C16B).
We found that:

- RPAH could save 9% on multifocal, silicone lenses (for a hypothetical annual saving of $11,880).
- RNSH could save 2% on monofocal, acrylic lenses (for a hypothetical annual saving of $3,235).
- BLH could save 14% on multifocal, silicone lenses (for a hypothetical annual saving of $13,860).

Compared with the other prosthesis items we examined, the potential annual savings for hospitals through lower prices are much lower for lenses.

### 10.8 Patterns of use and prices paid for hip prostheses

A hip joint replacement is a surgical procedure whereby the diseased cartilage and bone of the hip joint is surgically replaced with artificial materials. This joint is a ball and socket joint: the ball is the femoral head (or head of the thigh bone), and the socket is a cup-shaped bone of the pelvis called the acetabulum.

There are 3 main categories of hip joint replacement procedure for which hip prostheses are required:

- primary partial hip replacement
- primary total hip replacement
- revision hip replacement.

These are explained in Box 10.3. In addition, there are 4 four main prosthesis components used in a total hip joint replacement procedure:

- the acetabular shell
- the liner or insert that goes between the acetabular shell and the femoral head (which are often made of polyethylene, but can also be made of other materials)
- the femoral head, and
- the hip stem implant.

The number of components required depends on whether the patient requires a partial hip replacement or a total hip replacement.

These components are illustrated in Figure 10.5.
Box 10.3 Types of hip joint replacement

Primary partial hip replacement
This procedure involves replacing the femoral head only. It accounted for 17% of all hip joint replacements in Australia in 2008. It is almost always used to treat broken (fractured) hips and is more common in elderly and frail patients.

Primary total hip replacement
This involves replacing both the femoral head and the acetabular shell. It accounted for 71% of all hip joint replacements in Australia in 2008. It is almost always used to treat severe arthritis, most commonly severe osteoarthritis. There are 2 major types of total hip replacement: conventional and resurfacing.

Revision hip replacement
Revisions occur when there is a need to revise a hip joint replacement procedure previously undertaken. They usually occur many years after the initial operation, and require all or some of the prosthesis components. The most common reason for revising a hip replacement is a condition called aseptic (non infective) loosening. This means that the replacement eventually becomes loose in the bone, which makes it painful to walk. Most often this is thought to occur because of an inflammatory reaction that develops around the replacement.

Revisions accounted for 12% of all hip replacements in Australia in 2008. The rate of revision varies depending on the type of hip prosthesis originally used. Procedures that used cementless types have a higher rate of revision than those that used either cemented and hybrid prostheses.

Figure 10.5 Prosthesis components used in hip joint replacements

Note: Not all hip components are required in all hip replacement or revision surgeries. Some components are single prosthesis components.

Source: Center for Minimally Invasive Surgery, Arkansas Orthopaedic Institute (www.misinstitute.com).

10.8.1 Types of hip prostheses

Each hip prosthesis component comes in a range of types, which vary in terms of the materials they are made of, the methods for fixing the individual components to each other and to the femur, and the price. There are also prostheses that do not involve separate components. These ‘all-in-one’ prostheses are known as monoprostheses.

In choosing between the different types, surgeons consider the condition and age of the patient, as some materials and fixing methods are considered preferable for younger patients (who typically have both longer lives ahead of them and more active lifestyles).

For example, acetabular shells and femoral heads can be made of ceramic or metal, while the liner or insert between these components can be polyethylene, ceramic or metal. The combination of surface materials used on these articulating components can influence the durability of the prosthesis and thus the need for revisions. Different options include metal on polyethylene (most common), ceramic on polyethylene, ceramic on ceramic and metal on metal. Metal on metal is often used on younger patients with osteoarthritis or rheumatoid arthritis of the hip because it conserves femoral bone, provides anatomical bone loading and eliminates polyethylene.\textsuperscript{124}

Whether or not the components require cement to fix them together and to the central core of femur can also influence durability. For example, using a cementless hip stem implant which fits tightly into the bone and is held in place by subsequent bone growth, is considered to have longer durability and to be especially suitable for younger patients. However, the cementless components are more expensive than those that require cement. Further, procedures which require cement have a lower risk of a revision.  

In partial hip replacements, Austin Moore and Thompson hemiarthroplasties are commonly used to manage subcapital neck of femur fractures, particularly in the frail elderly. The Austin Moore prostheses are also cementless but these are much less expensive than other the options and are only considered suitable for patients with limited mobility.

10.8.2 Prices paid for hip prostheses by the study hospitals

For hip prostheses, we compared the prices paid for individual prosthesis components, and the prices they paid for their most frequently purchased model of each component. This enabled a like-with-like comparison of product choices and prices, since surgeons can mix and match different hip components to some degree. (Note that in this section, RPAH includes IRO because the bulk of RPAH’s planned hip joint replacement surgery is done at IRO.)

As section 10.3.1 discussed, an area-level threshold pricing policy applied to RPAH and BLH’s purchases of orthopaedic prostheses. This policy places a ceiling on the price each hospital can pay per total hip prosthesis (ie, all the required components per case). In 2008/09, the threshold price for BLH ranged from $6,000 to $10,000 across 3 suppliers, and for RPAH it ranged from $3,500 to $14,000 across a single supplier.

However, at the study hospitals we found that the prices paid for individual components varied significantly:

- The price for most acetabular shell models ranged from $2,000 to $3,000, but was as high as $3,500 to $4,500 for porous coated, metal or cementless models.
- The price for the liner (or insert) ranged from $1,500 to $1,800 for polyethylene models, and $2,000 to $2,500 for alumina models. The price for ceramic models was anywhere between $2,000 and $5,000 (though a common price was $3,500).
- The price for femoral heads was as low as $400 to $600 for one particular model, but could cost anywhere up to around $2,500 for other models.

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127 For other prostheses examined, RPAH does most of the surgeries.
The prices for hip stem implants were as low as $400 to $600 for 2 particular models, but were mainly between $2,000 to $5,000.

These variations underline how widely the total cost of a hip prosthesis can vary per patient, depending on the particular model of each component used.

Appendix C (Table C.5) compares the price paid by the study hospitals for a sample of specific models of each of the 4 main components. Table 10.3 shows the type, model and price paid for each study hospital’s most frequently purchased model of each component in 2008/09. Figure 10.6 compares the price paid for these models in graph form. The table indicates that there was considerable consistency in the type and model of each component the hospitals’ most frequently purchased. In most cases, these models were supplied by the same global orthopaedic medical technology supplier.

However, for some components, there were some key differences. In particular, JHH’s most frequently purchased femoral head was the more expensive ceramic type, while other study hospitals’ were the metallic type. Also, RNSH’s most frequently purchased acetabular shell was the more expensive hemi porous coated type, while most hospitals’ were the hydroxyapatite covered type.

As noted above, a hospital’s patient mix is an important driver of the types of prostheses it most frequently uses. However, it is also clear that orthopaedic surgeons’ own preferences and philosophies can also influence their prostheses purchases.
Table 10.3 Most frequently purchased hip prosthesis components by study hospital, 2008/09

<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>Acetabular shell</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Shell C (HA)</td>
<td>Shell C (HA)</td>
<td>Shell E (PC)</td>
<td>Shell C (HA)</td>
<td>Shell A (PC)</td>
</tr>
<tr>
<td>Supplier</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 4</td>
<td>Supplier 2</td>
<td>Supplier 1</td>
</tr>
<tr>
<td>Price ($)</td>
<td>2,300</td>
<td>2,900</td>
<td>3,094</td>
<td>2,600</td>
<td>2,450</td>
</tr>
<tr>
<td><strong>Liner/insert</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Liner/Insert B</td>
<td>Liner/Insert B</td>
<td>Liner/Insert B</td>
<td>Liner/Insert B</td>
<td>Liner/Insert B</td>
</tr>
<tr>
<td>Supplier</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
</tr>
<tr>
<td>Price ($)</td>
<td>1,300</td>
<td>1,836</td>
<td>1,500</td>
<td>1,400</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Femoral head</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Femoral Head E</td>
<td>Femoral Head E</td>
<td>Femoral Head E</td>
<td>Femoral Head E</td>
<td>Femoral Head B</td>
</tr>
<tr>
<td>Supplier</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 1</td>
</tr>
<tr>
<td>Price ($)</td>
<td>780</td>
<td>718</td>
<td>810</td>
<td>600</td>
<td>2,100</td>
</tr>
<tr>
<td><strong>Hip stem implant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Hip Stem C</td>
<td>Hip Stem C</td>
<td>Hip Stem C</td>
<td>Hip Stem C</td>
<td>Hip Stem C</td>
</tr>
<tr>
<td>Supplier</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
<td>Supplier 2</td>
</tr>
<tr>
<td>Price ($)</td>
<td>2,000</td>
<td>1,873</td>
<td>2,500</td>
<td>2,390</td>
<td>2,100</td>
</tr>
</tbody>
</table>

**Note:** “HA” = Hydroxyapatite covered, “PC” = porous coated.

**Data source:** Study hospitals’ purchasing databases and direct advice to IPART. All frequent purchases and prices were checked by study hospitals.
Figure 10.6 Prices study hospitals paid for their most frequently purchased model of each hip prosthesis component, 2008/09 ($)

Data source: Study hospitals’ purchasing databases. All frequent purchases and prices were checked by study hospitals.

10.8.3 Rankings of study hospitals based on prices paid for comparable hip prosthesis components

We used the same approach to rank the hospitals in terms of the prices they paid for directly comparable hip prosthesis components as we did for the other prosthesis items. This analysis indicated that:

- GH and BLH paid relatively lower prices than the other study hospitals. They paid the lowest price for 55% and 50% of their comparable purchases of hip prosthesis components respectively.
- JHH and RPAH both paid the lowest price for 38% of their comparable purchases.
- RNSH paid the lowest price for only 13% of its comparable purchases.

10.8.4 Estimated potential annual savings from paying lowest price for most frequently purchased hip prosthesis components

As for the other prosthesis items, we looked at the potential savings available to each study hospital if it negotiated better prices for hip prostheses. For each component, we estimated the annual savings each hospital could hypothetically make if it purchased the total volume of the component it required in 2008/09 at the lowest price paid for its most frequently purchased model of that component by any study hospital. We calculated this volume by summing the total number of hip replacement cases each hospital treated that year (DRGs I03A, I03B and I03C).128

128 DRGs I03A, I03B and I03C include hip replacements and revisions.
Our analysis indicated that all study hospitals could make savings on hip prosthesis components. However, GH, RNSH and JHH had the greatest potential savings:

- **GH** could save a total of $323,532 on hip prosthesis components – including 21% on acetabular shells (for a hypothetical annual saving of $154,800), 29% on liners/inserts (for a hypothetical annual saving of $138,288) and 16% on femoral heads (for a hypothetical annual saving of $30,444).

- **JHH** could save a total of $150,304 – including 13% on liner/inserts (for a hypothetical annual saving of $70,400) and 11% on hip stem implants (for a hypothetical annual saving of $79,904).

- **RNSH** could save a total of $135,847 – including 13% on liners/inserts (for a hypothetical annual saving of $26,200), 26% on femoral heads (for a hypothetical annual saving of $27,510) and 25% on hip stem implants (for a hypothetical annual saving of $82,137).

- **BLH** could save a total of $123,795 – including 12% on acetabular shells (for a hypothetical annual saving of $40,500), 7% on liners/inserts (for a hypothetical annual saving of $13,500) and 22% on hip stem implants (for a hypothetical annual saving of $69,795).

- **RPAH** could save a total of $25,788 – including 23% on femoral heads (for a hypothetical annual saving of $15,120) and 6% on hip stem implants (for a hypothetical annual saving of $10,668).

**10.9 Implications of our findings on prosthesis costs for hospital approaches to prosthesis purchasing**

Overall, our analysis highlights that potential savings in prosthesis purchasing costs can be made through negotiation of lower prices for frequently purchased prostheses. At the time of our study, the study hospitals did not usually share information on the prices they pay for prostheses with other hospitals, often not even with hospitals within the same area. As a result, some hospitals do not realise when other hospitals are paying much less for exactly the same items.

The hospitals that paid relatively low prices for prostheses were generally those that engaged in regular price agreements with suppliers. For example, RPAH and BLH benefited from lower costs as a result of the SSWAHS’s threshold pricing approach in orthopaedics and associated supplier agreements. RPAH also benefited substantially from this AHS’s tender process for pacemakers and ICDs. Similarly, JHH benefited from a range of price agreements for its prostheses (including pacemakers and ICDs). RNSH staff indicated that the hospital is likely to achieve considerable savings through the pacemaker and ICD tender process it plans to introduce.\(^\text{129}\)

\(^{129}\) IPART visits to study hospitals, November to December 2009.
During our hospital visits, hospital staff indicated that they consider there is scope for more organised purchasing or broader supply agreements of some prostheses items. They noted that the smaller hospitals, in particular, would benefit from area-wide tenders since they often lack the bargaining power that the larger hospitals have in price negotiations. In addition, they noted that area-wide tenders usually require fewer resources for negotiation compared to when hospitals negotiating prices themselves individually.

This raises the question as to whether or not some prosthesis items would be better purchased at the state-level, since the bargaining power would be even greater. The current state-wide tender process in health involves procurement of food, linen and other medical consumables being negotiated at the centralised level by NSW Health Supply.

On the other hand, clinicians put the view that state-wide tenders could potentially stifle competition and innovation in the supply of prostheses. They also emphasised the need for some flexibility in the system to allow clinicians some choice in meeting individual patient needs and, at times, to accommodate their own familiarity with certain types or models to ensure the safety of the patient. Further, we acknowledge that hospitals have varying needs for prosthesis items due to their different patient mix, and may have different interests to the state hospital system as a whole.

However, our pricing comparisons provide solid evidence that more organised approaches by hospitals or areas to purchasing, and some controls on clinicians’ product choices, do lead to savings on frequently purchased prostheses. In addition, RPAH demonstrated the benefit of having a dedicated business manager to negotiate price reductions on behalf of an individual hospital (although we recognise that this approach may not be cost-effective at smaller hospitals).

Recommendations

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.
10.10 Estimated prosthesis costs per patient across study hospitals, based on NHCDC data

Australian hospitals provide estimates of their prosthesis costs per patient (for DRGs that involve prostheses) as part of the information that is submitted annually for the NHCDC. We examined the study hospitals’ final NHCDC estimates of their average prosthesis costs per patient for 2008/09. We also examined the estimate of the national average prosthesis cost per patient in the NHCDC for the previous year (2007/08). This enabled us to gauge how reasonable the study hospitals’ estimates were.

As Table 10.4 shows, the study hospitals reported a wide range of average prosthesis costs per patient. In some cases, the reported costs appeared to be unreliable. For example, the average stent cost per patient reported by JHH and RPAH were just $2 and $123 respectively, while the average hip prosthesis cost per patient reported by BLH and JHH was also very low. In addition, the level of variation in study hospitals’ average lens cost per patient seems unlikely to be accurate, given our findings that the variations in lens purchase prices are relatively small (see section 10.7.3). Further, in most cases, the study hospitals’ reported cost estimates are below the national public hospital average cost reported for 2007/08.

The costs reported by RNSH and GH appear to be the most reasonable among the study hospitals, which may reflect the access to patient-level expenditure data at these hospitals.
Prosthesis costs

Table 10.4 Study hospitals’ average prosthesis cost per patient for selected DRGs as reported to the NHCDC (2008/09) and the national public hospital average prosthesis cost per patient included in the NHCDC (2007/08)

<table>
<thead>
<tr>
<th>DRG</th>
<th>DRG description</th>
<th>Prosthesis</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>National public hospital average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>F15Z</td>
<td>Percutaneous coronary intervention w/o AMI w stent implantation</td>
<td>Stent</td>
<td>123</td>
<td>2,042</td>
<td>1,504</td>
<td>na</td>
<td>2</td>
<td>1,279</td>
</tr>
<tr>
<td>F12Z</td>
<td>Cardiac pacemaker implantation</td>
<td>Pacemaker and lead</td>
<td>652</td>
<td>5,191</td>
<td>3,808</td>
<td>145</td>
<td>119</td>
<td>3,260</td>
</tr>
<tr>
<td>F17Z</td>
<td>Cardiac pacemaker replacement</td>
<td>Pacemaker and lead</td>
<td>321</td>
<td>3,619</td>
<td>2,646</td>
<td>na</td>
<td>50</td>
<td>3,283</td>
</tr>
<tr>
<td>F01A</td>
<td>Implantation or replacement of AICD total system w cs cc</td>
<td>ICD</td>
<td>1,676</td>
<td>na</td>
<td>19,611</td>
<td>na</td>
<td>95</td>
<td>13,953</td>
</tr>
<tr>
<td>F01B</td>
<td>Implantation or replacement of AICD total system w/o cs cc</td>
<td>ICD</td>
<td>1,578</td>
<td>na</td>
<td>18,821</td>
<td>na</td>
<td>18</td>
<td>12,253</td>
</tr>
<tr>
<td>F02Z</td>
<td>AICD component implantation/replacement</td>
<td>ICD</td>
<td>976</td>
<td>na</td>
<td>6,195</td>
<td>251</td>
<td>76</td>
<td>7,879</td>
</tr>
<tr>
<td>C16A</td>
<td>Lens procedures</td>
<td>Lens</td>
<td>305</td>
<td>186</td>
<td>136</td>
<td>259</td>
<td>195</td>
<td>252</td>
</tr>
<tr>
<td>C16B</td>
<td>Lens procedures, same day</td>
<td>Lens</td>
<td>261</td>
<td>177</td>
<td>129</td>
<td>272</td>
<td>154</td>
<td>249</td>
</tr>
<tr>
<td>I03A</td>
<td>Hip revision w cs cc</td>
<td>Hip prostheses</td>
<td>5,111</td>
<td>5,859</td>
<td>4,344</td>
<td>1,386</td>
<td>855</td>
<td>7,862</td>
</tr>
<tr>
<td>I03B</td>
<td>Hip replacement w cs cc or hip revision w/o cs cc</td>
<td>Hip prostheses</td>
<td>4,999</td>
<td>3,490</td>
<td>2,577</td>
<td>815</td>
<td>676</td>
<td>4,541</td>
</tr>
<tr>
<td>I03C</td>
<td>Hip replacement w/o cs cc</td>
<td>Hip prostheses</td>
<td>3,973</td>
<td>4,433</td>
<td>3,266</td>
<td>746</td>
<td>632</td>
<td>5,611</td>
</tr>
</tbody>
</table>

Note: “w” = with; “w/o” = without; “cs cc” = catastrophic or severe consequences, ICD = Implantable cardioverter-defibrillator.

DRG F10Z is excluded because there are many coronary interventions which do not require stents and so cost estimates would not represent average stent costs for patients receiving stents.

11 Imaging costs

Imaging tests are an increasingly important diagnostic tool in healthcare. By facilitating timely, accurate diagnosis, imaging can help ensure that a patient’s condition is appropriately treated at an early stage. Thus, it can prevent or reduce the length of hospital stays, and improve patient outcomes. However, some imaging tests are costly, so unnecessary or inappropriate tests waste resources. In addition, over-use of certain tests can lead to adverse patient outcomes.\(^\text{130}\)

To better understand and compare the use and cost of imaging tests across hospitals, we calculated the number of each common test type used at each study hospital in our case study areas. We attributed a value to each test type, then estimated the hospitals’ average imaging costs per patient in each area. We also compared our estimated costs per patient with estimates based on data in the NHCDC. In addition, we looked at the study hospitals’ protocols for managing the use of imaging, and how they and the healthcare system currently use available imaging data, and how they can make better use of this data.

The sections below summarise our overall findings on imaging costs, then discuss our analysis and findings in more detail. Box 11.1 outlines the differences in the availability of imaging services across the study hospitals. Box 11.2 provides an overview of the approach we used to estimate the value of each imaging test type and imaging costs per patient.

Box 11.1 Availability of imaging services at study hospitals

The imaging tests available at the study hospitals varied, depending on the size of the hospital. Not all of the hospitals had access to in-hospital imaging services for all tests 24 hours a day, 7 days a week.

Most of the study hospitals had general X-Ray services available at all times. After hours, most had on-call access to more complex imaging procedures such as CT scans, MRIs, angiographies, ultrasounds and fluoroscopy.

However, BLH did not have in-hospital access to MRIs at any time. GH had on-call access to more complex imaging tests after hours. It also used a private imaging company to provide on-call fee-for-service imaging to cover for staff specialists.

\(^{130}\) For example, the overuse of X-Rays can increase the incidence of radiation-related cancers.
11.1 Summary of findings on imaging costs

At the case study level, we found that:

- Certain conditions or procedures – including stroke, tracheostomy and cardiology – were associated with much higher imaging costs per patient than others at all hospitals.

- For most conditions, emergency cases also involved much higher imaging costs than planned cases.

- There was considerable variability in our estimates of imaging costs per patient across the study hospitals, as well as between these estimates and those included in the NHCDC. RNSH’s and GH’s NHCDC estimates of imaging costs were the most consistent with our estimates, while those for RPAH and BLH varied the most from our estimates.

At the hospital level, we found that:

- There were differences in the study hospitals’ protocols for managing imaging use (and therefore controlling the associated costs). JHH appeared to have generally sound controls, including a requirement that approval from a senior clinician be obtained before high-cost tests are used (ie, out-of-hours MRIs and CT scans). However, RNSH’s guidelines appeared likely to increase its imaging use in some cases, and may partly explain the relatively high use of MRI and CT scans for emergency cases at this hospital.

In relation to using imaging data, we found that:

- Not all imaging services provided detailed information to the study hospitals on their imaging use.

- Not all hospitals routinely provided information on the numbers and types of test used to heads of clinical units or individual clinicians.

- None of the study hospital’s internal charging arrangements for imaging services reflected the actual costs of the services they used. Instead, they were based on an agreed aggregate budget for imaging services per year.

- Not all area health services were using imaging data for their clinical costing, and those that were using this data were not doing so on a consistent basis.

- At the time of our study, files containing information on imaging use at the patient level were provided for the NHCDC, but this information was not being used for benchmarking or comparing patterns of practice, or to calculate clinical performance measures.

- Imaging data is currently not standardised to make it suitable for routine use for costing and clinical improvement.
We consider that imaging data could be better used to compare and improve clinical practice. For example, these data could be particularly useful for comparing practices and outcomes for stroke and cholecystectomy cases. Imaging data could also be better used to improve the quality of clinical cost estimates. For example, area health services should use patient-level imaging data for this purpose, and value each type of tests based on the actual cost of service delivery, or another standard basis.

To facilitate better use of imaging data, the format of the data collected at the patient level should be standardised, and this data should be shared. Standardising the data would not be a difficult task and would assist clinicians and health managers to better understand the variation in cost and practice patterns.

NSW Health may need to review imaging services’ and hospitals’ internal charging arrangements, and consider whether standard charging arrangements should be applied across NSW or a service-specific charge based on actual imaging costs should be applied.

**Box 11.2 How we estimated average imaging costs at the hospital and case study levels**

The main types of imaging tests include general imaging (such as X-Ray), CT, ultrasound, angiography, fluoroscopy, interventional, MRI, nuclear medicine and mammography tests. Due to the limited time available for this study, and the large number of tests, test types and tests within each type, we did not do a ‘bottom up’ costing of imaging (based on the costs of imaging staff time, a value of machine use, use of chemicals etc). Nor did we calculate the total number of imaging tests used at each hospital.

Instead, we limited the focus of our analysis to our 11 case study areas. For each of these areas, we:

- Obtained ‘test level’ data for each study hospital from its area health service’s imaging system, and calculated the number of each test type used in 2008/09.
- Attributed a dollar value to each test type equal to 100% of the MBS rate for this test. This ensured we attributed these values on a consistent basis, and that the hospital’s different internal charging practices would not affect the analysis of their imaging use.
- Applied the number of each test type to its attributed value, and summed the results to provide the estimated imaging costs for each area and each hospital.

To estimate the average imaging costs per patient, we divided the total estimated value of imaging in each case study grouping or subgrouping by the total number of patients. Note that the number of patients included all cases in that grouping/subgrouping, not only those who had an imaging test during their hospital stay.
11.2 Imaging use at the hospital level

As Box 11.2 discussed, we did not calculate the total number of imaging tests used at each study hospital, or estimate the total value of these tests. Instead, we focused only on the tests used in our case study areas. As a rough indication of the magnitude of costs associated with imaging, we estimated that the total value of these tests for all 11 case studies and all study hospitals (including the IRO) in 2008/09 was $5.7 million.\textsuperscript{131}

Table 11.1 shows the total number of imaging tests used in these areas at each hospital, and the number of selected test types. Note that given that the study hospitals have different numbers of patients and different casemixes (cases with different levels of complexity), a higher imaging use at a particular hospital does not necessarily indicate excessive imaging use.

Table 11.1 Number of imaging tests used in the 11 case study areas at each study hospital, by test type, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>1,432</td>
<td>6</td>
<td>1,469</td>
<td>1,977</td>
<td>1,028</td>
<td>1,451</td>
<td>7,363</td>
</tr>
<tr>
<td>Angiography</td>
<td>111</td>
<td>-</td>
<td>47</td>
<td>147</td>
<td>-</td>
<td>59</td>
<td>364</td>
</tr>
<tr>
<td>MRI</td>
<td>58</td>
<td>1</td>
<td>54</td>
<td>297</td>
<td>-</td>
<td>182</td>
<td>592</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>385</td>
<td>6</td>
<td>209</td>
<td>416</td>
<td>-</td>
<td>501</td>
<td>1,517</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>67</td>
<td>1</td>
<td>231</td>
<td>721</td>
<td>279</td>
<td>328</td>
<td>1,627</td>
</tr>
<tr>
<td>Other\textsuperscript{a}</td>
<td>11,910</td>
<td>538</td>
<td>6,045</td>
<td>9,125</td>
<td>5,178</td>
<td>9,152</td>
<td>41,948</td>
</tr>
<tr>
<td>Total</td>
<td>13,963</td>
<td>552</td>
<td>8,055</td>
<td>12,683</td>
<td>6,485</td>
<td>11,673</td>
<td>53,411</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Includes general imaging (eg X-Ray), interventional, nuclear medicine, and mammography.

**Note**: Includes tests in IPART’s 11 case study areas only; includes emergency and planned admissions; includes episodes that occurred completely within the 2008/09 financial year only.

**Source**: IPART analysis using data from imaging systems from area health services, 2008/09.

The individual test types shown on this table were selected because they are high-cost tests. Box 11.3 provides the MBS fee of some common tests within these types.

\textsuperscript{131} As another indication of the magnitude of imaging costs, the public NHCDC data suggests that imaging costs comprised 3.1% of total inpatient costs in Australia in 2007/08, up from 2.9% in 2002/03. See National Hospital Cost Data Collection, Cost Report Round 12 (2007/08), September 2009, p 30; and National Hospital Cost Data Collection, Cost Report Round 7 (2002/03), December 2004, p 27.
Box 11.3 Sample common high-cost imaging tests and their MBS rates

- For CT scans, the most commonly conducted scans are ‘CT scans of the brain without intravenous contrast medium’ (MBS Item# 56001). The MBS fee for this test is $195.05.

- For angiography, the most common test is ‘examination of the head and neck with or without aortography’ (MBS Item#60009). This test has an MBS fee of $1,376.30.

- For MRIs, the most commonly conducted scans are ‘scans of the head and neck vessels’ (MBS Item# 63101), which have an MBS fee of $492.80.

Source: IPART analysis using data from hospital imaging services and the Australian Department of Health and Ageing (http://www9.health.gov.au/mbs/search.cfm?q=63101&sopt=i (as at 3/5/10)).

11.3 Estimated imaging cost per patient at the case study level

In estimating the imaging cost per patient at the case study level, we divided patients in selected case study areas into emergency and planned admissions. Emergency cases usually require more diagnostic tests such as imaging, so it was useful to distinguish between emergency and planned cases. We also compared our estimates of the imaging cost per patient with estimates of this cost based on NHCDC data.
11.3.1 Imaging cost per patient for emergency and planned admissions

Table 11.2 shows our estimated average imaging cost per patient for selected patients that are either emergency or planned admissions.

Table 11.2 Average imaging cost per patient at the case study level – emergency and planned admissions, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH ($)</th>
<th>IRO ($)</th>
<th>GH ($)</th>
<th>RNSH ($)</th>
<th>BLH ($)</th>
<th>JHH ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholecystectomy -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Emergency)</td>
<td>348</td>
<td>-</td>
<td>450</td>
<td><strong>532</strong></td>
<td>381</td>
<td>272</td>
</tr>
<tr>
<td>Cholecystectomy -</td>
<td>28</td>
<td>-</td>
<td>83</td>
<td><strong>138</strong></td>
<td>56</td>
<td>76</td>
</tr>
<tr>
<td>(Planned)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip replacement -</td>
<td>430</td>
<td>-</td>
<td>392</td>
<td>328</td>
<td><strong>456</strong></td>
<td>317</td>
</tr>
<tr>
<td>Fracture (Emergency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip replacement -</td>
<td>281</td>
<td>126</td>
<td>157</td>
<td>137</td>
<td>127</td>
<td>94</td>
</tr>
<tr>
<td>Arthritis (Planned)a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major chest procedure</td>
<td>435</td>
<td>-</td>
<td>-</td>
<td>442</td>
<td>-</td>
<td><strong>566</strong></td>
</tr>
<tr>
<td>- Pneumothorax (Emergency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major chest procedure</td>
<td>331</td>
<td>-</td>
<td>-</td>
<td><strong>507</strong></td>
<td>-</td>
<td>371</td>
</tr>
<tr>
<td>- Malignancy (Planned)b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**a** Hip replacements – arthritis: RPAH arthritis cases are not a typical arthritis group (only 17 cases) and ‘normal’ arthritis cases are handled at IRO.

**b** Major Chest – malignancy - there were only a small number of cases for malignancy at RNSH.

**Note:** Total imaging cost based on 100% MBS fee for each test. Highest cost facility for this subgroup highlighted in yellow.

**Source:** Imaging systems from area health services and IPART analysis, 2008-09 (only episodes that occur completely within the 2008/09 financial year).

When comparing the average cost per patient across the case study areas, the table shows that for certain patient groups, patients who are admitted through the emergency department sometimes involve much higher imaging costs because their diagnosis may be unclear or unknown at the time of admission, whereas for planned admissions, diagnosis should be known. In addition, for planned cases, imaging may have been previously undertaken out of hospital.

RNSH appeared to have the highest imaging cost per patient in 3 of the above clinical areas, mainly due to its higher MRIs and CT scan usage.

11.3.2 Comparison with NHCDC imaging cost per patient

As discussed in Chapter 7, we compared our estimates of the average imaging cost per patient in each case study grouping or subgrouping with estimates calculated using data provided by the area health services to the NSW Department of Health for the NHCDC. The results of this analysis are shown on Table 11.3.
We found that there was a fair degree of variability between hospitals in imaging costs in both our estimates and the NHCDC. However, there was greater variability in the NHCDC costs for some subgroupings. For example, for hip joint replacement for arthritis, our estimates of the average cost per patient ranged from $94 to $156 across hospitals, whereas the NHCDC costs ranged from $36 to $516. For caesarean delivery, our estimates ranged from $3 to $29, while the NHCDC estimates ranged from $20 to $226. Comparing hospitals, we found that the NHCDC imaging estimates for RNSH and GH were the most consistent with our estimates, while the NHCDC estimates for JHH were consistently higher than our estimates. The NHCDC estimates for RPAH and BLH varied the most from our estimates, probably due to the top-down cost allocation methods used by SSWAHS. (See Table 11.4. Cost allocation methods are discussed in Chapter 7.)

In addition, we identified some clear anomalies in the estimates based on NHCDC data. For example, we would expect that the average imaging cost per patient for cataract/lens procedures would be very low, as imaging tests are not usually required for this procedure. Our estimates of this cost were close to zero for all hospitals. However, the NHCDC cost for RPAH was $81 and for BLH it was $99. This is unlikely to be accurate, and probably reflects the cost allocation methods used by the area health service. In our view, this finding suggests that data in the NHCDC at the DRG level is not always sufficiently reliable or consistent to provide a basis for comparing hospital costs.
Table 11.3 Comparison on IPART’s estimates of imaging costs per patient for selected patient groups and estimates based on National Hospital Cost Data Collection data, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPART</strong></td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
</tr>
<tr>
<td><strong>NHCDC</strong></td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
<td>($)</td>
</tr>
<tr>
<td><strong>RPAH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataract/lens procedure</td>
<td>1</td>
<td>81</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>-</td>
<td>-</td>
<td>126</td>
<td>36</td>
<td>157</td>
<td>175</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>430</td>
<td>587</td>
<td>-</td>
<td>392</td>
<td>397</td>
<td>328</td>
</tr>
<tr>
<td>Major chest procedures – Pneumothorax</td>
<td>435</td>
<td>410</td>
<td>-</td>
<td>442</td>
<td>385</td>
<td>-</td>
</tr>
<tr>
<td>Major chest procedures – Malignancy</td>
<td>331</td>
<td>533</td>
<td>-</td>
<td>507</td>
<td>499</td>
<td>-</td>
</tr>
<tr>
<td>Obstetrics delivery - Caesarean section</td>
<td>18</td>
<td>195</td>
<td>-</td>
<td>12</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Obstetrics delivery - Vaginal delivery</td>
<td>4</td>
<td>148</td>
<td>-</td>
<td>3</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Stroke B70A</td>
<td>721</td>
<td>1286</td>
<td>-</td>
<td>824</td>
<td>946</td>
<td>1105</td>
</tr>
<tr>
<td>Stroke B70B</td>
<td>761</td>
<td>671</td>
<td>-</td>
<td>696</td>
<td>769</td>
<td>999</td>
</tr>
<tr>
<td>Stroke B70C</td>
<td>717</td>
<td>307</td>
<td>-</td>
<td>557</td>
<td>673</td>
<td>1060</td>
</tr>
<tr>
<td>Cardiology – AMI</td>
<td>88</td>
<td>206</td>
<td>-</td>
<td>121</td>
<td>121</td>
<td>87</td>
</tr>
<tr>
<td>Cardiology – Angina/ Chest pain</td>
<td>50</td>
<td>102</td>
<td>-</td>
<td>134</td>
<td>104</td>
<td>129</td>
</tr>
</tbody>
</table>

Note: The table compares IPART’s estimates of imaging costs per patient for selected patient groups with estimates based on National Hospital Cost Data Collection (NHCDC) data for the year 2008/09.
## Imaging costs

<table>
<thead>
<tr>
<th>Procedure</th>
<th>RPAH IPART ($)</th>
<th>RPAH NHCDC ($)</th>
<th>IRO IPART ($)</th>
<th>IRO NHCDC ($)</th>
<th>GH IPART ($)</th>
<th>GH NHCDC ($)</th>
<th>RNSH IPART ($)</th>
<th>RNSH NHCDC ($)</th>
<th>BLH IPART ($)</th>
<th>BLH NHCDC ($)</th>
<th>JHH IPART ($)</th>
<th>JHH NHCDC ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendicectomy DRG G07A</td>
<td>457</td>
<td>297</td>
<td>-</td>
<td>-</td>
<td>484</td>
<td>405</td>
<td>505</td>
<td>405</td>
<td>560</td>
<td>339</td>
<td>326</td>
<td>574</td>
</tr>
<tr>
<td>Appendicectomy DRG G07B</td>
<td>100</td>
<td>136</td>
<td>-</td>
<td>-</td>
<td>124</td>
<td>91</td>
<td>150</td>
<td>136</td>
<td>136</td>
<td>168</td>
<td>104</td>
<td>115</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency (Incl. transfer ins)</td>
<td>348</td>
<td>182</td>
<td>-</td>
<td>-</td>
<td>450</td>
<td>547</td>
<td>532</td>
<td>619</td>
<td>381</td>
<td>218</td>
<td>272</td>
<td>334</td>
</tr>
<tr>
<td>Cholecystectomy – Elective</td>
<td>28</td>
<td>151</td>
<td>-</td>
<td>-</td>
<td>83</td>
<td>149</td>
<td>138</td>
<td>262</td>
<td>56</td>
<td>169</td>
<td>76</td>
<td>145</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>5</td>
<td>174</td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>28</td>
<td>283</td>
<td>538</td>
<td>38</td>
<td>214</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Breast surgery – Excision of lesion – malignant</td>
<td>6</td>
<td>144</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>82</td>
<td>234</td>
<td>523</td>
<td>2</td>
<td>187</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tracheostomy or ventilation &gt; 95hrs</td>
<td>2,130</td>
<td>2,122</td>
<td>-</td>
<td>-</td>
<td>1,741</td>
<td>1,970</td>
<td>2,852</td>
<td>2,823</td>
<td>2,102</td>
<td>2,195</td>
<td>1,538</td>
<td>2,142</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>47</td>
<td>193</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>37</td>
<td>20</td>
<td>13</td>
<td>35</td>
<td>241</td>
<td>44</td>
<td>91</td>
</tr>
</tbody>
</table>

*a* Estimated cost for hip replacement for arthritis at RPAH is not shown because it was based on small patient numbers, as IRO handles the majority of these cases.

**Source:** Imaging data from hospitals and IPART analysis, and NHCDC provisional estimates for 2008/09 provided by NSW Health.
Table 11.4  Difference between our attributed imaging costs and the NHCDC costs (%)

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract/lens procedure</td>
<td>8000</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis&lt;sup&gt;a&lt;/sup&gt;</td>
<td>na</td>
<td>-71</td>
<td>11</td>
<td>-41</td>
<td>306</td>
<td>97</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>37</td>
<td>1</td>
<td>-11</td>
<td>33</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Major chest procedures – Pneumothorax</td>
<td>-6</td>
<td>-13</td>
<td></td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Major chest procedures – Malignancy</td>
<td>61</td>
<td>-2</td>
<td></td>
<td></td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Stroke B70A</td>
<td>78</td>
<td>15</td>
<td>-12</td>
<td>64</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Stroke B70B</td>
<td>-12</td>
<td>10</td>
<td>-12</td>
<td>59</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Stroke B70C</td>
<td>-57</td>
<td>21</td>
<td>-14</td>
<td>-17</td>
<td>-9</td>
<td></td>
</tr>
<tr>
<td>Cardiology – AMI</td>
<td>134</td>
<td>0</td>
<td>6</td>
<td>90</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Cardiology – Angina/ Chest pain</td>
<td>104</td>
<td>-22</td>
<td>-14</td>
<td>-27</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Appendicectomy DRG G07A</td>
<td>-35</td>
<td>-16</td>
<td>-20</td>
<td>-39</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Appendicectomy DRG G07B</td>
<td>36</td>
<td>-27</td>
<td>-9</td>
<td>24</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Cholecystectomy – Emergency (Incl. transfer ins)</td>
<td>-48</td>
<td>22</td>
<td>16</td>
<td>-43</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Cholecystectomy – Elective</td>
<td>439</td>
<td>80</td>
<td>90</td>
<td>202</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>3380</td>
<td>75</td>
<td>90</td>
<td>463</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>Breast surgery - Excision of lesion – malignant</td>
<td>2300</td>
<td>183</td>
<td>124</td>
<td>9250</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>Tracheostomy or ventilation &gt; 95hrs</td>
<td>0</td>
<td>13</td>
<td>-1</td>
<td>4</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>311</td>
<td>28%</td>
<td>-35</td>
<td>589</td>
<td>107</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Estimated cost for hip replacement for arthritis at RPAH is not shown because it was based on small patient numbers, as IRO handles the majority of these cases.

Source: IPART estimates and NHCDC provisional estimates for 2008/09 provided by NSW Health.
11.4 Protocols for managing the use of imaging services at the study hospitals

During our hospital visits, we obtained information about each study hospital’s protocols or controls for the use of imaging services. We found that the extent to which the hospitals attempt to manage this use varied across hospitals.

Only some of the study hospitals had guidelines for the use of imaging services. JHH had guidelines for both imaging use and test ordering which appeared to be sound. In particular, these guidelines:

- Included clinical protocols for imaging use that were established by the radiologist registrar and reviewed regularly. For example, they included a set of protocols for stroke patients which requires the registrar to liaise with the neurologist, and involves ED staff and ambulance officers as well.
- Specified that all CTs must be ordered by a senior registrar or consultant. For after hours CTs, registrars need to be contacted before the tests are carried out.

During our discussions with JHH staff, we asked clinicians whether they had any concerns about access to CTs at the hospital, and they indicated that they did not. They also indicated that urgent scans are usually done within 30-40 minutes. They noted that senior radiologists in some imaging units speak with junior clinicians if they have concerns about the appropriateness of tests for certain conditions.

In our view, RNSH’s guidelines may lead to greater use of imaging services than might otherwise be the case. In particular, this hospital’s guidelines for imaging use in the emergency department effectively mandate that an extensive series of tests be undertaken for certain cases. This may help to explain why our estimates of RNSH’s average imaging cost per patient for emergency admissions were often the highest among the study hospitals (see section 11.3.1 above).

11.5 Making better use of available imaging data

Based on our analysis and observations, we consider that the healthcare system, as well as individual hospitals and clinicians can make better use of imaging data to improve clinical practice, better manage the use of imaging services and the associated costs, and improve the quality of the clinical cost estimates provided for the NHCDC.

11.5.1 Improving clinical practice

We found that not all hospitals obtained detailed information from their imaging service providers on the number and types of tests they use. In addition, not all hospitals routinely provide this kind of information to the heads of clinical units or individual clinicians.
We consider this is a lost opportunity, as there are likely to be many ways in which NSW Health, hospitals and bodies such as the CEC or ACI could use imaging and other data to inform decisions on the way care is provided and to improve patient outcomes. One obvious example relates to the treatment of stroke patients. When these patients are admitted, a CT scan is normally required to determine whether they have an ischaemic or haemorrhagic stroke before the appropriate treatment can commence. It would be useful for clinicians to analyse and compare patient outcomes, and their hospital’s performance, in terms of the time taken from when the ambulance is called and the patient arrives in ED to when the CT is conducted and treatment commences.

Another example relates to the treatment of cholecystectomy patients. Some surgeons routinely perform an operative cholangiogram on patients to check for stones in the bile duct and improve visibility of the biliary tree. This procedure requires fluoroscopy that is captured in imaging data. Performing this test adds time to the operation, but it may also avoid a subsequent procedure to remove any missed stones and/or reduce the rate of accidental division of a biliary duct. It would be useful for clinicians to analyse and compare the benefits and costs of cholecystectomies with and without the use of fluoroscopy and availability of imaging data would help in streamlining this analysis.

11.5.2 Managing the use of imaging services

Hospitals can also use detailed information on their own imaging use, as well as comparative information on imaging use at similar hospitals, to make meaningful judgements on their protocols for managing their use without having negative impacts on patient outcomes.

At the time of our study, this information was available for the NHCDC process, but was not available to clinicians. Hospitals could look at their own data based on internal charging mechanisms, but the information was not linked at the hospital level to changes in patient types that may be driving change in imaging use.

As noted above, we found that JHH had sound guidelines on imaging use. This hospital also reviewed its imaging statistics on a monthly basis with ED staff.

Recommendation

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

- All hospitals obtain detailed reports from 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 tests among hospitals and area health services.

11.5.3 Improving the quality of imaging clinical cost estimates

As previously discussed in Chapter 7, the area health services undertake clinical costing, including estimates of the cost of imaging services, and submit these to the NSW Department of Health for the NHCDC. However, we found differences in the way the area health services made use of imaging data in calculating these costing estimates.

In particular, JHH, RNSH and GH used patient-level imaging information in calculating these costs. However, RPAH and BLH did not – they modelled their costs instead. We consider that consistent use of patient-level imaging data would improve the accuracy and reliability of clinical costing.

In addition, we found that where area health services were using patient-level imaging data in clinical costing, they attributed different values to different test types, and we could not identify a clear pattern in terms of which test types were attributed higher values and which lower values. Our analysis indicated that the average value the area health services attributed to all imaging tests ranged from 120% to 130% of the MBS rate of these tests. We are not aware that the area health services have conducted local studies to establish appropriate values for imaging tests.

To improve consistency and reliability, NSW Health should decide on a standard basis for attributing a value to specific imaging tests for clinical costing purposes. If it considers the MBS fees are appropriate for this, it should set a standard percentage of these rates to be used by all public hospitals, preferably based on the actual cost of each imaging test. For our analysis, we used 100% of the Medicare Benefit Schedule (MBS) fee for each type of test. However, some other basis could also be used.

In addition, the data used for clinical costing should be available to hospitals. We note that the costing process takes place at least annually, so this data could be used by the hospitals and clinicians to improve clinical practice and better manage imaging use.

Recommendation

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.
Pathology tests include a wide range of tests on samples of tissue, blood and other bodily fluids, and are an important tool for diagnosing a patient’s condition and monitoring their response to treatment. Thus, pathology use can help clinicians make more informed decisions about patient care, and so reduce length of hospital stays and improve patient outcomes. However, like imaging tests they involve costs and so unnecessary or inappropriate tests waste resources.

To better understand pathology costs across the study hospitals, we used data on the amounts pathology services charged each study hospital in 2008/09 to estimate and compare average pathology costs per patient in each of our case study areas. We also compared our estimates of these costs with estimates based on NHCDC data. And we examined how the study hospitals managed their use of and expenditure on pathology services.

We tried to obtain de-identified patient-level data on the specific types of pathology tests used by the hospitals, and the results of these tests, to conduct more detailed analyses of comparative pathology costs per patient and to assess clinical practice, medical record, coding case complexity and quality of care. But we could only access these data for RPAH and BLH. However, we used the data from these 2 hospitals to explore how the healthcare system and hospitals can make better use of pathology data to analyse patterns of clinical practice, medical record coding, case complexity and quality of care.

The sections below summarise our overall findings, then discuss our analysis and findings in more detail. Box 12.1 describes the approach we used to estimate the pathology costs per patient.

12.1 **Summary of overall findings on pathology costs**

At the case study level, we found that average pathology costs per patient varied considerably across the study hospitals. These costs appeared to be highest at RNSH for most of the case study areas. However, our estimates of average pathology costs per patient indicate there is a higher degree of consistency in these costs across hospitals than is suggested by the NHCDC for a number of patient groups. As for

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132 As explained later in this chapter, we initially used the provisional NHCDC data, but updated some of our analysis with the final data once these became available.
imaging, the NHCDC costs for RNSH and GH were the most consistent with our estimates.

At the hospital level, we found that the study hospitals used a range of approaches to manage the use of pathology services to control costs and ensure patients have appropriate tests for their condition. All the hospitals had pre-admission test ordering guidelines. JHH’s guidelines appeared to be the most comprehensive and included explicit standards of care. Some also had requirements that specialist approval be obtained before high-cost tests were ordered, or certain tests were reordered. Most had electronic systems in place to ensure test ordering protocols were followed.

In relation to making better use of pathology data, we found that available data can potentially be used to assess the accuracy and consistency of hospitals’ medical record coding and coding practices. As Chapter 6 discussed, when we analysed patient-level data and associated pathology test results provided by RPAH and BLH, we found that these hospitals had not coded all cases of acute myocardial infarction, hyponatremia, anaemia, diabetes and other conditions. Other hospitals may be able to audit the quality of their coding using a similar analysis to the one we undertook in this study.

We also found that some pathology test results can potentially be used to compare and improve the quality of care. For example, it may be possible to use INR level test results to assess whether patients have been administered too much warfarin, and to use sodium or potassium level test results to assess patients’ fluid management.

In addition, pathology data may be able to be used to monitor and control pathology costs at the hospital and ward levels. However, for this to occur the pathology services need to provide hospitals (and hospitals need to provide wards) with detailed information on the number of tests they ordered by test type and the costs of these tests. In addition, more accurate information on the costs associated with specific tests and the consequences of different test ordering patterns needs to be provided, so clinicians can consider pathology costs in the context of their clinical decision-making.
**Box 12.1 How we estimated pathology costs per patient**

We did not use a ‘bottom-up’ approach to estimate pathology costs at the study hospitals. Instead, we used internal billing data attached to the tests performed in 2008/09 to estimate the value of tests per like patient. These data included the amount the pathology service charged hospitals for carrying out tests on a patient level. It did not provide the number and type of tests performed. Therefore, we were only able to estimate and compare the average dollar values of pathology tests per patient in each of our case study groupings or subgroupings.

*Why did we use this approach?*

This was not our preferred method for comparing pathology costs, but we were not able to access the data required for more detailed analyses. We sought information on the cost of providing a range of pathology tests, but could not obtain sufficiently detailed information in the timeframe of our study. However, we understand that these data are available to pathology services and could possibly be used in future analyses by NSW Health.

We also sought de-identified patient-level data on the number of each test type used by the study hospitals, which would have enabled us to apply a consistent value to each test type based on the MBS fee as we did for imaging costs. However, we did not use this approach as 3 hospitals could not provide the data. In addition, the MBS rules for pathology are very complex.

*Complexities of MBS rules*

Pathology services apply some MBS ‘rules’ in calculating their internal charging for hospitals. The most significant of these rules is ‘coning’. This rule reduces the percentage of the MBS rebate that can be charged when multiple tests are ordered. After 3 tests there are no additional rebates. Coning rules can be applied at the test set level (tests on the one set of patient samples). Some coning rules also apply to tests on samples that may have been taken from a patient at different times on the same day or even up to several days apart.

Due to the complexities of coning rules, we based our estimates of the pathology costs per patient on the pathology services’ charges for each hospital, rather than assigning a value based on MBS item numbers.

*How consistent were the pathology services’ charges for the study hospitals?*

These charges were not identical for all hospitals. But they were all based on the MBS and were broadly similar. Some pathology services had uniform charges for all the hospitals they serve. Others varied their charges to reflect differences in their costs (eg, the higher transport involved in serving rural hospitals). They may also have charged more or less than 100% of the MBS fee for other reasons (eg, they may have charged a certain percentage of the MBS fee to reflect historical levels of capital investments incurred prior to an amalgamation of pathology services).

To illustrate the variation in pathology charges, Table 12.1 shows the charge for a troponin T level test for each hospital.
Table 12.1 Amount pathology services charged each study hospital for a troponin T level test (MBS item number 66518), 2008/09 ($)

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>20.40</td>
<td>20.40</td>
<td>20.40</td>
</tr>
<tr>
<td>IRO</td>
<td>20.40</td>
<td>20.40</td>
<td>20.40</td>
</tr>
<tr>
<td>BLH</td>
<td>20.40</td>
<td>20.40</td>
<td>20.40</td>
</tr>
<tr>
<td>JHH</td>
<td>17.35</td>
<td>20.40</td>
<td>18.88</td>
</tr>
<tr>
<td>GH</td>
<td>20.20</td>
<td>21.22</td>
<td>20.45</td>
</tr>
<tr>
<td>RNSH</td>
<td>20.20</td>
<td>21.22</td>
<td>20.45</td>
</tr>
</tbody>
</table>

Source: Pathology billing data provided by study hospitals.

12.2 Average pathology costs per like patient across study hospitals

We did not attempt to compare pathology costs at the hospital level, as this comparison would be difficult to interpret without a very comprehensive understanding of the patient mix at each hospital. This is because the appropriate number and type of pathology tests a hospital uses depends strongly on the number and type of patients it treats. To avoid this issue, we compared the value of pathology tests per patient for each grouping or subgrouping of similar patients in our case study areas.

As Box 12.1 explained, we were not able to obtain de-identified data on the number or types of tests performed at the patient level from all the hospitals. Therefore, we were only able to estimate and compare the average value of pathology charges per patient based on internal billing data provided by the hospitals. We also estimated this value based on provisional and final costing data from the Area Health Services for the NHCDC.\(^{133}\) Table 12.2 shows the results of this analysis.

Looking at our estimates, the table indicates that there was wide variation in the average pathology cost per patient for the different conditions/procedures we examined. For example, for planned cholecystectomy cases this cost was fairly low, ranging from $114 at RPAH to $144 at RNSH. In contrast, for tracheostomy cases, the cost ranged from $2,518 at JHH to $6,958 at RNSH. The table also indicates that there was variation in the average cost of pathology tests per patient across the study hospitals. This average cost appeared to be highest at RNSH in most of the patient groupings we examined.

\(^{133}\) The final NHCDC costs for 2008/09 became available towards the end of our study. We compared these to the provisional costs and found that the pathology costs had changed substantially for RNSH and GH. Given the limited time frame for our study, we were not able to redo all our analysis based on the final costs. Instead, we used the final NHCDC costs when we analysed conditions based on DRGs (eg, appendicectomy, cataracts and hysterectomy). For the other conditions we used the provisional NHCDC data, but adjusted the costs for GH and RNSH to reflect the changes between the provisional and final data (using the weighted average changes for the relevant DRGs).
Comparing our estimates to the hospitals’ NH CDC estimates, the table shows that for some patient groupings, there is much more consistency across the study hospitals costs than indicated by the hospitals’ estimates for the NH CDC. For example, for stroke patients in DRG B70B, our estimates ranged from $273 to $550 per patient, while the hospitals’ NH CDC estimates ranged from $379 at to $1,158. For hysterectomy cases excluding GH, our estimates ranged from $221 to $276, while the hospital’s NH CDC estimates ranged from $186 to $547. We found that RNSH’s and GH’s NH CDC estimates were fairly consistent with our estimates for most case studies, while JHH’s NH CDC estimates were consistently higher than our estimates. RPAH’s and BLH’s NH CDC estimates varied the most from our estimates, probably due to the cost allocation methods used by SSWAHS. (See Table 12.3. Cost allocation methods are discussed in Chapter 7.)

As for imaging costs, we also identified some anomalies which raise questions about the accuracy and reliability of the NH CDC data. For example, for cataracts/lens cases – where we would expect pathology costs per patient to be very low – our estimate of this cost was zero or close to zero for all study hospitals. However, the NH CDC estimates of this cost were $93 and $94 for RPAH and BLH, respectively. This seems unlikely to be accurate, and again probably reflects the cost allocation methods used by SSWAHS.

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134 We found that the cost for pathology tests at GH was far lower than at the other hospitals, but this is probably due to a charging anomaly (with some costs excluded from anatomical pathology).
Table 12.2 Comparison of IPART’s estimates of pathology costs per patient and estimates based on NHCDC data, 2008/09 ($)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>IPART</th>
<th>NHCDC</th>
<th>IPART</th>
<th>NHCDC</th>
<th>IPART</th>
<th>NHCDC</th>
<th>IPART</th>
<th>NHCDC</th>
<th>IPART</th>
<th>NHCDC</th>
<th>IPART</th>
<th>NHCDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract/lens - DRG C16B</td>
<td>0</td>
<td>93</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>94</td>
<td>2</td>
<td>4</td>
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<td></td>
</tr>
<tr>
<td>Hip replacement - Arthritis</td>
<td>a</td>
<td>931</td>
<td>182</td>
<td>287</td>
<td>385</td>
<td>420</td>
<td>254</td>
<td>261</td>
<td>322</td>
<td>625</td>
<td>193</td>
<td>353</td>
</tr>
<tr>
<td>Hip replacement - Fracture</td>
<td>707</td>
<td>937</td>
<td>0</td>
<td>0</td>
<td>716</td>
<td>769</td>
<td>752</td>
<td>663</td>
<td>729</td>
<td>747</td>
<td>583</td>
<td>744</td>
</tr>
<tr>
<td>Major chest procedure - Pneumothorax</td>
<td>331</td>
<td>624</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>564</td>
<td>504</td>
<td>0</td>
<td>0</td>
<td>346</td>
<td>505</td>
</tr>
<tr>
<td>Major chest procedure - Malignancy</td>
<td>636</td>
<td>829</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,304</td>
<td>1,143</td>
<td>0</td>
<td>0</td>
<td>583</td>
<td>1,048</td>
</tr>
<tr>
<td>Pacemaker – DRG F12Z</td>
<td>331</td>
<td>273</td>
<td>0</td>
<td>0</td>
<td>536</td>
<td>611</td>
<td>387</td>
<td>338</td>
<td>b</td>
<td>252</td>
<td>168</td>
<td>304</td>
</tr>
<tr>
<td>Stroke – DRG B70A</td>
<td>668</td>
<td>2,216</td>
<td>0</td>
<td>0</td>
<td>713</td>
<td>749</td>
<td>965</td>
<td>898</td>
<td>1,002</td>
<td>1,610</td>
<td>586</td>
<td>1,000</td>
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<tr>
<td>Stroke – DRG B70B</td>
<td>339</td>
<td>1,158</td>
<td>0</td>
<td>0</td>
<td>353</td>
<td>379</td>
<td>550</td>
<td>512</td>
<td>415</td>
<td>838</td>
<td>273</td>
<td>457</td>
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<tr>
<td>Stroke – DRG B70C</td>
<td>277</td>
<td>479</td>
<td>0</td>
<td>0</td>
<td>254</td>
<td>276</td>
<td>382</td>
<td>370</td>
<td>257</td>
<td>384</td>
<td>216</td>
<td>246</td>
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<tr>
<td>Cardiology – AMI</td>
<td>331</td>
<td>299</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>304</td>
<td>345</td>
<td>390</td>
<td>356</td>
<td>348</td>
<td>206</td>
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<tr>
<td>Cardiology – Angina/chest pain</td>
<td>113</td>
<td>132</td>
<td>0</td>
<td>0</td>
<td>167</td>
<td>168</td>
<td>193</td>
<td>172</td>
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<td>109</td>
<td>150</td>
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<tr>
<td>Appendicectomy - DRG G07A</td>
<td>521</td>
<td>447</td>
<td>0</td>
<td>0</td>
<td>709</td>
<td>757</td>
<td>701</td>
<td>612</td>
<td>488</td>
<td>375</td>
<td>543</td>
<td>833</td>
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<tr>
<td>Appendicectomy - DRG G07B</td>
<td>204</td>
<td>181</td>
<td>0</td>
<td>0</td>
<td>127</td>
<td>140</td>
<td>234</td>
<td>191</td>
<td>185</td>
<td>169</td>
<td>199</td>
<td>253</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency (incl. Transfers in)</td>
<td>480</td>
<td>279</td>
<td>0</td>
<td>0</td>
<td>720</td>
<td>746</td>
<td>717</td>
<td>617</td>
<td>540</td>
<td>231</td>
<td>354</td>
<td>458</td>
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<tr>
<td>Cholecystectomy – Planned</td>
<td>114</td>
<td>202</td>
<td>0</td>
<td>0</td>
<td>d</td>
<td>100</td>
<td>144</td>
<td>143</td>
<td>123</td>
<td>166</td>
<td>131</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>RPAH IPART</td>
<td>RPAH NHCDC</td>
<td>IRO IPART</td>
<td>IRO NHCDC</td>
<td>GH IPART</td>
<td>GH NHCDC</td>
<td>RNSH IPART</td>
<td>RNSH NHCDC</td>
<td>BLH IPART</td>
<td>BLH NHCDC</td>
<td>JHH IPART</td>
<td>JHH NHCDC</td>
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<tr>
<td><strong>Breast surgery -</strong></td>
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<tr>
<td>Mastectomy</td>
<td>493</td>
<td>243</td>
<td>0</td>
<td>0</td>
<td>d</td>
<td>e</td>
<td>368</td>
<td>202</td>
<td>518</td>
<td>222</td>
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<td>c</td>
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<td><strong>Breast Surgery -</strong></td>
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<tr>
<td>Excision</td>
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<td>196</td>
<td>0</td>
<td>0</td>
<td>d</td>
<td>e</td>
<td>404</td>
<td>185</td>
<td>389</td>
<td>192</td>
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<tr>
<td>Lesion malignant</td>
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<tr>
<td><strong>Tracheostomy or</strong></td>
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</tr>
<tr>
<td>Ventilation &gt; 95hrs - DRG</td>
<td>5,268</td>
<td>3,713</td>
<td>0</td>
<td>4,841</td>
<td>5,248</td>
<td>6,958</td>
<td>6,325</td>
<td>5,215</td>
<td>2,705</td>
<td>2,518</td>
<td>3,321</td>
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<tr>
<td>A06Z</td>
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<tr>
<td><strong>Hysterectomy -</strong></td>
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<td></td>
</tr>
<tr>
<td>DRG N04Z</td>
<td>259</td>
<td>265</td>
<td>0</td>
<td>d</td>
<td>103</td>
<td>221</td>
<td>186</td>
<td>251</td>
<td>241</td>
<td>276</td>
<td>547</td>
<td></td>
</tr>
</tbody>
</table>

- a Value for RPAH Hip replacement – arthritis is not presented as there were very low case numbers and a review of these patients indicated they are not typical of this category.
- b BLH does not perform pacemaker procedures.
- c Value for JHH is excluded due to low case numbers.
- d We found that for GH, pathology costs were much lower than other hospitals for planned cholecystectomy, hysterectomy and breast surgery patients, but this is probably due to a charging anomaly (with some costs excluded from anatomical pathology). We therefore excluded these costs from this table.
- e We could not adjust the NHCDC costs for GH for breast surgery because the changes between the provisional and final data were significantly different for the relevant DRGs.

**Note:** We used the final NHCDC costs for the DRG based conditions. For the other conditions we used the provisional NHCDC data, but adjusted the costs for GH and RNSH to reflect the changes between the provisional and final data (using the weighted average change for the relevant DRGs).

**Source:** IPART estimates and NHCDC provisional and final estimates for 2008/09 provided by NSW Health.
Table 12.3 Difference between our attributed pathology costs and the NHCDC costs (%)

<table>
<thead>
<tr>
<th>Condition</th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract/lens - DRG C16B</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>88</td>
</tr>
<tr>
<td>Hip replacement - Arthritis</td>
<td>na</td>
<td>58</td>
<td>9</td>
<td>3</td>
<td>94</td>
<td>83</td>
</tr>
<tr>
<td>Hip replacement - Fracture</td>
<td>33</td>
<td>na</td>
<td>7</td>
<td>-12</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Major chest procedure - Pneumothorax</td>
<td>89</td>
<td>na</td>
<td>na</td>
<td>-11</td>
<td>na</td>
<td>46</td>
</tr>
<tr>
<td>Major chest procedure - Malignancy</td>
<td>30</td>
<td>na</td>
<td>na</td>
<td>-12</td>
<td>na</td>
<td>80</td>
</tr>
<tr>
<td>Pacemaker – DRG F12Z</td>
<td>-17</td>
<td>na</td>
<td>14</td>
<td>-13</td>
<td>na</td>
<td>81</td>
</tr>
<tr>
<td>Stroke B70A</td>
<td>232</td>
<td>na</td>
<td>5</td>
<td>-7</td>
<td>61</td>
<td>71</td>
</tr>
<tr>
<td>Stroke B70B</td>
<td>242</td>
<td>na</td>
<td>7</td>
<td>-7</td>
<td>102</td>
<td>68</td>
</tr>
<tr>
<td>Stroke B70C</td>
<td>73</td>
<td>na</td>
<td>9</td>
<td>-3</td>
<td>49</td>
<td>14</td>
</tr>
<tr>
<td>Cardiology – AMI</td>
<td>-10</td>
<td>na</td>
<td>13</td>
<td>-9</td>
<td>-41</td>
<td>38</td>
</tr>
<tr>
<td>Cardiology – Angina/chest pain</td>
<td>17</td>
<td>na</td>
<td>1</td>
<td>-11</td>
<td>-43</td>
<td>38</td>
</tr>
<tr>
<td>Appendicectomy CRG G07A</td>
<td>-14</td>
<td>na</td>
<td>7</td>
<td>-13</td>
<td>-23</td>
<td>53</td>
</tr>
<tr>
<td>Appendicectomy CRG G07B</td>
<td>-11</td>
<td>na</td>
<td>10</td>
<td>-18</td>
<td>-9</td>
<td>27</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>-42</td>
<td>na</td>
<td>4</td>
<td>-14</td>
<td>-57</td>
<td>29</td>
</tr>
<tr>
<td>Cholecystectomy - Planned</td>
<td>77</td>
<td>na</td>
<td>na</td>
<td>0</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>Breast surgery - Mastectomy</td>
<td>-51</td>
<td>na</td>
<td>na</td>
<td>-49</td>
<td>-57</td>
<td>na</td>
</tr>
<tr>
<td>Breast Surgery - Excision Lesion</td>
<td>-43</td>
<td>na</td>
<td>na</td>
<td>-57</td>
<td>-51</td>
<td>na</td>
</tr>
<tr>
<td>malignant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracheostomy or ventilation &gt; 95hrs</td>
<td>-30</td>
<td>na</td>
<td>8</td>
<td>-9</td>
<td>-48</td>
<td>32</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>2</td>
<td>na</td>
<td>na</td>
<td>-16</td>
<td>-4</td>
<td>98</td>
</tr>
</tbody>
</table>

Note: We used the final NHCDC costs for DRG based conditions. For the other conditions we used the provisional NHCDC data, but adjusted the costs for GH and RNSH to reflect the changes between the provisional and final data (using the average for the relevant DRGs).

Source: IPART estimates and NHCDC provisional and final estimates for 2008/09 provided by NSW Health.

12.3 Protocols for managing the use of pathology tests at the study hospitals

During our hospital visits, we asked hospital managers, pathology managers and clinicians about how they managed their use of pathology services to control costs and ensure patients have appropriate tests for their condition. We found that the study hospitals used a range of approaches to control the growth of pathology test costs, some of which are listed in Table 12.4.
Table 12.4 How the study hospitals managed the use of pathology tests

<table>
<thead>
<tr>
<th>Type of control</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines</td>
<td>All hospitals had pre-admission test ordering guidelines. JHH’s guidelines appeared to be the most comprehensive and included explicit standards of care. BLH’s guidelines included some standard profiles for test ordering which helped control costs on initial orders and excessive costs on subsequent orders. RNSH’s guidelines included some protocols for the appropriate use of certain tests, such as Bone Morphogenic Protein (BMP) and troponin T levels.</td>
</tr>
<tr>
<td>Test request delegations</td>
<td>JHH required the approval of a specialist before high-cost tests can be ordered. RPAH had clear rules for re-ordering troponin T tests.</td>
</tr>
<tr>
<td>Electronic request restrictions</td>
<td>RPAH and BLH had a few examples of restricted ordering rules implemented within Cerner and had many protocol orders setup to ensure they were followed. In particular for RPAH, they had protocols on troponin T tests, and an e-flagging system in place to facilitate appropriate ordering of tests. Under this system, if a patient’s test result is positive, or if 2 test results are negatives then no more tests are allowed unless the patient has had chest pains for 24 hours.</td>
</tr>
</tbody>
</table>

Source: IPART visits to study hospitals, November to December 2009.

We also found differences in the way pathology charges were treated at the hospitals. JHH, GH and RNSH included pathology charges as part of the budget of clinical departments, whereas RPAH and BLH treated pathology charges as central hospital costs.

However, the charges currently applied for using pathology services may not reflect the cost of providing the service. The lack of cost transparency may lead to higher use of some high-cost tests than would otherwise be the case.

We also found that apart from monitoring internal charging data, the hospitals did not appear to routinely analyse or report on pathology test usage – either for cost control or quality of care purposes.

12.4 Making better use of available pathology data

Pathology data represents a rich set of information on many aspects of clinical care. It includes information on a patient’s renal function, blood electrolytes and blood infections (which may change significantly during a hospital stay). The timing of the tests makes it possible to assess whether the onset of some conditions occurred before the patient was admitted, or during the hospital stay and therefore may have been preventable.

135 For example, staphylococcus bacteraemia infections.
Pathology data has been used as the trigger for infectious disease notification for many years. We believe there is significant opportunity for NSW Health, bodies such as the CEC, and hospitals to make further use of this high-quality source of data. We have identified several ways in which these data could be used, including:

- to assess the accuracy and consistency of hospitals’ medical record coding and coding practices (which has implications for DRG-based cost comparisons and episode funding)
- to assess and improve the quality of care
- to monitor and control pathology costs
- as markers of patient complexity.

### 12.4.1 Assessing the accuracy and consistency of hospitals’ coding and coding practices

Pathology data can be used to assess the accuracy and consistency of hospital record coding. This is important because the workload of a hospital, and the complexity of that workload, is often estimated on the basis of DRGs, and the DRGs patients are assigned to depend on how their medical notes and discharge summaries have been documented. In addition, the performance of hospitals is often compared on this basis, and hospitals can be funded on this basis (using an episode-based or casemix funding system).

As Chapter 6 discussed, we examined patient-level pathology test results data provided by RPAH and BLH to assess the current accuracy and consistency of the study hospitals’ coding. We compared these data with the codes included in patients’ medical records, to see if they had been coded in a way which is inconsistent with their test results. Our findings indicate that these hospitals had not coded all cases of acute myocardial infarction (AMI), hyponatremia, anaemia, diabetes and other conditions. This suggests that these hospitals (and probably other NSW hospitals) are likely to be understating their casemix complexity, which would have funding implications in a federal casemix funding system.

### 12.4.2 Comparing and improving the quality of care

In addition to being used to assess coding, some pathology test results can also be used to compare and improve the quality of care. We identified several potential examples of this use, including:

- using INR level test results to assess whether patients have been administered to much warfarin
- using sodium or potassium level test results to assess patients’ fluid management.
**INR levels and potential warfarin overdose**

Warfarin is a drug commonly administered to help prevent blood clots (thrombosis) in patients who have had surgery. Occasionally, patients are given too much warfarin, which causes their International Normalised Ratio (INR) levels to rise. However, high INR levels can also be due to other clinical conditions unrelated to warfarin use, such as liver failure and DIC related to sepsis.

To help determine whether patients with a critically high INR were given too much warfarin, their pathology test data could be examined to assess whether they were admitted with a high INR or whether this occurred post-admission. This could be done by clinicians to inform their decisions about individual patient’s care during their hospital stay, or it could be done by hospitals or clinical bodies to identify systemic issues in relation to warfarin prescribing. For example, we note that the Australian Commission on Safety and Quality in Health Care’s National Medication Chart project developed a policy to improve the prescribing of warfarin. INR test result data could be used to identify possible policy compliance issues.

Table 12.5 shows the number of patients in our case study areas at RPAH and BLH whose pathology test results indicated they had a high INR (greater than 12) 7 or more days into their hospital stay, and so potentially were given too much warfarin. We did not have time to review clinical notes to determine whether this was the case, or whether some other condition explained their INR. Therefore, the value of these test results as a marker of poor warfarin management would need to be validated by a chart review.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Number Patients</th>
<th>Total Bilirubin&gt;30</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>BLH</td>
<td>19</td>
<td>4</td>
</tr>
</tbody>
</table>

*Note:* Bilirubin is a substance found in bile that is produced by the liver. Too much warfarin will stimulate excess production.

*Source:* Extract from Cerner Pathology SSWAHS.

**Sodium or potassium levels and fluid management**

Similarly, it may be possible to use pathology test results indicating patients have electrolyte issues, such as high sodium levels (hyponatremia), low sodium levels (hypernatremia) or high potassium levels (hyperkalemia) as markers of fluid management issues. These conditions may be present on admission, or can arise as a complication of being on intravenous fluids (IV).
Patients on IV fluids require routine pathology tests to assess the sodium and potassium levels in the blood to avoid these conditions. Their pathology test contains the results of these tests, plus information on when each test was done. Therefore, these data can be used if an electrolyte issue was present on admission or arose during a hospital stay.

For example, Table 12.6 shows the number of patients whose test results suggest they have critical hyponatremia (a sodium level of 120 or below), and whether they were coded for this condition. It also shows whether the first test that identified this condition was conducted during the patient’s first 5 days in hospital (which means it’s possible that it was present on admission) or after this time (which means it’s likely to have arisen during the hospital care and was possibly preventable).

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Coded for hyponatremia</th>
<th>Less than 5 Days</th>
<th>After 5 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>47</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>73</td>
<td>64</td>
</tr>
<tr>
<td>RPAH</td>
<td>No</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>72</td>
<td>0</td>
</tr>
<tr>
<td>BLH</td>
<td>No</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% coded</td>
<td>72</td>
<td>0</td>
</tr>
</tbody>
</table>

This type of analysis clearly has the potential to be used to monitor clinical quality.

**Recommendations**

1. **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.**
2. **That NSW Health addresses issues that prevent the actual costs associated with specific pathology tests and ordering patterns being disclosed by pathology services.**

**12.4.3 Monitoring and controlling pathology use and costs**

Hospitals can also use detailed data on their use of pathology services and the associated costs to make meaningful judgements on their protocols for controlling these costs. However, as noted above, we found that none of the study hospitals appeared to routinely analyse or report on their pathology test usage and costs for this purpose. We identified 2 issues that need to be addressed to enable this to happen.
First, the hospitals need to receive appropriately detailed information from the pathology services. There appeared to be differences in the quality of information provided to the study hospitals. For example, BLH received ward-level reports that enable it to see trends in test usage and charges. It also receives details of the tests ordered per inpatient episode. However, GH only appeared to receive aggregate charging information, rather than detailed information on test use.

Second, the costs of specific pathology tests, and the implications of how they are ordered on these costs, need to be transparent. As Box 12.1 discussed, pathology services charge hospitals a percentage of the MBS fee for each test they undertake, with coning rules applied. (Box 12.2 lists some of the main types of pathology tests undertaken and the MBS fee for these tests.)

However, when we spoke to the pathology services the study hospitals used, they indicated that the MBS fee for pathology tests do not accurately reflect the costs these services incur in providing the tests. For some tests, the MBS fee is lower than the actual cost, while for others it is higher. In addition, the application of coning rules mean the gap between the MBS fee and the actual cost to the pathology service can vary significantly, depending on when the tests are ordered.

The pathology services the study hospitals used provided information on their charging rates for specific tests, but for the reasons noted above, this information does not enable clinicians to accurately estimate the actual cost of the tests they order, and thus to consider this cost in the context of their clinical decision-making. For example, based on the information provided, clinicians may not be aware that certain tests involve very little cost, while others involve substantial costs. Or they may not be aware that ordering multiple tests to be done at the same time is less costly to the pathology services than ordering a number of separate tests on the same sample at different times.

We consider that all hospitals should receive detailed information on their pathology use, so they can monitor trends in this usage. In addition, the hospitals should provide detailed pathology data to clinicians and clinical units or wards, so they can monitor trends. Further, hospitals should receive more accurate information of the costs involved in ordering specific tests, and the implications of different ordering patterns, so they can better consider pathology test costs in the context of their clinical decision making.

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136 Pacific Laboratory Medicine Services (PaLMs) provides pathology services to GH and RNSH. Hunter Area Pathology Service (HAPS) provides services to JHH. Sydney West Area Pathology Service (SWAPS), which is part of the SSWAHS, provides pathology services to RPAH and BLH.
Recommendations

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

- All hospitals obtain detailed reports from pathology 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 pathology tests for clinical groupings and circulates these to area health services and hospitals.

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.

Box 12.2 Common types of pathology tests and their Medicare Benefits Schedule rates

Common types of pathology tests include:

- Full blood count (MBS items 65129 and 65070), for which the MBS fee ranges from $17.05 to $35.75.
- Blood sugar levels (MBS item 66542), for which the MBS fee is $19.10.
- Simple chemistry (MBS items 66500-66512), for which the MBS fee ranges from $9.75 to $17.80.
- Troponin T levels (MBS items 66518-66519), for which the MBS fee ranges from $20.20 to $40.40.

In several of our case study areas, patient care involves surgery. Within these areas, the accessibility of a hospital’s operating theatres and the efficiency with which they are used and managed can influence a patient’s length of stay, configuration of care and outcomes.

We analysed data from our case studies and observations from our hospital visits to compare the study hospitals’ operating theatre capacity and theatre management practices. We did not attempt to estimate the costs of operating theatre use at each hospital; instead we compared data on average operating times for similar patients across the hospitals. We also examined how theatre access and theatre management can affect patient flow and patient care at the hospitals. In addition, we analysed data from the NHCDC to assess whether this information can be used to compare the costs associated with the use of operating theatres across hospitals.

The sections below summarise our overall findings, then discuss our analysis in more detail.

13.1 Summary of findings on operating theatres

We found that the study hospitals’ theatre capacity varied widely, as did their theatre management practices. In general, we found that the hospitals that separated planned surgery from emergency surgery (particularly for trauma cases, such as car accidents) had more efficient and effective theatre management. In particular:

- RPAH and JHH both appeared to have sound theatre management practices. Some of these practices could be adopted in other hospitals or hospital networks. Both RPAH and JHH separate planned and emergency surgery. Individual hospitals may not have the theatre capacity to do this but networks of hospital may.

- GH appeared to have a more difficult management task than BLH (its peer hospital) due to its high emergency caseload, more limited theatre capacity, and because it generally takes the acute trauma cases within its network. In contrast, BLH is not a designated trauma centre, which aids the management of its theatres.
In relation to average operating theatre times, we noted that available theatre data were not always comparable, and there were gaps and inconsistencies in the recorded information. However, in general, we found that average theatre times were similar for many of the like-patient groupings from our case studies. We also identified a range of factors that can influence theatre times and lead to differences in the reported times across hospitals.

In relation to the effect of theatre access and theatre management on patient flow, we found that limited theatre availability and inflexible theatre start and finish times can hinder the efficient flow of patients through a hospital, and in some cases influence patient care. Likewise, limited after-hours access to diagnostic tests (such as CT scans) can hinder the efficient flow of patients, particularly for emergency cases.

In relation to the NHCDC, we identified many issues that raise doubts about the quality of the theatre data within this collection, and therefore its usefulness for comparing operating theatre costs across hospitals.

13.2 Theatre capacity and theatre management practices

The overall capacity of a hospital’s operating theatres depends on both the number of operating theatres it has and how it manages these theatres. However, the resources available at a hospital also influence its options for managing its operating theatres and daily operating lists. Our analysis of the available data on theatre capacity and management at the study hospitals identified both similarities and differences in their management practices. In many cases, the differences appear to be due to different resources available at each hospital.

Table 13.1 provides a high level summary of the physical operating theatre capacity at each of the study hospitals. These figures exclude procedure rooms such as endoscopy units, but include theatres dedicated to certain specialties, such as obstetrics and emergency. The sections below provide a brief description of the theatre capacity and management at each hospital.
Table 13.1 Overview of operating theatre capacity across the study hospitals, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of theatres that are staffed</td>
<td>14</td>
<td>3</td>
<td>8</td>
<td>12</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Dedicated emergency theatres</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dedicated theatres to other specialities</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes (on certain days)</td>
<td>yes</td>
</tr>
<tr>
<td>General operating hours</td>
<td>8am-6pm</td>
<td>8am-6pm</td>
<td>8am-5:30pm</td>
<td>8am-5pm</td>
<td>8am-5pm</td>
<td>8am-10pm</td>
</tr>
</tbody>
</table>

a RPAH has 22 physical theatres but not all are in use at the one time. We are informed that generally, 14 are fully used while more can be opened for use, depending on demand. RPAH indicated that the end-time for its theatres is flexible.

b All IRO’s theatres are dedicated to planned orthopaedic surgery.

c GH and BLH indicated that although the official end-time for their theatres is 5:30pm and 5pm respectively, they often do not finish until around 6pm.

d JHH has 9 theatres in the main hospital and 5 theatres in RNC. The main theatres operate on 3 sessions in the day from 8am-10pm and the RNC operates on 2 sessions from 8am-5.30pm.

Source: IPART visits to study hospitals, November to December 2009.

13.2.1 Royal Prince Alfred Hospital

RPAH has the highest number of available theatres of all the study hospitals and, in our view, one of the better theatre management models. Its theatre management is clinician-led, by a Theatres Operations Committee comprising representatives from a range of clinical specialties. The committee sets theatre management protocols, and provides strong leadership and support to the theatre Nursing Unit Managers (NUMs). The hospital separates planned and emergency surgery. It also works closely with the adjacent IRO, which is used for planned orthopaedic surgery.

Theatre capacity

RPAH has a total of 22 physical operating theatres, but not all are staffed at the same time. On average, it uses 14 operating theatres per day and can use more on days when demand is high. The high number of physical theatres means it is able to dedicate almost all to a particular clinical specialty – for example, liver transplant, colorectal, head and neck, and obstetrics. This provides certain economies of scale that make theatre management easier, for example reduced set-up times, and easier prioritisation of cases.

The hospital has one dedicated emergency theatre. Trauma and emergency lists are prepared every morning and spaces are kept on scheduled operating lists for anticipated cases admitted through the Emergency Department.
RPAH organises theatre time into all-day sessions, which run from 8am to around 6pm. It indicated that this provides more flexibility than morning and afternoon sessions with fixed start and end times. It also indicated that if extra hours are needed at the end of a session to complete the scheduled operating list, the hospital usually accommodates this so that all theatre time is fully used and cancellations are avoided. This flexibility is supported by the collegiate attitude of the anaesthetic and nursing staff.

**Theatre lists and rostering**

Surgeons are responsible for drawing up and prioritising the theatre operating lists, and must specify the expected duration of each operation (including anaesthesia time). They submit these lists to each theatre’s NUM, who reviews each day’s lists the previous afternoon. If a theatre is overbooked, the NUM will contact the surgeons to make changes. Much of the oversight work is carried out by the nurses with the endorsement of management. Conflicting priorities for limited theatre time are initially sorted out between the surgeons themselves. But if no resolution is reached, the matter can escalate up to the Chair of the Theatres Operations Committee.

The theatre booking and management system is run by the NUM and Access Nurse in the theatres. It includes an online emergency list and an E-booking facility using the CERNER system. This gives doctors up-to-date access to the theatre lists via their own computers. The fact that the hospital has a high number of theatres which are mostly dedicated to clinical specialities makes case prioritisation easier. There are also separate rosters for different specialities.

Unlike some hospitals, RPAH does not schedule rotating theatre closures. Instead, surgical sessions continue throughout the year. On average, 85% of surgeons’ time is allocated to clinical duties, while the remaining 15% is allocated to non-clinical responsibilities, such as leave, meetings or training.

**13.2.2 Gosford Hospital**

The hospitals in the Central Coast region operate on a networked basis. In general, GH takes the acute trauma cases, while Wyong Hospital takes more of the planned surgery cases. Complex trauma cases may also be transferred to other hospitals, such as RNSH.

We found that GH’s theatre management task was more difficult than the other study hospitals’ because it has a relatively high volume of emergency surgery cases for its small size and theatre capacity.
Theatre capacity

GH has 8 operating theatres. There is a 24 hour Emergency Theatre and the remaining theatres are dedicated to certain specialties. Theatre time usually starts at 8am and finishes around 6pm, although the official closing time is 5.30pm. During the day, if the list looks like it will overrun, negotiations occur to extend the list, with rescheduling occurring only if this cannot be accommodated. Some cases are moved to the emergency list if possible. Alternatively, the endoscopy unit may be used if all other operating theatres are at capacity and a team can be assembled to staff that theatre. GH ensures that it overruns the theatres where possible rather than reschedule cases. Rescheduling only occurs when all possibilities are exhausted.

In terms of the Emergency Theatre, only emergency cases that fall into categories 1, 2 or 3, are undertaken after 9pm.

GH indicated that the lack of available equipment can block access to its theatres. In some instances it also shares certain equipment with Wyong Hospital and issues may also arise from such arrangements.

Theatre lists and rostering

Operating theatre lists at GH are drawn up through the following process. Surgeons put forward recommendations of cases to the hospital’s Integrated Booking Unit (IBU). The team at IBU draws up the lists, weighting the cases by category and urgency. The surgeons are notified of the lists and prioritising of the cases can still be changed by negotiation. Competing demands for theatre time are settled through negotiations between the surgeons, anaesthetist and the floor manager, who is the NUM 1. A multidisciplinary team reviews the lists each week, evaluates the caseload, and finalises the lists.

The IBU team also runs the pre-admission clinic which screens patients on the lists to determine their risks. Patients who are over 60 years of age, on certain medications, or likely to be in for more than one night are asked to come into the clinic for full screening and checks, including reviews by a nurse and anaesthetist, so that appropriate preparations are made for that patient’s admission. Patients that are considered low risk are not required to come in for full checks. All patients are asked to call in the day before to get fasting instructions and to check on their fitness for surgery. This will allow rescheduling of the lists if patients are not fit for surgery. Since the set up of the IBU, on-the-day cancellation rates have reduced greatly and therefore improved the utilisation of theatre time.

13.2.3 Royal North Shore Hospital

At the time of review, a new theatre complex at RNSH was under construction. It is expected that there will be 18 new operating theatres. In addition, 2 existing operating theatres in the Douglas Building will be retained, thus there will be a total of 20 theatres once the new hospital is completed.
Theatre capacity

RNSH has 12 operating theatres available at present. The majority of the theatres are located in the theatre complex, although there are a few theatres at other locations within the hospital. Due to the construction of the new hospital, 2 theatres in the day surgery unit have been closed since July 2008.

The operating theatre sessions are generally separated into morning and afternoon sessions. However, the hospital indicated that there is increasing flexibility about moving to full day sessions with more flexibility around when its theatres close for lunch break.

RNSH has a dedicated 24 hour emergency theatre. It indicated that there is normally sufficient capacity for emergency surgery to minimise delays and cancellations of planned lists. When the emergency workload is greater than the allocated emergency theatre time, the NUM and Clinical Director will assess the planned surgery lists and may make changes to increase theatre time for emergency cases.

Theatre lists and rostering

At RNSH, space on each theatre’s planned surgery list is generally allocated to a particular surgeon or department (eg, the cardiac team), and reviewed quarterly. The NUM, in conjunction with the clinical director, considers each day’s lists the previous day to see if there is room for more bookings. Each day’s lists are finalised the previous day, although changes can be made the following morning if required.

Paediatric lists run from 8am to 2.30pm but may run over time if required. After-hours surgery is only carried out on acute cases categorised as 1 to 6 with a surgeon, duty director (anaesthetist) and NUM.

There is a general practice of scheduling 2 operating sessions per day, separated by a fixed lunch break. Surgeons indicated that this practice reduces the accessibility of RNSH’s theatres. For instance, this practice can result in operations needing to be rescheduled because an earlier operation took longer than the estimated time.

When there are competing demands for theatre time, the surgeons resolve this matter themselves. If they cannot, either the NUM (during normal theatre hours) or the duty director (anaesthetist, after hours) determines the priority.

13.2.4 Bankstown-Lidcombe Hospital

BLH is not a designated trauma centre. It specialises in upper gastro-intestinal surgery. Some surgical services, such as cardio-thoracic surgery, are carried out through a collaborative care model with RPAH. That is, patients are transferred to RPAH for these procedures.
Theatre capacity

BLH has 8 operating theatres which generally run from 8am to 5pm (although staff indicated that the finish time is often around 6pm). One of these is a dedicated emergency theatre, which is fully staffed from 8am to 11 pm. After hours, the emergency theatre staffs are on-call. The hospital has accommodation facilities for staff to stay overnight while on-call to ensure that they are no more than 30 minutes away from the hospital if called.

Some of the other theatres are dedicated to other clinical specialities on certain days.

Theatre lists and rostering

At BLH, the attending medical officer calls the theatres and books theatre time for general surgery, and may also talk to the anaesthetist in the emergency theatre, depending on the urgency. The anaesthetist sets the priorities in discussion with the NUM. The NUM then advises the surgeons accordingly, and organises the preparation of the theatre.

The pre-admission screening clinic contacts patients 3 days prior to their scheduled surgery to confirm that they are still fit for surgery. The current rate of on-the-day cancellations is 3%, and the hospital aims to reduce that to 2%. We are informed that around 98% of patients come in on the day of their scheduled surgery.

13.2.5 John Hunter Hospital

Like RPAH, we consider that JHH has one of the better theatre management models. Its operating theatre service includes an acute general surgery unit (AGSU) and one dedicated emergency theatre. It also has another facility – the Royal Newcastle Centre (RNC) – which is dedicated to elective surgery.

JHH’s operating theatres are managed by an Operation Management Committee, which includes clinical staff. The theatre management team at JHH and RNC have weekly meetings to consider and address issues that may affect the efficient use of the theatres, such as equipment needs, competing demand for theatre time and cancellations. These meetings are attended by representatives from different clinical specialties and operational areas, such as the sterilizing department, oncology, paediatrics, ICU, etc. Therefore, if any part of the surgery chain has an issue, eg, cancellations or equipment shortages, respective departments can make changes to accommodate.
Theatre capacity

JHH has 9 operating theatres in the main hospital and another 5 theatres in the RNC. The theatres in the main hospital operate on 3 sessions through the day: morning session is 8am-12.30pm, afternoon session is 1pm-5.30pm, and twilight session is 5pm/5.30pm-10pm. The RNC’s operating hours are generally from 8am to 5.30pm consisting of morning and afternoon sessions.

There is one 24 hour dedicated emergency operating theatre, and dedicated trauma services: 2 trauma rooms from Monday to Friday for 10 hours each day, and 3 urgent operating theatres on weekends (covering orthopaedic trauma, neurosurgery and general surgery, which run from 8am to 10pm). As part of the AGSU plan, they also have 1 session per day from Monday to Friday dedicated to AGSU for urgent general surgery.

Similar to RPAH and RNSH, they have dedicated theatre rooms set up for specialities to spare wastage movement of equipment. However their room dedications are based on a 4 week schedule determined by historical relationships and size (ie, cardiac, vascular, neurosurgery, general need time each day) as well as the surgical waitlist demand.

The hospital aims to develop a model that involves moving patients to procedure rooms for post-surgery procedures (rather than doing these procedures in the operating theatre) to free up more operating theatre time.

JHH indicated that it generally has sufficient equipment for its operating theatres, so equipment issues do not normally limit theatre availability.

Theatre lists and rostering

At JHH, theatre time is allocated to surgeons based on their historical operation durations, as this can vary from surgeon to surgeon.

To reduce scheduling conflicts, there is a 2-tiered process for the duty anaesthetists. One takes overall responsibility (including forward planning for the next day) and the other is responsible for the 24-hour emergency theatre. The nurses also play an active role as the NUM liaises with the anaesthetist and surgeon about priority.

Patients are called up the day before their scheduled surgery to confirm their attendance and also to check that they are still fit and able to undergo surgery. This helps minimise cancellations and allows theatre time to be reallocated if patients are not fit for surgery.

Recommendation

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.
13.3 Average operating times

To compare the average operating times across the study hospitals, we used theatre data provided by the hospitals. To ensure we compared like-with-like, we focused on selected clinical areas (or patient sub-groups within these areas) where the principal diagnosis or procedure is very similar.

We defined the operating time as the difference between the surgery start time and the surgery end time. We selected this measure because the dataset available on it was more complete and comparable than the data on other possible time measures (see Box 13.1 for more information).

Table 13.2 shows our findings on the average operating time for the first operation in the selected clinical areas and subgroups. In general, it shows that the average operating time for groups of similar patients are broadly consistent across the study hospitals. However, there are also some apparent anomalies.

Table 13.2 Average operating time for the first operation across study hospitals for selected case study groups (minutes)

<table>
<thead>
<tr>
<th>Clinical area and patient subgroups</th>
<th>RPAH</th>
<th>IRO</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract/lens</td>
<td>26.9</td>
<td>16.7</td>
<td>29.7</td>
<td>33.2</td>
<td>20.2</td>
<td></td>
</tr>
<tr>
<td>Major chest procedure – Malignant</td>
<td>75.3</td>
<td>89.6</td>
<td></td>
<td>80.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appendectomy</td>
<td>70.2</td>
<td>62.8</td>
<td>64.4</td>
<td>53.9</td>
<td>64.4</td>
<td></td>
</tr>
<tr>
<td>Cholecystectomy – with fluoroscopy</td>
<td>101.0</td>
<td>93.0</td>
<td>94.2</td>
<td>82.2</td>
<td>99.7</td>
<td></td>
</tr>
<tr>
<td>Cholecystectomy – without fluoroscopy</td>
<td>69.9</td>
<td>89.9</td>
<td>95.3</td>
<td>67.2</td>
<td>82.0</td>
<td></td>
</tr>
<tr>
<td>Breast surgery – Excision of lesion malignant</td>
<td>53.0</td>
<td>47.5</td>
<td>118.9</td>
<td>81.0</td>
<td>94.7</td>
<td></td>
</tr>
<tr>
<td>Breast surgery - Mastectomy</td>
<td>99.8</td>
<td>14.7</td>
<td>45.0</td>
<td>68.0</td>
<td>139.9</td>
<td></td>
</tr>
<tr>
<td>Hip replacement - Arthritis</td>
<td>a</td>
<td>103.0</td>
<td>106.6</td>
<td>113.8</td>
<td>96.1</td>
<td>100.4</td>
</tr>
<tr>
<td>Hip replacement - Fracture</td>
<td>112.7</td>
<td>a</td>
<td>94.0</td>
<td>90.0</td>
<td>88.5</td>
<td>90.6</td>
</tr>
<tr>
<td>Hip replacement - Other diagnosis (Revision)</td>
<td>172.0</td>
<td>146.8</td>
<td>154.9</td>
<td>150.9</td>
<td>145.3</td>
<td>135.9</td>
</tr>
</tbody>
</table>

The HIE data shows that there were 9 patients at RPAH in the Hips- arthritis category. We have not reported the surgery minutes for this group because, notwithstanding the low number of cases, analysis of these patients’ diagnosis codes indicates that they are not the usual arthritis cases and so are not comparable to the rest of the group. The Hips-fracture category at IRO is not presented for similar reasons.

Source: Operating theatre data provide by hospitals.
Our discussions with hospital staff identified a range of factors that can lead to differences in the recorded time taken to perform similar operations at different hospitals. For example, these factors include:

- **Whether or not the hospital is a teaching hospital.** At many hospitals, training registrars is a major part of their role. At these hospitals, the specialists performing operations are often training registrars at the same time. As a consequence, the average time taken per operation may be higher (and the number of cases per theatre list may be lower) than where training is not being provided. For example, Table 13.2 shows that the average operating time for cataract surgery at RPAH and RNSH (both of which are teaching hospitals) is around 30 minutes, whereas at GH (which doesn’t conduct training in this area) this time is around 17 minutes.

- **Differences in case types within DRGs.** Even when patients are categorised in the same DRG, there may be differences in their condition or principal diagnosis that can lead to differences in the required operating time. For example, hip joint replacement cases are categorised into 3 DRGs (I03A, I03B and I03C). However, for our case study analysis we found it was necessary to divide these cases into 6 subgroups based on principal diagnosis and whether they had a primary hip replacement or a revision. As Table 1.3 shows, the average operating time for patients in the same subgroup is reasonably similar across the study hospitals. But there are significant differences in the operating times for patients in different subgroups – ranging from around 100 minutes for arthritis and fracture cases, and more than 150 minutes for other diagnosis (revisions).

- **Differences in case complexity.** There can be differences in the complexity of cases treated that may not be captured in the coded data items held in the inpatient data collection but which lead to differences in operating times.

- **Differences in what data is recorded and the quality of this data.** Different hospitals use different paper and computer systems to capture operating theatre information. This can lead to differences in what they record in relation to operating times and the quality and completeness of these data. While we tried to minimise these differences in selecting the measure we used for this analysis and by eliminating cases where the data was clearly incomplete, we still have concerns about the quality of the data (see Box 13.1 for more information).

- **Differences in surgeons and their preferences.** Different surgeons perform the same procedure within different timeframes. This can be partly due to differences in the techniques they use. For example, some clinicians who perform cholecystectomies (to remove the gall bladder) routinely do an operative cholangiogram (a type of imaging used in surgery) which adds to the duration of the operation, while others do not.

**Recommendation**

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.
Box 13.1 Why we measured operating time as the difference between the surgery start time and end time

Operating theatre data is either entered directly into an operating theatre system by nursing staff in the theatres, or entered by theatre nurses onto paper sheets that are included in the patient’s medical records and then entered into an electronic theatre system later.

We found that the operating theatre data provided by the hospitals were not always comparable. Some hospitals recorded different data in relation to the duration of the operation. For example, there are several possible points from which an operation’s start time could be measured, including when the patient entered the theatre suite, when the patient entered the theatre room, when the anaesthetic was administered and when the surgeon started. Some hospitals usually recorded all of these points, while others did not, or did not do so consistently.

We also found that the operating theatre data provided by the hospitals included anomalies, gaps and inconsistencies. For example, we found that in some cases, the wrong start and end time had been recorded (ie, the start time recorded was later than the end time, resulting in a negative surgery duration). In other cases, we found that start or end time was simply not recorded.

In discussions with the staff who manage the operating theatres at the hospitals, it is clear that there is a lack of guidance on how to record surgery times, and therefore lack of consistency. There is also a lack of administrative resources to capture and record quality data.

To minimise the impact of data issues on our analysis, we chose to measure the operating time as the difference between the surgery start time and surgery end time, as the data on this measure was the most complete. Staff at RPAH suggested that the difference between the time the patient entered the theatre room and left this room is a more reliable measure. However, when we examined the data provided by the study hospitals, we found that the data on 36% of RNSH’s relevant cases and 9% of GH’s relevant cases had missing entries for the room departure time. Therefore we were unable to undertake comparisons on this basis. We also omitted data on cases where the data indicated a negative surgery time, and where either the surgery start time or end time was missing.

Nevertheless, we still have concerns about the quality and consistency of the data and therefore our comparison of average operating times across the study hospitals should be interpreted with care.
13.4 Effect of theatre access and management on patient flow

The accessibility of a hospital’s operating theatres can influence how efficiently patients flow through the hospital, as well as patient care and outcomes. For example, GH has a relatively high number of emergency cases for a hospital of its size. It tends to treat cholecystectomy cases presenting at emergency by stabilising the patient’s condition and arranging for them to return for a planned operation. During discussions, GH indicated that it would prefer to operate on these cases acutely, but opts for this path of treatment to manage the limited access to its emergency theatre. In contrast, at RPAH – where theatre access is not so limited – more of these cases are operated on acutely.

Theatre management practices, such as whether theatres have flexible and fixed sessions in the day and whether overtime can be used to complete scheduled operating lists, can also affect patient flow. For example, RPAH indicated that it aims to use up all the available theatre time in a day, even if this means that overtime will be required to complete the last operation. However, GH indicated that it reviews its operating lists during the day and where overtime is likely to be required to complete the last operation, it considers re-scheduling that operation to the next day. Similarly, RNSH indicated that its general practice of scheduling 2 operating sessions per day, separated by a fixed lunch break, reduces the accessibility of its theatres. For instance, this practice can result in operations needing to be rescheduled because an earlier operation took longer than the estimated time.

In addition, limited access to diagnostic testing services can delay patients going to the operating theatres, which then hinders their flow through the hospital. For example, in acute cases of appendicitis and cholecystectomy, the surgeon may require CT scanning before operating. At some hospitals, access to CT scanning is not readily available after hours, and this can lead to delays in these operations. We noted evidence of this issue when we reviewed data and samples of medical records at GH. Similarly, in discussions with BLH, the hospital indicated that while it can undertake a particular diagnostic test on-site, the results of this test need to be verified at Liverpool Hospital, and this can delay the patient’s progress through treatment.

13.5 National Hospital Cost Data Collection information on operating theatre costs

We attempted to compare the costs of running operating theatres across the study hospitals using final data from the National Hospital Cost Data Collection (NHCDC) for 2008/09 provided by area health services to the NSW Department of Health. The data were provided at the patient level, which enabled us to identify the costs relating to the specific clinical areas (or subgroups of these areas) we focused on in assessing operating theatre costs.
However, when we examined the data closely, we identified many concerns about its quality. For example, we noted that for some patients, there was no allocated operating theatre cost even though they were allocated a surgery DRG such as appendicectomy or hysterectomy. We also noted that at one hospital all patients in a DRG were allocated the same surgery cost regardless of time spent in surgery.

In addition, when we calculated the average operating theatre cost per minute of surgery for similar procedures (using total operating theatre costs allocated to these procedures in the NHCDC data and the average operating times for these procedures discussed above), we found that the average cost per minute varied markedly across the study hospitals. More significantly, we found that this cost varied even where the average operating times were very similar across the hospitals.

To illustrate this point, Table 13.3 compares operating theatre data for patients undergoing cataract surgery (lens replacement) and hysterectomy. It shows that in relation to cataract surgery at GH and RNSH, the total operating theatre cost per patient is similar at these hospitals even though the amount of time in surgery varies by a factor of 1.8. In other cases, hospitals with similar average operating times have a very different average operating theatre cost per minute. We are not suggesting that average operating time is a perfect proxy for operating theatre costs, but include this comparison to show the variability in the relationship among hospitals.

### Table 13.3 Operating theatre cost data for cataract surgery and hysterectomy DRGs

<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>NHCDC data on total operating theatre cost per patient ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataract surgery/lens replacement*</td>
<td>1,103</td>
<td>606</td>
<td>666</td>
<td>1,344</td>
<td>755</td>
</tr>
<tr>
<td>Hysterectomyb</td>
<td>3,752</td>
<td>3,549</td>
<td>2,070</td>
<td>2,909</td>
<td>3,965</td>
</tr>
<tr>
<td><strong>IPART analysis of average operating time (minutes)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataract surgery/lens replacement*</td>
<td>27</td>
<td>17</td>
<td>30</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>Hysterectomyb</td>
<td>128</td>
<td>98</td>
<td>92</td>
<td>133</td>
<td>103</td>
</tr>
<tr>
<td><strong>IPART calculation of average operating theatre cost per minute of surgery ($)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cataract surgery/lens replacement*</td>
<td>41</td>
<td>36</td>
<td>22</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>Hysterectomyb</td>
<td>29</td>
<td>36</td>
<td>23</td>
<td>22</td>
<td>38</td>
</tr>
</tbody>
</table>

* DRGs C16A and C16B (weighted by number of cases). Less than 5% of cases are in DRG C16A.

b DRG N04Z.

**Source:** NSW Health, NHCDC, final data for 2008/09.
13.6 Other data quality issues

In using and comparing data from the HIE with the data sets from the operating theatres, we found that some data fields included incomplete, or in some cases inaccurate information. In some instances, this reflected incomplete entry of data by hospital staff. We emphasise that these fields recorded in the HIE do not affect patient care, since this data entry usually occurs after a patient has been discharged from hospital. However, the accuracy of this data does affect the reliability of cost analysis, clinical research and other analysis.

Recommendation

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.
14 Pharmacy

Hospital pharmacies provide medications for the hospitals’ inpatients during their hospital stay and upon discharge, and for patients of ambulatory care services provided by the hospitals (including outreach services).137 The hospital pharmacies work closely with clinicians to ensure optimal prescribing choices are made, and provide medication reviews for inpatients. They may also be involved in research, and may make use of clinical trial opportunities that arise. Those at major hospitals also have an education and training function because of the complex clinical medication management issues inherent in their work.

On average, hospital pharmacy costs amount to about 5% of NSW hospitals’ total expenditures (which is higher than both imaging and pathology costs).138 Therefore, good pharmaceutical management has significant implications for hospital costs, as well as for the quality of patient care and safety. In addition, the management of antibiotic use to minimise antibiotic resistance is an important hospital-wide issue, and has implications for public health in general.

Due to the lack of readily available, consistent data on medication use and the wide scope of this study, we were not able to analyse hospital pharmacy costs in detail in the timeframe of this review. Section 14.4 at the end of this chapter sets out particular issues that cause significant difficulties in estimating patient-level pharmacy costs. We instead undertook a high-level review of selected aspects of hospital pharmacy management likely to influence hospital pharmacy costs, patient care and outcomes at the 5 study hospitals. These included each hospital’s:

- proportion of drugs dispensed by the pharmacy versus kept on imprest
- approach to purchasing pharmaceuticals
- policies and guidelines for the use of certain drugs
- formal approval processes for the use of certain drugs
- measures to encourage wards to return unused drugs to minimise waste
- participation in antibiotic/antimicrobial stewardship programs

137 Some hospitals also contain commercial pharmacies, which sell over the counter and prescription medications to the public, but these are not the subject of this chapter.

138 National Hospital Cost Data Collection, Public Sector - Peer Group A1 – Sample Round 12 (2007-08) AR-DRG 5.1 Cost Report, pp 48-49. Pathology costs and imaging costs each amounted to around 3% of total costs.
policies on the number of days’ medication provided on discharge

policies on the provision of medication to patients treated through ‘hospital in the home’ programs

systems and practices for monitoring, reporting, auditing and reviewing the use of certain drugs

practices in relation to allocating hospital pharmacy costs.

The section below summarises the overall findings and recommendations from this high level review. The subsequent sections briefly discuss our findings on each of the aspects we reviewed. Box 14.1 briefly describes the two main ways that medications are stored and distributed to patients in hospitals – ‘dispensed’ or ‘imprest’.

Box 14.1 The two main ways that pharmacies distribute medications - dispensed and imprest

There are 2 broad ways that medications can be managed and provided to patients in hospital. They can either be ‘dispensed’ or ‘imprest’.

Dispensed medications are managed and controlled by the hospital’s pharmacy and allocated (or dispensed) by pharmacists directly to patients.

Imprest medications are stored and controlled in or near wards, and normally allocated to patients by nursing staff as required.

The specific medications that are dispensed versus imprest vary from hospital to hospital. However, ‘high risk’ eg, addictive or high cost drugs tend to be dispensed, while lower risk, low cost, drugs tend to be ‘imprest’.

The proportion of all medications that are dispensed vary from hospital to hospital.

14.1 Summary of findings on pharmacy management

We found that:

The proportion of drugs that were dispensed to patients by pharmacists varied markedly across the study hospitals. Likely reasons for the variation include differences in the hospitals’ specific needs, as well as considerations of cost, safety and convenience. However, further investigation would be required to understand the cost and outcome implications.

The study hospitals used various approaches for purchasing drugs. Some were covered by the State contract for pharmaceuticals, and some were not covered by this contract. While different approaches are likely to produce different levels of cost savings, we did not have the data needed to analyse these differences.
All the study hospitals had guidelines and policies in place to ensure appropriate use of high-cost drugs and antibiotics. They monitored the use of antibiotics, non-section-100\textsuperscript{139} high-cost drugs and drugs held on imprest to identify trends and anomalies. In addition, they all regularly conducted audits and reviews of medication usage and compliance with guidelines.

Only 3 of the 5 study hospitals had incentives in place for wards to return unused medication to minimise wastage and reduce costs.

Four of the study hospitals participated in the National Antimicrobial Utilisation Surveillance Program (NAUSP), and 3 had active antimicrobial stewardship programs in place. These stewardship programs have been shown to reduce institutional infection rates, as well as morbidity, mortality, and costs.

There are some differences in the number of days of medication the hospitals provided patients upon discharge. These differences are primarily due to the hospitals considerations of drug safety, costs, and also the ease with which the patient is able to collect further medication from a pharmacy outside the hospital once the discharge medication has run out.

All of the hospitals have home-based or community care services in their area. BLH and JHH have Hospital in the Home (HITH) programs where the patients are treated as inpatients of the hospital; RNSH and GH transfer to an APAC\textsuperscript{140} ‘virtual hospital’ service while RPAH noted that their community care option is a growing area of care. The different study hospitals also have slightly different policies with regard to the provision of medication to these patients. Some are treated as inpatients and the hospital meets all the pharmacy costs, while some are discharged with the medication.

### 14.2 Hospital pharmacy practices for management of pharmaceuticals

From our visits to the hospitals, we learnt about study hospitals approaches to the management of their hospital pharmacy function. This section provides an overview of our findings on key aspects of hospital pharmacy practices that affect medication safety, patient outcomes and pharmaceutical costs at the hospitals.

#### 14.2.1 Proportion of drugs dispensed versus held on imprest

Hospital pharmacies hold a large range of medications, including highly specialised drugs and drugs being used in clinical trials. Some are dispensed to patients from the pharmacy itself, while others are held in the wards on imprest (a fixed amount of named drugs) so they are available for clinicians and nurses to use as required.\textsuperscript{141}

\textsuperscript{139} Section 100 drugs refer to Highly Specialised Drugs (HSDs) because the funding arrangements are authorised through Section 100 of the Commonwealth’s National Health Act 1953.

\textsuperscript{140} Acute and Post Acute Care.

\textsuperscript{141} IPART visits to study hospitals, November to December 2009.
Hospitals’ policies and practices on the types and amounts of drugs that must be dispensed or can be held on imprest have implications for their pharmacy costs, as well as for managing the use of certain drugs and patient safety. Of course, a certain level of drugs held on imprest is appropriate, especially in the case of emergency departments and intensive care units, where the ability to administer drugs swiftly can have a significant impact on patient outcomes. Table 14.1 summarises some of the advantages and disadvantages of having a high proportion of drugs being dispensed by the pharmacy, as opposed to being held on imprest.

Table 14.1 Advantages of dispensing medication

<table>
<thead>
<tr>
<th>Advantages of dispensing</th>
<th>Disadvantages of dispensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes it easier to record and monitor drug use, allowing for increased pharmacy control of appropriate drug use and therefore safety and costs</td>
<td>Requires more pharmacy staff to handle dispensing</td>
</tr>
<tr>
<td>Helps prevent theft and misuse of medication</td>
<td>Increases burden on medical and nursing staff as there is a need to visit pharmacy more frequently</td>
</tr>
<tr>
<td>Increases ability to monitor expiry and minimise wastage</td>
<td></td>
</tr>
</tbody>
</table>

We found marked differences between the proportions of drugs dispensed versus those held on imprest across the study hospitals (Table 14.2). There was a very low level of imprest at BLH (20%) and very high levels at RPAH (75%) and JHH (80%-85%). RNSH and GH had 50% imprest.

These variations are likely to be due partly to variations in the hospitals’ policies based on considerations of costs and convenience, as well as policies relating to the use of high-cost and high-risk drugs. The hospitals’ past practices are also likely to be a contributing factor in deciding on the proportion of drugs to hold on imprest. However, further investigation would be needed to identify the reasons for the differences in the hospitals’ imprest levels, and the impact these have on patient outcomes, drug safety and costs.

Table 14.2 Proportions of drugs dispensed and held on imprest, 2008/09

<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>Imprest</td>
<td>75</td>
<td>50</td>
<td>50</td>
<td>20</td>
<td>80-85</td>
</tr>
<tr>
<td>Dispensed</td>
<td>25</td>
<td>50</td>
<td>50</td>
<td>80</td>
<td>15-20</td>
</tr>
</tbody>
</table>

Source: IPART visits to study hospitals, November to December 2009.

Several of the study hospitals indicated that the use of electronic dispensing machines for their imprest stock could potentially provide a means of improving patient safety and reducing costs through increased control of drug use. For example, these machines could help reduce medication errors, pilfering and wastage through better control of expiry dates. RNSH has indicated that they are moving towards introduction of the Pixus electronic dispensing system as part of its...
redevelopment. This will potentially improve medications safety and reduce dispensing from the pharmacy itself and improve controls of drug usage.142

### 14.2.2 Approach to purchasing pharmaceuticals

Based on discussions during our hospital visits, we found that each study hospital procured the majority of the pharmaceuticals it requires through the state-wide contract for pharmaceuticals.143 This contract is one of a number of state-wide contracts administered by NSW Procurement, a division of the NSW Department of Services, Technology and Administration. The purpose of these contracts is to aggregate the buying power of the whole of the State Government, with the aim of achieving large cost savings. The current State contract for pharmaceuticals involves 3 major distributors and over 30 large pharmaceutical companies. NSW Procurement has estimated that the annual cost saving across the NSW health sector as a result of this contract is $4.6 million.144

However, not all the pharmaceuticals hospitals need can be procured under the State contract. For example, GH indicated that although it purchased between 90% and 95% of all its medications under the contract, the contract only covered around 60% of the pharmaceutical products it used. We found that the study hospitals used a variety of approaches to purchase products not available under the contract. Some simply bought direct from the wholesaler. Others ran tender processes, or engaged in direct negotiation with the suppliers.

The hospitals that ran tenders or negotiated with suppliers tended to collaborate with others to strengthen their bargaining power. A well-run tender or negotiation process is likely to produce some cost savings for the hospitals involved. Occasionally, hospitals were offered bundled deals from suppliers, which could also provide some savings.

The pharmacies at some hospitals, including GH, do not have a dedicated purchasing officer, and GH believed that more savings could be made if it did. For example, this would allow it to more readily and effectively request tenders and negotiate contracts with suppliers.145

Due to the lack of data on pharmaceutical costs, we are unable to provide an in-depth analysis of the different approaches used by the hospitals to identify and compare the cost savings they produce.

However, we note that the current pharmacy reforms in NSW will have a major impact on NSW Department of Health contract implementation and pharmaceutical supply and procurement in NSW hospitals (see section 14.3.1 below).

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142 IPART visits to study hospitals, November to December 2009.
143 IPART visits to study hospitals, November to December 2009.
145 IPART visits to study hospitals, November to December 2009.
14.2.3 Policies and guidelines on the use of certain drugs

A hospital’s pharmacy, together with its drug committees, is responsible for setting its policies and guidelines on the use of certain drugs (or categories of drugs) to limit or manage their use. These policies usually focus on high-cost drugs, or drugs that may involve a significant risk to the patient or to public health (e.g., some antibiotics). Therefore, appropriate policies (and compliance with these policies) can help control hospital costs and improve patient care and outcomes.

We found that all 5 study hospitals had a wide set of clinical policies and guidelines that govern their use of high-cost drugs and antibiotics to encourage responsible usage and reduce inappropriate dosage. Some of these policies were based on national or state guidelines, while others were internal to the hospitals. They covered matters such as:

- appropriate medication and dosage
- which drugs can be held on imprest
- which drugs require approval from hospital drug committees before they can be acquired or dispensed (see section 14.2.4 below)
- who may prescribe or dispense certain drugs
- the number of days of medication to be dispensed to the patient upon discharge (see section 14.2.7 below).

JHH advised us that several of its clinical practice guidelines (such as those for community-acquired pneumonia, cellulitis, and infectious diseases) are available in summarised form on guidance cards, which the doctors and nurses can carry with them.

We also found that all study hospitals conducted regular audits and reviews to measure compliance with these policies and guidelines (see section 14.2.9 below).146

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146 IPART visits to study hospitals, November to December 2009.
14.2.4 Formal approval processes for the use of certain drugs

All study hospitals appeared to have formal procedures in place for approving the use of certain drugs, including:

- high-cost drugs that are not Section 100 drugs\(^\text{147}\)
- drugs that may involve significant risk to the patient
- drugs where the total treatment course cost per patient exceeds $10,000.\(^\text{148}\)

In most cases, approval must be sought from the hospital’s drug committee. This committee then considers the evidence of the drug’s effectiveness, the number of patients to be using the drug, the risk to the patients from using the drug, and the cost to the hospital of using the drug.

All study hospitals also indicated that they monitor high-cost drug use. Although only one hospital (RNSH) explicitly noted that the hospital drug committee is involved in this process, this is likely to be the case at all hospitals.\(^\text{149}\)

A review of the effectiveness of these controls was outside the scope of this study, however we understand that management and support processes for these types of controls does differ among hospitals, thus impacting their relative effectiveness.

14.2.5 Measures to encourage the return of unused medication by wards

In some cases, not all the drugs on imprest in a ward or dispensed for an inpatient are used before expiry. During our hospital visits, most of the study hospitals indicated that they encourage wards to return unused medication to pharmacies to minimise waste and to ensure safe disposal.\(^\text{150}\) For example:

- GH has a process around returns medication (when the hospital collects/returns unused items) and monitors and calculates saving via credits (which are costed back to wards). However, the pharmacy’s policy is to only process returns with a nominal value of at least $2 to $3.

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\(^{147}\) As stated in footnote 3, ‘Section 100’ drugs refer to Highly Specialised Drugs (HSDs) because the funding arrangements are authorised through Section 100 of the Commonwealth’s National Health Act 1953. Such drugs “are medicines used in the treatment of chronic medical conditions which, because of their clinical use or other special features, are restricted to supply to outpatients through hospitals having access to appropriate specialist facilities. Benefits are available for listed clinical indications only.” (Western Australia Department of Health, 2010) (http://www.health.wa.gov.au/hsd/healthconsumers/index.cfm).

\(^{148}\) This applied at RNSH (IPART visits to study hospitals, November to December 2009).

\(^{149}\) IPART visits to study hospitals, November to December 2009.

\(^{150}\) However, any medication brought into the hospital by patients is disposed of rather than placed into pharmacy stock for supply to other patients as the integrity of the medication cannot be guaranteed (NSW Health Patient Matters Manual - Pharmaceutical Matters, amended January 2010, Chapter 20, section 4.4.1.1).
RNSH credits the value of returned medication back to the cost centre, but this value must be more than $50 (to ensure the handling cost does not outweigh the value of the benefit).

BLH also has a policy where wards can return unused drugs to the pharmacy and get credit for their value.

At RPAH, both ward pharmacists and NUMs are responsible for returning suitable medication. This is then re-entered back into the system and is reflected in negative stock movement in inventory reports. A review is currently being undertaken of the overall process, largely to improve uniformity.

One of the key issues related to encouraging the return of unused drugs to hospital pharmacies is the risk that medication that looks similar could be mistaken for one another, which could result in medication errors. For that reason, RNSH noted it did not process returns for white tablets.

In terms of guidance in this area, NSW Health already publishes guidelines on various pharmaceutical matters for hospitals including storage and disposal. However, there are no guidelines specifically addressing the return of unused drugs from wards or units to pharmacies.

### 14.2.6 Participation in antimicrobial/antibiotic stewardship programs

According to the ACSQHC, an antimicrobial stewardship program is as ‘an ongoing effort by a health-care institution to optimise antimicrobial use among hospital patients in order to improve patient outcomes, ensure cost-effective therapy and reduce adverse impacts of antimicrobial use (including antimicrobial resistance)’. The key aims of such a program include reducing unnecessary use and promoting use of antimicrobials (such as antibiotics) that are less likely to cause antimicrobial resistance. Successful programs have been shown to reduce institutional infection rates, as well as morbidity, mortality, and costs.

Among our study hospitals, RPAH, RNSH and JHH indicated that they had active antimicrobial stewardship programs in place. These programs involved:

- restricting who can prescribe or dispense antimicrobials
- limiting the antimicrobials available on imprest, and monitoring usage to determine whether certain antimicrobials should be removed from or added to imprest

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151 IPART visits to study hospitals, November to December 2009.
requiring approval by infectious disease or microbiology specialists (if available) before administering certain antimicrobials

- regular monitoring and reporting (eg, monthly), and repeated reviews and audits on antimicrobials usage and occurrences of Methicillin-Resistant Staphylococcus Aureus (MRSA) acquisition (also known as Staph infection).

BLH stated that it was aware that it used more antibiotics than strictly necessary, and considered that implementing an antimicrobial stewardship program would likely provide significant cost savings and help prevent antimicrobial resistance.

All study hospitals except BLH participated in the National Antimicrobial Utilisation Surveillance Program (NAUSP). This program has monitored antimicrobial usage rates in hospitals on a national level since 1994, and at June 2009, 26 tertiary referral hospitals and one large private hospital participated in it. However, GH noted that although it collected antimicrobial usage data for NAUSP, it considered that lack of resources is preventing the hospital from analysing and using the data in a meaningful way.

See Chapter 16 on outcome, safety and quality indicators for a range of infection control indicators.

Recommendation

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.

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155 IPART visits to study hospitals, November to December 2009.
14.2.7 Policies on provision of medication on discharge

Policies on the number of days of medication provided to inpatients on discharge varied across the study hospitals:

- RPAH provided 5 days supply except where the patient requires a full course of antibiotics or a steroid reduction program, or has poor access to a GP.
- GH provided 5 to 7 days supply.
- RNSH provided 3 days supply, except where patient is discharged on Thursday to Saturday (5 days supply), or is a stent patient (7 days supply). The maximum supply provided was 2 weeks. In these cases the hospital may request a copayment.
- BLH provided 7 days supply, but not to all patients discharged.
- JHH provided 7 days supply, except where the patient requires a full course of antibiotics or is a stent patient (28 days supply).

We note that there is no specified state or national level policy on the number of days of discharge medication that should be provided. A NSW Department of Health policy directive states that the hospitals “must develop appropriate systems for the supply of medication to patients at discharge, with the aim of reducing adverse events resulting from the discharge process and ensuring continuity of care between the hospital and the community”. The policy directive further states that the hospitals should refer to the Australian Pharmaceutical Advisory Council’s *Guiding principles to achieve continuity in medication management (2005)* when developing such systems, and that the systems need to ensure that “an adequate quantity of medication is supplied to ensure continuity until the patient is able to obtain further supplies outside the hospital.”

The variations in the study hospitals’ policies reflect the hospitals’ considerations of drug costs and safety, as well as practical matters such as the patient’s access to a GP and a commercial pharmacy due to the timing of discharge or the location of their home.

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156 IPART visits to study hospitals, November to December 2009.
14.2.8 Policies on provision of medication to patients in ‘Hospital in the Home’ programs

Hospital in the Home (HITH) programs are defined as “the delivery of acute and post-acute care in the patient’s home as a substitute for being in hospital”. All of the hospitals have home-based or community care services in their area. However, BLH and JHH have HITH programs where the patients are treated as inpatients of the hospital. This compares with RNSH’s and GH’s transfer of patients to an APAC ‘virtual hospital’ service, while RPAH has a community care option available, noting this is a growing area of care. Even among the 2 hospitals with HITH inpatient programs (BLH and JHH), the policies in relation to providing medication to patients varied. BLH indicated it increasingly provides antibiotic treatment for patients in the home. It classes these patients as inpatients, and the hospital pharmacy bears the costs involved, including the costs of the infuser device if intravenous therapy is prescribed. However, the pharmacy recommends clinicians prescribe and use oral rather than intravenous antibiotics for these patients.

JHH indicated that it also provides antibiotic and other drug treatment for patients with infectious diseases as part of its ‘Out and About’ program. Clinicians determine a patient’s suitability for the ‘Out and About’ program. However, in contrast to BLH, these patients are usually those that need IV therapy. If the patient needs oral antibiotics, they are merely discharged with the antibiotics.

14.2.9 Systems and practices for monitoring, reporting, auditing and reviewing the use of certain drugs

As noted above, regular monitoring and reporting is an integral part of the antimicrobial stewardship programs in place at RPAH, RNSH and JHH. In addition, all study hospitals monitor high-cost drug use for trends and anomalies. They also monitor drugs held on imprest to identify changing needs and anomalies, while considering drug safety and limited shelf space in the wards.

Pharmacists and review committees conduct audits and reviews of medication usage and compliance with guidelines, and information is fed back to clinicians and, presumably, hospital drug committees.

RPAH advised that it has an incident monitoring system in place, in which medication incidents are recorded. We would expect the other hospitals to have similar systems in place.

159 Acute and Post Acute Care.
160 IPART visits to study hospitals, November to December 2009.
161 IPART visits to study hospitals, November to December 2009.
14.3 Current national and states initiatives to promote appropriate use of medication

A number of initiatives, both at state and national level aim to promote appropriate and safe use of medication. Ensuring that the patient is administered with the right medication, at the right time, and at the right dosage, is important for patient outcomes as well as costs. Medication errors can lead to co-morbidities and even mortality.

A recent review of Australian research papers published between 2002 and 2008, noted that 2% to 3% of hospital admissions in Australia are medication related. This is estimated to account for approximately 190,000 admissions per year in Australia, with estimated costs of about $660 million. Medication incidents are the second most common cause of hospital admissions in Australia.\textsuperscript{162}

Hospital pharmacists play an important role in ensuring medication safety of the patients. Hospital pharmacists are not only responsible for ensuring that the medication dispensed matches that which has been prescribed by the doctors, but also that the doctors do not prescribe inappropriate medication for the patients. The pharmacists typically also have an education role, and are responsible for ensuring medical and nursing staff stay well-informed on appropriate usage of medicines. Along with hospital drug committees, the pharmacists develop guidelines and policies on appropriate drug usage, and assist with ensuring these are adhered to.

This section provides a brief overview of key national and state-wide initiatives with a focus on promoting appropriate use of medication in Australian public hospitals.

14.3.1 NSW Department of Health Medication Management Program

The NSW Department of Health established the Statewide Medication Strategy Coordination Committee in December 2009 to take responsibility for the strategic coordination of activities to deliver safe, effective and cost efficient use of medications across NSW.

The Committee is responsible for the NSW Health Medication Management Forward Plan aimed at improving the safety and quality of activities related to acquiring and using medicines in NSW health services.

The core areas of work\textsuperscript{163} are:

\begin{itemize}
  \item Procurement, funding and supply chain for medicines (Pharmacy Reform Program).
  \item Clinical pharmacy model.
  \item Electronic medication management.
  \item Medication Safety Policies and Advice.\textsuperscript{164}
\end{itemize}

Each of these areas is outlined below.

\section*{Procurement, funding and supply chain for medicines}

The Pharmacy Reform program includes structural, financial management and safety aspects. These include:

\begin{itemize}
  \item An improved pharmacy business model, improved categorisation of drugs, better contracting for pharmaceuticals, an optimised supply chain, and funding reform.
  \item Implementing a single electronic pharmacy system (‘iPharmacy’) across all pharmacies in NSW public hospitals with direct links to the current purchasing system.
  \item Developing a NSW Health Master Pharmacy Catalogue using the National eHealth Transition Authority (NeHTA) Australian Medicines Terminology, and linking the individual pharmacy systems with this master catalogue.\textsuperscript{165}
\end{itemize}

\section*{Clinical pharmacy model}

The Clinical Pharmacy Model Development program aims to develop and provide a high-level implementation strategy for a model of care for clinical pharmacy. It aims to achieve this by reviewing current practice and relevant literature to identify and recommend principles for a clinical pharmacy model which sets out the complementary roles of health care team members including pharmacy staff. In developing the model, NSW Health will consider the role of the private sector in supporting patient safety strategies, and they will liaise with key stakeholders.

\textsuperscript{163} Other committees involved in this work are the NSW Pharmacy Reform Committee, the Clinical Pharmacy Model Working Party and the Medication Safety Expert Advisory Committee.


Electronic Medication Management

The Electronic Medication Management (eMM) program will review existing eMM pilots, develop an implementation strategy and business case.\textsuperscript{166}

The forward program on medication management highlighted that a comprehensive eMM system should support the 3 main activities of medication knowledge, medication delivery and medication supply. A key objective was to achieve better integration of local processes of pharmacy management and the clinical role of pharmacy into the system.

To date, three pilot implementations of ePrescribing and eAdministering of medications in NSW have been carried out at St Vincents, Concord and JHH. Hunter New England AHS, for example, has pursued pilot implementation of eMM on several fronts, including an electronic drug catalogue (with decision support) to be integrated across the clinical information systems, and a plan to roll out full electronic prescribing for discharge medications (during 2010).\textsuperscript{167}

Medication Safety Policies and Advice

The Medication Safety Policies and Advice program aims to:

\begin{itemize}
  \item Implement Prevention of Venous Thromboembolism policy.
  \item Develop Standardised Chart Change Request Register website.
  \item Implement Standardised Medication Chart policy.
  \item Implement High Risk Medicines policy.
  \item Roll-out Paediatric NIMC chart and education toolkit.\textsuperscript{168}
\end{itemize}

\textsuperscript{166} NSW Department of Health, \textit{NSW Medication Management Program Outline}, Updated 17 May 2010, pp 3-4.
\textsuperscript{167} CHIK Services Pty Ltd (Consultancy for NSW Health), \textit{Mapping Medication Management Forward Plan - Final Report}, December 2009, pp 3-11.
14.3.2 National and NSW initiatives to promote appropriate use of medication

Performance Indicators and Medication Safety

NSW TAG\textsuperscript{169} and the CEC have been working together on a two-phased Performance Indicators and Medication Safety (PIMS) project, focused on improving medication safety systems and monitoring performance in quality use of medicines in Australian hospitals.\textsuperscript{170}

The first phase was the adaptation of the Medication Safety Self Assessment for Australian Hospitals (MSSA), originally developed by the Institute of Safe Medication Practice (ISMP) in the United States. The MSSA is designed to allow the hospitals to identify opportunities for improvement, and to compare themselves with other hospitals of similar characteristics. The CEC has also developed an MSSA for Antithrombotic therapy.

The ACSQHC completed a National Medication Safety and Quality Scoping Study in 2009 which made 45 recommendations to improve patient safety and the quality of health outcomes.\textsuperscript{171} The ACSQHC has recommended national adoption of the MSSA to “identify risks in acute care medication management systems and to drive improvement”. The ACSQHC is assessing development of additional specialised MSSAs for other high risk areas.

The second phase of the PIMS project was the development of the manual of Indicators for Quality Use of Medicines in Australian Hospitals, which involved the revision of indicators included in two NSW TAG indicator manuals used previously in Australian hospitals. Indicators were selected based on the following principles:\textsuperscript{172}

\begin{itemize}
\item The indicators were likely to drive clinical practice and/or system improvement.
\item There was evidence that the highlighted practice would result in improved outcomes.
\item There was evidence of an important gap in hospital practice.
\item The indicators were likely to be meaningful for a variety of hospitals and useful to a variety of clinical and administrative groups.
\end{itemize}

\textsuperscript{169} The NSW Therapeutic Advisory Group Inc. (NSW TAG) is an independent, not-for-profit association representing Drug and Therapeutics Committees (DTCs) in NSW hospitals. Its members include clinical pharmacologists, pharmacists and other clinicians from the teaching hospitals of NSW and affiliated academic units. The goal of NSW TAG is “to promote quality use of medicines by sharing unbiased, evidence-based information about drug therapy.” (NSW TAG, \url{http://www.ciap.health.nsw.gov.au/nswtag/about_nswtag.html}).


\textsuperscript{171} Australian Commission on Safety and Quality in Healthcare, Update Issue, Issue 9, September 2009.

The final set of indicators consists of 30 indicators in the following areas of practice:173

- Antithrombotic therapy.
- Antibiotic therapy.
- Medication ordering.
- Pain management.
- Continuity of care.
- Hospital wide medication management policies.

**National Inpatient Medication Chart**

In April 2004, Health Ministers put forward a requirement that a common medication chart was to be in use in all Australian public hospitals by June 2006. As a result, the ACSQHC developed the National Inpatient Medication Chart (NIMC), a standard inpatient medication chart intended to assist with minimising medication errors and related adverse patient outcomes.

Following the introduction of the NIMC, a few revisions have been made to accommodate the outcomes of NIMC quality improvement projects. The Commission has also developed paediatric versions of the NIMC, and a version suitable for use in private hospitals.174

In November and December 2009, the Commission conducted an audit of NIMCs in participating facilities, in order to examine and compare the use of the NIMC safety features and provide guidance on future quality improvements. Results from the audit are not currently publicly available.

174 Private hospitals had issues with implementing the standard NIMC due to Pharmaceutical Benefits Scheme prescription requirements.
National Terminology, Abbreviations and Symbols for Prescribing and Administering Medicines

Use of unclear and potentially dangerous abbreviations and dose expressions is presently a significant risk to patient safety. In 2006, the NSW TAG Safer Medicines Group developed and released the Recommendations for Terminology, Abbreviations and Symbols used in the Prescribing and Administration of Medicines. In 2008, Health Ministers agreed to adopt these recommendations on a national basis, and the document is now maintained by the ACSQHC, and is named the National terminology, abbreviations and symbols to be used in the prescribing and administering of medicines in Australian Hospitals.175,176

Electronic Prescribing and Dispensing of Medicines

The national eHealth initiative aims to replace the current paper based prescription systems with electronic prescribing and dispensing of medicines.177

As part of this process, the NeHTA is developing and establishing standards that will enable electronic management of health information consistently throughout Australia. Of relevance to all states, including NSW, are the NeHTA initiatives focused upon:

- Supply chain issues – This involves the development of a national catalogue including medications.
- e-Medication management – Progress has been made on standards for EMM but there is more work to be done to integrate these into software applications.
- Healthcare identifiers – Considered a key enabler of the new eMM regime, the unique validated Healthcare Identifier numbers are to be fully allocated by 2012.
- Secure messaging – While the timing for implementation is unclear, secure messaging will enable a closed-loop exchange of medication information to cover all types and levels of healthcare settings.

Among the benefits expected from these electronic prescribing initiatives are:

- Improved confidentiality and security of medication information.
- Better clarity and communication of prescription information.
- Reduction in medication and dispensing errors.
- Decline in adverse drug events.
- Reduction in fraud risks present in the paper-based process.178

Safe Hospital ePrescribing and Electronic Medication Management Practice

NeHTA and ACSQHC are both developing tools to ensure that eMM systems are implemented safely, and that their use optimises both safety and quality of care in the hospital environment.

Guidelines will include:

- user requirements and a procurement guide for hospital ePrescribing and electronic medication management (EMM) systems
- an implementation toolkit for ePrescribing and EMM in hospitals, including safe ePrescribing and EMM practice.

Consideration is also being given to the development of a standard optimal user interface which builds on the National Inpatient Medication Chart, as well as the national standard terms, abbreviations and units.  

High 5s Medication Reconciliation Project

The High 5s Project is a patient safety collaboration among a group of countries and the WHO Collaborating Centre for Patient Safety in support of the WHO Patient Safety Program. The ACSQHC is driving the project in Australia.

The major part of the High 5s Project is the development and implementation of “Standard Operating Protocols” (SOPs) in high risk areas, including:

- assuring medication accuracy at transitions in care
- managing concentrated injectable medicines
- addressing health care-associated infections.

Nineteen hospitals from five Australian states have been recruited to participate in the 5-year medication reconciliation project from 2010. The hospitals will test the feasibility of implementing the medication reconciliation SOP across a range of health care settings and evaluate the effectiveness of the process.

Clinical practice guideline for the prevention of venous thromboembolism

The National Health and Medical Research Council’s (NHMRC) National Institute of Clinical Studies (NICS) has developed an evidence-based clinical practice guideline for the prevention of venous thromboembolism (VTE or blood-clots) in patients admitted to Australian hospitals.

Within this guideline, recommendations are presented by clinical procedure (eg, total hip replacement, hip fracture surgery, general surgery, gynaecological surgery) or medical condition (eg, stroke, myocardial infarction). Specific sections are included for cancer patients (surgical and non-surgical) and pregnancy and childbirth.¹⁸¹

14.4 Hospital pharmacy costs

14.4.1 Practices for allocating hospital pharmacy costs

Pharmacy costs are allocated in different ways across the study hospitals, and a summary is provided in Table 14.3. These differences make estimating pharmacy costs for patient-episodes and comparing these estimates across hospitals very difficult (see section 14.4.2 below).

Table 14.3 Allocation of hospital pharmacy costs at study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Allocation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH  Pharmacy costs are centralised.</td>
</tr>
<tr>
<td>GH     Individually dispensed pharmaceutical and drug inventory costs are allocated to wards on a pro-rata basis. There is no mechanism for internal charging of pharmacy operational costs which are managed through an allocated pharmacy costs centre.</td>
</tr>
<tr>
<td>RNSH    Pharmacy costs are allocated to wards on a pro-rata basis. Allocations for imprest are based on DRG service weights for pharmacy, and include overheads. Those for high-cost drugs and imprest are devolved to specialty departments and costed to the divisional cost centre or clinic.</td>
</tr>
<tr>
<td>BLH     Pharmacy costs are centralised.</td>
</tr>
<tr>
<td>JHH     Drug costs are devolved and allocated to wards monthly based on DRG service weights. Pharmacy overheads (mainly salaries and wages) are treated as fixed costs within corporate services, so that a fixed amount is charged back to the wards.</td>
</tr>
</tbody>
</table>

¹⁸¹ NHMRC, Clinical Practice Guideline
14.4.2 Why we did not estimate the cost of pharmaceuticals at the patient-level

Several aspects about the way hospitals and their pharmacies work in practice make estimating pharmaceutical costs for patient groups very difficult. These aspects include the following:

- As previously discussed, there was a significant difference in the proportion of medications that were dispensed directly to patients. Since only dispensed drugs can be directly attributed to a patient, only a share of the hospitals’ pharmaceutical costs can be estimated at the patient-level.

- As also noted, the study hospitals accounted for pharmacy costs in very different ways. For example, some hospitals recorded all pharmacy costs to a central cost centre, while others allocated them to wards and specialty areas (albeit using different approaches). Moreover, whether or not the costs allocated to wards included overheads or not also differed. In particular where the costs are centralised, patient-level cost estimates would be difficult and would likely prove unreliable.

- The differences in the number of days of medication provided upon discharge may have a significant impact upon total hospital pharmacy costs, and the total pharmaceutical costs of the patient episodes.

- Some hospitals also have Hospital in the Home programs to which the patient may be discharged.

- Moreover, some hospitals’ practices or policies promote earlier discharge of the patients than that of other hospitals. This may require the patient to obtain a larger portion of the medication from outside the hospital, and this will reduce the hospitals’ costs of providing medication for the treatment of the patient.

- As a consequence, the total pharmacy costs for patient episodes will also differ, even though the patients may be nearly identical in terms of their treatment needs and the care they receive in the course of their treatment. The difference may simply be that costs are apportioned differently between the different stages of the patient journey, while the total cost of treatment may be very closely aligned.

Due to the difficulties arising from these aspects for estimating patient-level pharmacy costs, we considered that the only way to obtain comparable patient level pharmacy cost estimates would be to conduct a medical records review. The limited time available for this study did not allow such a review to be carried out. However, we consider that conducting such a review in the near future could add considerable value to the analysis already provided in this study.

In addition, given the importance of medication errors to patient safety and the relatively high cost of pharmacy within hospital budgets, the significant differences in dispensing practice between the hospitals makes this an area of interesting and important future work by NSW Health.
15 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.

During our hospital visits, we had discussions with hospital management, medical, nursing and other staff about the ways that each study hospital configures specific services. Our aim was to identify the major differences across hospitals and understand the reasons for them. We mainly considered configurations of care at the case study level, but we also explored hospital management practices.

The sections below summarise the main differences in configurations of care we identified at the study hospitals. The subsequent sections discuss each of these differences in more detail and indicate whether we have recommended further clinical review to explore their impact on patient outcomes. For a more complete discussion of our analysis, findings and recommendations on configurations of care, please refer to our reports on each case study area.

15.1 Summary of our main findings on configurations of care

We identified a range of differences in the configurations of care provided at the study hospitals in our case study areas. The main differences related to:

- How operating theatre time is managed (hip joint replacement case study).
- How emergency surgery is managed (cholecystectomy case study).
- How planned surgery is managed (major chest procedure case study).
- Proportion of cases where planned surgery is done as day surgery or on a 23 hour basis (various case studies).
- Whether registrar training is provided during planned surgery (cataracts case study).
- How emergency surgery cases are diagnosed (appendicectomy case study).
How emergency medical cases are managed (stroke case study).

How discharge support and home-based post-surgery care is provided (breast surgery case study).

How discharge support and home-based obstetric care is provided (obstetrics case study).

How prostheses are selected and the types most frequently used (various case studies).

The types of surgery performed (various studies).

### 15.2 List of recommendations on configurations of care

It is suggested that NSW Health should consider or note these clinical differences or clinical issues.

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.

15.3 How theatres and surgery are managed and planned (hip joint replacement case study)

As Chapter 13 discussed, our analysis of operating theatre time identified differences in how the study hospitals manage and plan their surgery workloads. One of the most significant differences was that RPAH and JHH separated their planned (or elective) surgery workload from their emergency surgery workload by using dedicated elective surgical centres. In contrast, the other 3 hospitals scheduled a mix of planned and emergency surgery in their theatres.

One reason hospitals adopt the dedicated elective surgery centre model is to improve the efficiency of theatre management and planning. For example, this model allows elective surgery to be undertaken as planned, without the risk of patients being deferred to give priority to emergency cases. Another reason is to separate patients where there is a greater risk of infection from those where this risk is lower (such as those undergoing elective procedures).

In addition, our hip joint replacement case study analysis suggests that this approach may lead to a lower length of stay for patients, particularly those having planned surgery. This can be seen in Table 15.1 below, which indicates that length of stay for arthritis cases – which are virtually all planned surgery cases – was lower at IRO and JHH. Both of these hospitals used dedicated elective surgery centres for their patients. Length of stay was also lower at BLH, which may reflect the fact that this hospital treats a lower volume of trauma cases than other hospitals (see Box 15.1).
Table 15.1 Average length of stay for hip replacement for arthritis patients across study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Cases (number)</th>
<th>LOS3 (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRO(^a)</td>
<td>185</td>
<td>8.5</td>
</tr>
<tr>
<td>GH</td>
<td>87</td>
<td>9.0</td>
</tr>
<tr>
<td>RNSH</td>
<td>34</td>
<td>12.0</td>
</tr>
<tr>
<td>BLH</td>
<td>65</td>
<td>7.7</td>
</tr>
<tr>
<td>JHH</td>
<td>152</td>
<td>7.4</td>
</tr>
</tbody>
</table>

\(^a\) The cases shown were treated at IRO, which is the dedicated orthopaedic surgery centre at RPAH and undertakes all elective orthopaedic surgery for RPAH, including virtually all hip replacement for arthritis cases. RPAH treated only 7 such cases during 2008/09, 2 of which were admitted through the Emergency Department, and these cases have been omitted from the data.

Note: DRGs I03A, I03B and I03C, arthritis diagnosis codes. LOS3 measures total length of stay at the study hospital plus up to 2 other hospitals.

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

Box 15.1 Hip replacement case study - how the hospitals manage their theatres

- RPAH uses the IRO to separate planned and emergency orthopaedic work, including hip replacements. In effect, IRO operates as RPAH’s dedicated elective surgical centre for hip replacement and other orthopaedic procedures, while RPAH handles all emergency surgery cases. We also observed that there was strong clinical involvement in the management of theatre access.

- JHH has an integrated public surgery centre (the RNC) which undertakes most of its planned hip replacement cases.

- GH has a mix of planned and emergency surgery using common theatres. Due to the high volume of trauma and emergency cases at the hospital, theatre access for planned cases was perceived as an issue by hospitals staff.\(^a\)

- RNSH also has a mix of planned and emergency surgery, including trauma cases, and surgeons also raised theatre access for planned surgery as an issue.

- BLH has a mixture of planned and emergency surgery in its theatres, but receives less trauma cases, which are generally diverted to Liverpool or another hospital. Our overall observation from our visit was that there appeared to be less issue with theatre access than for GH or RNSH.

\(^a\) GH has advised that a recent increase in trauma theatre usage has lowered the incidence of elective surgery being cancelled due to access issues.
15.4 How emergency surgery is managed (cholecystectomy case study)

We identified 2 differences relating to how emergency surgery for cholecystectomy cases are managed at the study hospitals:

- One hospital – JHH – had a dedicated surgical team for emergency surgery.
- There were also significant differences in the proportion of cholecystectomy cases operated on as emergency cases.

15.4.1 Dedicated emergency surgical team

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. As discussed in section 15.3 above, 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 average length of stay for these cases was lower at JHH compared to the other study hospitals (see Table 15.2).

<table>
<thead>
<tr>
<th></th>
<th>RPAH days</th>
<th>GH days</th>
<th>RNSH days</th>
<th>BLH days</th>
<th>JHH days</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: DRGs H07A, H07B, H08A and H08B.  
Source: HIE inpatient statistics, 2008/09 and IPART analysis.

The average total number of days in hospital for emergency admissions and patients who were ‘transferred in’ ranges from 6.1 days at JHH to 10.8 days at GH. 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 acute stays (LOS1) at RPAH, GH, RNSH and BLH. JHH continues to have the shortest length of stay using this measure.

182 A similar model is used at some other hospitals including Nepean.
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.\(^{183}\)

### 15.4.2 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.\(^{184}\) In general, approximately half of these patients are suitable to receive cholecystectomy surgery within the next 24 hours.\(^{185}\)

Our case study analysis suggests there is considerable variation in the percentage of cholecystectomies performed acutely as emergency admissions across the study hospitals (Table 15.3). For example, we found that this percentage was only 16% at GH, compared to close to 50% at RPAH and JHH. (See Box 15.2 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>
<thead>
<tr>
<th>Table 15.3 Rate of cholecystectomies for emergency admissions, 2008/09</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RPAH</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Number of emergency admissions for cholecystitis or cholelithiasis</td>
</tr>
<tr>
<td>Number operated on acutely</td>
</tr>
<tr>
<td>Percentage operated on acutely</td>
</tr>
</tbody>
</table>

*Note: See Box 15.2 for details on how we compared the rate of surgery for emergency admissions.*

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

Table 15.3 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 other hospitals, specifically RPAH, which may account for the discrepancy in rates.\(^{186}\)


\(^{184}\) Often these patients will be admitted for a number of days.

\(^{185}\) 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.
the adjoining private hospital (North Shore Private Hospital). These cholecystectomies are not included in Table 15.3.

Box 15.2 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. ‘Cholecystitis’ refers to inflammation of the gall bladder, while ‘cholelithiasis’ refers to gallstones.

Based on the above findings, we recommended that NSW Health examine whether the difference in acute operative rates for cholelithiasis or cholecystitis 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 through emergency again with another acute episode. This can be seen in Table 15.4, 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 15.4 Cholecystectomy cases with previous emergency admissions for cholelithiasis or cholecystitis in the 12 months prior to surgery, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients with 1 prior emergency admission</td>
<td>27</td>
<td>34</td>
<td>19</td>
<td>28</td>
<td>18</td>
<td>126</td>
</tr>
<tr>
<td>Number of patients with 2 prior emergency admissions</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Number of patients with 3 prior emergency admissions</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total number of patients with prior emergency admissions</td>
<td>32</td>
<td>42</td>
<td>22</td>
<td>34</td>
<td>18</td>
<td>148</td>
</tr>
<tr>
<td>Total number of emergency admissions for these patients</td>
<td>37</td>
<td>51</td>
<td>25</td>
<td>40</td>
<td>18</td>
<td>171</td>
</tr>
</tbody>
</table>

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 (i.e., 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.

### 15.5 How planned surgery is managed (major chest procedure case study)

We noted a range of differences relating to the management of planned lung cancer surgery cases (the largest patient grouping in the major chest procedure case study). These included differences in:

- the proportion of these patients who had their principal surgical procedure on the day of admission
- the pre-admission processes for these patients
- the use of ICU staff and integration of clinical pathways in thoracic surgery
- the timing of chest drain removal after surgery.

These differences appeared to influence the average length of stay for these cases. In particular, we found that the average length of an acute episode (LOS1) for planned lung cancer surgery cases was lower for patients treated at RPAH (7 days) than for those treated at JHH (9 days) or RNSH (11 days).
15.5.1 Proportion of cases who had surgery on day of admission

We found that RPAH configured its care for planned lung cancer surgery cases so that virtually all the patients (99%) admitted from its waiting list had their principal procedure on the day of admission. In comparison, only 67% of such patients at JHH and 65% at RNSH had their procedure on the day of admission.

15.5.2 Pre-admission processes

We also found RPAH’s pre-admission processes differed from the other hospitals’, and these differences appeared to contribute to its ability to operate on almost all planned lung cancer surgery cases on the day of admission.

RPAH ran a pre-admission clinic for patients having day of admission surgery to educate them about their operation and to manage patient flow. It also employed a case manager to manage thoracic surgery patients and their pre-admission processes, including arranging motel/hotel or relative accommodation for regional patients for a day or so before the operation if needed. In addition, RPAH had separate, dedicated beds for cardiothoracic surgery cases.

In contrast, at both RNSH and JHH, the cardiothoracic beds were shared among allocations for other surgical wards. RNSH admitted about one third of its planned lung cancer surgery patients the day before their principal procedure to ensure they would be ready in the morning and had a bed. At JHH, some of its patients were transferred from another hospital and were admitted one or 2 days before the procedure for assessment. These patients tended to live a significant distance from JHH.

To some degree, RPAH’s pre-admission processes reflect the fact that it treats higher number of major chest cases than the other study hospitals. For example, it had 146 planned lung cancer surgery cases in 2008/09, while RNSH had 17 and JHH had 39. Therefore, it is likely to allocate more resources to managing pre-admission processes and patient flow for these cases than the other hospitals.

15.5.3 Use of ICU staff and integration of clinical pathways

Another likely reason for the shorter average length of stay for lung cancer surgery cases at RPAH was that the hospital ran a combined High Dependency Unit (HDU) and Intensive Care Unit (ICU) on one floor, and these units shared resources, including nursing staff. All major chest procedure patients, including lung cancer surgery patients, are cared for in this ward, and therefore have access to a highly skilled nursing staff 24 hours a day. This more intensive nursing appears to shorten the time they need to stay in the ward.
At RNSH and JHH, the ICU and HDU are separately located and managed. Therefore, only major chest procedure patients who require intensive care have access to the highly qualified nursing staff employed in the ICU. These are more likely to be patients admitted for an emergency major chest procedure (eg, due to collapsed or punctured lungs or infection-relation abscess or pyothorax conditions) than those receiving planned lung cancer surgery.

We also noted that RPAH ran a multidisciplinary clinic which facilitated the integration of cardiology and cardiothoracic medical pathways.

15.5.4 Timing of chest drain removal after surgery

In most cases, the treatment of planned lung cancer surgery patients includes 2 major chest operations: one to remove the tumour and surrounding lung tissue, and then another to remove the drains or tubes used to keep the lungs clear of blood and other fluid after the first operation. Based on advice we obtained during this study, we understand that clinicians at RPAH may be removing the drains at an earlier stage than at the other study hospitals.

As part of the major chest procedure case study, we reviewed a small sample of patient notes at each of the hospitals. We found that RPAH kept more complete notes regarding drainage from chest drains. However, we did not have time to estimate the average timing of the removal of drains across the study hospitals. To calculate a reliable estimate, we would have needed to undertake a comprehensive review of patient notes for all major chest procedure cases at the 3 hospitals.

We have recommended that NSW Health arranges for appropriate clinical expert groups to note these differences in configurations of care, and consider whether aspects of the model of care at RPAH are suitable to be used in other hospitals.

15.6 Proportion of cases where planned surgery is done as day surgery (various case studies)

In several of our case study areas, we noted differences in the proportion of like planned surgery cases performed as day surgery or on a 23 hour basis across the study hospitals. These cases included planned stenting procedures and hysterectomies.

15.6.1 Planned stenting procedures

In the cardiology case study, we found that JHH was performing stenting procedures on around 15% of patients in DRG F15Z ‘Stent without AMI’ as day surgery. In contrast, virtually all patients in this DRG at the other study hospitals spent at least 1 night in hospital.
15.6.2 Hysterectomy

In the hysterectomy case study, we found that RNSH was performing hysterectomies on around 10% of patients in DRG N04Z ‘hysterectomy for non-malignancy’ on a 23 hour basis. The other hospitals had far lower 23 hour surgery rates.\textsuperscript{186}

15.7 Whether registrar training is provided during planned surgery (cataracts case study)

In our cataracts case study, we noted that all the study hospitals except GH provided training opportunities for junior medical staff (registrars) on planned surgical procedures. At GH, only VMOs performed lens procedures, while at the other hospitals more junior staff also performed the operations under the supervision of senior medical staff. That said, JHH provided less training than the remaining study hospitals (about 75% of lens procedures were performed by VMOs). This may explain why the average length of lens procedures was shorter at GH and JHH than at the other hospitals.

We found that each lens procedure took roughly 30 minutes at RPAH, RNSH and BLH. Surgeons at GH took about half the time, on average (17 minutes), while surgeons at JHH took on average 20 minutes. Similarly, we found that the time between the end of one procedure and the beginning of the next procedure was significantly shorter at GH (7 minutes) than at RPAH, RNSH and BLH (18 to 19 minutes). The time between procedures was 11 minutes at JHH.

The implication of our findings is that hospitals that provide training opportunities for junior medical staff may appear to be ‘less efficient’ than hospitals that don’t because training requires additional time and resources. This has implications for activity-based funding.

15.8 Management of emergency medical cases (stroke case study)

We identified a number of differences in the way the study hospitals managed and provided care for stroke patients, and in particular differences in the administration of a recently new clot-dissolving medication (tPA). The effective use of tPA relies on early and clear diagnosis of the type of stroke (ie, whether is an ischaemic stroke caused by a clot or a haemorrhagic stroke caused by bleeding). Diagnosis is usually based on a CT scan of the brain. In order to receive tPA treatment, patients also need to arrive at a stroke unit with medical staff to dispense tPA within a given time period.

\textsuperscript{186} These figures include emergency hysterectomies, not just planned hysterectomies. However, including emergency hysterectomies is unlikely to materially affect the analysis, as they only comprise 2% of hysterectomies on average at the study hospitals.
All the study hospitals had specialised stroke units for acute stroke patient care since about 2003. However, they differ in size, opening hours and the care they provide. We found that only RPAH and RNSH remove blood clots surgically (a low number). We found that JHH and GH had the highest rates of tPA use.

Stroke unit operating hours and staff preferences limited the use of tPA in some instances. We note that the use of tPA for stroke is not universally accepted because it carries a risk of complications due to bleeding. We understand that senior clinicians have differences of opinion regarding the risks and benefits of using tPA for stroke, and that this may be a factor limiting the use of this treatment option.

Both JHH and GH have implemented bypass arrangements with NSW Ambulance Service to deliver some stroke patients to the stroke unit with minimum delay. As a consequence of these arrangements, as well as less traffic congestion, JHH and GH have higher rates of tPA administration than any of the other study hospitals.

None of the other hospitals have rapid notification or emergency department bypass protocols with the NSW Ambulance Service, and delays occur in getting patients to the stroke units.

We found that the emergency departments at GH and, particularly, JHH work well with the stroke unit to minimise delays (for those patients who are eligible for bypass arrangements). At RNSH, the stroke unit is notified immediately if a suspected stroke patient arrives during standard working hours, and staff members then go to the emergency department to do the assessment. RPAH has a very busy emergency department, and this may cause delays for stroke patients who might be eligible for tPA treatment. These delays arise mainly because ambulances are sometimes redirected to other hospitals when RPAH’s emergency department is too busy.

We recommended that NSW Health arranges for appropriate clinical expert groups to:

- 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.
Finally, we found that there were differences in the way hospitals arrange rehabilitation services for patients who need it. At BLH, almost all rehabilitation occurs on-site, beginning in the acute ward. JHH transfers some patients to a residential ward within the hospital as part of rehabilitation. The other hospitals transfer most or all their patients to other facilities for rehabilitation. Shortages of places in these rehabilitation facilities can lead to longer than necessary stays in acute wards. One specialist raised the possibility that a significant component of rehabilitation could be provided in the home, if resources were shifted to this setting. Given the shortage of rehabilitation places, we recommended that NSW Health arranges for appropriate clinical expert groups to consider investigating the costs and benefits of providing more rehabilitation care in the home setting.

15.9 Discharge support and home based care (breast surgery case study)

We found significant variation among the discharge support policies and post-surgical care models of study hospitals regarding mastectomy patients. This reflected hospitals’ different approaches to management of the patients’ post-surgical drains, and utilisation of home-care models such as the NSCCAHS Acute/Post Acute Care (APAC) service and other community care options in this process. The different approaches have resulted in variations in lengths of stay and costs for this patient subgroup.

Some hospitals like RNSH and GH encourage post-surgical care, such as drain management to be undertaken at home where possible. The APAC service supports this approach by providing skilled nurses and allied health staff (if needed) to patients in their homes. Other hospitals like BLH have community care options in place but BLH lengths of stay do not reflect the systematic early discharge practice of RNSH and GH.

RNSH also has a 23-hour post surgical ward where patients undergoing mastectomies may be safely discharged home within 23 hours and access ongoing care from home. Patients may also go to the outpatient breast surgery clinics to access post-surgical care. In fact, just 20% to 30% of RNSH breast surgery patients are treated as inpatients.

187 Patients who undergo simple mastectomy can usually leave the hospital after a brief stay. Frequently, a drainage tube is inserted during surgery in their chest and attached to a small suction device to remove subcutaneous fluid. Daily management of the drain puncture and surgical wound are required until the drains may be removed. Drains may be required for up to 14 days or until the drainage has reduced gradually to 30 mls.

188 That said, since IPART’s hospital visits, BLH has introduced a new model of care for mastectomy patients. Now the majority of patients undergoing mastectomies are discharged in 3 days as part of the early discharge program. The patient is then reviewed on day 5 or 6 by the surgeon for removal of drains.

189 These outpatient clinics form part of the Breast Cancer Care Clinic which is made up of a Multidisciplinary Team (MDT) of Privately Referred Non-Inpatient (PRNI) clinics. The day surgery unit at RNSH has closed with the redevelopment of the new hospital.

190 IPART visit to RNSH, 2 December 2009.
The early discharge model is supported by a range of patient care protocols implemented by the NSCCAHS. This model is followed by 1 senior breast surgeon in particular at RNSH. This surgeon performed approximately 40% of mastectomies on a 23 hour basis in 2008/09, while other surgeons at GH and RNSH were doing most cases on a 2 day basis (50% to 70% of cases). The other 2 study hospitals had very few mastectomy patients who stayed less than 2 days and this was reflected in longer average lengths of stay at these hospitals.

NSW Health should arrange for appropriate clinical expert groups to note the early discharge models 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).

**15.10 Discharge support and home based obstetric care (obstetrics case study)**

We found that all study hospitals provided a variety of birthing options. All study hospitals had some form of early discharge program with support and one hospital provided a home birthing option.

**Early discharge programs**

We found that there were a range of early discharge programs with support for obstetrics services at the hospitals.

- At BLH, the midwifery support program is available for patients who would like an early discharge from hospital. Midwives visit the patients in their home at regular intervals during the initial post-partum period. While the midwifery support program can cater for patients from as early as four hours after obstetric delivery, clinicians indicated that most patients under this program leave hospital on day 3.

- At GH, the midwifery support program aims to return patients to their homes within 24 hours of obstetric delivery. Around 85% of patients have follow-up visits in the home, either by phone or in person within 7 days of birth.

- At JHH, clinicians estimated that around 50% of patients go home under the early discharge model. Most of these patients are discharged within 24 hours of obstetric delivery, with a further one-third of these patients discharged on day 2. A home maternity service is offered for up to 5 days. Women who need an assessment for complications such as a breast abscess or newborn jaundice will be readmitted to hospital.

- At RNSH, early discharge depends on the level of patient risk. If patients are low risk, clinicians indicated that they are usually discharged within 48 hours.

- One program which complements RPAH’s early discharge model is the ‘bili’ bed at home. If a newborn has mild jaundice, they can be managed at home.
Study hospitals had different timeframes for patients leaving hospital, with GH and JHH having the shortest timeframe.

To understand the impact of the early discharge programs, we analysed the time taken from obstetric delivery to discharge from the hospital for a patient’s acute episode. When compared to the other study hospitals, a substantially higher percentage of patients were discharged from GH within 72 hours of delivery for caesarean section and within 48 hours of delivery for vaginal delivery. These results are consistent with our findings of GH having shorter average length of stays.

**Home births**

Planned home births represent around 0.3% of births in Australia. JHH offers a publicly funded home birthing service. Clinicians at JHH noted that they managed around 50 home births each year.

### 15.11 Choice of prostheses and managing selection of these types (hip replacements, stents, pacemakers and lenses)

Three of our case studies involved the use of prostheses – hip joint replacements (hip prostheses), cardiology (stents and pacemakers) and cataracts (lenses). As previously discussed in Chapter 10 on prostheses, we found there were differences in the types of prostheses selected in each hospital as well as in the hospital management practices relating to prostheses selection. We also found that there was substantial variation in the types of products selected by individual clinicians.

#### Hip prostheses

For hip replacements, we identified a number of differences in the types of hip replacement components used (including press fit, cementless hip stems versus cemented hip stems and ceramic femoral heads versus metal femoral heads). We recommended that NSW Health notes the variation in the use of various hip prosthesis components among study hospitals.

#### Cardiac stents

For cardiac stents, we found that there were significant differences in the types of stents chosen in study hospitals. There are 2 major types of coronary stents - drug eluting stents (DES) and bare metal stents (BMS). Significant differences in the rates of use of BMS or DES were noted between the hospitals. RNSH used about 70% DES while at the other study hospitals, these percentages were much less, around 20% to 35% (see Table 15.5). IPART was informed that evidence is still emerging on the medium and long term differences in outcomes for different patient types receiving a BMS or DES.
Table 15.5 Comparison on the use of bare metal and drug eluting stents

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Metal Stents (%)</td>
<td>80.0</td>
<td>65.0</td>
<td>30.0</td>
<td>73.0</td>
</tr>
<tr>
<td>Drug Eluting Stents</td>
<td>20.0</td>
<td>35.0</td>
<td>70.0</td>
<td>27.0</td>
</tr>
</tbody>
</table>

Note: Percentages based on prostheses purchasing data at the hospitals.
Source: Study Hospitals.

Given the large variation in use of DES, we recommended that NSW Health notes the variation in the use of DES versus BMS among study hospitals.

Pacemakers

We found that there were differences in the use of single chamber, dual chamber and biventricular pacemakers. One hospital tended to use a higher proportion of dual chamber pacemakers.

At RPAH, GH and RNSH, we found around 80% of the pacemakers used in 2008/09 were the single chamber device, while the other 20% were the dual chamber device (and only a small number were biventricular). At JHH, 51% were single chamber and 46% were dual chamber (with the remaining 3% being biventricular).

Lenses

For the cataracts case study, one notable difference was the use of toric lenses at the study hospitals. Toric lenses are used for visual correction where there is astigmatism, and are more expensive than other lenses. Some hospitals use toric lenses sparingly, while others did not use them at all. We recommended that NSW Health arranges for appropriate clinical expert groups to assess the costs and benefits of toric lenses and develop guidelines for their use in public hospitals.

15.12 Use of imaging for diagnosis of emergency surgery cases (appendicectomy case study)

While appendicectomies are generally a common procedure with few adverse consequences, acute appendicectomies are regarded as emergency procedures because the appendix may burst leading to infection.

There is no definitive test to diagnose appendicitis and diagnosis is sometimes difficult because of similar symptoms caused by other illnesses. As such, different approaches are used by different clinicians in different hospitals. We found that there were differences in the reliance placed on imaging for diagnosing acute appendicitis at different hospitals.
Our discussions with clinicians at different hospitals indicated a range of views existed about the use of ultrasounds or CTs as diagnostic tools in cases of suspected appendicitis and for which groups of patients these were more appropriate. Some clinicians believed imaging led to lower complication rates and earlier diagnosis.

Others believed that imaging results were often inconclusive (particularly ultrasounds) and in some instances led to delays in diagnosis and treatment. Our own review of selected clinical notes did identify instances where imaging results were inconclusive, or where it appeared as though treatment or surgery was delayed while patients waited to obtain imaging results, which then proved to be inconclusive.

This issue was of interest because it could potentially lead to patients experiencing longer delays waiting for treatment, as well as hospitals incurring higher diagnostic costs.

We recommended that NSW Health arranges for appropriate clinical expert groups to 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, they should consider whether these diagnostic tools only be used for certain patient groups (eg, older patients who are more likely to be suffering from other conditions with symptoms similar to acute appendicitis).

### 15.13 Differences in the type of surgery performed at study hospitals

#### 15.13.1 Use of operative cholangiograms (cholecystectomy case study)

We found that there was a variation in surgical practice between the hospitals relating to the use of fluoroscopy imaging during cholecystectomy procedures (operative cholangiograms). 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 and
- improve visualisation of the ducts, which can reduce mistaken surgical division of a duct.

However, 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.

We recommended that 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.
15.13.2 Laparoscopic versus open surgery (appendicectomy case study)

There are two major types of appendicectomy surgery – laparoscopic and open surgery. There was considerable variation in the type of surgery across the study hospitals (see Table 15.6). RNSH and BLH had the highest rates of laparoscopic surgery and GH had the lowest rate. Clinicians at GH are significantly less likely to perform an appendicectomy using laparoscopic surgery than the other study hospitals. The rate of laparoscopic surgery at GH is 41%, compared with 94% at RNSH.

<table>
<thead>
<tr>
<th>Table 15.6</th>
<th>Laparoscopic surgery and open surgery rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
</tr>
<tr>
<td>Laparoscopic surgery</td>
<td>%</td>
</tr>
<tr>
<td>All patients</td>
<td>85</td>
</tr>
<tr>
<td>Patients aged 20 years and under</td>
<td>81</td>
</tr>
<tr>
<td>Patients aged 50 years and over</td>
<td>64</td>
</tr>
<tr>
<td>Open surgery</td>
<td>%</td>
</tr>
<tr>
<td>All patients</td>
<td>13</td>
</tr>
<tr>
<td>Patients aged 20 years and under</td>
<td>17</td>
</tr>
<tr>
<td>Patients aged 50 years and over</td>
<td>29</td>
</tr>
</tbody>
</table>

Note: Numbers will not add to 100% due to a small number of other procedures coded as appendicectomies.
Source: HIE inpatient statistics, 2008/09 and IPART analysis.

Patients who underwent laparoscopic surgery had lower average length of stays than those who underwent open surgery (see Table 15.7), however, the cost of equipment used in surgery was higher for these cases.

<table>
<thead>
<tr>
<th>Table 15.7</th>
<th>Average length of stay (LOS1 measure) by surgical procedure type – DRGs G07A and G07B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
</tr>
<tr>
<td>Laparoscopic surgery</td>
<td>days</td>
</tr>
<tr>
<td>All patients</td>
<td>3.0</td>
</tr>
<tr>
<td>Open surgery</td>
<td>4.3</td>
</tr>
<tr>
<td>Difference in average length of stay</td>
<td>-1.3</td>
</tr>
</tbody>
</table>

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

Laparoscopic surgery generally involves significantly higher equipment costs than open surgery. One of the study hospitals provided an estimate of the average equipment costs involved in an appendicectomy:

- laparoscopic appendicectomy – $443.55
- open appendicectomy – $101.32.
Most hospitals are less likely to perform laparoscopic surgery on appendicectomy patients aged 50 years and over. They prefer to instead perform open surgery. However, BLH does not follow this pattern. Its rates of laparoscopic and open surgery do not change significantly by patient age.

A review of the literature does not clearly indicate whether laparoscopic surgery is preferable to open surgery. Some studies find that laparoscopic appendicectomy is associated with less postoperative pain, lower incidence of infectious complications and shorter hospital stays. Other studies suggest that laparoscopic appendicectomy increases cost but has no significant impact on length of stay or complication rates. Another study found that the cost implications of laparoscopic appendicectomy were uncertain as it was associated with shorter hospital stays but higher subsequent readmission rates.

We recommended that NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of laparoscopic versus open surgery for appendicitis.

### 15.13.3 Tracheostomies performed surgically or percutaneously (tracheostomy case study)

We found that the procedure performed for tracheostomy differed among study hospitals. Tracheostomies at BLH tended to be performed by cardiothoracic surgeons in operating theatres, while at other hospitals they were performed percutaneously by ICU clinicians. The move at BLH to have tracheostomies performed surgically was due to the risk of complications. As a result, patients at BLH may have to wait longer before they get their tracheostomies due to prioritising of access to the operating theatres.

We recommended that NSW Health arrange for appropriate clinical expert groups to note that at BLH clinicians tended to perform surgical tracheostomies, whereas at the other hospitals, these were usually performed percutaneously.

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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, while there are a number of safety and quality indicators being collected locally, at the State level and through clinical registries, there are few clinically agreed outcome indicators. As such, we found that data on only a few 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.

These indicators included:
- mortality and survival rates
- unplanned hospital readmission rates
- unplanned return to theatre rates
- wound infection rates
- blood transfusion rates
- compliance with requirements to assess patients for antibiotic and venous thromboembolism (VTE) prophylaxis, and
- patient experience of care.

Where possible, we obtained data and compared the study hospitals’ performance against the outcome indicators at both the clinical case study level and the hospital-wide level. Where necessary, analyses were risk adjusted to take account of differences in patient characteristics. Of the 20 hospital-wide indicators, all but 6 are currently being collected and reported either at the hospital or State level.

We also reviewed the problems we encountered in collecting reliable, consistent data on outcome indicators, and considered the steps being taken by the Commonwealth and the States to improve outcomes data and monitoring and develop national outcome indicators. We identified a range of actions NSW Health can take to improve its own outcomes data and noted significant work underway with States and Territories (including NSW) to prepare for the introduction of a national performance reporting regime.
Finally, we reviewed our findings on the differences in the study hospitals’ performance against the outcome indicators to identify and recommend the matters that NSW Health should consider in completing stages 5 and 6 of NSW Health’s wider review.

The sections below summarise the key findings of our outcomes analysis, and then discuss the analysis in more detail. They also provide more information on how we developed our set of outcome indicators, and adjusted the analyses for some of these indicators in order to make fair comparisons between hospitals and show how hospitals would rate if they served similar populations of patients.

### 16.1 Summary of findings on outcome indicators

We found that many outcome indicators, such as mortality, survival, unplanned readmission and wound infection rates, are more meaningful when set, measured and monitored at the clinical procedure/condition level, rather than the hospital-wide level. As for cost comparisons, this allows for the comparison of ‘like’ patient groups who could be expected to have similar risks and outcomes (ie, groups based on the DRGs or subgroups within DRGs, as our case study groupings were).

It’s also 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, and the degree to which a patient is ill 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 16.1). (This issue is discussed in further detail in Chapter 17.)
Box 16.1 How data on indicators was risk-adjusted for differences in patient characteristics

To make meaningful and fair comparisons of the performance of the study hospitals on some outcome indicators, the analyses were risk-adjusted to account for differences in patient characteristics that can influence the likelihood of adverse outcomes. In particular, NSW Health adjusted analyses on mortality, unplanned readmission 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.

NSW Health also adjusted the dataset for the cardiology case study to reflect differences in configurations of care among the hospitals. Namely, that some of the hospitals received most of their patients directly through the emergency department, while others received a large proportion of patients from other hospitals via transfers. In order to enable consistent comparisons between the study hospitals for the 30-day mortality rate and 6-month survival rate (AMI), NSW Health omitted admissions where death occurred on the day of admission and admissions resulting from a transfer from another hospital.

To make these adjustments, NSW Health used logistic regression in SAS 9.2. Where there was 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.

a 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.

16.1.1 Variations in study hospitals’ performance against key outcome indicators

We considered the performance of the study hospitals against several key outcome indicators. In general, these were the indicators where there was variation between the hospitals or where we were able to analyse their performance across several clinical levels. We found:

- Differences in risk-adjusted mortality and survival rates for major chest procedure patients, noting the methodology for measuring mortality continues to be discussed nationally and internationally.

- Differences in risk-adjusted unplanned readmission rates (to any public hospital) at the hospital-wide level. At the case study level, we found no statistically significant differences in unplanned readmission rates for hip joint replacement for arthritis patients at the main study hospitals. However, the readmission rate for such patients treated at the IRO was substantially lower than those for the other study hospitals.

- Differences in risk-adjusted wound infection rates in some case study areas and at the hospital-wide level, noting that these rates include both ‘clean’ wounds (ie, sterile wounds) and ‘contaminated’ wounds (ie, wounds already contaminated prior to surgery or surgery into contaminated areas such as the bowel).

- Differences in the blood transfusion rates at the hospital level, and that patients admitted through emergency departments were more likely to receive blood transfusions than non-emergency admissions. One hospital (GH) had significantly higher blood transfusion rates for patients with higher haemoglobin levels (80-89 g/L and 90-99 g/L) than other hospitals, for both emergency and non-emergency admissions.

- Audits indicate similar levels of compliance with the requirement to conduct antibiotic and VTE prophylaxis assessments, which exceeded 95% in the last quarter measured (February 2010). However, the data for this indicator needs review to ensure similar proportions of records are audited. We also consider that these indicators would be enhanced if there was agreement on patient risk status and treatment so that data on the appropriate administration of prophylaxis should also be collected and monitored.

- Differences in the proportion of overnight and day only inpatients surveyed who rated their overall care experience as excellent. For overnight patients, this proportion was highest at RPAH (39%) and GH (33%), and lowest at RNSH and BLH (each with 25%). For day only patients, there was a smaller range between the study hospitals, with the proportion highest at RPAH (37%) and lowest at RNSH (33%).

Note we were not able to compare the study hospitals’ unplanned returns to theatre rates due to differences concerning the definition of this indicator and consistency of the data.
16.1.2 Variations in study hospitals’ performance against additional outcome indicators

We also considered the performance of the study hospitals against several additional outcome indicators, such as rates of healthcare associated infections and in-hospital falls leading to death, as well as indicators for complaint and incident (Root Cause Analyses) management. In general, we found little variation in the study hospitals’ performance against these indicators, or the data was difficult to analyse because of the low number of incidences.

16.1.3 Actions NSW can take to improve outcomes data for local action and to prepare for a national performance reporting regime

We encountered several issues when collecting data for the hospital-wide and clinical level outcome indicators. Some data sets proved to be unreliable or were not collected consistently across study hospitals. In addition, there were several indicators for which data was either unavailable or was unable to be provided within the timeframe for our study. This was particularly the case for many of the clinical level indicators.

We note that the NSW Department of Health and the CEC have taken several steps to improve outcomes monitoring and reporting. In addition, the Commonwealth and the States are working to introduce national hospital performance reporting that will include national safety and quality indicators. While these initiatives will improve outcomes data, NSW Health can further improve these data and prepare for the introduction of this reporting regime by:

- continuing to contribute to the national debate on the best methodology for risk adjusting or standardising key outcome indicators, particularly mortality, survival, unplanned readmission and wound infection rates
- encouraging consistent coding of comorbidities, so that coding of comorbidities is more reliable
- facilitating ready access to outcomes data collected and held by third parties (such as the Australian Council on Healthcare Standards, the National Stroke Research Institute and clinical registries eg, ANZICS196, CHASM197, orthopaedic registry)
- disseminating outcomes information to hospital management and clinicians on a regular basis
- supporting data collection with appropriate resources.

196 ANZICS is the Australian and New Zealand Intensive Care Society, the professional and advocacy body for medical practitioners specialising in the treatment and management of critically ill patients in public and private hospitals (http://www.anzics.com.au/).
16.1.4 Matters that should be considered in completing stages 5 and 6 of NSW Health’s wider review

Based on our analysis of the study hospitals’ performance against the key outcome indicators and the additional outcome indicators, we identified a range of matters NSW Health should consider in completing stages 5 and 6 of NSW Health’s wider review. These matters include:

- the areas where there were statistically significant differences in the study hospitals’ performance against outcome indicators, outlined in section 16.1.1 above
- the costs and benefits of collecting data for areas where indicators are not commonly used due to lack of clinical agreement, including warfarin management, and visual outcomes for patients undergoing cataract/lens procedures.

16.2 How we developed a set of outcome indicators

In establishing our list of indicators, we took a relatively pragmatic approach. We recognised that while there are many useful proxies for clinical outcomes, only a few true outcome indicators are systematically collected across Australian hospitals and generally these are held by independent clinical registries. In addition, given the scope of our task, timeline and resources, we would not be able to collect data on a comprehensive range of indicators. We accepted that the type and range of indicators we could feasibly collect data on would not be ‘perfect’.

To identify the indicators we should focus on for this study, we worked with a number of eminent clinicians on our Clinical Reference Group to develop a set of clinical-level and hospital-wide outcome indicators.\(^{198}\) 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 for both hospitals and case study areas 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.

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\(^{198}\) 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 a set of indicators for each of our case study areas, and a set of hospital-wide indicators. Many of these indicators are not true outcome indicators, but are safety and quality process indicators. Data was not readily available for all of these indicators. This chapter discusses our findings on those for which we could obtain data and, at the clinical level, those that were common across case studies areas.

Appendix D provides a list of all the indicators and summarises our specific findings on each. Appendix E contains details of the risk-adjusted information provided by NSW Health, including the data sources and definitions used.

16.3 Study hospitals’ performance against key outcome indicators

We compared the study hospitals’ performance against a range of indicators that clinicians agreed were useful for the purpose of identifying the impact of differences in clinical practice and promoting best clinical practice, and for which we could readily obtain data. Where possible, we compared performance at the case study level, as well as at the hospital level.

The sections below discuss each of the indicators, and our findings on differences in the study hospitals’ performance against them.

16.3.1 Mortality and survival rates

For 8 of our 11 case study areas, clinicians identified mortality and/or survival rates as important indicators of the clinical outcome of hospital care. Therefore, we asked NSW Health to provide information on mortality rates within 30 days of separation, and (in some cases) the survival rates within 6 months, 12 months, 2 years and 3 years of separation for these areas.

There is considerable debate regarding the credibility of measuring and comparing patient mortality and survival rates. A patient’s risk of death varies significantly based on factors such as his or her age, comorbidity and diagnosis. Therefore, these rates need to take these factors into account.
Outcome, safety and quality indicators

One way to do this is to consider mortality at the hospital level, using risk-adjusted Hospital Standardised Mortality Ratios (HSMRs). A hospital’s HSMR compares the number of observed deaths to the number of expected deaths within 30 days of admission at the hospital. (See Box 16.2.)

**Box 16.2 Calculating HSMRs**

To determine a hospital’s HSMR:

- A risk-adjusted model is used to estimate how many patient deaths would be expected in the hospital over a certain period, adjusting for factors such as the patient’s diagnosis, age, sex, comorbidities, length of stay, admission status (emergency or elective) and whether they were transferred from another hospital.

- Then this estimate of expected deaths is compared with the number of observed deaths over that period.

There is currently significant debate nationally and internationally on use of, and the methodology for calculating, HSMRs. Critics of HSMRs consider that they are an unsuitable measure of hospital performance. For example, HSMRs may not take into account geographic variation in the proportion of deaths that occur in hospital, which reflect factors such as alternative forms of end-of-life care (hospices/community palliative services). Further, comorbidities, which are crucial for casemix adjustment, are commonly missing from hospital episode statistics.

Eminent clinicians working with the UK National Health Services have recently published a statement outlining caution with respect to the use of HSMR for comparisons. While they consider that, along with other indicators, HSMRs can help with analysing information about in hospital deaths, HSMRs should not be used as a sole indicator of patient safety. To do so could potentially give a misleading interpretation of a hospital’s safety record. These clinicians are currently working to develop a single, agreed HSMR methodology to use in the UK National Health Service.

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The Australian Commission on Safety and Quality in Health Care (ACSQHC) provided funding for a study by the Australian Institute of Health and Welfare into HSMRs. The AIHW found that HSMRs could be useful screening tests. For example, a high HSMR may signal that a problem exists, so that further investigation is required. In addition, a low HSMR may indicate good performance, from which lessons could be learned. The Productivity Commission has also recently used HSMRs to analyse public and private hospitals. However, it used a different methodology to calculate HSMRs than that used by the AIHW.

**Mortality and survival information provided by NSW Health**

While NSW Health did not provide HSMRs for our 8 case study areas, it did calculate and provide mortality and survival rates for these areas using the method set out in Box 16.3, as well as odds ratios for these rates. Odds ratios are used to highlight differences in rates between the hospitals (see Box 16.4).

NSW Health risk-adjusted each hospital’s mortality and survival data for patient age, sex, comorbidities (using the Charlson index) and socio-economic status using the approach set out in Box 16.1. In relation to the cardiology case study, in order to allow comparisons between the study hospitals, additional risk-adjustment was carried out for the 30-day mortality rate and 6-month survival rate (AMI). This involved excluding admissions where death occurred on the day of admission and admissions resulting from a transfer from another hospital. See Case Study 7 – Cardiology.

When we compared the risk-adjusted results across hospitals, we found there were no statistically significant differences in the 30-day mortality rates for patients in the hip replacement (fracture), breast surgery, cholecystectomy, appendicectomy and cardiology areas. The number of deaths in the hip replacement (arthritis) and hysterectomy case studies were too small to allow comparisons between the hospitals. In addition, there were no statistically significant differences in 6-month survival rates for patients in the stroke and cardiology (AMI and angina) areas.

However, we did identify some differences between the study hospitals in relation to their risk-adjusted mortality and survival rates for major chest procedure patients. In particular:

- RPAH had the lowest 30-day mortality rate and highest 3-year survival rate.
- RPAH and RNSH had the highest 12-month survival rates.

There were no differences in the 2-year survival rates for these patients across the hospitals.

We recognise that outcomes for major chest procedure patients are likely to differ depending on their principal diagnosis – eg, whether the principal diagnosis is lung cancer, infection-related abscess/pyothorax or collapsed/punctured lung. However, due to the relatively small number of cases at the study hospitals, we analysed
outcomes for all major chest patients, rather than for these diagnosis-based patient subgroups. It is therefore possible that differences in outcome indicators reflect differences in casemix. To better understand our findings on differences in mortality and survival rates for this patient group, further analysis may be needed.

NSW Health and appropriate clinical expert groups should consider whether to recommend changes to clinical practice or undertake further investigation. We suggest that this analysis should involve a larger sample of hospitals and include a comparison of ‘like patients’ (ie, using the patient subgroups within or across DRGs). A state-wide examination of hospitals may be required to ensure sufficient patient numbers. We also note that in comparing outcomes for lung cancer patients, appropriate cancer staging information may need to be considered.

**Box 16.3 Calculating risk-adjusted mortality and survival rates**

The NSW Department of Health’s Centre for Epidemiology and Research calculated risk-adjusted odds ratios for mortality and survival for patients treated in each study hospital in the hip replacement, major chest, breast surgery, cholecystectomy, appendicectomy, stroke, cardiology and hysterectomy case study areas, using the methodology outlined below. We note that the NSW Department of Health does not usually undertake this type of analysis. However, NSW has recently been engaged with work at a National level on mortality indicators (in addition to other indicators). See section 16.6 and Box 16.14.

**Data sources**

The analyses for mortality and survival, apart from in-hospital mortality, were 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 analyses for in-hospital mortality were 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 16.1. Hospitals that were not significantly different in the adjustment model (at p<0.05) were grouped.
**Box 16.4 Risk-adjusted odds ratios**

Risk-adjusted odds ratios were calculated for hospitals in order to highlight differences in rates between the hospitals. 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.

If the odds ratio between two hospitals is:

- 1 – the event is equally likely to occur at both hospitals
- >1 – the event is more likely to occur at the first hospital
- <1 – the event is less likely to occur at the first hospital.

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.

**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”, 320 British Medical Journal 2000, p 1468; S Simon “Understanding the Odds Ratio and the Relative Risk”, 22 Journal of Andrology 2001, p 533). The odds ratios were risk-adjusted for patient characteristics using the approach discussed in Box 16.1.

**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.

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**16.3.2 Unplanned hospital readmission rates**

While NSW has for the past 6 months reviewed monthly performance of Area Health Services on general readmission rates to the same hospital, IPART obtained linked data from NSW Health to identify unplanned readmissions to any NSW public hospitals within 28 days of separation. This indicator is more difficult to measure as it requires dedicated linkages, so it would not be a routine indicator.

An ‘unplanned hospital readmission’ refers to an unexpected admission for:

- further treatment of the same condition for which the patient was previously hospitalised
- treatment of a condition related to one for which the patient was previously hospitalised
- a complication of the condition for which the patient was previously hospitalised.  

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The Australian Institute of Health and Welfare (AIHW) has noted that an unplanned hospital readmission may reflect less than optimal patient management and ineffective care pre-discharge, post discharge and/or during the transition between acute and community-based care. Good medical and/or surgical intervention, together with good discharge planning, will decrease the likelihood of unplanned hospital readmissions. However, we note that unplanned readmissions can also relate to levels of primary care services such as access to GPs that bulk bill.

‘Unplanned readmissions for selected DRGs’ is one of the indicators that Commonwealth, State and Territory Health Ministers agreed in November 2009 should be regularly collected by hospitals (see section 16.6 and Box 16.14). NSW Health is currently working with the ACSQHC to develop a nationally agreed definition on what constitutes an ‘unplanned readmission’ in order to collect data for this indicator. In the interim, Area Health Services are reviewing their data to investigate any variance monthly readmissions. For the purposes of this study, NSW Health defined an ‘unplanned readmission’ using the approach set out in Box 16.5.

NSW Health provided unplanned readmission rates at the hospital-wide level and at the clinical level for the hip joint replacement case study area for the period 2005/06 to 2007/08. These rates were calculated using the method set out in Box 16.5, and risk-adjusted for patient characteristics using the approach discussed in Box 16.1. When comparing these rates across the study hospitals, we found differences between them at both levels.

At the hospital-wide level, there were 39,561 readmissions from 493,200 hospital separations at the 5 study hospitals, giving an average crude readmission rate of 80.2 per 1,000. After adjusting for patient characteristics, the odds of unplanned readmission were lowest at BLH. (See Table 16.1.)

### Table 16.1 Unplanned readmissions to hospital within 28 days of separation, 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>GH and JHH</td>
<td>1.40</td>
<td>1.32-1.50</td>
</tr>
<tr>
<td>RNSH</td>
<td>1.25</td>
<td>1.16-1.35</td>
</tr>
<tr>
<td>RPAH</td>
<td>1.09</td>
<td>1.03-1.16</td>
</tr>
<tr>
<td>BLH</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** See Box 16.4 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:** Linked records from the APDC (HOIST), Centre for Epidemiology and Research, NSW Department of Health.

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At the clinical case study level for hip joint replacement, we found no statistically significant differences in the unplanned readmission rates for fracture patients. Further, we found no statistically significant differences in the rates for arthritis patients at RPAH, GH, RNSH, BLH and JHH. However, the readmission rate for arthritis patients treated at the IRO was substantially lower than those for the other study hospitals. We have recommended that NSW Health examine this variation (see Case Study 1 – Hip Joint Replacement).

**Box 16.5 Calculating unplanned hospital readmission rates**

Data on unplanned readmission rates were obtained using linked records of the APDC for 2005/06 to 2007/08.

Readmissions included readmission to any public hospital. However, the following hospital stays were excluded:

- stays for chemotherapy or dialysis
- stays with any cancer diagnosis
- stays which were transfers from another hospital
- in-hospital deaths.

A stay was flagged as an ‘unplanned readmission’ if the following criteria were met:

- the stay was ‘unplanned or unexpected’ (emergency status = ‘1’) and
- the patient’s age at readmission was within 28 days of the age at separation of a previous stay for the same patient at any public hospital.

As one person may have more than one admission for a specified condition, the analysis was ‘case-based’ where a case represents a hospital admission for a specified condition.

**16.3.3 Unplanned return to theatre rates**

This indicator measures the rate of unplanned returns to theatre for patients with complications relating to surgery performed within the previous 72 hours during the same admission. The 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.

This is an important indicator for 5 of our case study areas – hip joint replacement, major chest procedures, breast surgery, cholecystectomy and appendicectomy. However, we were unable to compare the study hospitals’ performance in this area, due to problems with the quality of outcomes data provided. During our hospital visits, we reviewed a sample of clinical notes for patients who appeared from the

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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.203

▼ 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.204

▼ 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.205

▼ 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.

**16.3.4 Wound infection rates**

This indicator is important for 5 of our case study areas. It measures the rate of wound infections within 6 weeks of planned or emergency surgery (or 30 days for hysterectomy patients). The reliability of this indicator depends on consistent reporting practices and that the relevant patients re-attend hospital for treatment. We note that some may be treated by their GP, and so may not be included in the data.

NSW Health provided information on wound infections at the hospital-wide level, and for the hip joint replacement, major chest procedure, cardiology, and cholecystectomy and appendicectomy case study areas. The information on wound infections was not readily available for hysterectomy patients.

203 We note that this indicator was not included in the set of safety and quality indicators that Commonwealth, State and Territory Health Ministers agreed should be collected nationally. See section 16.6 and Box 16.14.


NSW Health sourced the data from the APDC, and included wound infections reported within the hospital stay. It also risk-adjusted the results to take account of patient characteristics as outlined in Box 16.1.

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.

When we compared the study hospitals’ performance at the case study level, we found no differences in wound infection rates for cardiology patients. However, there were differences for hip joint replacement, and cholecystectomy and appendicectomy patients:

- RPAH had the highest wound infection rate for all hip joint replacement patients. However, it had a more complex casemix than the other hospitals.
- JHH and RPAH had the highest wound infection rates for cholecystectomy and appendicectomy patients combined.

The number of infections for major chest patients was too low across the study hospitals to make comparisons.

At the hospital level, there were 2,763 infections from 169,457 hospital separations at the 5 study hospitals, giving an average crude infection rate of 16.3 per 1,000. After adjusting for patient characteristics, the odds of wound infection were lowest at GH and BLH. (See Table 16.2.)

<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>1.98</td>
<td>1.71-2.31</td>
</tr>
<tr>
<td>RPAH and RNSH</td>
<td>1.42</td>
<td>1.26-1.60</td>
</tr>
<tr>
<td>GH and BLH</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 16.2 Wound infection, 2005/06 to 2007/08

Note: See Box 16.4 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 have recommended that NSW Health examine the variations at the case study levels (see Case Study 1 – Hip Joint Replacement, Case Study 4 – Cholecystectomy and Case Study 5 – Appendicectomy).

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206 The data only includes admissions where a procedure was carried out (eg, hip replacement, cholecystectomy, appendicectomy).

207 The distinction between wound types is considered to be less relevant for the DRGs included in the cardiology case study area than for some other types of surgery (eg, gastrointestinal surgery).
We note that NSW Health routinely monitors information on post surgery infections (‘surgical site infections’) for hip joint replacements, knee joint replacements and cardiac artery bypass grafts. The information is publicly reported at the State level. The surgical site infection information is for ‘clean’ wounds only, and so differs from the information set out in Table 16.2, which contains information on ‘contaminated’ as well as ‘clean’ wounds.

16.3.5 Blood transfusion rates

This indicator measures the rate of transfusing red blood cells 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 Cells, 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. Errors in requesting, supplying (including transporting) and administering blood can lead to significant adverse outcomes for patients, including transfusion infections, severe allergic reactions and death.

Table 16.3 sets out the clinical practice guidelines for different haemoglobin levels.

<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. 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. In some patients who are asymptomatic and/or where specific therapy is available, lower threshold levels may be acceptable</td>
</tr>
</tbody>
</table>


209 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 70 g/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
- there is a need 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.211

Raising awareness about the appropriateness of blood transfusions is one of the priorities of Blood Watch, the Clinical Excellence Commission’s (CEC’s) transfusion medicine improvement program. Its research into current transfusion prescribing practices found widespread variation in practice between hospitals. It also uncovered very high rates of patients receiving transfusions with haemoglobins above 70g/L without evidence in the medical record of clinical indication for transfusion. See Box 16.6 for further details.

**Box 16.6 Blood Watch**

In 2007, the CEC conducted several initiatives as part of its Blood Watch program. These included:

- Conducting a comprehensive red cell audit of 323 transfusion episodes at major hospitals. It found that:
  - 12.7% of patients were anaemic and had surgery with haemoglobins under 105g/L. The underlying cause of probable iron deficiency anaemia was not investigated or treated pre-operatively.
  - 95% of patients had post-operative red cell transfusion with haemoglobins above 70g/L and of those, 83% received a transfusion without evidence in the medical record of clinical indication for transfusion.

- Establishing the Red Cell Relative Use database, which allows comparison of red cell usage and dosage by DRG and by hospital:
  - This shows the ratio of transfusions which are occurring above the state average and indicates widespread variation in practice. For example, 6 out of the 9 large metropolitan hospitals were prescribing up to 42% above the state average.
  - The database has been provided to the Area Health Service Transfusion Committees. New data feeds will occur annually.

Blood transfusion rates where patients have haemoglobin levels in the range 70 g/L to 100 g/L are an important outcome indicator for 5 of our 11 case study areas. However, we were only able to calculate and compare the study hospitals’ performance in this area at the hospital-wide level.

We looked at haemoglobin levels for patients admitted overnight for surgical procedures, using each patient’s minimum haemoglobin level as reported in the pathology system. Table 16.4 and Figure 16.1 set out the proportion of these patients that received blood transfusions, grouped into their haemoglobin level ranges.

We found that at the lowest haemoglobin level range (70-79 g/L), all the study hospitals except JHH had relatively similar blood transfusion rates (JHH’s rate was the lowest). However, at the higher ranges (80-89 g/L and 90-99 g/L), GH had significantly higher blood transfusion rates than the other study hospitals, with BLH falling between GH and the other 3 study hospitals in the 80-89 g/L range.

As noted above, clinical indications may exist for transfusing patients with haemoglobin level in the range 70 g/L to 100 g/L. For example, acute blood loss is an indication for blood independent of haemoglobin level.

**Table 16.4 Overnight surgical admissions receiving blood transfusions, by patient’s minimum haemoglobin level, 2008/09**

<table>
<thead>
<tr>
<th></th>
<th>70-79 g/L</th>
<th>80-89 g/L</th>
<th>90-99 g/L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no. of cases</td>
<td>% transfused</td>
<td>no. of cases</td>
</tr>
<tr>
<td>RPAH</td>
<td>769</td>
<td>80</td>
<td>732</td>
</tr>
<tr>
<td>GH</td>
<td>113</td>
<td>87</td>
<td>277</td>
</tr>
<tr>
<td>RNSH</td>
<td>550</td>
<td>79</td>
<td>565</td>
</tr>
<tr>
<td>BLH</td>
<td>164</td>
<td>82</td>
<td>246</td>
</tr>
<tr>
<td>JHH</td>
<td>537</td>
<td>72</td>
<td>664</td>
</tr>
</tbody>
</table>

*Source: IPART analysis using data from hospital pathology services, Blood Bank data and HIE inpatient statistics, 2008/09.*
We also looked at the blood transfusion rates between patients admitted through the emergency department and non-emergency department patients (see Table 16.5 and Figure 16.2). We found that:

- in general, patients admitted through the emergency department were more likely to receive a blood transfusion than non-emergency department patients
- GH had significantly higher blood transfusion rates at the higher range haemoglobin levels (80-89 g/L and 90-99 g/L) for both emergency and non-emergency department patients, and
- BLH also had a relatively high blood transfusion rate for emergency department patients with haemoglobin levels 80-89 g/L.
Table 16.5 Emergency and non-emergency overnight surgical admissions receiving blood transfusions, by patient’s minimum haemoglobin level, 2008/09

<table>
<thead>
<tr>
<th></th>
<th>70-79 g/L</th>
<th></th>
<th>80-89 g/L</th>
<th></th>
<th>90-99 g/L</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no. of</td>
<td>% transfused</td>
<td>no. of</td>
<td>% transfused</td>
<td>no. of</td>
<td>% transfused</td>
</tr>
<tr>
<td></td>
<td>cases</td>
<td></td>
<td>cases</td>
<td></td>
<td>cases</td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>admissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAH</td>
<td>330</td>
<td>85</td>
<td>237</td>
<td>41</td>
<td>257</td>
<td>9</td>
</tr>
<tr>
<td>GH</td>
<td>50</td>
<td>100</td>
<td>122</td>
<td>79</td>
<td>175</td>
<td>41</td>
</tr>
<tr>
<td>RNSH</td>
<td>253</td>
<td>81</td>
<td>241</td>
<td>40</td>
<td>257</td>
<td>16</td>
</tr>
<tr>
<td>BLH</td>
<td>74</td>
<td>86</td>
<td>121</td>
<td>65</td>
<td>98</td>
<td>15</td>
</tr>
<tr>
<td>JHH</td>
<td>258</td>
<td>79</td>
<td>243</td>
<td>37</td>
<td>258</td>
<td>10</td>
</tr>
<tr>
<td>Non-emergency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>admissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAH</td>
<td>439</td>
<td>76</td>
<td>495</td>
<td>34</td>
<td>627</td>
<td>8</td>
</tr>
<tr>
<td>GH</td>
<td>63</td>
<td>76</td>
<td>155</td>
<td>59</td>
<td>241</td>
<td>35</td>
</tr>
<tr>
<td>RNSH</td>
<td>297</td>
<td>76</td>
<td>324</td>
<td>37</td>
<td>373</td>
<td>12</td>
</tr>
<tr>
<td>BLH</td>
<td>90</td>
<td>79</td>
<td>125</td>
<td>37</td>
<td>206</td>
<td>10</td>
</tr>
<tr>
<td>JHH</td>
<td>279</td>
<td>65</td>
<td>421</td>
<td>41</td>
<td>561</td>
<td>12</td>
</tr>
</tbody>
</table>

**Note:** Emergency status was determined by linkage with EDIS data.

**Source:** IPART analysis using data from hospital pathology services, Blood Bank data and HIE inpatient statistics, 2008/09.
As variability in blood transfusion rates is being addressed by the CEC’s Blood Watch program, we consider that the CEC should note the higher rates at GH and (to a lesser extent) BLH.

### 16.3.6 Antibiotic and VTE prophylaxis

Antibiotic and VTE prophylaxis indicators are important for measuring the effectiveness of processes for preventing hospital-acquired infections and VTE. They are relevant to 6 of our 11 case study areas; however, without full clinical audit, it is only possible to compare the study hospitals’ performance at the hospital-wide level.
Antibiotic prophylaxis

Through our clinical consultation, we found that administration of antibiotic prophylaxis was virtually universally accepted by surgeons as important for clinical outcomes relating to surgical site infections and an important indicator of quality. The NSW Therapeutic Advisory Group has noted that the use of antibiotics in preventing surgical site infection has been consistently demonstrated, yet gaps in prophylactic surgical antibiotics continue to occur.\(^{212}\)

We looked at 2 indicators related to antibiotic prophylaxis – compliance with the requirement to conduct an antibiotic prophylaxis assessment and administration of antibiotic prophylaxis.

Compliance with requirement to conduct an antibiotic prophylaxis assessment

This indicator measures the proportion of finalised patient case reports that indicate that an antibiotic prophylaxis assessment was undertaken before or at Time Out (see Box 16.7). NSW hospitals are required to assess whether patients require antibiotic prophylaxis before or at Time Out, and report on their compliance with this guideline to the NSW Department of Health on a quarterly basis. Hospitals collect the relevant data from quarterly audits of the Time Out sheets included in patients’ medical records.

Box 16.7 What is Time Out?\(^{a}\)

Time Out is the final patient safety check. It is undertaken immediately before commencing a procedure by the team involved in the procedure. It involves checking:

- correct patient, procedure and site
- imaging data
- availability of the correct prostheses or implant
- VTE and antibiotic prophylaxis assessment, and
- special medications administered.


NSW Health provided data on this indicator for the period from the August 2008 to the February 2010 quarters. These data show a general improvement in compliance with the requirement to conduct antibiotic prophylaxis assessments across the study hospitals (see Table 16.6 and Figure 16.3). All study hospitals had compliance rates exceeding 95% in last quarter measured (February 2010).

Table 16.6 Finalised case reports with antibiotic prophylaxis assessment prior to or at Time Out, quarterly audit periods

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Aug-08</th>
<th>Nov-08</th>
<th>Feb-09</th>
<th>May-09</th>
<th>Aug-09</th>
<th>Nov-09</th>
<th>Feb-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>RPAH</td>
<td>100</td>
<td>100</td>
<td>95</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>GH</td>
<td>90</td>
<td>94</td>
<td>100</td>
<td>98</td>
<td>99</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>RNSH</td>
<td>86</td>
<td>85</td>
<td>93</td>
<td>98</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>BLH</td>
<td>100</td>
<td>80</td>
<td>NDP</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>JHH</td>
<td>74</td>
<td>83</td>
<td>84</td>
<td>96</td>
<td>90</td>
<td>92</td>
<td>97</td>
</tr>
</tbody>
</table>

Note: The time periods reflect the timing of the audits which occur every three months. "NDP" = no data provided to NSW Department of Health.
Source: Quarterly Correct Site Audit Data Collection, NSW Department of Health.

Figure 16.3 Finalised case reports with antibiotic prophylaxis assessment prior to or at Time Out, quarterly audit periods

Note: The time periods reflect the three month compliance periods.
Data Source: Quarterly Correct Site Audit Data Collection, NSW Department of Health.

There are some concerns about using this information to compare hospitals. Our examination of the reported data found that the number of medical records audited to check for compliance with antibiotic (and VTE) prophylaxis guidelines varied among the study hospitals (see Table 16.7). The number of audits undertaken was not directly related to hospital size. For example, JHH conducted 266 audits (from the August 2008 quarter to the February 2010 quarter), significantly more audits than the other study hospitals, including RPAH, which had a similar number of acute case weighted separations as JHH. BLH audited only 12 records.
Table 16.7 Number of medical records audited for compliance with antibiotic and VTE prophylaxis guidelines

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Average no. of medical records audited (Aug-08 to Feb-10 quarters)</th>
<th>Upper and lower number of records audited in a quarter</th>
<th>No. of acute case weighted separations (2008/09)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>48</td>
<td>26 – 70</td>
<td>79,925</td>
</tr>
<tr>
<td>GH</td>
<td>74</td>
<td>40 – 80</td>
<td>44,594</td>
</tr>
<tr>
<td>RNSH</td>
<td>76</td>
<td>54 – 80</td>
<td>60,767</td>
</tr>
<tr>
<td>BLH</td>
<td>12</td>
<td>7 – 17</td>
<td>32,106</td>
</tr>
<tr>
<td>JHH</td>
<td>266</td>
<td>246 – 291</td>
<td>76,137</td>
</tr>
</tbody>
</table>

a Excludes unqualified neonates.

Note: Data for BLH excludes the audit period (February 2009) for which no data was provided to the NSW Department of Health.

Source: Quarterly Correct Site Audit Data Collection, NSW Department of Health.

Administration of antibiotic prophylaxis

This indicator measures the proportion of patients who are administered antibiotic prophylaxis. The Clinical Excellence Commission and the NSW Therapeutic Advisory Group consider that an appropriate prophylactic antibiotic regimen entails:

- correct antibiotic choice – correct medication choice, route of administration and dosing schedule
- correct timing – generally means up to 60 minutes prior to skin incision
- correct duration – antibiotic prophylaxis is ceased within 24 hours of completion of surgery (or within 48 hours for vascular surgery).

We found that clinicians in most surgical areas (excluding obstetrics) thought that it was important to routinely administer antibiotic prophylaxis to patients. However, the NSW Department of Health has noted that there is no formal clinical agreement in place about antibiotic prophylaxis. As such, it does not collect data for this indicator.

Instead, this indicator is included in the manual Indicators for Quality Use of Medicines in Australian Hospitals\(^{214}\), which was produced by the Clinical Excellence Commission and the NSW Therapeutic Advisory Group as part of the Performance Indicators and Medication Safety (PIMS) project. The manual provides clinicians with a set of indicators for them to use to measure and understand medication use at their hospitals. Although designed as tools for internal hospital use, the manual notes that


these indicators may also be used to inform system improvements at the State or National level as well.215

**VTE prophylaxis**

VTE is a disease process covering deep vein thrombosis (DVT) and pulmonary embolism (PE). It is one of the commonest causes of death in hospital, accounting for 10% of all hospital deaths. It is also associated with significant long-term morbidity.216 Table 16.8 sets out the types of patients at high risk of VTE.

**Table 16.8 Types of patients at high risk of VTE**

<table>
<thead>
<tr>
<th>High risk surgical patients</th>
<th>High risk medical patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Orthopaedic surgery of pelvis, hip or lower limb</td>
<td>• admitted with a new ischaemic stroke</td>
</tr>
<tr>
<td>• Multiple trauma</td>
<td>• history or DVT or PE</td>
</tr>
<tr>
<td>• Major surgery (intra-abdominal or lasting more than 45 minutes) and aged over 60 years</td>
<td>• active cancer</td>
</tr>
</tbody>
</table>


The incidence of VTE is an indicator of the quality of postoperative care, possibly reflecting inappropriate or inadequate medical or nursing care.217 However, other factors impact on the incidence of VTE, including age, medical condition, type of surgery and prolonged immobiliation.218

A strong evidence base exists for VTE prevention, and VTE prevention in hospitalised patients has been widely acknowledged in Australia and internationally as a major opportunity to improve patient safety.219 NSW Health recognises the importance of appropriate VTE prophylaxis in the prevention of avoidable deaths and is currently working towards introducing a mandatory VTE risk assessment and


prophylaxis policy. In the interim, it has issued a VTE prevention booklet to all NSW operating theatres. The booklet contains guidelines developed by the Australia and New Zealand Working Party on the Management and Prevention of VTE.\textsuperscript{220}

We looked at 2 indicators related to VTE prophylaxis - compliance with the requirement to conduct a VTE prophylaxis assessment and administration of VTE prophylaxis.

**Compliance with requirement to conduct a VTE prophylaxis assessment**

This indicator measures the proportion of finalised case reports in the quarterly audit with a VTE prophylaxis assessment before or at Time Out (see Box 16.7). As for antibiotic prophylaxis, NSW hospitals are required to assess whether patients require VTE prophylaxis before or at Time Out, and report on their compliance with this guideline to the NSW Department of Health on a quarterly basis. They collect the data from quarterly audits of the Time Out sheets included in patients’ medical records.

NSW Health provided data on this indicator for the period from the August 2008 to the February 2010 quarters. These data show a general improvement in compliance at the study hospitals (see Table 16.9 and Figure 16.4). All study hospitals had compliance rates exceeding 95% in last quarter measured (February 2010).

**Table 16.9 Finalised case reports with a VTE prophylaxis assessment prior to or at Time Out, quarterly audit periods**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Aug-08</th>
<th>Nov-08</th>
<th>Feb-09</th>
<th>May-09</th>
<th>Aug-09</th>
<th>Nov-09</th>
<th>Feb-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>91</td>
<td>100</td>
<td>95</td>
<td>89</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>GH</td>
<td>89</td>
<td>91</td>
<td>100</td>
<td>99</td>
<td>100</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>RNSH</td>
<td>86</td>
<td>85</td>
<td>93</td>
<td>98</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>BLH</td>
<td>100</td>
<td>80</td>
<td>NDP</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>JHH</td>
<td>76</td>
<td>85</td>
<td>85</td>
<td>97</td>
<td>90</td>
<td>94</td>
<td>97</td>
</tr>
</tbody>
</table>

*Note:* The time periods reflect the timing of the audits which occur every three months. “NDP” = no data provided to NSW Department of Health.

*Source:* Quarterly Correct Site Audit Data Collection, NSW Department of Health.

Administration of VTE prophylaxis

This indicator measures the proportion of patients who are administered VTE prophylaxis. This may take the form of mechanical methods (eg, graduated compression stockings), chemoprophylaxis (ie, medicinal methods) or combinations of these. The correct choice of prophylaxis depends on the clinical situation and should be determined by local hospital policy.\textsuperscript{221}

The Australia and New Zealand Working Party on the Management and Prevention of VTE notes that bleeding is the major complication for VTE prophylaxis. Further, the relative risks of bleeding versus VTE must be considered when commencing VTE prophylaxis.\textsuperscript{222} This may be one reason why VTE prophylaxis is not given to all high risk patients.

The NSW Department of Health does not currently collect data for this indicator. However, as for antibiotic prophylaxis, we consider it a more meaningful outcome indicator than the current indicator on its own (ie, compliance with the requirement to conduct a VTE prophylaxis assessment). We note that this indicator is included in the Clinical Excellence Commission’s and NSW Therapeutic Advisory Group’s


16.3.7 Patient experience following treatment

This indicator measures the patient’s evaluation of the quality of hospital care received. Since 2007, NSW Department of Health has undertaken a patient survey to monitor patient experience with hospital care in NSW. It is mailed to 200,000 patients in NSW who received inpatient and non-inpatient services in 7 patient categories. The categories are ‘overnight inpatients’, ‘day only inpatients’, ‘paediatric inpatients’, ‘adult rehabilitation inpatients’, ‘non-admitted emergency patients’, ‘outpatients’ and ‘community health clients’.

Almost 80,000 patients responded to the 2009 survey, scoring their health services against the Picker Institute’s 8 dimensions of patient-centred care (see Table 16.10) and providing their impressions of the overall care they received.

<table>
<thead>
<tr>
<th>No.</th>
<th>Dimension</th>
<th>Patient experience associated with high scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Access to care</td>
<td>Staff being available to meet patients’ needs and answer questions; and scheduling health services to minimise conflicts</td>
</tr>
<tr>
<td>2.</td>
<td>Information and education</td>
<td>Staff providing information to patients to reduce their fears</td>
</tr>
<tr>
<td>3.</td>
<td>Emotional support</td>
<td>Staff paying attention to patients’ fears and anxieties associated with their illness, which can be as debilitating as its physical effects</td>
</tr>
<tr>
<td>4.</td>
<td>Coordination and integration of care</td>
<td>Staff properly coordinating care to ease patients’ feelings of vulnerability and powerlessness in the face of their illness</td>
</tr>
<tr>
<td>5.</td>
<td>Respect for patient’s values, preferences, and expressed needs</td>
<td>Staff recognising and treating patients as individuals. This involves focusing on quality of life and providing the patient with dignity; including the patient in medical decisions; and respecting a patient’s autonomy</td>
</tr>
<tr>
<td>6.</td>
<td>Family and friends</td>
<td>Staff arranging accommodation for family and friends; involving family and close friends in decision making; and supporting family members as caregivers</td>
</tr>
<tr>
<td>7.</td>
<td>Physical comfort</td>
<td>Staff being aware of pain management and assisting with daily living needs</td>
</tr>
<tr>
<td>8.</td>
<td>Continuity and transition after discharge</td>
<td>Staff providing understandable, detailed information (eg, regarding medications, physical limitations, dietary needs); coordinating ongoing treatment and services after discharge; and providing information regarding access to support services on a continuing basis</td>
</tr>
</tbody>
</table>

Note: The Picker Institute is an independent, not for profit research and development institute that provides research and information on patient experience with healthcare systems (www.pickereurope.org).


In order to support fair comparisons between hospitals, the Bureau of Health Information (BHI) standardised statistically the patient ratings of care experiences to show how the hospitals would rate if they served very similar populations of patients. The BHI considers that standardisation is important because different hospitals provide services to different kinds of people with different illnesses and severity of illness. These differences can affect patients’ ratings of care independently of the quality of the care healthcare workers give them during their stay in hospital (see Box 16.8).

**Box 16.8 Standardising patient ratings of care experiences**

**Standardisation process**

Using information from the survey, the BHI determined that age group, self reported health status, education, language spoken at home, Aboriginality, gender, patient classification (Medicare, private, other), days that illness or injury kept them in bed in February 2009, planned or emergency admission and surgery patient influenced their ratings of care. A statistical analysis was done to standardise ratings on the basis of these patient characteristics. There may be other characteristics of patients that differ between area health services or hospitals and influence ratings, such as type of illness, but the BHI could not include them in the statistical analysis because they were not recorded in the survey.

**Effects of standardisation**

Standardisation had a noticeable impact on Sydney South West and Sydney West Area Health Services. The types of patients cared for in these regions were, on average, more likely to give fair or poor ratings of overall care and of staff teamwork than those cared for by other area health services. Standardisation reduced these differences but did not remove them completely.

Standardisation also had an important impact on the ratings for large public hospitals that served younger patients or patients who did not speak English in their home. These groups of patients were more likely to give negative ratings than older patients and patients who spoke English at home. Thus standardisation with respect to them was particularly important to comparing patients’ ratings of care in large public hospitals.

Aboriginality refers to both Aboriginal and Torres Strait Islander people.


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Figure 16.5 shows how overnight and day only patient rated their overall care at the study hospitals. These results indicate that:

- The percentage of overnight patients who gave excellent ratings for overall care was highest at RPAH (39%) and GH (33%), and lowest at RNSH and BLH (each with 25%). RPAH was the only study hospital that exceeded the NSW average (34%) for excellent overall care.

- There was a smaller range between the study hospitals in relation to day only patient ratings. The percentage of patients who gave excellent ratings was still highest at RPAH (37%) and lowest at RNSH (33%). No study hospital exceeded the NSW average (42%) for excellent overall care.

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225 Overnight patients include individuals that stayed one or more nights in a public hospital. Day only patients include individuals who spent a day in a public hospital receiving a test, surgery or other procedure. These categories do not include patients less than 17 years of age, patients who received all their care in emergency departments or those who received cancer, rehabilitation or mental health care services. BHI excluded maternity patients for this analysis.
Another method of gauging patient experience with their health services is to use patient-reported outcome measures (PROMs). This involves asking patients to fill in a questionnaire before and after treatment to measure their health status (e.g., mobility, pain/discomfort and anxiety/depression). As part of our 2008 review for...
NSW Health, we recommended that NSW Health consider using PROMs to increase its understanding of how patients view the outcome of its services.\textsuperscript{226}

### 16.4 Study hospitals’ performance against additional outcome indicators

We also considered the performance of the study hospitals against several additional outcome indicators. In general, there was little variation in the hospitals’ performance against these indicators, or the data was difficult to analyse because of the low number of incidences.

#### 16.4.1 Healthcare associated infection rates

Prevention of healthcare associated infections (HAIs) and multi-resistant organism (MRO) colonisations is one of the key patient quality and safety initiatives for NSW Health. Its goal is to prevent every patient from acquiring an HAI or MRO colonisation during all stages of their care and treatment.\textsuperscript{227}

HAIs are varied, complex and difficult to measure. Many are caused by MROs and so are difficult to treat. They can cause significant excess morbidity, mortality and costs and a significant proportion is preventable. Box 16.9 outlines NSW Health’s HAI prevention strategies.

NSW Health’s has had a HAI prevention strategy in place for many years. Further, in January 2008 it introduced a mandatory data collection system that involves monthly monitoring of 8 types of HAI data across all public hospitals in the state. These indicators form a critical part of monthly performance reviews with Area Health Services. Infection rates are published on the NSW Health website. NSW Health is the only state that has mandated data collection and reporting of this information in this way.\textsuperscript{228}


Box 16.9 How can HAIs be reduced?\(^a\)

NSW Health considers that reductions in HAI rates can be achieved by preventive measures such as:

- thorough hand cleaning by everyone who enters a hospital - healthcare staff, patients and their visitors
- keeping the healthcare environment clean through effective cleaning programs in clinical care and treatment areas
- complying with standard sterile techniques for the insertion and care of intravenous cannulas and other clinical items
- identifying patients who are at greater risk of contracting an infection
- taking prudent precautions such as isolating patients who have contracted MROs, and
- using antibiotics appropriately to prevent and treat infections.


We looked at data for several indicators associated with HAIs which NSW Health currently monitors. These included the rates of CLAB infections in ICUs, ICU-associated MRSA and MRAB acquisitions, and healthcare-associated SA-BSIs in acute care hospitals.

**CLAB infection rates in ICUs**

These indicators measure the rate of centrally inserted and peripherally inserted central line associated bacteraemia (CLAB) infections in intensive care units (ICUs) per 1,000 central line days.\(^{229}\)

A central line is a catheter introduced via a vein into a major vein or the heart for the administration of fluids, medications or for the measurement of central venous pressure. Central lines are either centrally inserted (via the neck or trunk) or peripherally inserted (via a limb or the scalp).\(^{230}\) Days of exposure to a central line device (‘central line days’) comprises the most important risk factor for infection and is therefore used as the denominator for rate calculation.\(^{231}\)

\(^{229}\) A CLAB infection is defined as a significant blood stream infection with no other apparent focus of infection that occurs in a patient who either has a central line in place or who has had a central line removed within 48 hours of the blood stream infection diagnosis. ICU associated CLABs are those that are detected more than 48 hours after intensive care admission and within 48 hours of ICU discharge. See NSW Health, Healthcare Associated Infection: Clinical Indicator Manual, November 2008, p 4 (http://www.cec.health.nsw.gov.au/files/clab-icu/publications/hai-manual.pdf).


CLAB infections are responsible for 40% to 60% of HAIs in intensive care patients.232 As part of the NSW Health HAI prevention strategy, the CEC and Intensive Care Coordination & Monitoring Unit (ICCMU), were tasked with a state-wide initiative to reduce CLAB infections in ICUs.233 See Box 16.10 for further details.

**Box 16.10  CLAB-ICU project**

The CLAB-ICU project uses a top down/bottom up collaborative methodology based on a quality improvement program which has been successfully implemented in the United States and demonstrates that compliance with maximum sterile barrier precautions can result in a reduction in CLAB infections.

The project promotes appropriate hand hygiene, skin preparation and maximum sterile barrier precautions during insertion. Intensive care specialists have developed practice guidelines and an insertion checklist to support sterile insertion of central lines. All level 5 and 6 ICUs are participating in the project.

Participating units can access several resources to support local practice, including:

- an insertion checklist: a record of procedure that encourages compliance with policy
- an education and training framework to improve transferability of skill, recognition of prior competence between units and improve patient safety and care
- e-learning tools to support standard education and training
- regular compliance reports to support clinical governance and celebrate excellence in care, and
- a standardised central line procedure pack.

In March 2010, the CEC and ICCMU developed draft guidelines dealing with central line insertion and post insertion care.b


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We found that the centrally inserted CLAB rate varied across the study hospitals (Figures 16.6 and 16.7). GH had the highest rate of the study hospitals in the last 2 quarters measured (although it had zero rates in the previous 2 quarters). We have not included the data for peripherally inserted CLAB infections as these are relatively rare occurrences at the study hospitals.

Figure 16.6 Number of adult ICU associated centrally inserted CLAB infections (per 1,000 centrally inserted central line days), quarterly data, 2008/09

Note: Data was only available for RPAH and BLH for the March and June 2009 quarters. 
Data source: HAI Indicator 1.1 (adult), NSW Department of Health.


**Figure 16.7 Number of adult and paediatric ICU associated centrally inserted CLAB infections (per 1,000 centrally inserted central line days), quarterly data, 2008/09**

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Rate per 1,000 centrally inserted central line days in ICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Prince Alfred</td>
<td></td>
</tr>
<tr>
<td>Bankstown/Lidcombe</td>
<td></td>
</tr>
<tr>
<td>Royal North Shore</td>
<td></td>
</tr>
<tr>
<td>Gosford</td>
<td></td>
</tr>
<tr>
<td>John Hunter</td>
<td></td>
</tr>
</tbody>
</table>

**Data source:** NSW Department of Health.

**ICU-associated MRSA and MRAB acquisition rates**

These indicators measure the rate of MRSA\(^{234}\) and MRAB\(^{235}\) acquisitions (infections and colonisations)\(^{236}\) in ICUs per 1,000 ICU bed days.

ICU patients are often exposed to antibiotics and are at a higher risk of acquiring MROs. Further, ICUs that have a high admitted burden of MRO patients may experience greater difficulty with MRO containment.\(^{237}\)

We found that MRSA rates decreased or stayed the same at most of the study hospitals over the 4 quarters of 2008/09 (Figure 16.8). While GH’s rate was tracking up in the final quarter measured, its rate in that quarter was similar to those at RPAH and BLH. We have not included information on MRAB acquisitions as these are relatively rare occurrences at the study hospitals.

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\(^{234}\) Methicillin-resistant Staphylococcus aureus.

\(^{235}\) Meropenem-resistant Acinetobacter baumannii.

\(^{236}\) Infection is the invasion of body tissues by a micro-organism resulting in disease and often requiring treatment. Colonisation is the presence of micro-organisms that usually do not cause harm to the person. (Source: Casadevall A and Pirofski L-A. Host-Pathogen Interactions: Basic Concepts of Microbial Commensalism, Colonization, Infection, and Disease. Infection and Immunity 2000; 68(12):6511-6518 at http://iai.asm.org/cgi/content/full/68/12/6511)

Figure 16.8 Number of MRSA acquisitions (infections and colonisations) in ICU (per 1,000 ICU bed days), quarterly data, 2008/09

Data source: HAI Indicator 4.1, NSW Department of Health.

Healthcare associated SA-BSIs rates in acute care hospitals

This indicator measures the rate of healthcare associated staphylococcus aureus bloodstream infections (SA-BSIs) by inpatients per 10,000 occupied bed days.\(^{238}\)

Staphylococcus aureus is among the commonest and most serious causes of healthcare associated sepsis. The bloodstream infections caused by staphylococcus aureus are MRSA and MSSA\(^{239}\). SA-BSIs are associated with substantial morbidity and mortality worldwide.\(^{240}\)

\(^{238}\) A ‘healthcare associated’ event satisfies at least one of the following criteria:
1. acquired during hospitalisation and not present or incubating on admission
2. is a complication of the presence of an indwelling medical device (eg, urinary catheter)
3. occurs within thirty days of a surgical procedure, where the bloodstream infection is related to the surgical site infection
4. an invasive instrumentation or incision related to the bloodstream infection was performed within 48 hours before onset of the infection. If the time interval was longer than 48 hours, there must be compelling evidence that the infection was related to the invasive device or procedure.
5. associated with neutropenia (<1000 neutrophils x10^6/L) contributed to by cytotoxic therapy.


\(^{239}\) Methicillin-sensitive Staphylococcus aureus.

The 2008 National Healthcare Agreement has set a performance benchmark of no more than 2.0 infections per 10,000 occupied bed days for acute care public hospitals by 2011/12 in each State and Territory.\textsuperscript{241} We found that the study hospitals complied with this benchmark over the first 2 quarters of 2009 (Figure 16.9).

\textbf{Figure 16.9 Number of healthcare associated SA-BSIs for inpatients (per 10,000 occupied bed days), quarterly data, 2009}

![Graph showing number of healthcare associated SA-BSIs for inpatients per 10,000 occupied bed days for RPAH, GH, RNSH, BLH, and JHH for Mar-09 and Jun-09.]

\begin{quote}
\textbf{Data source:} HAI Indicator 2.1 & 2.2, NSW Department of Health.
\end{quote}

\textbf{16.4.2 Incorrect patient, incorrect procedure, incorrect site}

This indicator measures the number of incidents involving an incorrect patient, an incorrect procedure or an incorrect site of a procedure. This includes incorrect procedures in operating theatre, radiology, radiation oncology and nuclear medicine.

The NSW Department of Health notes that these are relatively rare but serious incidents in healthcare, and may be devastating when they occur, not only for the patient and their families or carers, but also for the staff involved. It considers that they are preventable and largely the result of miscommunication and unavailable or incorrect information. The major contributing factors are the lack of a standardised checking process and a degree of staff automaticity (checking without thinking) in the pre-procedure check routines.\textsuperscript{242}


The NSW Department of Health has developed a policy directive aimed at preventing these incidents by describing the steps that must be taken to ensure that procedures are performed on the correct patient, at the correct site and, if applicable, with the correct implants/prostheses and equipment.243

We found that the incidence of incorrect patient, incorrect procedure, incorrect site was very low at the study hospitals over 2008/09 (Table 16.11).

Table 16.11 Incorrect patient, incorrect procedure, incorrect site incidents, 2008/09

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Incidents</th>
<th>Acute case weighted separations(^a)</th>
<th>Rate (per 1,000 separations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>8</td>
<td>79,925</td>
<td>0.10</td>
</tr>
<tr>
<td>GH</td>
<td>2</td>
<td>44,594</td>
<td>0.05</td>
</tr>
<tr>
<td>RNSH</td>
<td>6</td>
<td>60,767</td>
<td>0.10</td>
</tr>
<tr>
<td>BLH</td>
<td>1</td>
<td>32,106</td>
<td>0.03</td>
</tr>
<tr>
<td>JHH</td>
<td>3</td>
<td>76,137</td>
<td>0.04</td>
</tr>
</tbody>
</table>

\(^a\) Excludes unqualified neonates.

Source: NSW Department of Health.

16.4.3 In-hospital falls leading to death

This indicator measures the rate of in-hospital falls associated with death. Patient falls are the most common adverse event reported in hospitals, affecting between 2% to 10% of hospital admissions each year.244 Indeed, hospital settings are associated with an increased falls risk. The older patient is confronted with a new, strange environment on admission, and may be confused, suffering an acute illness or being treated with balance-affecting medication. In addition, chronic risk factors are likely to exist such as comorbidities, muscle weakness and impaired balance and gait.245

Patient falls in hospitals increase length of stay, require additional diagnostic investigations and impact on patient treatment, resulting in increased costs and adverse outcomes.246 Over time, the NSW Department of Health has put significant effort into reducing falls in the home and hospital environment. Area Health Services have been regularly monitoring and reporting fall numbers. NSW Health has advised that these reports have shown a decline in the number of falls resulting in serious harm, which is attributable to implementing risk assessment and other prevention tools.

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More recently, as part of the state-wide NSW Health Plan for the Prevention of Falls and Harm from Falls among older people (2010-2014), the CEC has been tasked with supporting Area Health Services in continuing to prevent falls in hospitals, as well as distributing and supporting the implementation of recently agreed national guidelines on falls prevention (see Box 16.11).

**Box 16.11  CEC Falls Prevention Program**

The CEC Falls Prevention Program involves implementing a range of strategies to prevent falls across hospital, community and residential aged care settings. Hospital initiatives include:

- identifying people at risk for falls and implementing strategies to care for people at risk
- implementing post-fall guidelines following in-hospital falls
- reporting and monitoring fall incidences, and providing feedback to ward staff
- implementing the ACSQHC best-evidence falls prevention guidelines for hospitals.

We found that despite in-hospital falls being relatively common events, those directly leading to death were very rare occurrences at the study hospitals during 2007/08 and 2008/09 (Table 16.12).

**Table 16.12 Adult patient falls in hospitals directly resulting in death, 2007/08 and 2008/09**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>2007/08 No.</th>
<th>2008/09 No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>GH</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RNSH</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>BLH</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>JHH</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>NSW total</td>
<td>35</td>
<td>44</td>
</tr>
</tbody>
</table>

**Note:** Number of clinical incidents with a principal incident type of “Falls – SAC1 – patient died as a direct result of fall”. This data has not been presented as a rate per 100 adult occupied bed days due to the very low number of incidences.

**Source:** NSW Health, Incident Information Management System (IIMS), data extracted on 22 October 2009.
16.4.4 Complaints management

This indicator measures the proportion of complaints dealt with within 35 days. The NSW Department of Health considers that management of a complaint provides an opportunity to identify risks and ensure that action is taken to minimise or eliminate those risks. Its benchmark is for 80% of complaints to be dealt with within 35 days.\textsuperscript{247}

We found that most of the study hospitals met this benchmark during the September 2007 to June 2009 quarters (Table 16.13). However, there are relatively low percentages for RNSH and RPAH in several quarters, with both hospitals falling below the benchmark in 4 of the 8 quarters measured. Although for RPAH, the achieved rate was only marginally less than the benchmark rate for 2 of those quarters, at 79%.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Sep-07</th>
<th>Dec-07</th>
<th>Mar-08</th>
<th>Jun-08</th>
<th>Sep-08</th>
<th>Dec-08</th>
<th>Mar-09</th>
<th>Jun-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>87</td>
<td>67</td>
<td>82</td>
<td>79</td>
<td>89</td>
<td>73</td>
<td>79</td>
<td>84</td>
</tr>
<tr>
<td>GH</td>
<td>100</td>
<td>100</td>
<td>92</td>
<td>96</td>
<td>87</td>
<td>88</td>
<td>94</td>
<td>92</td>
</tr>
<tr>
<td>RNSH</td>
<td>65</td>
<td>70</td>
<td>69</td>
<td>84</td>
<td>74</td>
<td>83</td>
<td>86</td>
<td>95</td>
</tr>
<tr>
<td>BLH</td>
<td>92</td>
<td>95</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>97</td>
<td>95</td>
</tr>
<tr>
<td>JHH</td>
<td>91</td>
<td>82</td>
<td>83</td>
<td>91</td>
<td>79</td>
<td>92</td>
<td>94</td>
<td>78</td>
</tr>
<tr>
<td>State average</td>
<td>82</td>
<td>82</td>
<td>83</td>
<td>86</td>
<td>85</td>
<td>81</td>
<td>83</td>
<td>85</td>
</tr>
</tbody>
</table>

Note: The Children’s Hospital at Westmead does not use IIMS for complaints management. Therefore the Children’s Hospital at Westmead’s data is not included in the state figures provided.

Source: NSW Department of Health, Incident Information Management System (IIMS), data extracted on 22 & 23 October 2009.

16.4.5 Root Cause Analyses completed within 70 days

This indicator measures the proportion of Root Cause Analyses (RCAs) provided to the NSW Department of Health within 70 days of the incident notification in the electronic Incident Information Management System (IIMS).

It is mandatory for health system employees to report clinical incidents through IIMS. Once clinical incidents are reported, managers are required to conduct certain reviews within specified timeframes, depending on the severity of the clinical incident. Managers must undertake an RCA for the most severe clinical incidents.\textsuperscript{248}


\textsuperscript{248} That is, incidents assigned a Severity Assessment Code 1. These are incidents with serious clinical consequences that have a frequent, likely, possible or unlikely probability of recurring and those incidents with major clinical consequences that have a frequent or likely probability of recurring. See NSW Health, Policy Directive, Incident Management, July 2007, (http://amwac.health.nsw.gov.au/policies/pd/2007/pdf/PD2007_061.pdf.)
The aim of the RCA is to help managers understand all of the contributing factors to the incident and to take action (see Box 16.12). Managers are required to provide RCA reports to the NSW Department of Health within 70 days of the incident notification.249

**Box 16.12  What is a RCA?**

RCA is a method used to investigate an incident. There are 6 key steps in undertaking an RCA:

1. Simple flow charting – determining what the team knows about the sequence of events and what they don’t know and need to find out.
2. Final flow charting – identifying relevant actions and/or inactions and the most significant points where barriers might interrupt the flow of events.
3. Cause and effect – defining the causation statement and identifying the elements which led to the incident.
4. Causation statement – developing a description of the causal chain as a statement from the root cause to the incident.
5. Barriers and recommendations – using the causation statement to identify barriers that to prevent or mitigate the problem and then determining appropriate recommendations.
6. Reporting to NSW Department of Health.


We found that, during the September 2007 to March 2009 quarters, there was a failure to meet the target set by the NSW Department of Health around 40% of the time (Table 16.14). However, due to the low number of RCAs, the NSW Department of Health notes that this failure may have been caused by only one or two RCAs being received a few days after the deadline.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Sep-07</th>
<th>Dec-07</th>
<th>Mar-08</th>
<th>Jun-08</th>
<th>Sep-08</th>
<th>Dec-08</th>
<th>Mar-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>na</td>
<td>100</td>
<td>25</td>
<td>na</td>
<td>0</td>
<td>83</td>
<td>66</td>
</tr>
<tr>
<td>GH</td>
<td>100</td>
<td>na</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>RNSH</td>
<td>na</td>
<td>0</td>
<td>na</td>
<td>100</td>
<td>100</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>BLH</td>
<td>100</td>
<td>na</td>
<td>na</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>JHH</td>
<td>100</td>
<td>na</td>
<td>na</td>
<td>100</td>
<td>75</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note:* “na” refers to no RCAs being due in that month.

*Source:* NSW Health, Incident Information Management System (IIMS), data extracted on 22 October 2009.

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16.4.6 Warfarin management

Warfarin is a high risk medicine. It is an anticoagulant – a medication that prevents blood from clotting – with a narrow therapeutic range. Doses outside the therapeutic range can lead to serious complications, including severe bleeding and death.

When deciding what constitutes an appropriate dosage of warfarin, health staff are guided by International Normalised Ratio (INR) blood test results. The INR measures the anticoagulant effect of warfarin. When a patient first starts taking warfarin, blood tests are done frequently until the INR result begins to stabilise. Less frequent tests are done once stabilisation is reached.250

Some hospitals conduct audits to check compliance with their warfarin management protocols. However, The NSW Department of Health does not regularly collect data on warfarin management. Table 16.15 outlines 2 indicators which may be used to assess a hospital’s warfarin management.

Table 16.15 Warfarin management indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with NIMC guidelines</td>
<td>Measures whether documentation on patients on warfarin are in accordance with the guidelines. The National Inpatient Medication Chart (NIMC) has been designed to reduce the potential for error in prescribing, dispensing and administering medications. While not recommending dosage or risk levels, the chart contains space for warfarin therapy to be prescribed. An evaluation of the use of the NIMC in a pilot study demonstrated a 30% reduction in toxic levels of warfarin. NIMC guidelines recommend that:</td>
</tr>
<tr>
<td></td>
<td>- a standard dose time of 1600 hours (4pm) be followed, as this allows the medical team caring for the patient to order the next dose of warfarin based on INR results, rather than leaving it for after-hours staff to do</td>
</tr>
<tr>
<td></td>
<td>- the indication and target INR be included when warfarin is initially ordered</td>
</tr>
<tr>
<td></td>
<td>- for each day of therapy, the following information be documented: INR result; warfarin dose; doctor’s initials; initials of nurse that administers the dose and the checking nurse.</td>
</tr>
<tr>
<td>Warfarin INR exceeding 5</td>
<td>Measures the proportion of patients administered warfarin who have an INR exceeding 5. For most patients requiring warfarin, the target INR range is between 2 and 3. There is a strong relationship between INR levels and bleeding. The risk of bleeding is markedly increased once the INR exceeds 4.</td>
</tr>
</tbody>
</table>


16.5 Problems associated with collecting consistent, reliable outcomes data

The reliability of outcome indicators depends on the NSW Department of Health and hospitals maintaining consistent reporting practices. Otherwise, there is the potential for one hospital to be more diligent in collecting data than another hospital, leading to incorrect assumptions on safety and quality.

In general, while we found that the NSW Department of Health and the study hospitals collected a number of safety and quality indicators, they did not systematically monitor outcomes, particularly at the clinical level. There were some exceptions, such as cardiology, where the study hospitals conducted performance monitoring or had participated in various benchmarking studies. Further, several clinical groups have taken a leading role by maintaining their own databases and adopting quality and outcomes measures for their specialisation (eg, interventional cardiothoracic and orthopaedic surgery).

In addition, there are a few clinical areas with extensive outcomes reporting. For example, study hospitals routinely collected obstetrics outcomes information for publication in the NSW Mothers and Babies report.

In relation the study hospitals, this lack of systematic performance monitoring may be due to lack of clinical agreement, access to registry data, organisational, resourcing or other clinical reasons. We found only limited organisational structures or processes in place at the study hospitals to collect, maintain and analyse outcomes data. Further, staff indicated during our hospital visits that there were few resources to allocate to data collection. That said, there are some clinical areas where clinicians submit comprehensive data to clinical registries. In addition, while clinicians considered it important to monitor outcomes, in many instances there was a lack of consensus around the appropriate indicators to take account of and collect data for.

More recently, NSW Health has taken several steps to improve outcomes monitoring and reporting. These include:

- introducing mandatory reporting of clinical incidents, through an electronic Incident Information Management System (IIMS), and HAIs
- publishing an overview of five-year trends in quality and safety across the NSW healthcare system for certain specialties (eg, cardiac and stroke).

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While mandatory reporting may assist with developing outcomes monitoring, it does not resolve all of these problems. For example, hospitals are currently required to report HAIs within 30 days of infection. We found that as the collection of these data require clinical interpretation. The method used to collect HAI can vary from that prescribed in the HAI Clinical Indicator Manual developed by infectious disease professionals, potentially affecting the reliability and comparability of the HAI indicators. We understand that the NSW Department of Health is currently reviewing systems to streamline these processes.

16.6 Steps being taken to improve outcomes monitoring and develop national indicators

There has been significant work undertaken on safety and quality indicator development and initiatives are in place that will improve outcomes data. The National Health and Hospitals Network Agreement (2010) includes new Hospital Performance Reports outlining the performance of all public and private hospitals. Reports will include selected clinical quality and safety measures drawn from the quality and safety standards developed by the ACSQHC.

Box 16.13 COAG health agreements

The Council of Australian Governments (COAG) health agreements set out the arrangements between the Commonwealth and States for funding and delivering health services in Australia. Recent COAG agreements have placed a greater emphasis on developing a set of national outcome indicators. In particular, the National Health and Hospitals Network Agreement (2010) provides for the implementation of a ‘Performance and Accountability Framework’ that includes:

- National clinical quality and safety standards developed by the ACSQHC.
- New Hospital Performance Reports outlining the performance of all public and private hospitals. Reports will include selected clinical quality and safety measures drawn from the quality and safety standards developed by the ACSQHC.

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259 COAG, National Health and Hospitals Network Agreement, April 2010, p 7
To support these reports, the States have agreed to a data regime that includes providing such de-identified clinical data to the ACSQHC for developing agreed quality and safety standards, and reporting against these standards. The timetable for this data provision is to be determined by the ACSQHC and agreed by State and Territory Health Ministers. As national standards are developed and agreed, it is expected that these standards will assist in gaining clinical agreement on outcome measures.

The quality and safety standards referred to in the COAG agreements are likely to be based on those developed as part of the National Indicators Project, a major project funded by the ACSQHC and undertaken by the Australian Institute of Health and Welfare (AIHW). The purpose of the National Indicators Project was to systematically identify and develop information that could be used to monitor Australia’s performance in safety and quality in health care for intra-jurisdictional, inter-jurisdictional and international benchmarking and reporting purposes.

The AIHW proposed 55 national safety and quality indicators as part of this project, comprising:
- 13 primary and community health service indicators
- 25 hospital indicators
- 6 specialised health service indicators
- 5 residential aged care indicators
- 11 indicators which cover multiple or all types of health services.

Separately from the COAG process, in November 2009 the ACSQHC presented Commonwealth, State and Territory Health Ministers with a set of national indicators it considered hospitals should regularly be reviewing. These Health Ministers agreed to aim to have systems in place to review these indicators by December 2010 (see Box 16.14).


Box 16.14  Indicators agreed by Commonwealth, State and Territory Health Ministers

The indicators agreed by the Commonwealth, State and Territory Health Ministers for regular review by hospitals include:

- HSMRs.
- Death in low mortality DRGs.
- In-hospital mortality rates for:
  - AMI
  - heart failure
  - stroke
  - fractured neck of femur, and
  - pneumonia.
- Unplanned hospital readmission of patients discharged following management of:
  - AMI
  - Heart failure
  - Knee and hip replacements
  - Depression
  - Schizophrenia, and
  - Paediatric tonsillectomy and adenoidectomy.
- Obstetric trauma – third and fourth degree tears.

Work is currently underway on defining the scope of the indicators. This is to ensure that hospitals in different States use consistent definitions when collecting data for the indicators. After this stage is complete, the ACSQHC will work with States in developing tools to assist hospitals to routinely collect and analyse the indicator data.

Table 16.16 lists the indicators in the National Indicators Project relevant to hospitals. It also indicates the overlap between these indicators and the outcome indicators we have considered in our study, as well as those included in the recent COAG agreements and agreement by the Commonwealth, State and Territory Health Ministers.
### Table 16.16 AIHW’s proposed national safety and quality indicators

<table>
<thead>
<tr>
<th>No.</th>
<th>AIHW’s indicators</th>
<th>Similar indicator in:</th>
<th>COAG agreement</th>
<th>IPART’s study</th>
<th>Agreement of Health Ministers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Hospital indicators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Assessment for risk of venous thromboembolism in hospitals</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>2.</td>
<td>Pain assessment in the emergency department</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td>Reperfusion for acute myocardial infarction in hospitals</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td>Stroke patients treated in a stroke unit</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>5.</td>
<td>Complications of transfusion</td>
<td></td>
<td></td>
<td></td>
<td>a</td>
</tr>
<tr>
<td>6.</td>
<td>Health care associated infections acquired in hospital</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>7.</td>
<td><em>Staphylococcus aureus</em> (including MRSA) bacteraemia in hospitals</td>
<td></td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>8.</td>
<td>Adverse drug events in hospitals</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>9.</td>
<td>Intentional self-harm in hospitals</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10.</td>
<td>Malnutrition in hospitals and residential aged care facilities</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11.</td>
<td>Pressure ulcers in hospitals and residential aged care facilities</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>12.</td>
<td>Falls resulting in patient harm in hospitals and residential aged care facilities</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>13.</td>
<td>Complications of anaesthesia</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14.</td>
<td>Accidental puncture/laceration in hospitals</td>
<td></td>
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<td>•</td>
</tr>
<tr>
<td>15.</td>
<td>Obstetric trauma – third and fourth degree tears</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>16.</td>
<td>Birth trauma— injury to neonate</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>17.</td>
<td>Postoperative haemorrhage</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18.</td>
<td>Postoperative venous thromboembolism</td>
<td></td>
<td></td>
<td></td>
<td>b</td>
</tr>
<tr>
<td>19.</td>
<td>Unplanned return to operating theatre</td>
<td></td>
<td></td>
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<td>•</td>
</tr>
<tr>
<td>20.</td>
<td>Unplanned re-admission to an intensive care unit</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>21.</td>
<td>Hospital standardised mortality ratio (HSMR)</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>22.</td>
<td>Death in low mortality DRGs</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>23.</td>
<td>Independent peer review of surgical deaths</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>No.</td>
<td>AIHW’s indicators</td>
<td>Similar indicator in:</td>
<td></td>
<td></td>
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<tr>
<td>-----</td>
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<td>-----------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>COAG agreement</td>
<td>IPART’s study</td>
<td>Agreement of Health Ministers</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Discharge medication management for acute myocardial infarction</td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Timely transmission of discharge summaries</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>26.</td>
<td>Unplanned hospital readmissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Inappropriate co-prescribing of medicines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Selected potentially preventable hospitalisations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>End stage kidney disease in people with diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>Lower-extremity amputation in people with diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>Cancer survival</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>Failure to diagnose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>Potentially avoidable deaths</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>Patient experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>Presence of appropriate incident monitoring arrangements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Accreditation of health care services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Indicators which cover multiple or all types of health services

- IPART’s indicator is the transfusions rate for patients with haemoglobin levels within a certain range.
- IPART’s indicator is the rate of patients receiving prophylaxis for venous thromboembolism.
- IPART’s indicator is the survival rate for patients undergoing major chest and breast surgeries, which include lung and breast cancer patients.


16.7 Actions NSW can take to improve its outcomes data and prepare for national performance reporting regime

Based on our analysis of key outcome indicators, and our consideration of the steps being taken by the Commonwealth and the States to establish national safety and quality indicators for hospitals, we identified a range of actions NSW should take to improve its outcomes data and prepare for the national performance reporting regime. These include continuing to contribute to the national debate on the best methodology for risk adjusting or standardising key outcome indicators, ensuring consistent coding of comorbidities, facilitating ongoing access to registry data, disseminating outcomes data, and supporting data collection.
16.7.1 Continuing to contribute to the national debate on the best methodology for risk adjusting or standardising key outcome indicators

While we found that the process of modelling and interpreting risk-adjusted mortality, survival, unplanned readmission and wound infection rates was a very complex task, we also consider that these rates can be useful indicators to highlight areas where further analysis of outcomes, safety and quality is needed. In light of this, NSW Health should:

▼ Continue to contribute to the development of ACSQHC’s safety and quality standards for these rates.

▼ Enhance understanding of standardising or risk-adjusting these rates through further analysis and research in this area. This will involve developing a standardisation or risk-adjustment methodology. The methodology used for this study, described in Box 16.1, could be refined for this purpose.

▼ Continue to consult with clinicians regarding the agreed presentation of mortality, survival, unplanned readmission and wound infection information.

▼ Report this information on a more routine and regular basis consistent with ACSQHC data sets.

This issue is also discussed in Chapter 17.

Recommendation

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.

To assist with the process of risk-adjusting and reporting indicators, NSW Health may wish to consider Queensland’s experiences with the variable-life-adjusted-display (VLAD) model it uses to analyse and present outcome indicators.

▼ VLADs are a type of statistical process control charting, which allow hospitals to monitor their performance against a range of outcome indicators (eg, readmissions, long stays, mortality).

▼ Thresholds are set so that the VLAD charts ‘flag’ when there is a particular variation in a hospital’s outcomes compared to the State average.

▼ If a flag occurs, the hospital is required to investigate and take certain actions.
As part of our 2008 review for NSW Health, we recommended that NSW Health monitor the impact of Queensland’s model on improving safety and quality to see if it was appropriate to adopt in the future. We note that there are also other methods of data monitoring systems being developed.

### 16.7.2 Encouraging consistent coding of comorbidities

Ideally, outcome indicators should take into account patient complexity at each hospital (ie, casemix). To do this, the indicators need to be risk-adjusted for factors such as age, sex and comorbidities. This is relatively straightforward for the first 2 factors. However, it is more difficult to risk-adjust for the third factor, as there are a wide range of comorbidities that may affect patients.

As outlined in Box 16.1, the Charlson index is used to simplify this range of comorbidities. Since a patient’s Charlson index score is determined by the different comorbidities assigned to them, coding of comorbidities is critical to properly risk-adjusting outcome indicators. Therefore, it is important for hospitals to have appropriate systems in place to facilitate accurate coding and that coding practices are consistent across hospitals.

To help assess if the coders in the study hospitals were coding patients similarly, we compared the average number of diagnosis codes per patient for various clinical conditions or procedures. This approach provides a rough guide to help assess whether there is a significant difference in coding practice between hospitals. For example, if one hospital is coding cases in higher complexity categories, we would expect to find that it uses more diagnosis codes on average. Conversely, if a hospital is paying little attention to coding complexity, we would expect to find that it uses few diagnosis codes.

We found that there was variation in the average number of codes assigned to patients for certain clinical conditions or procedures. For example, there was variation in the average number of diagnosis codes assigned to AMI patients at the study hospitals (see Table 16.17). While some of this variation may reflect difference in their casemixes, it may also indicate differences in their coding practices.

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264 For example, the Classification of Hospital Acquired Diagnoses or 'CHADx'. This system is designed to allow hospitals to monitor their complication rates month-to-month using a standard method (source: http://www.himaa.org.au/Public/print_currentjournalfeature_38_3.html).

265 A diagnosis code is recorded for each medical condition. For example, a stroke patient may also have high blood pressure, diabetes and dementia.
Table 16.17 Number of ICD 10 codes completed for each patient with AMI as a principal diagnosis, 2007/08

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Cases</th>
<th>Average no. of codes</th>
<th>Minimum no. of codes</th>
<th>Maximum no. of codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>779</td>
<td>6.7</td>
<td>1</td>
<td>42</td>
</tr>
<tr>
<td>GH</td>
<td>584</td>
<td>5.4</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>RNSH</td>
<td>845</td>
<td>6.2</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>BLH</td>
<td>391</td>
<td>4.6</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>JHH</td>
<td>758</td>
<td>5.7</td>
<td>1</td>
<td>21</td>
</tr>
</tbody>
</table>

Source: Linked records of the NSW Admitted Patient Data Collection (HOIST). Centre for Epidemiology and Research, NSW Health.

The study hospitals generally agreed that coding of information needed improvement. Several study hospitals were looking into electronic discharge templates or some form of discharge guide to improve the information captured on discharge sheets. The ACI has informed us that the electronic medical record system includes discharge summaries and this is currently being implemented throughout NSW. Improvement in the quality of discharge summaries and hence coding will go some way to improving the data for outcomes analysis.

Recommendation

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.

Coding practices are discussed in further detail in Chapter 6.

16.7.3 Facilitating ongoing access to data held by third parties

Data was unavailable for many hospital-wide and clinical level outcome indicators. Sometimes this was because the data was not routinely collected by the NSW Department of Health or hospitals. In the cardiology case study, we found that data was collected by organisations such as the Australian Council on Healthcare Standards, but only for hospitals participating in its programs. Therefore, we were unable to get information on indicators such as the proportion of patients discharged on specific medication and time to thrombolysis.

Another reason was the length of time required to access the data. Most of the data required for the stroke outcome indicators was collected by the National Stroke Research Institute as part of its audit program. However, we needed permission from the National Stroke Foundation and/or the hospitals to gain access to the data. As such, we were unable to obtain the data within the timeframe for our study.

Several clinicians indicated that the information collected by these third parties should either be publicly available or more readily available. However, they indicated that the red-tape required to negotiate access to this data can become a time consuming process.

We suggest that NSW Health work with ACSQHC to negotiate more streamlined arrangements for routine access to data held by third parties (such as clinical registries) for clinical analysis.

**Recommendation**

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.

This issue is also discussed in Chapter 17.

### 16.7.4 Disseminating outcomes information

Clinicians indicated that they would like to be able to access outcomes information from NSW Health on a regular basis. We found that clinicians were currently using a range of approaches to track the outcomes of their patients in order to review clinical cases. For example, in some clinical areas where death was not uncommon (eg, cardiology, stroke, major chest and breast surgery), clinicians were tracking death notices, obtaining ethics approval and contacting patients or obtaining data from clinical registries (where available).

NSW Health should explore the possibility of providing outcomes information to hospital management and clinicians in a more systematic way as an aid to clinical improvement and a key indicator of performance. This may involve providing access to:

- reports published by clinical registries
- linked hospital activity and deaths registry data, to assist clinicians in monitoring survival of their patients and comparing this with similar services.

**Recommendations**

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.

Providing hospital management and clinicians with better access to other data sets (eg, costing data) is discussed in Chapter 17.
16.7.5 Supporting data collection

A number of clinicians at the study hospitals indicated that data collection would be improved by having additional administrative resources to collect outcomes information and maintain data collection on a consistent basis. This is an issue NSW Health should take into account when establishing the data regime required under the National Health and Hospitals Network Agreement (2010).

16.8 Matters that should be considered in completing stages 5 and 6 of NSW Health’s wider review

Our hospital costs and outcomes study is part of a larger, multi-stage project the NSW Department of Health is coordinating with the assistance of other organisations (see Chapter 1). The results of this study will be used by clinical experts to complete other stages of the overall project. In particular, these clinical experts will:

- determine whether variations in configurations of care lead to different clinical outcomes, and
- identify the extent to which clinical variation exists, with the aim of achieving clinical best practice and maximum efficiency.

Based on our analysis of the study hospitals’ performance against our key and additional outcome indicators (discussed above), we consider that when completing stages 5 and 6 of this project, NSW Health should consider the following areas where outcomes differed for the study hospitals:

- Mortality and survival rates for major chest patients (see section 16.3.1).
- Unplanned hospital readmission rates at the hospital-wide level, as well as at the clinical level for the hip joint replacement case study (see section 16.3.2).
- Wound infection rates at the hospital-wide level, as well as at the clinical level for the hip joint replacement, cholecystectomy and appendicectomy case studies (see section 16.3.4).
- Caesarean section rates – after adjusting for socio-economic status, GH had substantially higher rates than BLH and JHH. This could not be easily explained by differences in configurations of care at the study hospitals or patient complexity. Further, there was not a link between caesarean section rates and differences in other outcome indicators in our clinical indicator set, such as Apgar score and significant perineal trauma. This issue is discussed in greater detail in Case Study 11 – Obstetric Delivery.
Recommendations

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 variations.

In addition, NSW Health should also consider the costs and benefits of collecting data for the following areas where indicators are not commonly used:

- **Warfarin management** – Some hospitals conduct audits to check compliance with their warfarin management protocols. However, NSW Health does not regularly collect data on warfarin management (see section 16.4.6).
Cataracts – clinicians routinely review visual outcomes for patients at a follow-up visit after surgery. Further, some hospitals conduct regular audits of their surgical cases, as well as peer review meetings to analyse any complications arising from these cases. However, other hospitals do not appear to be reporting or auditing their outcomes or providing feedback on benchmarking or performance to their clinicians. See Case Study 9 – Cataracts.

Recommendation

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.

In the tracheostomy case study, a consistent theme coming across from the study hospitals was that, although it is important to collect data to monitor performance and guide improvements in work practices, there is a lack of agreement over the appropriate indicators to monitor. Patients in this case study usually receive care in an intensive care unit (ICU). As such, we consider there is a case for NSW Health to undertake further work to develop a set of standard indicators for measuring care and/or outcomes in ICUs.

Recommendation

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

As noted in section 16.3.6 above, we observed that the number of cases audited as part of the Time Out process did not appear to be related to separation numbers. We consider that further guidance be given to hospitals on the number or proportion of cases that should be audited as part of Time Out.

Recommendation

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

We were asked by the NSW Department of Health and our Clinical Reference Group to indicate areas for further work, areas where we encountered problems obtaining consistent data, and issues relevant for Federal-State reform.

As discussed in Chapter 1, this hospital costs and outcomes study is part of a larger, project. Our role has mainly focused on collecting and compiling comparable information on costs, configurations of care and outcomes and making observations on differences in clinical practice. The next 2 steps of the wider NSW Health project (Terms of Reference 5 and 6, see Box 1.1) are mainly for clinical experts to consider our observations on variations in configurations of care, along with indicators of clinical safety, quality and outcomes. Through this clinical review of our findings, clinical experts can decide whether variations in clinical practice or variations in clinical outcomes warrant further research, investigation or further action. This further action may include, for example, establishing new or improved clinical protocols, standardised guidelines, or changes to patterns of care in hospitals.

As previously mentioned in Chapter 2, the task defined by the terms of reference for this study was a relatively broad and complex one. Given the limited timeframe and budget for the study, we had to be pragmatic in defining the scope and deciding on the approach and methodologies we would use to complete this task. In some instances, we were unable to fully explore important issues because of the scope of this project eg, limited number of case studies, limited analysis of pharmacy and medical costs. In the main, we focused on compiling data and comparisons that were useful for clinicians and hospital management to consider in relation to clinical practice and outcomes as well as cost management. However, in several areas, we regard this study as a preliminary body of work and expect that several aspects of our work will be developed further by others.

Apart from matters for clinical review, our study also includes observations on a number of other matters, such as hospital management practices, costing and coding, making better use of available data and data quality. We have also made recommendations relating to these areas for action by NSW Health.

This Chapter includes a discussion of the next steps of the larger health project and areas for further analysis and improvements in data quality in the context of reforms that are already underway within NSW Health and reforms to Federal-State health arrangements as well as IT systems.
17.1 Next steps

17.1.1 Initial assessment of findings and recommendations in context of other reforms

A logical first step in benefitting from this review is for NSW Health to consider our recommendations and assess the benefits and priority of these recommendations in the context of other priority areas and other health reforms that are taking place.

While our reports have not contained a strong focus on these reforms, it is clear from our hospitals visits, discussions with clinicians and research that a range of hospital and health reforms are already ‘in the pipeline’. These reforms include fundamental changes on many fronts, including:

- Changes to Federal-State funding arrangements, including activity-based funding of hospitals.
- Changes to the structure of hospital networks and linkages between hospitals and other parts of the health system.
- Changes to IT infrastructure and system integration in NSW and nationally and E-health initiatives, including a unique patient identifier, standardisation of naming and data quality improvements.
- A range of safety and quality initiatives initiated across NSW Health, eg initiatives from the CEC, the ACSQHC and pharmacy reforms.
- Improved performance monitoring and public reporting of outcome information eg, the establishment of the BHI.

Some of our recommendations may already be underway or planned through these broader health reforms eg, improvements to costing, changes to pharmacy management. For others, changes associated with E-health initiatives, such as unique patient identifiers, may facilitate opportunities for better use of information. Discussion of data quality and IT changes are included in section 17.3 and section 17.4. It is also possible that the priority of certain recommendations may be heightened by Federal or State changes, such as activity-based funding. However, some of our recommendations, particularly our observations about variations in care among hospitals or variations in outcomes, will stand alone regardless of these other reforms.

Once our recommendations are prioritised, it will also be important to establish which health organisation(s) will have responsibility for each recommendation or task and to establish timeframes and assess the resources required for implementation.
In accordance with their establishing legislation, we would expect that:

- The NSW Department of Health will have a coordination role across a range of areas as well as a funding role.
- The ACI will have principal responsibility for clinical variation issues.
- The CEC will have principal responsibility for safety and quality issues.
- The BHI will have shared responsibility for public reporting.

For many of our recommendations, more than one NSW Health organisation will have shared responsibility.

The next section discusses the next steps of the larger health project and suggested areas for further analysis or improvement.

### 17.1.2 Stages 5 and 6 of the broader NSW Health project – consideration of clinical variation and outcomes

As previously mentioned in Chapter 1, this hospital costs and outcomes study is part of a larger, multi-stage project NSW Health is coordinating. We assessed patient mix, costs, configurations of care and outcomes in accordance with Terms of Reference 2, 3 and 4.

In accordance with terms of reference 5 and 6 for the wider health project, the next steps are for clinical experts to consider our observations on variations in configurations of care, along with indicators of clinical safety, quality and outcomes to:

- Determine whether variations in configurations of care lead to different clinical outcomes.
- Identify the extent to which clinical variation exists, with the aim of achieving clinical best practice and maximum efficiency.

For many of case study areas, we identified differences in configurations of care, variations in practice and also reported indicators of outcomes. The main differences we identified relating to configurations of care or variations in practices are included in Recommendation 31 and also summarised in Chapter 15. Information on clinical outcomes is included in Chapter 16 and recommendations relating to variation in reported indicators are included in Recommendation 36.

Based on clinical review, in these next two stages, clinical experts will decide whether to undertake further analysis or take steps to introduce protocols or standardise practice. Informed clinical debate following consideration of our findings and, in some cases, following further clinical research, will help to promote clinical best practice, as well as sustainable, quality health care and value for money.
17.2 Outcomes data

In collecting and analysing data for this study, the collection of a useful set of clinical indicators was possibly one of our most difficult tasks. We encountered a number of issues obtaining reliable data on outcomes. We found that compiling safety, quality and outcomes data for the 5 hospitals was made more difficult because collections of indicators and data were fragmented, both within hospitals and across the health system. We also found that some indicators were not collected consistently and through our analysis we identified some data quality issues. These issues are discussed in Chapter 16.

However, we observed that a number of organisations working to improve the quality and consistency of indicators and the systems for their collection eg, NSW Department of Health, the CEC, the ACSQH and the AIHW. The BHI has recently been established in NSW, which should also help to improve the public reporting of health information. We also expect that changes to the performance framework that will occur as part of agreed Federal-State funding reforms will impact on the consistency of indicators nationally. Given these, and other reforms, we have identified two main areas for attention: further building up knowledge in NSW Health on standardisation of indicators, such as mortality ratios and aiming to streamline access to data held by third party registries.

17.2.1 Enhance understanding of risk-adjusted mortality rates

As part of this study, the NSW Department of Health’s Epidemiology and Research Branch calculated risk-adjusted mortality rates for selected case study areas. This analysis was undertaken using information from the HIE and linked mortality data from the Registry of Births Deaths and Marriages. The mortality data were adjusted for age, sex, comorbidities (using the Charlson Index) and socio-economic status.

We observed that this type of analysis was not frequently undertaken by the NSW Department of Health. We believe this will be a growing area of interest and it is suggested that additional resources and training be dedicated towards this function within NSW Health eg, within the Department or the BHI.

We observed that the process for modelling and interpreting risk-adjusted mortality rates is a complex task and our interpretation of the rates was helped by having undertaken a detailed analysis of the hospitals, their patient casemix and their configurations of care. We observed that the risk-adjustment of the unadjusted mortality data was not straightforward. There was limited data available and potentially a large number of variables that could be relevant for risk-adjusting the mortality results for different clinical conditions. Our detailed analysis of the case study areas helped to inform the relevant patient data or variables used for the modelling. A knowledge of the hospitals, the patients and the configurations of care helped with both the modelling stage and the interpretation stage.
In the absence of this knowledge, interpretation of mortality rates could have been misleading and unfairly highlighted variations in mortality rates that were related to other factors eg, we observed differences in mortality results within our cardiology case study between AMI patients who had been stabilised and transferred, compared with those that were emergency admissions. This is a very important lesson because apparent variations in mortality rates can easily be misinterpreted or misused if considered in isolation of an understanding of the patients and the configurations of care in different hospitals.

We would also caution against the use of ‘hospital-wide’ measures of mortality for comparing hospitals. These are very difficult to interpret with any meaning and do not assist clinicians to understand their clinical outcomes.

For a number of our case study areas where death of patients is not uncommon eg, cardiology, stroke, some major chest surgery and some breast surgery, a number of clinicians indicated that they would like to have access to linked death data, such as 30-day mortality data and survival data. We were advised that some clinicians used cumbersome mechanisms to attempt to track if any of their patients had died, in order to review clinical cases eg, reviewing death notices.

While a range of other outcome indicators are important, and ethical and patient privacy issues would need to be addressed, information on patient mortality is an important clinical indicator and should be available for clinical review and analysis. We have recommended that NSW Health expand the reporting of mortality and survival information on a more routine and regular basis and that NSW Health, explore the possibility of providing mortality and survival data to clinicians in a more systematic way as an aid to clinical improvement and a key indicator of performance (Recommendation 35).

### 17.2.2 Facilitating ongoing access to registry data

For some of our outcome indicators, we found that third parties held outcome data that may have been useful for the study and this was not publicly available, nor was this information available to NSW Health. Several clinicians indicated that this information should either be publicly available or more readily available. We suggest that NSW Health seek to negotiate arrangements for more streamlined access to this data for clinical analysis (Recommendation 34).

For the hip joint replacement case study, we found that much useful information is held by the Australian Orthopaedic Association’s National Joint Replacement Registry. For the Stroke case study, data was held by the National Stroke Research Institute (NSRI). For our renal case study (which did not proceed) data was held by the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA). Each of these organisations publish useful information relevant for both the public and clinicians. However, they also maintain more detailed or other outcome information that is available to individual clinicians, but not to NSW Health.
The process of obtaining outcomes data for a study like this one requires approval from clinicians in each hospital, which may in some instances require further approvals from ethics committees in each hospital. Some clinicians who were involved in clinical research highlighted that the red-tape required in negotiating access to this data and individual ethics approvals was a cumbersome and time consuming process. If this study were to be repeated or become a more routine exercise, it would be desirable to establish streamlined arrangements for access to registry data. It may also be worthwhile considering whether it is appropriate and practical to put in place a series of streamlined data access and ethics approvals for standardised linked mortality or survival data that meet the needs of clinicians for clinical review in selected clinical areas eg, strokes, acute myocardial infarctions.

We note that the Commonwealth is currently consulting with States and Territories about introducing a nationally consistent model for Integrating Authorities that would provide the service of linking unit record data, enabling expanded analysis across different data sets. This will include establishment of data laboratories, equipped with software to enable researchers and authorised users to investigate integrated datasets and perform analytical investigations. Our feedback from clinicians during this study indicate the importance of streamlining access to such a service, to enable NSW Health bodies, such as the CEC and the ACI, as well as individual clinicians to compare clinical practice and clinical outcomes.

17.3 Data quality issues

We were asked by our Clinical Reference Group to identify areas where we encountered data problems and to indicate areas for further work. Throughout this report and our case studies, we have highlighted areas where we encountered fragmented patient datasets or difficulties obtaining or calculating comparable data. We have also identified areas for further refinement by NSW Health.

The next section discusses areas where:

- datasets were fragmented or poorly integrated
- we could not obtain or calculate comparable data among hospitals, or
- currently reported data is not well understood.

Section 17.4 includes a summary of a range of data quality and IT reforms that are being implemented in health in the short, medium and longer term, which will help to address some of these issues.
17.3.1 Completeness and consistency of patient numbers and datasets

As discussed in Chapter 5 some patient datasets were fragmented, particularly where there were large numbers of privately referred non inpatients and patients were treated in outpatient settings or procedure rooms eg, cardiology for stents, pacemakers and defibrillators and cataracts and lens procedures. We also found that patient numbers were more difficult to compare among hospitals where there was a mix of inpatient and outpatient care eg, obstetrics.

In view of the importance for monitoring clinical outcomes for cardiology patients in particular, we regard the fragmentation of cardiac catheter lab data as an important area for attention. However, the broader issue of fragmentation of patient data should also be addressed.

If we had explored other types of care eg, emergency departments, outpatient activity, hospital in the home or some care in the community, there would have been even greater variation in the way patient activity is counted and therefore less ready ability to compare patient numbers or activity. This is an area that will need greater consistency in the future, as activity-based funding is expanded into these areas.

Incorrect patient numbers or incomplete patient datasets can influence calculations of average costs (used in clinical costing) and also the accuracy of clinical research or outcome indicators (ie, if subsets of patient data are missing, the validity of research or accuracy of outcome data may be compromised).

17.3.2 Use of episodes and consistency of reported lengths of stay and costs

As discussed in Chapter 5 on lengths of stay and Chapter 8 on nursing costs, lengths of stay and cost comparisons based on episodes can be misleading because they may reflect only part of a patient’s hospital care, particularly where the patient is transferred between facilities or if their hospital stay is ‘fragmented’ into more than one episode because of a change in care type eg, acute to rehabilitation.

As part of this study, we used LOS3 which added together the stays in up to 3 hospitals to provide a more comparable measure of length of stay. This is not routinely done, however it is a fairly basic piece of information about hospital care that is necessary to compare hospitals on a valid basis. After recalculating lengths of stay on this basis, we often found that lengths of stay were more similar for similar procedures.

We believe that many users of hospital data would not be aware of the consistency issues that arise when comparing episode-based measures of length of stay or cost among hospitals. The introduction of activity-based funding and a national performance framework heightens the importance of ensuring that hospitals in NSW, as well as in other jurisdictions adopt a consistent approach to measurement.
We would also emphasise the importance of linking episodes of care together to measure and track the full pathway of care for patients. Our case studies highlight examples of why this is important eg, comparisons of length of stay among hospitals can be misleading, nursing cost comparisons can be misleading and comparisons of configurations of care may be misleading. We believe that comparisons among linked care pathways will be facilitated through the establishment of a unique patient identifier.

The cholecystectomy case study provides an example of why it is important to examine related presentations as part of considering the whole cost of care. Costs may appear lower for planned surgery than for emergency surgery, but the single episode for planned surgery may mask previous emergency presentations.

**Linkage of data**

Many of the one-off data ‘workarounds’ in this review that were necessary to obtain consistent hospital data reflect limitations in health data management related to the lack of a unique patient identifier in Australia. This is discussed further in Box 17.1. Progress on this important project should help to facilitate more consistent hospital comparisons in the future, by enabling linking of data across different health facilities and settings.
Box 17.1 Linking of patient data by NSW Health and the Unique Patient Identifier

The introduction of unique identifiers for patients and health providers in Australia is being coordinated by the National E-Health Transition Authority (NEHTA). Legislation concerning the establishment and use of a unique patient identifier (labelled the Individual Health Identifier) and a system for the identification of health providers (labelled the Health Provider Index) is currently before the Commonwealth Parliament.

The timing for the introduction of a unique patient identifier is dependent on legislation to allow the creation and use of these patient identifiers. (It was expected that patient identifiers would be available from mid 2010, but this is subject to approval of legislation).

In the absence of a unique patient identifier, data matching techniques have been used and a specialised data linkage agency set up in NSW, called the Centre for Health Records Linkage (CHEReL). However, given the technical, privacy and data management issues associated with data linkage, the NSW Department of Health do not currently use linked data for routine reporting of health system information. It is however used for research purposes, including policy work by the Department of Health and various types of population-level reports produced by Epidemiology & Research Branch eg, the NSW Mothers and Babies Report, and the biennial report ‘The health of the people of New South Wales: Report of the Chief Health Officer.

There is also a significant and extensive ICT program currently under way in NSW, called Business Information (BI) Program, which aims to develop a new Data Warehouse for NSW Health. One of the objectives of this project is to enable easier linking of data across facilities and settings of care to produce a longitudinal view of a patient’s journey through the system. The first significant deliverables from that project are currently scheduled for September/October 2011. (Further detail is provided in section 17.4).


17.3.3 HIE patient data quality issues

In comparing hospitals for this case study, we found limitations in the scope of information available within the HIE. This necessitated the use of ‘workaround’ solutions for this study.

Two of the areas where the current data captured within the HIE was not considered to be suitable for this study are listed below:

- Inter-hospital transfers – Not all inter-hospital transfers are recorded on the HIE system. Hospital staff do not always enter if a patient has been transferred in or out and which hospital they have been transferred from or to. This information is useful for examining patient journeys across multiple hospital settings eg, fracture patients, strokes.
Date of principal procedure – While theatre data is not perfect, this dataset is considered to be a more reliable source of information on the date of principal procedure than administrative data included in the HIE. This data item is useful for examining the period between admission and surgery.

We were able to use workaround solutions to address these data quality issues, however, NSW Health should aim to improve the quality of available information. We believe that the items listed above are important datasets that are required for future comparisons of hospital practice.

17.3.4 Theatre data quality issues

As discussed in Chapter 13 we found that the operating theatre data provided by the hospitals were not always complete and comparable and that there was a need for a consistent set of rules for recording operating theatre times eg, what ‘start time’ meant.

We made recommendations to improve clarity of definitions about theatre time, improve data capture on data sheets and consider auditing the quality of HIE data on returns to theatre through a review of clinical notes (Recommendations 28 and 29)

17.3.5 Medical records and coding

As part of our study we undertook a limited comparison of clinical coding and pathology results, as well as a limited audit of patients’ clinical notes. We indicated that differences in coding could impact on hospital comparisons and funding in the new Federal-State funding arrangements. It is suggested that clinical leaders in NSW hospitals will need to emphasise the growing importance of coding in this new funding environment and to ensure that this message is adopted by all medical staff, including junior staff, who often complete discharge summaries that are subsequently used in coding.

Our recommendations relating to medical records and coding were aimed at improving the quality of clinical coding in hospitals to both improve the quality of data for clinical research as well as to more accurately reflect casemix complexity. Hospitals should undertake education on coding and facilitate communication between clinical staff and coders regarding processes and documentation (Recommendations 8 and 9). In addition, de-identified pathology test information should also be employed (where readily accessible) to validate clinical coding and support variations in clinical practice (Recommendations 10 and 11).
17 Areas for further work

17.4 NSW Health data improvement program

During this study we identified opportunities for better use of existing data as well as data gaps and areas for improvement in the quality of datasets. However, we note that NSW Health’s data management environment is changing and a number of steps are being taken to address data systems and data quality in the short, medium and long term. These are discussed below.

Short term data quality and IT reforms

In the short term, NSW Health is refreshing its data quality framework, including its four key components:

- data collection policies and standards
- data coordinators at Area Health Services
- proactive data quality analysis with feedback to areas, and
- external data quality auditing program.

The fourth component is new in the sense of establishing routine, regular data quality audits in contrast to the current, ad hoc approach. IPART strongly supports these measures.

We also believe that the establishment of the BHI which is responsible for external, public reporting of hospital performance data, will further enhance the importance of data quality.

We were advised that considerable progress is also being made in joint analytical projects between the NSW Department of Health and bodies such as the Surgical Services Taskforce, Emergency Care Taskforce and other groups of clinicians and health service managers. This includes development of new performance indicators as well as weekly and monthly performance monitoring reports focusing on specific service improvement initiatives, eg, operating theatre utilisation or patient flow through emergency departments.

Medium term data quality and IT reforms

In the medium term (6 – 18 months), significant further improvements to data quality are expected to arise from the completion of the current state-wide ICT investment program. The program includes three significant sub-programs, namely:

- State-wide rollout of the Electronic Medical Records (EMR) system, including a new Emergency Department Information System (FirstNet) and a new Operating Theatre Information System (SurgiNet). Introduction of the new systems will improve the completeness and consistency of data captured by clinical units and will increase the scope of emergency and surgery data sets at both the local and state-wide levels.
Replacement of various existing applications used for collecting non-admitted patient data (outpatients, community health, home based care, community mental health) with 2 standard, state-wide systems. This should also result in improved consistency and quality of data and enable a move to unit record level data collection and reporting from mid-2011.

Replacement of the Health Information Exchange (HIE) (the current local and state-level data warehouse) with a new, integrated Enterprise-Wide Data Warehouse. The new data warehouse is being designed to enable easier integration and linking of data across different data sets and should provide a more flexible reporting platform that will be accessible to local hospitals and health networks as well as the NSW Department of Health. The data warehouse will be supplemented with a set of interactive reporting tools, some of which are already being implemented across the hospitals, eg, a bed management tool and predictive planning tool.

**Longer term data quality and IT reforms**

In the longer term (2 – 3 years), several national developments are likely to accelerate the progress of data management capabilities in health and improve data quality. These include: the implementation of the national Unique Patient Identifier and the Health Provider Index, and the introduction of the national Activity-Based Funding model. These have been previously discussed in Box 17.1.

**17.5 Opportunities for cost savings and better cost management**

Throughout the cost chapters in this report and in the case study reports, we have identified a number of opportunities for cost savings, opportunities for better cost management and also identified better hospital practices that we believe may help to control hospital costs.

**Prostheses**

There are clear opportunities for some hospitals to pay lower prices for prostheses and to improve management controls and purchasing arrangements. Chapter 10 highlighted differences in the types of prostheses purchased, prices paid and management arrangements. In some instances, clinical judgements vary about what type of prosthesis is most appropriate and should be reviewed by clinical experts.
Imaging and pathology

In relation to imaging and pathology, we found there were differences in the use of diagnostic services for similar types of patients. In some specific instances, we highlighted where differences in imaging use should be reviewed by clinical experts eg, use of ultrasound for appendicectomy and cholecystectomy. We also highlighted differences in controls. For example, we highlighted how JHH generally appeared to have tighter controls.

For pathology, we were unable to get detailed cost information and suggested that NSW Health addresses issues that prevent the actual costs associated with specific pathology tests and ordering patterns being disclosed, so that appropriate cost signals are sent with devolved pathology budgets.

In addition, we suggest that NSW Health considers whether the detailed cost estimates 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.

17.6 Cost areas for possible further analysis

The two main areas where we were unable to complete detailed analysis were in relation to medical staff costs and pharmacy costs.

Medical costs

In relation to costs, we were unable to undertake detailed comparisons of medical staffing due to inconsistent treatment of medical costs and the complexities of arrangements regarding the appointment and remuneration of medical staff.

Given the value of medical staff costs and the difficulties of obtaining consistent data for analysis, this is clearly an area where greater consistency and accuracy of information is warranted.

Pharmacy

We were unable to review pharmacy costs, configurations of care or outcomes in detail, due to the broad scope of the study.

The task of comparing pharmacy use was difficult because of differences in the proportion of dispensed and imprest pharmaceuticals among study hospitals as well as differences in pharmacy systems and naming of medications.
We noted a large difference in the proportion of medications that are dispensed among the 5 study hospitals, with JHH pharmacy dispensing a much lower proportion of medications than the other hospitals. Given the large variation in dispensed pharmacy, we suggest that this is an area for potential future comparisons of costs and medication safety.

We note that current initiatives to standardise pharmacy systems and nomenclature should assist future comparisons of hospital pharmacy functions. For example, the NSW Medication Management Program includes the use of NEHTA Australian Medicines Terminology, the establishment of a NSW Health Master Pharmacy catalogue, the introduction of a single version of iPharmacy and other pharmacy management initiatives. These are currently scheduled for the second half of 2011.

### 17.7 Improvements to clinical costing

As previously discussed in Chapter 7, we expect that the quality of clinical costing estimates will improve over time with the introduction of a state-wide clinical costing system and the introduction of a Federal-State activity-based funding arrangement.

#### 17.7.1 Standardisation of data

In this study, the IPART team and our consultant were required to spend a lot of time and effort understanding each hospital’s data and the way the data was formatted in each data system. We then had to standardise data from the different hospitals before we could actually compare or analyse data among hospitals. This applied to both financial data eg, cost centres and their contents and clinical data eg, imaging, pathology and theatre datasets.

In order to make future hospital comparisons more manageable, greater specification and standardisation of data formats is needed. Greater standardisation will also assist NSW to improve the quality of its clinical costing data. In order to achieve greater standardisation of data, NSW Health will need to take a much more proactive and forceful role in establishing data standards and ensuring they are applied. Consultation with users of data would be regarded as an essential part of the standardisation of the data.

We outline below some of the areas where greater standardisation is required.

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267 This applied to both financial and purchasing data in the HIE and data from clinical systems eg imaging and pathology.
Chart of accounts

As discussed in Chapter 7 we found a number of inconsistencies in accounting practices.

While the NSW Standard Chart of Accounts specifies account names and numbers and sets ranges of cost centres for area health services, there do not appear to be ‘rules’ about what expenditures those cost centres should contain. Consequently there is no consistency between hospitals with respect to cost centre names and the types of expenditures they contain. For example, there are no rules about where medical staff costs should be posted - Wards or Clinical departments - or whether JMO overtime should be allocated to a central cost centre or costed to the service where the overtime was accrued and so on.

Pathology and imaging charging for clinical costing

Our analysis of pathology and imaging costs highlighted that there appear to be no clear guidelines for the consistent valuation or costing attributed to pathology and imaging services.

We recommended there needs to be standardisation of the charge out process for diagnostics. This may equally apply to other business unit services. It would appear that there is no requirement for charges to be reviewed annually nor a standard approach to their calculation.

17.7.2 Use of costing data for multiple purposes

As we outlined in Chapter 7, we see a need for NSW Health to continue to standardise and improve the quality of clinical costing data. We see this as an opportunity to make clinical costing data suitable to use as an integral part of hospital management information and clinical analysis. At present, this is not the case. Outputs from clinical costing are reported to the NHCDC, but are not widely used by clinicians, hospitals or the NSW Department of Health. Inputs, with potentially valuable clinical uses are not made available or standardised for these uses.

The quality of clinical costing data will need to be improved in NSW since the NSW Department of Health and hospitals will have to have a better understanding of their clinical costs for activity–based funding. We have pointed to the need to standardise accounting formats and information from clinical feeder systems. In doing so, we believe that there is an opportunity to make this data suitable for more than just clinical costing, but also for hospital management and clinical analysis.

Clinical data feeds eg, information from imaging and pathology used as inputs to clinical costing could also be used to provide routine reports to clinical units.
17.8 Extensions to the scope of this project

17.8.1 Other hospitals

This review was limited to five principal referral hospitals. We expect that greater variation in costs and practice would have been seen among a greater number and range of hospitals, particularly smaller or regional hospitals. Future comparisons of these types of hospitals will be useful to inform NSW Health about cost differences. A deeper understanding of cost structures for a range of hospitals will be required as we move to the new hospital funding system.

If information was available, it would also be interesting to conduct similar comparisons with private hospitals to compare management approaches, controls, costing, coding, patient mix, availability of outcome indicators. The Productivity Commission has recently undertaken a study in this area, however, reported comparisons were at an aggregated level, rather than an individual hospital level and management approaches were not compared in depth.

17.8.2 Other types of hospital care and other conditions

This study focused on examples of conditions and procedures that involved acute episodes of care. We did this because we had a range of data from the HIE on the volume of patients, a nationally agreed data classification system and costing data from the NHCDC. We essentially selected acute care because better data was available for this care type. Despite this, we still found a number of data quality issues, which are discussed throughout this report and our case study reports.

In this study, we did not have capacity to assess the quality, reliability or comparability of data for many other types of hospital care, such as:

- Emergency department services.
- Sub-acute care (both inpatient and outpatient) such as rehabilitation and palliative care.
- Outpatient services.
- Hospital outreach and post-acute care services.
- Mental health.

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Advice from our clinical consultant, IPART’s previous review and other published sources would indicate that data quality for these areas of care either requires significant time to understand what aspects of care have been included or excluded and make them consistent, or greater standardisation of data in the future.

As discussed in Chapter 4, we had to limit the number of case study areas we examined to manage the workload for this study. We had intended to complete 2 additional case study areas – renal dialysis (haemodialysis) and infections and antibiotic management – but these did not proceed due to time constraints.

Our Clinical Reference Group also originally suggested that we consider selecting a number of other areas, including chemotherapy, asthma and a paediatric area.

All of these clinical areas are important areas of potential future analysis. Based on our preliminary discussions with hospitals there certainly would be differences in models of care for infections and antibiotic management, with some hospitals providing care in the community for a wider range of patients e.g., JHH was providing intravenous antibiotics to selected patients in the community. This is certainly an area worth exploring further, particularly with a view to comparing how costs and outcomes for models of care in the community compare with models for in-hospital care.

### 17.8.3 Other settings

This study has mainly focused on hospital based care. Given the prevalence of chronic diseases, it would also be important in the future to compare networking arrangements and configurations of care for patients with chronic conditions who frequently attend a number of different care settings e.g., hospitals, community care, GP care.

**Recommendation**

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.

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269 IPART, 2009, Framework for the Financial Performance of the NSW Health System

270 Professor Kathy Eagar, March 2010, *ABF Information Series No. 1, What is activity-based funding?* Centre for Health Service Development, University of Wollongong.
17 Areas for further work

17.9 Equity of access

A significant aspect of health care which we have not explored in depth is equity of access to services and differences in access that may exist for patients depending on which hospital they attend. We observed differences in waiting periods for surgery at different hospitals eg, cholecystectomy and also noted that there were sometimes delays for patients transferring into larger hospitals eg, for stents, pacemakers and ICDs. We also noted that access to rehabilitation or other services was also variable among hospitals. In conducting further reviews, this important issue should be considered. It is also suggested that NSW Health consider reviewing whether and why transferred patients sometimes have longer waits for access to services like cardiac catheter facilities than patients presenting through the emergency department of the main hospital. Consistent state-wide guidelines to ensure equity of access may be desirable.
Appendices
Areas for further work

NSW Health costs and outcomes study by IPART for selected NSW hospitals
A Summary of case study findings

A.1 Case study 1 – Hip joint replacement

This case study compared the length of stay, costs, configurations of care and outcomes related to surgical procedures involving removing the hip joint (or part of the joint and part of the femur) and replacing it with a hip prosthesis, or replacing a pre-existing hip prosthesis with a new one (hip revision). Three diagnostic related groups (DRGs) were included in the case study:

- I03A – Hip revision with catastrophic or severe complication or comorbidity
- I03B – Hip replacement with catastrophic or severe complication or comorbidity or hip revision without catastrophic or severe complication or comorbidity
- I03C – Hip replacement without catastrophic or severe complication or comorbidity.

For some procedures, like hip replacements, we found it was necessary to go beyond the DRG level to identify groups of reasonably similar patients, so as to provide more meaningful comparisons. For this case study, we broke the data into 5 patient subgroups (based on the patients’ principal diagnosis): hip replacement for arthritis, for fracture, for secondary cancer, for joint infections and for ‘other’ diagnosis. We also distinguished between primary hip replacements and revisions of previous hip replacements, because these types of hip replacements procedure typically involve different costs and outcomes.

In addition to our 5 study hospitals (JHH, RNSH, RPAH, BLH and GH), we included the Institute of Rheumatology and Orthopaedics (IRO) in our analysis. The IRO is an orthopaedic surgery centre adjacent to RPAH, which effectively operates as RPAH’s dedicated elective surgical centre for hip replacements.

For most of the case studies, we estimated the costs associated with the following clinical resources: ward nursing, imaging and pathology. We also examined blood use, operating theatre times and prosthesis costs as relevant in some cases. We had aimed to estimate medical staff costs and pharmacy costs for the case studies, but were unable to obtain consistent comparisons within the timeframe for this review. In addition, we did not include allied health costs in our data collection or analysis.

Our key findings for hip joint replacements included the following:
A.1.1 Type and mix of patients

The proportions of patients having hip replacement surgery for secondary cancer or joint infections were significantly higher at RPAH than the other hospitals. This is important because other study findings indicated that patients in these subgroups were associated with longer average length of stay and higher costs associated with imaging, pathology and blood use at all the study hospitals.

A.1.2 Average length of stay

- The average ‘acute episode length of stay’ (LOS1) did not provide a consistent basis for comparing lengths of stay among hospitals because of differences in the way hospitals reclassify patients’ care from ‘acute’ to ‘rehabilitation’ care and differences in access to other rehabilitation facilities. To facilitate meaningful comparisons between hospitals, the length of stay measure should include all consecutive episodes (acute, rehabilitation and other) at the study hospital plus the length of related stays at other hospitals (LOS3271).
- There was greater consistency in length of stay (LOS3) within each patient subgroup than for the hip replacement group as a whole. Stays were longer for patients with fractures, secondary cancers, joint infections and revisions, and shorter for those with arthritis.

A.1.3 Costs of inpatient care

- Ward nursing costs were influenced mainly by inpatient fractions (IFRACs), the length of stay and the nursing staff-to-patient ratio (ie, nursing hours per patient day).
- Within each patient subgroup, the average cost attributed to all imaging tests, pathology tests and operating theatre times per patient were broadly consistent across the study hospitals. However, comparing costs between the patient subgroups, we found that imaging and pathology costs for fracture patients were generally at least 2 times higher than those for arthritis patients.
- There was considerable variation in the cost of hip prostheses among the study hospitals. In some cases, the price paid for identical or similar types of products varied between hospitals. We also noted limited information sharing among hospitals regarding prostheses prices, even within the same Area Health Service. These findings indicate that potential savings could be made by study hospitals through the negotiation of lower prices for commonly purchased prosthesis components.

271 LOS3 is: total stay in study hospital plus length of stay for one adjoining previous stay in hospital (transfer in) and one adjoining subsequent hospital stay (transfer out).
A.1.4 Configurations of care

- RPAH and JHH separated their planned (or elective) surgery workloads from their emergency surgery workload by using dedicated elective surgery centres. This may improve the efficiency of theatre management and lead to a lower length of stay for patients.

- There was substantial variation in the range and types of prosthesis components used by the hospitals. Not all hospitals had broad guidelines for prosthesis selection or clear processes for the approval of new prostheses.

- Some hospitals transfer almost half of their hip replacement patients to rehabilitation facilities, while others transfer as little as 10% and 2%. In some cases, this was due to differences in hospitals’ access to rehabilitation facilities.

A.1.5 Outcome, safety and quality indicators

- There was no statistically significant difference in the study hospitals’ 30-day mortality rates for fracture patients. The number of deaths too small to allow comparisons between the hospitals for arthritis patients.

- IRO had the lowest unplanned readmissions rate for arthritis patients. There was no statistically significant difference in the study hospitals’ rates for fracture patients.

- RPAH had the highest rate for wound infections. However, it also had a more complex casemix than the other hospitals.

- RNSH had the highest proportion of fracture patients whose surgery commenced within 24 hours of their emergency admission.

- RNSH and JHH had the highest proportions of emergency patients aged 75 years and over who were discharged to their usual place of residence.

Recommendations

1. That NSW Health notes that separation of planned and emergency cases may reduce lengths of stay for planned (arthritis) cases.

2. That NSW Health arranges for appropriate clinical expert groups to 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.

3. That NSW Health and clinical expert groups review the variations in the following clinical indicators for hip joint replacement surgery at the study hospitals:

   - unplanned readmission rates, and
   - wound infection rates.
A.2 Case study 2 – Major chest procedures

This case study compared the length of stay, costs, configurations of care and outcomes related to major surgical procedures on the chest area (thoracic surgery) across 3 hospitals. Two DRGs were included in the scope of the case study:

- E01A – Major chest procedures with catastrophic complication or comorbidity
- E01B – Major chest procedures without catastrophic complication or comorbidity.

To enable more meaningful comparison among hospitals, we divided the 2 DRGs into the following patient subgroups (based on the patients’ principal diagnosis): lung cancer, collapsed or punctured lungs and infection-related abscess/pyothorax.

RPAH is the state referral hospital for thoracic surgery and handled the most major chest surgery. We omitted BLH and GH from most of our analysis due to the small number of cases at these hospitals in 2008/09. However, there were sufficient cases at BLH and GH to include them in our analysis of outcomes, as the outcomes data we used covers a 3-year period.

Our key findings for major chest procedures included the following:

A.2.1 Type and mix of patients

- RPAH performed the majority of major chest surgeries. Most of its patients were lung cancer patients through planned admissions. RNSH and JHH had a much lower share of lung cancer cases.
- RNSH and JHH had higher rates of emergency admissions than RPAH.

A.2.2 Average length of stay

- The 2 hospitals with the highest volume of cases, RPAH and JHH, had the shortest length of stay for all major chest cases.
- For the lung cancer patient subgroup, average length of stay was significantly shorter at RPAH. This was attributable to its unique configurations of care (see below).

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272 Bankstown-Lidcombe Hospital and Gosford Hospital were excluded from the analysis, as these hospitals transfer most of their major chest cases to other hospitals.
A.2.3 Costs of inpatient care

- JHH had the lowest nursing costs per patient, despite RPAH having a shorter average length of stay. This is partly because of the greater utilisation of intensive care unit (ICU) staff at RPAH for major chest patients, because its ICU and high dependency unit (HDU) are combined (and provide more intensive nursing care).

- RNSH had higher imaging costs, mainly due to more frequent use of CTs and MRIs. It also had higher pathology and blood use costs per patient.

- Surgeries for lung cancer required different levels of resources to other procedures for major chest conditions (like infection-related abscess/pyothorax and collapsed/punctured lungs). For example, average operating time for lung cancer patients were much longer than for collapsed/punctured lung patients, but significantly shorter than operating times for infection-related abscess/pyothorax patients.

A.2.4 Configurations of care

- RPAH configured its care for planned lung cancer surgery cases so that virtually all of the patients (99%) admitted from its waiting list had their principal procedure on the day of admission. In contrast, RNSH and JHH major chest patients often stay in hospital overnight before their operation.

- RPAH’s major chest patients (including lung cancer surgery patients) are cared for in a combined ICU and HDU ward, and therefore have access to a highly skilled nursing staff 24 hours a day. At RNSH and JHH, the ICU and HDU are separately located and managed, so that only major chest procedure patients who require intensive care have access to ICU nursing staff.

- RPAH tended to remove chest drains (inserted in patients during lung cancer surgery) earlier than at the other 2 hospitals.

- These differences appear to influence the average length of stay. The average length of stay for the acute episode (LOS1) for planned lung cancer surgery patients was lower for patients treated at RPAH than for those treated at JHH or RNSH.

A.2.5 Outcome, safety and quality indicators

- RPAH had the lowest 30-day mortality rate and highest 3-year survival rate.

- RPAH and RNSH had the highest 12-month survival rates.

- There was no statistically significant difference in the study hospitals’ 2-year survival rates.

- The number of infections was too low across the study hospitals to make comparisons.
Summary of case study findings

- RPAH had the highest proportion of lung cancer patients who had planned surgery on their admission days, as well as the shortest time for removing chest tubes post surgery.

Recommendations

1. That NSW Health arranges for appropriate clinical expert groups to:
   - note the different clinical pathways and high day of surgery admission rates for thoracic surgery patients at RPAH compared with other study hospitals; and
   - consider whether aspects of the model of care at RPAH are suitable to be used in other hospitals.

2. That NSW Health and clinical expert groups 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).

A.3 Case study 3 – Breast surgery

This case study compared the length of stay, costs, configurations of care and outcomes related to procedures for breast cancer and other non-malignant breast conditions and disorders across 4 hospitals.\(^{273}\) We used 5 DRGs to define the surgical procedures and identify the data included in the scope of the case study:

- J06A – Major procedures for malignant breast conditions
- J06B – Major procedures for non-malignant breast conditions
- J07A – Minor procedures for malignant breast conditions
- J07B – Minor procedures for non-malignant breast conditions
- J63Z – Non-malignant breast disorders.

To enable more meaningful comparison among hospitals, we divided these DRGs for breast surgery into 5 other patient subgroups based on the principal type of procedure performed: mastectomies, malignant lesion excisions, non-malignant lesion excisions, breast reconstruction or removal or breast prostheses, and other procedures.

Our key findings for breast surgery included the following:

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\(^{273}\) We omitted JHH from most of our analysis as it has very few breast surgery cases. Breast surgery is performed at the nearby Calvary Mater Newcastle Hospital, which is the region’s major centre for diagnosis and treatment of breast cancer. However, there were sufficient cases at JHH to include them in our analysis of outcomes, as the outcomes data we used covers a 3 year period.
A.3.1 Type and mix of patients

As a state referral centre for breast surgery, RPAH handled more than double the cases handled by RNSH and GH. BLH also performed a high number of breast surgeries, largely concentrated in less complex procedures. Most of the study hospitals’ breast surgeries were lesion excision procedures (accounting for 61%) followed by mastectomies (23%).

A.3.2 Average length of stay

Average lengths of stay varied significantly according to the procedures performed. For example, the study hospitals’ average length of stay was 1.3 days for malignant lesion excision cases and 4.6 days for mastectomy cases. There was little variation in the length of stay for lesion excision procedures (malignant and non-malignant) across the study hospitals. In contrast, average lengths of stay for patients having a mastectomy varied by as much as 1.8 days, with shortest lengths of stay at RNSH.

A.3.3 Costs of inpatient care

- There are significant differences in average costs associated with malignant lesion excision versus mastectomy procedures, which highlights the significant variation in costs that can occur between cases within the same DRG (J06A).

- Imaging services provided to breast surgery patients during their admission were usually very limited at the study hospitals. However, RNSH’s average imaging costs were higher because this hospital performs relatively more nuclear medicine tests for sentinel node biopsies on a patient’s day of admission. The other study hospitals perform similar types of tests prior to the day of surgery (ie, the day before) such that the patient is tested as an outpatient.

A.3.4 Configurations of care

- RNSH and GH have early discharge support for breast surgery patients (through the Acute/Post Acute Care (APAC) Service and outpatient clinics); which is reflected in their relatively short lengths of stay for mastectomy patients. These assist patients with management and removal of drains, for example.

- The other 2 hospitals (BLH and RPAH) tend to retain their mastectomy patients in hospital longer after the procedure, mainly to undertake fluid drainage of the surgical wounds. However since our hospital visits, BLH has introduced a new model of care for mastectomy patients with the majority of patients undergoing mastectomies now being discharged in 3 days.

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274 These nuclear medicine tests are coded as “repeat planar and single photon emission tomography” and “lymphoscintigraphy”.

275 The sentinel node is the first node that drains the breast. The biopsy is performed to determine whether more nodes should be removed during the surgery (ie, an axillary clearance).
A.3.5 Outcome, safety and quality indicators

We found that there were no statistically significant differences between the study hospitals’ 30-day risk-adjusted mortality rates.

Due to the relatively small number of breast surgery cases at the study hospitals, we analysed outcomes for all breast surgery patients rather than for the patient subgroups. We suggest that when future analyses are undertaken, they involve a larger sample of hospitals and ‘like patients’ (ie, the patient subgroups within or across DRGs). A state-wide examination of hospitals may be required to ensure sufficient patient numbers. We also note than in comparing outcomes for breast cancer patients, appropriate cancer staging information may need to be considered.

Recommendation

1. NSW Health arranges for appropriate clinical expert groups to:
   - 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).

A.4 Case study 4 – Cholecystectomy

This case study compared the length of stay, cost, configurations of care and outcomes related to surgical removal of the gall bladder. We used 4 DRGs to define the data included in the scope of the case study:

- **H07A** – Open cholecystectomy with closed common duct exploration or with catastrophic complication or comorbidity
- **H07B** – Open cholecystectomy without closed common duct exploration or without catastrophic complication or comorbidity
- **H08A** – Laparoscopic cholecystectomy with closed common duct exploration or with catastrophic or severe complication or comorbidity
- **H08B** – Laparoscopic cholecystectomy without closed common duct exploration or without catastrophic or severe complication or comorbidity.

We also 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 2 groups.

Our key findings for cholecystectomies included the following:
A.4.1 Type 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.

A.4.2 Average length of stay

In relation to planned admissions, BLH had the lowest average length of stay and GH and RNSH had the highest. For emergency admissions, JHH had the lowest average length of stay and GH had the highest. However if outliers (patients staying 20 days or more) are excluded, there is only a small difference between stays at RPAH, GH, RNSH and BLH.

A.4.3 Costs of inpatient care

- 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.
- The average operating theatre time for emergency procedures was fairly uniform at the study hospitals (around 90 to 100 minutes) and it was slightly higher than planned procedures at most hospitals.

A.4.4 Configurations of care

- 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.
- 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.
- 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.
- 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.
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.

A4.5 Outcome, safety and quality indicators

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 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.

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 appropriate 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.
A.5 Case study 5 – Appendicectomy

This case study compared the length of stay, cost, configurations of care and outcomes related to surgical removal of the appendix. We used 2 DRGs to define the surgical procedure and identify the data included in the scope of the case study:

- **G07A** – Appendicectomy with catastrophic or severe complication or comorbidity
- **G07B** – Appendicectomy without catastrophic or severe complication or comorbidity.

Appendicectomies are usually performed as emergency procedures on people who have an infected or ruptured appendix (acute appendicitis). The surgery is generally performed as open surgery or laparoscopic surgery.\(^{276}\)

Our key findings for appendicectomies included the following:

A.5.1 Type and mix of patients

The number of appendicectomy cases and mix of patients did not vary significantly across the study hospitals. Over 90% of appendicectomy patients at each study hospital are classified as DRG G07B.

A.5.2 Average length of stay

The average length of stay for patients in the more common, less complex DRG G07B was fairly similar at the study hospitals. For patients in this DRG, RNSH and BLH had shorter average length of stays and GH had the longest.

A.5.3 Costs of inpatient care

- For DRG G07B, average length of stay and nursing staff mix were the main drivers for nursing costs at the study hospitals. With inpatient fractions (IFRACs) set to 1\(^{277}\), hospitals with:
  - lower average length of stays – RNSH and BLH – had lower nursing costs per acute episode
  - staff mixes with higher proportions of enrolled nurses (ENs) and assistants in nursing (AINs) – GH and BLH – had slightly lower nursing costs per day.
- Hospitals with greater use of CT scans, MRIs and ultrasounds – in particular, RNSH – generally had higher imaging costs.

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\(^{276}\) Open surgery involves an incision being made through the lower right abdominal wall and laparoscopic surgery involves one to three small incisions made through the abdominal wall for a camera and instruments to pass through.

\(^{277}\) Setting IFRACs to 1 means that we allocated 100% of the nursing time to inpatient care.
### A.5.4 Configurations of care

- There are different configurations of care for diagnosing acute appendicitis. This can lead to patients experiencing longer delays to treatment at some hospitals than is necessary, as well as those hospitals incurring higher diagnostic costs. In particular, it is unclear whether it is appropriate for clinicians to use ultrasounds as a diagnostic tool in appendicectomies.

- There is considerable variation in the rates of laparoscopic surgery for appendicectomies across the study hospitals. RNSH and BLH had the highest rates and GH had the lowest rate.

- Patients who underwent laparoscopic surgery had lower average length of stays than those who underwent open surgery. However, the cost of equipment used during laparoscopic surgery is generally higher.

### A.5.5 Outcome, safety and quality indicators

- As with the cholecystectomy case study, we expanded the scope of the clinical indicators to cover ‘general surgery’, so that the data included both cholecystectomy and appendicectomy patients.

- 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.

#### Recommendations

1. That NSW Health and appropriate clinical expert groups note the variation in the use of imaging tests for diagnosing appendicitis.

2. That NSW Health arranges for appropriate clinical expert groups to consider establishing standard protocols for diagnosing appendicitis, indicating when it is appropriate to use CT scans, MRIs and ultrasounds.

3. That as part of establishing standard protocols for diagnosing appendicitis, NSW Health arranges for appropriate clinical expert groups to 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).

4. That NSW Health arranges for appropriate clinical expert groups to consider the relative costs and benefits of laparoscopic versus open surgery for appendicitis.

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

This case study compared the length of stay, costs, configurations of care and outcomes related to treating stroke patients across the 5 study hospitals. We used 4 DRGs to define the procedures and identify the data included in the scope of the case study:

- B70A – Stroke with catastrophic complication or comorbidity
- B70B – Stroke with severe complication or comorbidity
- B70C – Stroke without catastrophic or severe complication or comorbidity
- B70D – Stroke, died or transferred < 5 days.

In terms of the type and mix of patients, we were unable to separately analyse the two main types of strokes (ischaemic strokes and haemorrhagic strokes) because the cause of stroke was unspecified for about 25% of patients.

Our key findings for stroke included the following:

A.6.1 Average length of stay

For each DRG, we found that there was significant variation in the acute episode length of stay (LOS1) between hospitals, but far less variation in the length of stay when total hospitalisation (LOS3) is measured. This was mainly because LOS3 includes rehabilitation care and the hospitals differ in the way they arrange rehabilitation care (eg, whether rehabilitation occurs on-site or at other rehabilitation facilities).

A.6.2 Costs of inpatient care

- We found that average length of stay and nursing hours per patient day (ie, the staff-to-patient ratio) are the main drivers for nursing costs at the study hospitals. JHH had the lowest staff-to-patient ratio and the lowest nursing cost per patient day, while RPAH had the highest staff-to-patient ratio and the highest nursing cost per patient day.

- Imaging costs varied between the hospitals, with RNSH making the most use of imaging and BLH making the least use of imaging.\(^{278}\)

- Pathology costs varied more by DRG because stroke patients all have CT scans or MRIs, regardless of their DRG classification. Pathology costs were significantly higher in the most complex DRG. However, we note that small coding differences between the hospitals could shift patients between the DRGs and change some of the measures of relative pathology use. On average, pathology costs were highest at BLH and lowest at JHH.

\(^{278}\) BLH does not currently have MRI facilities on-site, and must transport patient to Liverpool Hospital if MRI scans are required for further diagnosis or treatment. However, we understand that there is a firm proposal for an MRI at BLH and planning is well underway.
A.6.3 Coding and classification practices

We identified three areas where improvements in diagnosis classification and coding practices could improve the quality of outcome information and the accuracy of episode-based cost comparisons and funding:

- Hospitals should reduce the proportion of stroke patients with a principal diagnosis of ‘stroke, not specified as haemorrhage or infarction’ (ICD-10 code I64) to allow ischaemic and haemorrhage strokes to be separately analysed.

- tPA administration should be coded as a procedure to help monitor and evaluate the outcomes associated with the use of this medication and treatment for ischaemic strokes.

- A consistent approach to ‘type changes’ would significantly improve the comparability of episode costs between hospitals.

A.6.4 Configurations of care

- JHH and GH have bypass arrangements with NSW Ambulance Service to deliver some stroke patients to the stroke unit with minimum delay. As a consequence of these arrangements, as well as less traffic congestion, JHH and GH have higher rates of tPA administration than any of the other study hospitals.\(^{279}\)

- The emergency departments at GH and, particularly, JHH work well with the stroke unit to minimise delays (for those patients who are eligible for bypass arrangements).

- Senior clinicians at BLH have differences of opinion regarding the risks and benefits of using tPA for stroke, and that this may be a factor limiting the use of this treatment option. Only RPAH and RNSH remove blood clots surgically.

- At BLH, almost all rehabilitation occurs on-site, beginning in the acute ward. The other hospitals transfer most or all their patients to other facilities for rehabilitation. Shortages of places in these rehabilitation facilities can lead to longer than necessary stays in acute wards.

A.6.5 Outcome, safety and quality indicators

- We developed a list of 12 outcome indicators for stroke but could not gain access to the data from the National Stroke Foundation and/or the study hospitals within the timeframe for this review.

- There were no statistically significant differences between the study hospitals’ risk-adjusted 6-month-survival rates.

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\(^{279}\) Tissue Plasminogen Activator (tPA) is a drug that is used to dissolve blood clots to treat ischaemic strokes (i.e., strokes caused by blood clots). It must be intravenously administered within 3 hours of the onset of a stroke, and it can significantly reduce the amount of damage to the brain. We note however that the use of tPA for stroke is not universally accepted because it carries a risk of complications due to bleeding.
Recommendations

1. That NSW Health considers ways to reduce the proportion of stroke patients coded with a principal diagnosis of ‘stroke, not specified as haemorrhage or infarction’ (ICD10 code I64).

2. That NSW Health arranges for appropriate clinical expert groups to consider developing consistent guidelines for the administration of tPA.

3. That NSW Health considers including tPA administration as a procedure in coding standards.

4. That NSW Health considers ways to improve transfers of suspected stroke patients to stroke units with minimum delay, including consultation with the Ambulance Service and Emergency Departments.

5. That NSW Health investigates 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.

6. That NSW Health arranges for appropriate clinical expert groups to consider the costs and benefits of providing more rehabilitation care in the home.

7. That NSW Health pursues the collection of the data on outcome indicators from the National Stroke Research Institute.

A.7 Case study 7 – Cardiology and Interventional Cardiology (including pacemaker and defibrillator)

This case study compares the length of stay, costs, configurations of care and outcomes for selected cardiology procedures and medical treatments relating to the heart and major blood vessels. We used a number of DRGs to define the procedures and identify the data included in the scope of the case study.280

We considered patients who had pacemaker or defibrillator procedures separately from patients who did not as the procedures involved are different and are usually classified under the category of electrophysiology. For the patients who did not receive pacemakers or defibrillators, we identified three main groups based on their principal diagnosis.

- **The Acute Myocardial Infarction (AMI) group.** These patients had coronary procedures or invasive cardiac investigative procedures and were coded with a heart attack (or AMI).

- **The Angina/Chest Pain group.** These patients had coronary procedures or invasive cardiac investigative procedures and were coded with a diagnosis related to angina or chest pain.

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280 A selection of these DRGs includes F01A, F01B, F02Z, F12Z, F17Z, F10Z, F41A, F41B, F60A, F60B, F60C, F15Z, F16Z, F42A, F42B and F74Z. For a full list of DRGs we used, refer to IPART’s *Case Study 7 – Cardiology - Stents, Pacemakers and Defibrillators*, July 2010, Appendix C.
Other group. These patients had a range of other cardiac diagnoses.

The range of services available at the study hospitals varies. The cardiology units at RPAH, RNSH and JHH all provide a broad range of services covering diagnostics and treatment. These hospitals offer 24 hour interventional cardiology services, which are provided in a cardiac catheterisation laboratory (Cath Lab), on all days of the week. GH offers a more limited range of services, with patients who require emergency care after hours being transferred to RNSH. BLH does not have an interventional cardiology service (or a Cath Lab). This hospital sends patients who require interventional cardiology assessment or procedures to other hospitals, mainly to RPAH under a ‘collaborative care’ arrangement.

Our key findings for cardiology/interventional cardiology cases included the following:

A.7.1 Coding

- There is scope to improve communication between clinicians and coders and thereby improve coding quality for cardiology cases.
- The documentation and coding of ‘collaborative care’ patients and their movements needs to be clarified and standardised so that the data can be used appropriately for measurements of outcomes and casemix funding.

A.7.2 Average length of stay and waiting times

- The average ‘acute episode length of stay’ (LOS1), which is the measure often used in NHCDC and DRG benchmarking, is not a consistent basis for comparing length of stay for clinical groupings like cardiology and interventional cardiology that involve a significant volume of transfers to and/or from other hospitals. For length of stay comparisons to be more meaningful, LOS3 should be used.
- JHH tended to have a slightly lower length of stay than the other study hospitals. We note that, for a limited number of patients, JHH is the only hospital that implants stents on a same day basis.
- For the pacemaker and defibrillator group only, average waiting time is probably longer for patients presenting to GH and BLH than the 3 larger hospitals. At GH, waiting times are affected by Cath Lab schedules and only having one lab. Patients presenting to BLH need to be transferred to other hospitals, and may wait for access to another facility for this procedure to be performed.

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281 The NSW Department of Health recognises that services are provided to some patients through a network of hospitals. Where two hospitals are involved in treating a patient, this enables both hospitals to report their work on the case and to flag it as being ‘collaborative care’.
A.7.3 Costs of inpatient care

- Average length of stay and nursing hours per patient day (ie, the staff-to-patient ratio) were the main drivers for nursing costs at the study hospitals. The proportions of ENs and AINs in their staffing mix had only a small impact on nursing costs, and the average nursing cost per hour depended more on the average hourly cost for CNSs and RNs than the proportion of ENs and AINs in the staff mix. For example, a significantly higher staff-to-patient ratio at JHH than at RNSH accounted for the higher episode cost at JHH, despite the slightly shorter length of stay at this hospital compared with RNSH.

- There was a large variation in pathology costs among study hospitals. JHH and RPAH had relatively lower pathology costs while RNSH had the highest costs. Part of the reason for this variation may be different criteria for ordering tests (eg, for repeat Troponin T tests).

- Imaging appeared to be a relatively small part of the total cost of treating cardiology patients, in part because a significant amount of imaging also occurs outside the imaging/radiology departments (which we did not include in our analysis). Imaging costs tended to be higher at GH and BLH, particularly for CT/MRI scans.

- There is considerable variation in the purchase price of prostheses (coronary stents, pacemakers and defibrillators) among the study hospitals. In some cases, the hospitals purchased different types of products for different prices. In other cases, the prices paid for identical products varied between hospitals.

A.7.4 Configurations of care

- RPAH and BLH appeared to have a more centralised and controlled approach to prosthesis purchasing, while RNSH\textsuperscript{282} appeared to have the least centralised approach. GH also had a less centralised approach to prosthesis purchasing than RPAH and BLH. Similarly, JHH has a less centralised approach, but we found that it had tight controls around the selection of prosthesis types and models and a culture of price scrutiny.

- Despite the presence of guidelines for NSW hospitals on the selection of patients for drug-eluting stents, our study hospitals differ significantly in the proportion of these stents they use.\textsuperscript{283} In particular, we found that RNSH used a far higher proportion of drug-eluting stents than the other study hospitals. We also found that there was variation in the types of pacemakers used. We also found that there was variation in the types of pacemakers used.

\textsuperscript{282} However we are informed that more controls over prostheses procurement have been implemented during the course of our review.

\textsuperscript{283} There are 2 major types of coronary stents: bare metal stents and drug-eluting stents. Drug eluting stents tend to be about 3 times as expensive as the bare metal stents, and clinical opinions about the appropriate stent selection for different patients differ.
A. Summary of case study findings

RPAH has a day-stay unit, where patients can have their procedures done and be discharged on the same day (although angioplasty patients are all kept overnight). Similarly, angioplasty patients at RNSH are admitted overnight, but patients living within the North Sydney area can have day surgery for echocardiograms, angiograms and (rarely) stenting. At GH, angiography is the only procedure that can be done as a day procedure. For other procedures, patients are admitted overnight. JHH is the only hospital in the study group that performs same-day stenting on elective patients to any significant extent.

Differences in the way hospitals count emergency department visits for patients with chest pain (DRG F74Z) - as attendances or admissions - may contribute to the small variation in re-admission rates we observed between hospitals.

A.7.5 Outcome, safety and quality indicators

We found that there were no statistically significant differences between the study hospitals’ risk-adjusted 30-day mortality, 6-month survival and wound infection rates.

While study hospitals conducted their own performance monitoring data or have participated in benchmarking studies in the past, a common message from clinicians was that there is a lack of resources to collect quality data in a consistent manner to inform decision making.

For the pacemaker and defibrillator cases, we sought to make some comparisons on the performance of study hospitals against 2 clinical indicators – waiting times before principal procedure for emergency admissions and unplanned returns to theatre.

- Due to low case numbers, we could only compare waiting times (for emergency admissions) for patients coded into DRG F12Z (pacemaker implantation) for RPAH and RNSH. There was little difference in waiting times between these 2 hospitals and on average, the waiting time for emergency admissions was longer than for planned admissions.

- While we received unplanned returns to theatre data from NSW Health, we found several problems with this data. In particular, the coding of whether a return to theatre was ‘planned’ or ‘unplanned’ was not consistently filled in between the study hospitals.

Recommendations

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

2. 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.

3. 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.

4. That NSW Health notes differences in hospitals’ counting practices and clarify and standardise administrative procedures, including guidelines for recording of non-inpatients of various types and ‘collaborative care’ patients.

5. That NSW Health considers ways of better integrating information held in cardiac catheter laboratories with the HIE data set.

6. That NSW Health arranges for appropriate clinical expert groups to address the variation in the use of drug-eluting stents versus bare metal stents among study hospitals.

7. That NSW Health arranges for appropriate clinical expert groups to 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.

8. That NSW Health arranges for appropriate clinical expert groups to address the variation in the types of pacemakers used among study hospitals.

A.8 Case study 8 – Tracheostomy or ventilation for greater than 95 hours

This case study sought to compare the length of stay, costs, configurations of care and outcomes related to patients who received a tracheostomy, or did not have a tracheostomy but were placed on ventilation for more than 95 hours. One DRG was included in the scope of this case study:

- A06Z Tracheostomy or ventilation > 95 hours.

Patients in this case study group are generally admitted to the Intensive Care Units (ICU) at the hospitals.

For other clinical case studies we were able to identify key subgroups of patients, by clinical condition, for our comparisons. This was not possible for this case study because the tracheostomy or ventilation group included such a large number of sub-groupings that the resultant cases per subgroup would be too low to draw meaningful conclusions.

The type of patients in this DRG was influenced by the specialist roles of the hospitals. For instance, RPAH has a specialist liver unit and is the liver transplant centre in NSW. It had more than 20 patients recorded under this DRG who had principal diagnosis codes related to liver failure. RNSH has the NSW spinal unit and was the only hospital with patients under this DRG with a principal diagnosis code relating to major cervical spinal cord damage.
Our key findings for the tracheostomy/ventilation case study included the following:

A.8.1 Average length of stay

- The variation among hospitals’ average length of stay is surprisingly small given the diversity of patient types and range in individual patient length of stay.
- RNSH had the longest length of stay, which was largely affected by its spinal injury patients who had extremely long stays.

A.8.2 Costs of inpatient care

- Caring for a patient in intensive care is very expensive. Patients in this DRG spend about half of their time in ICU. In some ICUs, there is flexibility to change beds between ICU and HDU depending on demand, while at other hospitals there are separate HDU wards.
- Hospitals with shorter stays or lower nursing hours per patient day had lower nursing costs. Staffing mix did not have a significant impact on nursing costs, as all 5 hospitals had similar nursing profiles.
- Regarding imaging and pathology costs, JHH had lowest while RNSH had the highest. However, it is important to bear in mind the significant variation between hospitals’ patient types within this DRG when interpreting the cost findings.

A.8.3 Configurations of care

- The types of services that the ICUs offer vary depending on their role delineation level, hospital casemix and how each hospital defines an ICU and HDU patient. RPAH, RNSH and JHH have Level 6 ICUs, which is the highest role delineation level, while GH and BLH have Level 5 ICUs.
- At BLH, tracheostomies are usually done surgically while at the other 4 hospitals they are largely done percutaneously. At BLH this can result in a delay of a few days.
- There can be different approaches to ventilating patients between the ICUs. For example, the type of technologies they may employ (e.g., Continuous Positive Airways Pressure (CPAP) and Extra-Corporeal Membrane Oxygenation (ECMO)). However, there was no data available on the use of these technologies.

284 Percutaneous means to be performed through the skin via needle puncture.
A.8.4 Outcome, safety and quality indicators

- A consistent theme coming across from the study hospitals was that, although it is important to collect data to monitor performance and guide improvements in work practices, there is a lack of agreement over the appropriate indicators to monitor.

- Given the nature of the patients within this case study group, comparisons using indicators need to take into account the complexity and acuity of patients and the varied casemix in different hospitals.

- Some indicators, adjusted by the Acute Physiology and Chronic Health Evaluation (APACHE) scores, are intended to reflect patient differences. However, some clinicians indicated that APACHE does not sufficiently account for differences in the ICU and casemix at the hospitals.

Recommendations

1. That NSW Health arranges for appropriate clinical expert groups to note that at BLH, clinicians tend to perform surgical tracheostomies, whereas at the other hospitals, these are usually performed percutaneously.

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

A.9 Case study 9 – Cataract

This case study compared the length of stay, costs, configurations of care and outcomes related to lens replacement for the treatment of cataracts.\(^{285}\) There are 2 DRGs for this case study, which are differentiated by whether patients are having same day procedures or staying in hospital overnight:

- C16A – Lens procedures
- C16B – Lens procedures, same day.

For this case study, we found that DRG classification allowed comparison between hospitals on a like-with-like basis. This reflects the fact that lens replacement is one of the most common procedures performed in Australian hospitals and is relatively straightforward and highly protocol-driven.

Our key findings for cataract procedures included the following:

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\(^{285}\) Cataracts can be surgically treated by replacing the lens in the eye with a prosthesis – an intraocular lens.
A.9.1 Type and mix of patients

- The 5 study hospitals treated a total of 3,607 cataract cases (inpatients and outpatients) during the study period.
- BLH treated more cataract patients than any of the other hospitals. However, over half of the patients at BLH were privately referred outpatients who were treated in the hospital’s eye clinic. We excluded these outpatients from further analysis because we did not have any information for them.
- The other study hospitals each treated a fairly similar number of cataract cases (roughly 650), and treated all cases as inpatients except JHH which treated a few patients as privately referred non-inpatients.
- Almost all lens procedures were planned procedures, and very few patients stayed in hospital overnight.

A.9.2 Average length of stay

Almost all overnight patients (DRG C16A) spent a single night in hospital. Patients who were discharged on the same day as the procedure (DRG C16B) stayed in hospital for about 5 hours (on average) at all the study hospitals.

A.9.3 Costs of inpatient care

- As with other relevant case studies, we found that hospitals paid different prices for the same prostheses, but for lenses, the differences were small in dollar terms.
- Operating times were significantly lower at GH than at the other study hospitals. One reason may be that the other hospitals provide training for junior medical officers. JHH’s operating times were also relatively low, possibly because it provides fewer training opportunities than the remaining hospitals.

A.9.4 Configurations of care

- Cataracts are almost all planned cases. However, cataract surgery can either be performed in dedicated planned surgery theatres, or in theatres which are used for both planned and emergency cases. Where there is a mix of emergency and planned activity, urgent emergency cases may take precedence over planned cases like cataracts.
- GH is part of a networked arrangement on the Central Coast and most cataract procedures are performed in Wyong Hospital (where there is more planned surgery). However, cataract activity is retained at GH (where there are both emergency and planned cases) to maintain theatre staff skills for the occasional trauma patient. In contrast, JHH performs its planned cataract surgery cases at the Royal Newcastle Centre.
GH uses only VMO staffing on a fee-for-service basis, and does not provide training opportunities for junior medical staff (registrars). JHH provides less training than the remaining study hospitals because about 75% of procedures at this hospital are provided by VMOs on a fee-for-service basis. As noted above, the efficiency in operating theatre time at GH and JHH may be achieved at the expense of training.

There were variations in toric lens use at the study hospitals. Toric lenses are used for visual correction where there is astigmatism, and are more expensive than other lenses. Some hospitals use them sparingly, while other hospitals do not use them at all.

At GH all pre- and post-operative care is provided in the VMOs’ rooms so the VMOs provide patients with prescriptions for medication in advance of surgery. In contrast, other hospitals like RPAH and RNSH provide eye medication (eg, drops) to patients on discharge.

A.9.5 Outcome, safety and quality indicators

Clinicians routinely review visual outcomes for patients at a follow-up visit after surgery. Further, some hospitals (eg, GH) conduct regular audits of their surgical cases, as well as peer review meetings to analyse any complications arising from these cases. However, other hospitals do not appear to be reporting or auditing their outcomes or providing feedback on benchmarking or performance to their clinicians.

During consultation for this case study we compiled a list of potentially useful indicators for future work, in particular post operative infection rates, visual outcomes, returns to theatre and rupture of the posterior lens capsule.

Recommendations

1. That NSW Health arranges for appropriate clinical expert groups to assess the costs and benefits of toric lenses and develop guidelines for their use in public hospitals.
2. That NSW Health considers the costs and benefits of collecting data and monitoring performance against visual outcomes for patients undergoing lens procedures.
A.10 Case study 10 – Hysterectomy

This case study compared the length of stay, costs, configurations of care and outcomes related to hysterectomies. We used a single DRG to define the procedures and identify the data to be included in the scope of the case study:

- NO4Z - Hysterectomy for non malignancy.

To enable more meaningful comparison among hospitals, we divided this DRG into 4 patient subgroups based on the principal surgical procedure performed. These subgroups, which have different implications for costs and length of stay, were abdominal, laparoscopic, vaginal and laparoscopically-assisted vaginal hysterectomy. Abdominal surgery is the oldest method and has the longest length of stay. Vaginal hysterectomy is not feasible for patients with a very large uterus.

Our key findings for hysterectomies included the following:

A.10.1 Differences between patient subgroups

Variations in length of stay and cost between the different surgical procedures and hospitals are small compared with DRGs for other clinical conditions (eg, hip replacement or major chest procedures).

A.10.2 Type and mix of patients

About 50% of patients in the study hospitals had abdominal surgery in 2008/09, and about 34% had vaginal surgery. BH had the highest rate of abdominal surgery (62% of cases), and RNSH had the lowest (44% of cases).

A.10.3 Average length of stay

- RNSH has the highest 23 hour surgery rate and the highest proportion of 1 or 2 day stays.
- GH has a shorter average length of stay, but this is because it has a significantly smaller share of stays of more than 4 days.
- The comparatively longer average length of stay at RPAH and JHH is largely due to a small number of cases at these hospitals with a length of stay exceeding 7 days.
- The average length of stay is higher for abdominal hysterectomies than for vaginal hysterectomies.
- There is a great deal of variation between treating physicians in length of stay of their patients and the proportion of patients staying for only 1 or 2 days.
A.10.4 Costs of inpatient care

- The number of nursing hours per patient day (ie, the nursing staff-to-patient ratio) is the main driver of the differences in the average cost per episode for this DRG as a whole, partly because the length of stay is fairly uniform across the hospitals (except JHH). A more senior nursing staff mix (with more CNSs and RNs), like at JHH, was associated with fewer nursing hours per patient day and a lower nursing cost per patient day.

- Imaging and blood use costs were low across the hospitals, although blood use was much higher for abdominal hysterectomies than for vaginal hysterectomies.

- There was little variation in pathology costs across the hospitals, except at GH. However, GH appears to exclude many item numbers for the higher cost tests, and so has a relatively lower cost per patient than the other study hospitals.

A.10.5 Configurations of care

Due to time constraints, we did not have detailed discussions about configurations of care for hysterectomies during our hospital visits. However, we make the following observations:

- JHH, RNSH and RPAH each have specialist gynaecology oncology units. As such, these hospitals may have a more complex casemix, because some patients admitted through these units may be coded into this DRG. For example, we found a number of cases with diagnoses like ‘carcinoma in situ of cervix, unspecified’ who were included in this DRG.

- Hysterectomy is an area of declining activity because hysterectomies are increasingly being replaced by more conservative procedures such as endometrial ablation and uterine artery embolisation.

A.10.6 Outcome, safety and quality indicators

NSW Department of Health provided risk-adjusted 30-day mortality rates to compare hospital outcomes for hysterectomy patients. However, there were fewer than 5 deaths following hysterectomies in the 5 hospitals over the 3-year period 2005/06 to 2007/08. The number of deaths was too small to allow comparisons between the hospitals.

Recommendation

1. 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.
A.11 Case study 11 – Obstetric delivery

This case study compares the length of stay, costs, configurations of care and outcomes related to a caesarean section or vaginal delivery. We used the following DRGs to identify the data included in the scope of the case study:

- O01A – Caesarean delivery with catastrophic complication or comorbidity
- O01B – Caesarean delivery with severe complication or comorbidity
- O01C – Caesarean delivery without catastrophic or severe complication or comorbidity
- O02A – Vaginal delivery with operating room procedure with catastrophic or severe complication or comorbidity
- O02B – Vaginal delivery with operating room procedure without catastrophic or severe complication or comorbidity
- O60A – Vaginal delivery with catastrophic or severe complication or comorbidity
- O60B – Vaginal delivery without catastrophic or severe complication or comorbidity
- O60C – Vaginal delivery single uncomplicated without other condition.

Our key findings for obstetric deliveries included the following:

A.11.1 Type and mix of patients

- RPAH treated the most patients, followed by JHH.
- RNSH, GH and RPAH had much higher caesarean section rates than GH, JHH and BLH.
- RPAH, RNSH and JHH had a higher percentage of patients with more complex DRGs (O01A, O02A and O06A) than GH and BLH.
- RNSH and RPAH had an older patient demographic than GH, JHH and BLH.

A.11.2 Average length of stay

- The average length of stay for vaginal deliveries is lower than for caesarean sections. The average total number of days in hospital for caesarean sections ranges from 3.8 days at GH to 6.8 days at JHH. For vaginal deliveries, the range was from 2.4 days at GH to 3.4 days at RPAH. The difference in length of stay between caesarean sections and vaginal deliveries ranges from 1.4 days at GH to 3.8 days at JHH, using the LOS3 measure.
Patient mix may partially explain the differences in average length of stays at the study hospitals. For example, GH has a relatively young patient mix, a factor which is typically associated with shorter stays. In addition, clinicians at GH indicated that their shorter stays partly reflect the high numbers of deliveries at the hospital. Staff proactively check wards to see whether patients are ready for discharge.

A.11.3 Costs of care

We were unable to meaningfully compare total costs of obstetric delivery care across hospitals, because a significant proportion of care involves outpatient activity and the study hospitals do not count their outpatient activity consistently.

A.11.4 Configurations of care

The study hospitals use broadly the same models of antenatal care, which are related to the complexity of the patient. All study hospitals had birthing suites and theatres for deliveries – although RPAH and JHH also have birth centres for low risk pregnancies, and JHH has configurations of care that support home births. All study hospitals have some form of early discharge program – although they appear to have different timeframes for patients leaving hospital under these programs, with GH and JHH having the shortest timeframe. When compared to the other study hospitals, a substantially higher percentage of patients were discharged from GH within 72 hours of delivery for caesarean section and within 48 hours of delivery for vaginal delivery.

A.11.5 Outcome, safety and quality indicators

There is already a substantial amount of monitoring and reporting on hospital performance regarding obstetric deliveries against clinical indicators. Further, the Maternity Services Inter-Jurisdictional Committee is currently developing a core set of national maternity care performance indicators. As the national clinical indicators are still being finalised, we considered the performance of the study hospitals against several commonly reported clinical indicators.
The study hospitals had broadly similar results for babies born with low Apgar scores and rates of severe perineal trauma. However, outcome indicators relating to caesarean sections highlighted significant differences between the hospitals. GH had the highest rates for caesarean sections for ‘selected primiparas’, caesarean sections after induction of labour and repeat caesarean sections. These rates were substantially lower at BLH and JHH.

Recommendation

1. That NSW Health and clinical expert groups 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.

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287 The ‘selected primipara’ is defined as a woman who is 20-34 years of age, giving birth for the first time at between 37-41 weeks gestation and with a singleton pregnancy (pregnancy with only one baby) in cephalic presentation (head-first).
B Nursing staff cost comparisons from case studies
Table B.1 Number of Episodes - clinical groups included in the nursing comparative analysis

<table>
<thead>
<tr>
<th>Clinical Group</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>41</td>
<td>111</td>
<td>52</td>
<td>56</td>
<td>119</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>192</td>
<td>87</td>
<td>34</td>
<td>65</td>
<td>152</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>167</td>
<td>0</td>
<td>23</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>35</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>91</td>
<td>41</td>
<td>28</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>97</td>
<td>37</td>
<td>55</td>
<td>50</td>
<td>151</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>182</td>
<td>164</td>
<td>74</td>
<td>233</td>
<td>119</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>227</td>
<td>233</td>
<td>244</td>
<td>144</td>
<td>236</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>165</td>
<td>262</td>
<td>230</td>
<td>112</td>
<td>226</td>
</tr>
<tr>
<td>Cardiology - without pacemakers</td>
<td>2,083</td>
<td>1,078</td>
<td>2,069</td>
<td>896</td>
<td>1,799</td>
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<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>258</td>
<td>87</td>
<td>216</td>
<td>57</td>
<td>223</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>200</td>
<td>101</td>
<td>52</td>
<td>52</td>
<td>204</td>
</tr>
</tbody>
</table>

Source: HIE inpatient statistics, 2008/09, and IPART analysis.
### Table B.2 Number of Episodes - clinical groups excluded from the nursing analysis

<table>
<thead>
<tr>
<th>Excluded due to low case volumes</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major chest procedure – abscess or pyothorax</td>
<td>6</td>
<td>9</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appendicectomy – With complications (G07A)</td>
<td>21</td>
<td>19</td>
<td>25</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td><strong>Excluded due to short length of stay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast surgery – Excision of malignant lesions</td>
<td>140</td>
<td>36</td>
<td>59</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>Breast surgery – Excision of non-malignant lesions</td>
<td>75</td>
<td>33</td>
<td>29</td>
<td>76</td>
<td>1</td>
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<tr>
<td>Cataracts – Lens procedures (admitted patients)</td>
<td>595</td>
<td>689</td>
<td>628</td>
<td>462</td>
<td>614</td>
</tr>
<tr>
<td><strong>Excluded due to other complications in identifying ward nursing costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke – most complex DRG (B70A)</td>
<td>51</td>
<td>133</td>
<td>86</td>
<td>89</td>
<td>107</td>
</tr>
<tr>
<td>Obstetrics delivery</td>
<td>5,146</td>
<td>2,407</td>
<td>1,906</td>
<td>2,135</td>
<td>3,894</td>
</tr>
</tbody>
</table>

*Source:* HIE inpatient statistics, 2008/09, and IPART analysis.
**Table B.3 Average Length of Stay 1 (LOS1 and LOS3) (Days)**

<table>
<thead>
<tr>
<th>Episode length of stay (LOS1)</th>
<th>Total length of stay (LOS3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>12.9</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>7.4</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>6.9</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>7.0</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>4.8</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>6.8</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>1.6</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>2.8</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>7.4</td>
</tr>
<tr>
<td>Cardiology - without pacemakers</td>
<td>3.0</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>29.7</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>4.6</td>
</tr>
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</table>

Source: HIE inpatient statistics, 2008/09 and IPART analysis.
Table B.4 Average Nursing Hours per Patient Day

<table>
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<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th>IFRAC = 1</th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
<td>BLH</td>
<td>JHH</td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>6.6</td>
<td>4.1</td>
<td>4.7</td>
<td>6.0</td>
<td>5.2</td>
<td>6.7</td>
<td>5.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>5.0</td>
<td>3.6</td>
<td>4.5</td>
<td>6.1</td>
<td>4.8</td>
<td>5.0</td>
<td>5.8</td>
<td>5.6</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>9.5</td>
<td>na</td>
<td>6.8</td>
<td>na</td>
<td>6.6</td>
<td>9.7</td>
<td>na</td>
<td>8.5</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>7.2</td>
<td>na</td>
<td>6.5</td>
<td>na</td>
<td>5.4</td>
<td>7.6</td>
<td>na</td>
<td>8.6</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>5.0</td>
<td>4.6</td>
<td>6.4</td>
<td>5.8</td>
<td>10.0</td>
<td>5.5</td>
<td>4.9</td>
<td>9.2</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>6.7</td>
<td>5.5</td>
<td>5.5</td>
<td>7.2</td>
<td>5.8</td>
<td>7.1</td>
<td>6.2</td>
<td>6.8</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>7.5</td>
<td>6.5</td>
<td>5.8</td>
<td>7.8</td>
<td>7.9</td>
<td>7.5</td>
<td>7.2</td>
<td>7.3</td>
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<td>6.0</td>
<td>5.7</td>
<td>6.8</td>
<td>6.6</td>
<td>7.2</td>
<td>6.5</td>
<td>7.3</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
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<td>5.4</td>
<td>5.4</td>
<td>6.1</td>
<td>4.9</td>
<td>7.5</td>
<td>6.0</td>
<td>7.0</td>
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<tr>
<td>Cardiology - without pacemakers</td>
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<td>5.8</td>
<td>4.1</td>
<td>4.6</td>
<td>6.1</td>
<td>7.8</td>
<td>6.2</td>
<td>7.2</td>
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<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>12.8</td>
<td>8.1</td>
<td>8.3</td>
<td>12.4</td>
<td>14.2</td>
<td>12.9</td>
<td>10.7</td>
<td>11.5</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>9.4</td>
<td>7.5</td>
<td>7.9</td>
<td>7.7</td>
<td>5.2</td>
<td>9.4</td>
<td>7.5</td>
<td>7.9</td>
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</table>

Source: HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
### Table B.5 Average Nursing Cost per Hour ($)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>With IFRAC</th>
<th>IFRAC = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
<td>GH</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>34</td>
<td>37</td>
</tr>
<tr>
<td>Cholecystectomy – Emergency</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>32</td>
<td>37</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Cardiology - without pacemakers</td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>33</td>
<td>36</td>
</tr>
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</table>

**Source:** HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
### Table B.6  Average Nursing Cost per Patient Day ($)

<table>
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<th>With IFRAC</th>
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<th></th>
<th>IFRAC = 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
<td>BLH</td>
<td>JHH</td>
<td>RPAH</td>
<td>GH</td>
<td>RNSH</td>
<td>BLH</td>
</tr>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>227</td>
<td>147</td>
<td>168</td>
<td>217</td>
<td>190</td>
<td>230</td>
<td>211</td>
<td>211</td>
<td>217</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>175</td>
<td>132</td>
<td>159</td>
<td>214</td>
<td>167</td>
<td>175</td>
<td>212</td>
<td>199</td>
<td>216</td>
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<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>342</td>
<td>248</td>
<td>238</td>
<td>352</td>
<td>311</td>
<td>247</td>
<td>311</td>
<td>247</td>
<td>311</td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>261</td>
<td>239</td>
<td>192</td>
<td>275</td>
<td>314</td>
<td>202</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>170</td>
<td>169</td>
<td>214</td>
<td>201</td>
<td>315</td>
<td>187</td>
<td>181</td>
<td>306</td>
<td>204</td>
</tr>
<tr>
<td>Cholecystectomy – Planned</td>
<td>242</td>
<td>240</td>
<td>202</td>
<td>257</td>
<td>270</td>
<td>242</td>
<td>263</td>
<td>253</td>
<td>267</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>244</td>
<td>222</td>
<td>197</td>
<td>240</td>
<td>248</td>
<td>252</td>
<td>239</td>
<td>254</td>
<td>240</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
<td>243</td>
<td>188</td>
<td>189</td>
<td>219</td>
<td>167</td>
<td>271</td>
<td>210</td>
<td>247</td>
<td>219</td>
</tr>
<tr>
<td>Cardiology - without pacemakers</td>
<td>243</td>
<td>224</td>
<td>147</td>
<td>178</td>
<td>230</td>
<td>276</td>
<td>241</td>
<td>260</td>
<td>179</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>493</td>
<td>324</td>
<td>323</td>
<td>504</td>
<td>565</td>
<td>499</td>
<td>427</td>
<td>450</td>
<td>504</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>309</td>
<td>254</td>
<td>217</td>
<td>256</td>
<td>201</td>
<td>314</td>
<td>271</td>
<td>273</td>
<td>260</td>
</tr>
</tbody>
</table>

**Source:** HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
### Table B.7 Average Total Episode Nursing Cost ($)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip joint replacement – Fracture</td>
<td>2,928</td>
<td>1,875</td>
<td>1,731</td>
<td>2,913</td>
<td>2,580</td>
<td>2,962</td>
<td>2,680</td>
<td>2,175</td>
<td>2,911</td>
<td>2,685</td>
</tr>
<tr>
<td>Hip joint replacement – Arthritis</td>
<td>1,288</td>
<td>969</td>
<td>1,291</td>
<td>1,530</td>
<td>1,247</td>
<td>1,287</td>
<td>1,552</td>
<td>1,613</td>
<td>1,545</td>
<td>1,248</td>
</tr>
<tr>
<td>Major chest procedure – Lung Cancer</td>
<td>2,373</td>
<td>2,650</td>
<td>2,087</td>
<td>2,440</td>
<td>3,311</td>
<td>2,171</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major chest procedure – Collapsed or punctured lung</td>
<td>1,816</td>
<td>2,076</td>
<td>2,017</td>
<td>1,916</td>
<td>2,735</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast surgery – Mastectomy</td>
<td>814</td>
<td>654</td>
<td>813</td>
<td>1,125</td>
<td>131</td>
<td>895</td>
<td>698</td>
<td>1,164</td>
<td>1,140</td>
<td>132</td>
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<tr>
<td>Cholecystectomy – Emergency</td>
<td>1,584</td>
<td>1,944</td>
<td>1,486</td>
<td>2,051</td>
<td>1,021</td>
<td>1,684</td>
<td>2,185</td>
<td>1,865</td>
<td>2,050</td>
<td>1,073</td>
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<tr>
<td>Cholecystectomy – Planned</td>
<td>381</td>
<td>453</td>
<td>360</td>
<td>377</td>
<td>453</td>
<td>381</td>
<td>497</td>
<td>450</td>
<td>390</td>
<td>462</td>
</tr>
<tr>
<td>Appendicectomy – Without complications (G07B)</td>
<td>681</td>
<td>667</td>
<td>469</td>
<td>594</td>
<td>693</td>
<td>703</td>
<td>718</td>
<td>606</td>
<td>594</td>
<td>713</td>
</tr>
<tr>
<td>Stroke – excluding most complex (B70B &amp; B70C)</td>
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<td>1,866</td>
<td>1,432</td>
<td>2,026</td>
<td>1,168</td>
<td>1,997</td>
<td>2,079</td>
<td>1,872</td>
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<tr>
<td>Cardiology - without pacemakers</td>
<td>726</td>
<td>727</td>
<td>364</td>
<td>465</td>
<td>522</td>
<td>827</td>
<td>781</td>
<td>645</td>
<td>465</td>
<td>688</td>
</tr>
<tr>
<td>Tracheostomy / Ventilation &gt; 95 hours</td>
<td>14,654</td>
<td>8,995</td>
<td>10,366</td>
<td>14,999</td>
<td>13,471</td>
<td>14,820</td>
<td>11,879</td>
<td>14,449</td>
<td>14,998</td>
<td>13,573</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>1,430</td>
<td>925</td>
<td>807</td>
<td>1,002</td>
<td>893</td>
<td>1,453</td>
<td>987</td>
<td>1,019</td>
<td>1,018</td>
<td>895</td>
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</table>

**Source:** HIE inpatient statistics, 2008/09, payroll data and IPART analysis.
### Table C.1  Sample stent prices paid by study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Bare Metal Stents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stent A</td>
<td>Supplier 1</td>
<td>405</td>
<td>700</td>
<td>700</td>
<td>na</td>
<td>800</td>
</tr>
<tr>
<td>Stent B</td>
<td>Supplier 2</td>
<td>na</td>
<td>800</td>
<td>na</td>
<td>na</td>
<td>800</td>
</tr>
<tr>
<td>Stent C</td>
<td>Supplier 3</td>
<td>450</td>
<td>na</td>
<td></td>
<td>525</td>
<td>na</td>
</tr>
<tr>
<td>Stent D</td>
<td>Supplier 4</td>
<td>650</td>
<td>na</td>
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<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Stent E</td>
<td>Supplier 5</td>
<td>650</td>
<td>na</td>
<td>700</td>
<td>na</td>
<td>800</td>
</tr>
<tr>
<td>Stent F</td>
<td>Supplier 6</td>
<td>na</td>
<td>700</td>
<td>700</td>
<td>na</td>
<td>800</td>
</tr>
<tr>
<td>Drug-Eluting Stents</td>
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<tr>
<td>Stent G</td>
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<td>na</td>
<td></td>
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<tr>
<td>Stent H</td>
<td>Supplier 1</td>
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<td>2,100</td>
<td>2,400</td>
<td>na</td>
<td>2,100</td>
</tr>
<tr>
<td>Stent I</td>
<td>Supplier 1</td>
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<td>2,100</td>
<td>2,400</td>
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<tr>
<td>Stent J</td>
<td>Supplier 5</td>
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<td>2,400</td>
<td>2,400</td>
<td>na</td>
<td>2,400</td>
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<tr>
<td>Stent K</td>
<td>Supplier 3</td>
<td>2,400</td>
<td>2,200 &amp; 2,200 &amp; 2,400</td>
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<td>na</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** This sample does not include all study hospitals' purchased stents - just those where we could usefully compare prices. Where there are two or more prices, the hospital is understood to have made reasonable amounts of purchases of the prosthesis item at these price levels in 2008/09. Most frequent purchases are highlighted in yellow.

**Source:** Study hospitals’ purchasing databases and direct advice to IPART. Hospitals were also asked to check prices.
### Table C.2 Sample pacemaker prices paid by study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single chamber</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC Pace A</td>
<td>Supplier 2</td>
<td>1,200</td>
<td>1,800</td>
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<td>Supplier 3</td>
<td>1,950</td>
<td>na</td>
<td>2,300</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC Pace C</td>
<td>Supplier 3</td>
<td>1,100</td>
<td>1,600</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC Pace D</td>
<td>Supplier 1</td>
<td>1,800</td>
<td>1,900</td>
<td>2,300</td>
<td>na</td>
<td>1,500</td>
</tr>
<tr>
<td>SC Pace E</td>
<td>Supplier 7</td>
<td>1,500</td>
<td>1,950</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC Pace F</td>
<td>Supplier 7</td>
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<td>1,950</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
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<td>SC Pace G</td>
<td>Supplier 7</td>
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<td>5,928</td>
<td>na</td>
<td>na</td>
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<tr>
<td><strong>Dual chamber</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Pace A</td>
<td>Supplier 2</td>
<td>1,900</td>
<td>2,800</td>
<td>2,233</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace B</td>
<td>Supplier 3</td>
<td>1,850</td>
<td>1,950</td>
<td>2,900</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace C</td>
<td>Supplier 1</td>
<td>2,350</td>
<td>2,250</td>
<td>na</td>
<td>na</td>
<td>2,050</td>
</tr>
<tr>
<td>DC Pace D</td>
<td>Supplier 1</td>
<td>1,650</td>
<td>1,900</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace E</td>
<td>Supplier 7</td>
<td>2,100</td>
<td>2,800</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace F</td>
<td>Supplier 7</td>
<td>2,100</td>
<td>2,800</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace G</td>
<td>Supplier 7</td>
<td>2,100</td>
<td>2,800</td>
<td>2,900</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace H</td>
<td>Supplier 7</td>
<td>5,600</td>
<td>na</td>
<td>3,700</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC Pace I</td>
<td>Supplier 7</td>
<td>4,200</td>
<td>2,800</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Pacemaker leads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead A</td>
<td>Supplier 3</td>
<td>na</td>
<td>500</td>
<td>450</td>
<td>na</td>
<td>450</td>
</tr>
<tr>
<td>Lead B</td>
<td>Supplier 1</td>
<td>500</td>
<td>475</td>
<td>450</td>
<td>na</td>
<td>450</td>
</tr>
</tbody>
</table>

**Note:** This sample does not include all study hospitals’ purchased pacemakers - just those where we could usefully compare prices. Most frequent purchases are highlighted in yellow.

**Source:** Study hospitals’ purchasing databases and direct advice to IPART. Hospitals were also asked to check prices.
## Table C.3  Sample ICD prices paid by study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single chamber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC ICD A</td>
<td>Supplier 1</td>
<td>$14,000</td>
<td>na</td>
<td>17,500</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC ICD B</td>
<td>Supplier 1</td>
<td>13,000</td>
<td>na</td>
<td>14,500</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC ICD C</td>
<td>Supplier 2</td>
<td>13,000</td>
<td>na</td>
<td>14,000</td>
<td>na</td>
<td>$11,500</td>
</tr>
<tr>
<td>SC ICD D</td>
<td>Supplier 3</td>
<td>na</td>
<td>na</td>
<td>16,000</td>
<td>na</td>
<td>$11,500</td>
</tr>
<tr>
<td>SC ICD E</td>
<td>Supplier 7</td>
<td>11,000</td>
<td>na</td>
<td>14,500</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>SC ICD F</td>
<td>Supplier 7</td>
<td>na</td>
<td>na</td>
<td>15,900</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Dual chamber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC ICD A</td>
<td>Supplier 1</td>
<td>17,000</td>
<td>na</td>
<td>18,000</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC ICD B</td>
<td>Supplier 1</td>
<td>$18,000</td>
<td>na</td>
<td>18,000</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC ICD C</td>
<td>Supplier 2</td>
<td>na</td>
<td>na</td>
<td>16,000</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC ICD D</td>
<td>Supplier 2</td>
<td>na</td>
<td>na</td>
<td>16,000</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>DC ICD E</td>
<td>Supplier 2</td>
<td>na</td>
<td>na</td>
<td>16,000</td>
<td>na</td>
<td>$15,200</td>
</tr>
<tr>
<td>DC ICD F</td>
<td>Supplier 3</td>
<td>na</td>
<td>na</td>
<td>$21,000</td>
<td>na</td>
<td>16,000</td>
</tr>
<tr>
<td>DC ICD G</td>
<td>Supplier 3</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>16,500</td>
</tr>
<tr>
<td>DC ICD H</td>
<td>Supplier 7</td>
<td>13,095</td>
<td>na</td>
<td>15,900</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

**Note:** This sample does not include all study hospitals’ purchased ICDs - just those where we could usefully compare prices. Most frequent purchases are highlighted in yellow.

**Source:** Study hospitals’ purchasing databases and direct advice to IPART. Hospitals were also asked to check prices.
### Table C.4  Sample lens prices paid by study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymethyl Methacrylate (PMMA)</td>
<td>Supplier 8</td>
<td>156</td>
<td>na</td>
<td>na</td>
<td>220</td>
<td>na</td>
</tr>
<tr>
<td>Acrylic PMMA Lens A</td>
<td>Supplier 8</td>
<td>220</td>
<td>205</td>
<td>220</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>Acrylic PMMA Lens B</td>
<td>Supplier 8</td>
<td>200</td>
<td>200</td>
<td>na</td>
<td>180</td>
<td>na</td>
</tr>
<tr>
<td>Acrylic PMMA Lens C</td>
<td>Supplier 9</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>220</td>
<td>na</td>
</tr>
<tr>
<td>Acrylic PMMA Lens D</td>
<td>Supplier 10</td>
<td>na</td>
<td>210</td>
<td>210</td>
<td>na</td>
<td>210</td>
</tr>
<tr>
<td>Acrylic PMMA Lens E</td>
<td>Supplier 11</td>
<td>210</td>
<td>na</td>
<td>na</td>
<td>200</td>
<td>190</td>
</tr>
<tr>
<td>Acrylic Acrylic Lens A</td>
<td>Supplier 8</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>Acrylic Acrylic Lens B</td>
<td>Supplier 8</td>
<td>200</td>
<td>200</td>
<td>na</td>
<td>180</td>
<td>na</td>
</tr>
<tr>
<td>Acrylic Acrylic Lens C</td>
<td>Supplier 9</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>220</td>
<td>190</td>
</tr>
<tr>
<td>Acrylic Acrylic Lens D</td>
<td>Supplier 10</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Acrylic Acrylic Lens E</td>
<td>Supplier 11</td>
<td>210</td>
<td>na</td>
<td>na</td>
<td>200</td>
<td>190</td>
</tr>
<tr>
<td>Silicone Silicone Lens A</td>
<td>Supplier 9</td>
<td>na</td>
<td>na</td>
<td>190</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>Silicone Silicone Lens B</td>
<td>Supplier 9</td>
<td>na</td>
<td>210</td>
<td>210</td>
<td>220</td>
<td>na</td>
</tr>
<tr>
<td>Silicone Silicone Lens C</td>
<td>Supplier 10</td>
<td>na</td>
<td>180</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Toric Toric Lens A</td>
<td>Supplier 8</td>
<td>na</td>
<td>na</td>
<td>450</td>
<td>450</td>
<td>na</td>
</tr>
<tr>
<td>Toric Toric Lens B</td>
<td>Supplier 10</td>
<td>na</td>
<td>430</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

**Note:** This sample does not include all study hospitals’ purchased lenses – just those where we could usefully compare prices. Most frequent purchases are highlighted in yellow. If a hospital is not highlighted for an item, we were not able to find that product in other hospital’s purchasing data.

**Source:** Study hospitals’ purchasing databases and direct advice to IPART. Hospitals were also asked to check prices.

### Table C.5  Sample hip joint prosthesis prices paid by study hospitals, 2008/09

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetabular Shell</td>
<td>Supplier 1</td>
<td>na</td>
<td>2,454</td>
<td>2,598</td>
<td>2,890</td>
<td>2,450</td>
</tr>
<tr>
<td>Shell A</td>
<td>Supplier 2</td>
<td>na</td>
<td>2,063</td>
<td>na</td>
<td>2,000</td>
<td>2,063</td>
</tr>
<tr>
<td>Shell B</td>
<td>Supplier 2</td>
<td>2,300</td>
<td>2,900</td>
<td>2,750</td>
<td>2,600</td>
<td>2,750</td>
</tr>
<tr>
<td>Shell C</td>
<td>Supplier 2</td>
<td>na</td>
<td>3,400</td>
<td>2,300</td>
<td>3,345</td>
<td></td>
</tr>
<tr>
<td>Liner/Insert</td>
<td>Supplier 1</td>
<td>na</td>
<td>3,500</td>
<td>5,203</td>
<td>3,500</td>
<td>3,500</td>
</tr>
<tr>
<td>Liner/Insert B</td>
<td>Supplier 2</td>
<td>1,300</td>
<td>1,836</td>
<td>1,500</td>
<td>1,400</td>
<td>1,500</td>
</tr>
<tr>
<td>Liner/Insert C</td>
<td>Supplier 2</td>
<td>2,187</td>
<td>2,083</td>
<td>2,558</td>
<td>2,560</td>
<td>2,083</td>
</tr>
<tr>
<td>Femoral head</td>
<td>Supplier 3/Supplier 2</td>
<td>na</td>
<td>na 615 &amp; 1,000</td>
<td>399</td>
<td>640 - 980</td>
<td></td>
</tr>
<tr>
<td>Femoral head A</td>
<td>Supplier 1</td>
<td>na</td>
<td>2,100</td>
<td>2,226</td>
<td>2,100</td>
<td>2,100</td>
</tr>
<tr>
<td>Femoral head B</td>
<td>Supplier 4</td>
<td>na</td>
<td>919</td>
<td>919</td>
<td>827</td>
<td>na</td>
</tr>
<tr>
<td>Femoral head C</td>
<td>Supplier 2</td>
<td>na</td>
<td>718</td>
<td>na</td>
<td>950</td>
<td>676</td>
</tr>
<tr>
<td>Femoral head D</td>
<td>Supplier 2</td>
<td>780</td>
<td>718</td>
<td>810</td>
<td>600</td>
<td>718</td>
</tr>
<tr>
<td>Femoral head E</td>
<td>Supplier 2</td>
<td>780</td>
<td>1,873</td>
<td>2,500</td>
<td>2,390</td>
<td>1,873</td>
</tr>
</tbody>
</table>
### Prostheses pricing comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>Supplier</th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral head G</td>
<td>Supplier 2</td>
<td>na</td>
<td>2,100 &amp; 2,500</td>
<td>2,436 &amp; 2,500</td>
<td>2,436 &amp; 2,500</td>
<td></td>
</tr>
<tr>
<td>Femoral head H</td>
<td>Supplier 5</td>
<td>na</td>
<td>944</td>
<td>800 &amp; 987</td>
<td>987</td>
<td>944</td>
</tr>
<tr>
<td><strong>Hip stem</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip stem A</td>
<td>Supplier 2</td>
<td>na</td>
<td>429</td>
<td>439 &amp; 615</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Hip stem B</td>
<td>Supplier 2</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>660</td>
</tr>
<tr>
<td>Hip stem C</td>
<td>Supplier 2</td>
<td>2,000</td>
<td>1,873</td>
<td>2,500</td>
<td>2,390</td>
<td>2,300</td>
</tr>
<tr>
<td>Hip stem D</td>
<td>Supplier 2</td>
<td>na</td>
<td>na</td>
<td>4,850</td>
<td>na</td>
<td>3,646</td>
</tr>
<tr>
<td>Hip stem E</td>
<td>Supplier 2</td>
<td>na</td>
<td>4,800</td>
<td>na</td>
<td>4,520</td>
<td>4,700</td>
</tr>
<tr>
<td>Hip stem F</td>
<td>Supplier 2</td>
<td>4,160</td>
<td>5,000 &amp;</td>
<td>5,250</td>
<td>5,250</td>
<td>5,250</td>
</tr>
</tbody>
</table>

*Note:* The prices shown for Femoral head A includes models supplied by 2 suppliers: Supplier 2 and Supplier 3. While they are very similar models, they are not identical (which is unlike our other comparisons).

Note: This sample does not include all study hospitals’ purchased hip joint prosthesis components - just those where we could usefully compare prices. Where there are two or more prices, the hospital is understood to have made reasonable amounts of purchases of the prosthesis item at these different price levels in 2008/09. Most frequent purchases are highlighted in yellow. If a hospital is not highlighted for an item, we were not able to find that product in other hospital’s purchasing data.

Source: Study hospitals’ purchasing databases and direct advice to IPART. Hospitals were also asked to check prices.
Summary of findings for outcome, safety and quality indicators

We examined a range of hospital-wide and clinical level outcome indicators (which we used in our case studies). Table E.1 and Table E.2 provide a summary of the study hospitals’ performance against these indicators. For a more complete discussion of these findings, please refer to Chapter 16 and our reports in each case study area.

D.1 Hospital-wide outcome indicators

Table D.1 Performance against hospital-wide outcome indicators

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Unplanned hospital readmissions</td>
<td>After adjusting for patient characteristics, the odds of unplanned readmission were lowest at BLH.</td>
</tr>
<tr>
<td>2.</td>
<td>Wound infection rates</td>
<td>After adjusting for patient characteristics, the odds of wound infection were lowest at GH and BLH.</td>
</tr>
<tr>
<td>3.</td>
<td>Blood transfusion rates</td>
<td>GH had significantly higher blood transfusion rates for emergency and non-emergency department patients (minimum haemoglobin levels between 80–100 g/L).</td>
</tr>
<tr>
<td>4.</td>
<td>Compliance with antibiotic prophylaxis assessment</td>
<td>General improvement in compliance by hospitals over 2008/10. All hospitals had compliance rates exceeding 95% in last quarter measured (February 2010). Audit sample size not consistent across hospitals. JHH performs significantly more audits than other hospitals.</td>
</tr>
<tr>
<td>5.</td>
<td>Administration of antibiotic prophylaxis</td>
<td>Data unavailable.</td>
</tr>
<tr>
<td>6.</td>
<td>Compliance with VTE prophylaxis assessment</td>
<td>General improvement in compliance by hospitals over 2008/09. All hospitals had compliance rates exceeding 95% in last quarter measured (February 2010). Audit sample size not consistent across hospitals. JHH performs significantly more audits than other hospitals.</td>
</tr>
<tr>
<td>7.</td>
<td>Administration of VTE prophylaxis</td>
<td>Data unavailable.</td>
</tr>
<tr>
<td>8.</td>
<td>Patient experience following treatment</td>
<td>RPAH had the highest overall care ratings for overnight and day only patients.</td>
</tr>
<tr>
<td>9.</td>
<td>Centrally inserted CLAB rate</td>
<td>Rate varies across the study hospitals. GH had the highest rate in the last 2 quarters measured (March &amp; June 2009), although it had zero rates in the previous 2 quarters.</td>
</tr>
</tbody>
</table>
Summary of findings for outcome, safety and quality indicators

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Peripherally inserted CLAB rate</td>
<td>Very low rates.</td>
</tr>
<tr>
<td>11</td>
<td>ICU associated new MRSA infections</td>
<td>Rates decreasing or staying the same at most of the hospitals over 2008/09. While GH’s rate was tracking up in the final quarter measured, its rate in that quarter was similar to those at RPAH and BLH.</td>
</tr>
<tr>
<td>12</td>
<td>ICU associated new MRAB infections</td>
<td>Very low rates.</td>
</tr>
<tr>
<td>13</td>
<td>Healthcare associated SA-BSIs in acute care hospitals</td>
<td>All hospitals were below the benchmark rate of 2 infections per 10,000 occupied bed days.</td>
</tr>
<tr>
<td>14</td>
<td>Incorrect patient, incorrect procedure, incorrect site</td>
<td>Very rare occurrences.</td>
</tr>
<tr>
<td>15</td>
<td>In-hospital falls leading to death</td>
<td>Very rare occurrences. There were no deaths from in-hospital falls at the hospitals in 2008/09.</td>
</tr>
<tr>
<td>16</td>
<td>Complaints management</td>
<td>Most hospitals met NSW Health’s benchmark of 80% of complaints dealt with within 35 days. RPAH and RNSH fell below this benchmark in 4 of 8 quarters measured (although for RPAH the achieved rate was only marginally less than the benchmark rate for 2 of those quarters).</td>
</tr>
<tr>
<td>17</td>
<td>RCAs completed within 70 days</td>
<td>There was a failure to meet this target around 40% of the time.</td>
</tr>
<tr>
<td>18</td>
<td>Compliance with NIMC dosage guidelines for warfarin</td>
<td>Data unavailable.</td>
</tr>
<tr>
<td>19</td>
<td>Warfarin INR exceeding 5</td>
<td>Data unavailable.</td>
</tr>
</tbody>
</table>

17.9.2 Clinical level outcome indicators

Table D.1 Performance against clinical level outcome indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case study 1 - Hip joint replacement</strong></td>
<td>No statistically significant difference in the study hospitals’ mortality rates for fracture patients. Number of deaths too small to allow comparisons between the hospitals for arthritis patients.</td>
</tr>
<tr>
<td>• 30-day mortality rates</td>
<td>IRO had the lowest unplanned readmissions rate for arthritis patients. There was no statistically significant difference in the study hospitals’ rates for fracture patients.</td>
</tr>
<tr>
<td>• Unplanned hospital readmissions</td>
<td>RPAH had the highest rate for wound infections. However, it also had a more complex casemix than the other hospitals.</td>
</tr>
<tr>
<td>• Unplanned returns to theatre</td>
<td>RNSH had the highest proportion of fracture patients whose surgery commenced within 24 hours of their emergency admission.</td>
</tr>
<tr>
<td>• Wound infection rates</td>
<td>RNSH and JHH had the highest proportions of emergency patients aged 75 years and over who were discharged to their usual place of residence.</td>
</tr>
<tr>
<td>• Surgical site infections (superficial &amp; deep incisional)</td>
<td></td>
</tr>
<tr>
<td>• Blood transfusion rates</td>
<td></td>
</tr>
<tr>
<td>• Administration of VTE prophylaxis</td>
<td></td>
</tr>
<tr>
<td>• Administration of antibiotic prophylaxis</td>
<td></td>
</tr>
<tr>
<td>• Surgery commencing within 24 hours of emergency admission</td>
<td></td>
</tr>
<tr>
<td>• Discharge to usual place of residence</td>
<td></td>
</tr>
</tbody>
</table>
### Summary of findings for outcome, safety and quality indicators

**Indicators**

**Main findings**

<table>
<thead>
<tr>
<th>Case study 2 – Major chest procedures</th>
<th>RPAH had the lowest 30-day mortality rate and highest 3-year survival rate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 30-day mortality rates</td>
<td>• RPAH and RNSH had the highest 12-month survival rates.</td>
</tr>
<tr>
<td>• Survival rates (12 months, 2 years &amp; 3 years post surgery)</td>
<td>• No statistically significant difference in the study hospitals’ 2-year survival rates.</td>
</tr>
<tr>
<td>• Unplanned returns to theatre</td>
<td>• Number of infections was too low across the study hospitals to make comparisons.</td>
</tr>
<tr>
<td>• Wound infection rates</td>
<td>• RPAH had the highest proportion of lung cancer patients who had planned surgery on their admission days, as well as the shortest time for removing chest tubes post surgery.</td>
</tr>
<tr>
<td>• Surgical site infections (superficial &amp; deep incisional)</td>
<td></td>
</tr>
<tr>
<td>• Blood transfusion rates</td>
<td></td>
</tr>
<tr>
<td>• Administration of VTE prophylaxis</td>
<td></td>
</tr>
<tr>
<td>• Administration of antibiotic prophylaxis</td>
<td></td>
</tr>
<tr>
<td>• Lung cancer surgeries on admission day</td>
<td></td>
</tr>
<tr>
<td>• Length of time before chest tube removed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case study 3 – Breast surgery</th>
<th>No statistically significant differences between the study hospitals’ 30-day mortality rates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 30 day mortality rates</td>
<td></td>
</tr>
<tr>
<td>• Unplanned returns to theatre</td>
<td></td>
</tr>
<tr>
<td>• Blood transfusion rates</td>
<td></td>
</tr>
<tr>
<td>• Administration of VTE prophylaxis</td>
<td></td>
</tr>
</tbody>
</table>

**Case studies 4 & 5 – Cholecystectomy & Appendicectomy**

(data combined due to low numbers)

| • 30 day mortality rates      | No statistically significant differences between the study hospitals’ 30-day mortality rates. |
| • Unplanned returns to theatre|                                                                                         |
| • Wound infection rates       | JHH and RPAH had the highest wound infection rates.                                      |
| • Blood transfusion rates     |                                                                                         |
| • Administration of VTE prophylaxis |                                               |
| • Administration of antibiotic prophylaxis |                                        |

**Case study 6 – Stroke**

| • 6-month survival rates      | Data for most outcome indicators suggested by clinicians is collected by the National Stroke Research Institute. However, we were unable to obtain this data within the timeframe for our study. |
| • Discharge to usual place of residence |                                                                                         |
| • Access to a stroke care unit |                                                                                         |
| • Stroke pathway utilisation  |                                                                                         |
| • CT/MRI scan within 12 hours of arrival at hospital |                                                                                       |
| • Patients admitted with a diagnosis of ischaemic stroke who receive thrombolysis | No statistically significant differences in the study hospitals’ survival rates.       |
| • Patients admitted with diagnosis of stroke who receive aspirin within 48 hours |                                                                                       |
| • Swallowing ability within 24 hours of arrival at hospital |                                                                                       |
| • Discharged on anti-platelet/anti-thromboembololytic agents |                                                                                      |
| • FIM Score recorded at discharge from hospital |                                                                                      |
| • Modified Rankin Score recorded at discharge from |                                                                                  |
## Indicators Main findings

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of days patient admitted with diagnosis of stroke spent at home in first 90 days post stroke</td>
<td>No statistically significant differences in the study hospitals’ mortality, survival and wound infection rates. Data unavailable for other outcome indicators.</td>
</tr>
</tbody>
</table>

**Case study 7 – Cardiology (Stents, Pacemakers and Defibrillators)**

- 30-day mortality rates (all cardiology patients)
- 6-month survival rates (AMI and angina patients)
- Post-procedural infection rates (all cardiology patients)
- Pathway compliance (acute coronary syndrome)
- Appropriate discharge medication for AMI patients
- Time to thrombolysis or percutaneous transluminal coronary angioplasty (acute coronary syndrome)

**Case study 8 – Tracheostomy, or ventilation for greater than 95 hours**

- No agreed set of indicators among clinicians.
- Unable to obtain consistent data to measure indicators suggested by clinicians.

**Case study 9 – Cataract/lens procedures**

- No agreed set of indicators among clinicians.

**Case study 10 – Hysterectomy**

- 30-day mortality rate
- Wound infection rate

**Case study 11 – Obstetric delivery**

- Caesarean section rates
- Vaginal deliveries following primary caesarean section
- Vaginal deliveries with third or fourth degree perineal tears
- Caesarean section after induction of labour
- Babies born with an Apgar score of 4 or below at 5 minutes
- Repeat caesarean section rates
- Administration of VTE prophylaxis
- Administration of antibiotic prophylaxis

Wide range of outcome indicators already reported and monitored. National maternity indicators project underway to determine an agreed set of indicators.

GH had substantially higher caesarean section rates than BLH and JHH. This could not be easily explained by differences in configurations of care or patient complexity.
Table E.1 includes the data sources and risk adjustment factors used for risk-adjusted indicators provided by NSW Health.

### Table E.1 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></td>
<td><strong>Hospital wide indicators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Unplanned readmission to hospital within 28 days of separation</td>
<td>Linked records of the APDC for 2005-06 to 2007-08</td>
<td><em>Numerator</em> - Number of unplanned readmissions</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Denominator</em> - Number of cases.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wound infection</td>
<td>APDC records for 2006-07 to 2008-09</td>
<td><em>Numerator</em> - Number of cases with a wound infection indicated by an ICD10-AM disease code in the following range: T81.41, T83.5, T83.6, T84.5, T84.6, T84.7.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Denominator</em> - Number of cases where the second and third digits of the DRG code string evaluated to less than 30.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Hip joint replacement indicators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>30 day mortality - hip joint replacement</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><em>Numerator</em> - Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Denominator</em> - Number of cases with the following DRGs: I03A, I03B, I03C.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Unplanned readmission to hospital within 28 days of separation - hip joint replacement - for arthritis</td>
<td>Linked records of the APDC for 2005-06 to 2007-08.</td>
<td><em>Numerator</em> - Number of unplanned readmissions</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Denominator</em> - Number of cases with one of the following ICD10AM codes as a primary diagnosis: M16.0, M16.1; and one of the following DRGs: I03A, I03B, I03C; and excluding private hospital admissions and certain conditions.</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Indicator</td>
<td>Data Source</td>
<td>Numerator &amp; denominator</td>
<td>Risk-adjustment</td>
</tr>
<tr>
<td>-----</td>
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<td>------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Unplanned readmission to hospital within 28 days of separation - hip joint replacement - hip fracture</td>
<td>Linked records of the APDC for 2005-06 to 2007-08.</td>
<td>Numerator - Number of unplanned readmissions Denominator - Number of cases with one of the following ICD10AM codes as a primary diagnosis: M80.95, S72.00, S72.02, S72.03, S72.04, S72.05, S72.08, S72.1, S72.10, S72.11, S72.2, S72.3; and one of the following DRGs: I03A, I03B, I03C; and excluding private hospital admissions and certain conditions.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>6</td>
<td>Wound infection - all hip replacements</td>
<td>APDC 2006-07 to 2008-09</td>
<td>Numerator - Number of cases with a wound infection indicated by an ICD10-AM disease code in the following range: T81.41, T83.5, T83.6, T84.5, T84.6, T84.7. Denominator - Number of cases with the following DRGs: I03A, I03B, I03C.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td>Major chest procedures indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>30 day mortality - major chest procedures</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 Denominator - Number of cases with the following DRGs: E01A, E01B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>8</td>
<td>Survival 12 months post surgery – major chest procedures</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 30/6/2009</td>
<td>Numerator - Number of deaths Denominator - Number of cases with the following DRGs: E01A, E01B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>9</td>
<td>Survival 2 years post surgery – major chest procedures</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2004-05 to 2006-07 and deaths to 30/6/2009</td>
<td>Numerator - Number of deaths Denominator - Number of cases with the following DRGs: E01A, E01B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>10</td>
<td>Survival 3 years post surgery – major chest procedures</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2003-04 to 2005-06 and deaths to 30/6/2009</td>
<td>Numerator - Number of deaths Denominator - Number of cases with the following DRGs: E01A, E01B.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>No.</td>
<td>Indicator</td>
<td>Data Source</td>
<td>Numerator &amp; denominator</td>
<td>Risk-adjustment</td>
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<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>Wound infection – major chest procedures</td>
<td>APDC 2006-07 to 2008-09</td>
<td><strong>Numerator</strong> - Number of cases with a wound infection indicated by the ICD10-AM disease code of T81.41.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Denominator</strong> - Number of cases with the following DRGs: E01A, E01B.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>30 day mortality - breast 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><strong>Numerator</strong> - Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>13</td>
<td>30 day mortality - Appendicectomy and cholecystectomy</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><strong>Numerator</strong> - Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>14</td>
<td>Wound infection - Appendicectomy and cholecystectomy</td>
<td>APDC 2006-07 to 2008-09</td>
<td><strong>Numerator</strong> - Number of cases with a wound infection indicated by the ICD10-AM disease code of T81.41.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Denominator</strong> - Number of cases with the following DRGs: G07A, G07B, H07A, H07B, H08A, H08B.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Survival - 6 months - stroke</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 31/12/2008</td>
<td><strong>Numerator</strong> - Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>16</td>
<td>30 day mortality - cardiology</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><strong>Numerator</strong> - Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Denominator</strong> - Number of cases with the following DRGs: F10Z, F15Z, F16Z, F19Z, F41A, F41B, F42A, F42B, F60A, F60B, F60C, F74Z; and excluding cases where there was a transfer from another hospital or where death occurred</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Indicator</td>
<td>Data Source</td>
<td>Numerator &amp; denominator</td>
<td>Risk-adjustment</td>
</tr>
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</tr>
<tr>
<td>17</td>
<td>Survival 6 months - Angina</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 31/12/2008</td>
<td>Numerator-Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 31/12/2008</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>18</td>
<td>Survival 6 months - AMI</td>
<td>Linked records of the APDC and RBDM death registration data. APDC records for 2005-06 to 2007-08 and deaths to 31/12/2008</td>
<td>Numerator-Number of deaths</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>19</td>
<td>Wound infection - cardiology</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.</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>20</td>
<td>30 day mortality - hysterectomy</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</td>
<td>Age, sex, comorbidity (Charlson index) and socio-economic status.</td>
</tr>
<tr>
<td>No.</td>
<td>Indicator</td>
<td>Data Source</td>
<td>Numerator &amp; denominator</td>
<td>Risk-adjustment</td>
</tr>
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<td>--------------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| 21  | Caesarean section rates | MDC 2007-2008 | Numerator – Number of caesarean sections  
Denominator – Number of selected primipara | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |
| 22  | Vaginal births following primary caesarean section | MDC 2007-2008 | Numerator – Number of vaginal births  
Denominator – Number of women aged 20-34 years giving birth who have had a previous primary caesarean section | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |
| 23  | Vaginal births with 3rd or 4th degree perineal tears | MDC 2007-2008 | Numerator – Vaginal births with significant tears (3rd or 4th degree)  
Denominator – Number of selected primipara | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |
| 24  | Caesarean section after induction of labour | MDC 2007-2008 | Numerator – Number of caesarean sections  
Denominator – Number of inductions among selected primipara | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |
| 25  | Apgar score of 4 or below at 5 minutes among selected primipara | MDC 2007-2008 | Numerator – Number of babies born with an Apgar score of 4 or below at 5 minutes  
Denominator – Number of term babies born to selected primipara | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |
| 26  | Repeat caesarean section rates (following primary caesarean section) | MDC 2007-2008 | Numerator – Number of caesarean sections  
Denominator – Number of women aged 20-34 years giving birth who have had a previous primary caesarean section | Care group (hospital based medical or midwife not transferred in; residual group - other), and socio-economic status |

**Note:** Data sources: APDC - NSW Admitted Patient Data Collection. RBDM - Registry of Births, Deaths and Marriages. MDC - NSW Midwives Data Collection. A case represents a hospital admission for a specified condition. DRG - Diagnosis Related Group v 5.1. A 'selected primipara' is a woman who: is 20-34 years of age at the time of giving birth; is giving birth for the first time at greater than 20 weeks gestation; has a singleton pregnancy (pregnancy with only one baby); has cephalic presentation (head-first), and is giving birth at term (between 37 to 41 weeks gestation). Charlson index (see Box 16.1). Socioeconomic status (see Box 16.1). AMI: acute myocardial infarction. Unplanned hospital readmissions (see Box 16.5).

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</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>Abscess/pyothorax</td>
<td></td>
<td>A condition where there is an accumulation of pus in the lung cavity.</td>
</tr>
<tr>
<td>Acetabular shell</td>
<td></td>
<td>A prosthetic shell for the cup shaved cavity on the service of the hip bone that holds the femur (thigh) bone.</td>
</tr>
<tr>
<td>Activity-based funding</td>
<td>ABF</td>
<td>A method of funding hospitals in which hospitals are funded on the activity they undertake in treating patients.</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>Acute myocardial infarction</td>
<td>AMI</td>
<td>See myocardial infarction.</td>
</tr>
<tr>
<td>Acute/Post Acute Care</td>
<td>APAC</td>
<td>A program providing acute care within the community by social workers, medical specialists and nurses.</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>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>Angina</td>
<td></td>
<td>An acute pain or tightness in the chest and in some cases, shoulders, jaw and arms. The pain is usually derived from insufficient blood reaching the heart muscle in the heart. Angina is a symptom of narrowing or blockage in the arteries that supply blood to the heart.</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Angiography</td>
<td></td>
<td>Medical imaging of blood vessels and organs using a contrast agent in the patient’s bloodstream.</td>
</tr>
<tr>
<td>Angioplasty</td>
<td></td>
<td>A method of reducing a blockage in an artery by opening out a balloon placed inside the artery at the point of narrowing. If the artery is a coronary artery the procedure is technically known as percutaneous transluminal coronary angioplasty (PTCA).</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td></td>
<td>A substance that is administered to eliminate micro-bacteria and related micro-organisms.</td>
</tr>
<tr>
<td>Apgar score</td>
<td>Apgar</td>
<td>A numerical score used to indicate a baby’s condition at one minute and five minutes after birth. Between 0 and 2 points are given for each of five characteristics: heart rate, breathing, colour, muscle tone and reflex irritability. The total score is between 0 and 10. Apgar stands for Activity, Pulse, Grimace, Appearance, and Respiration.</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>Atrial fibrillation</td>
<td></td>
<td>A condition marked by an irregular, rapid heart beat. It arises because the heart’s collecting chambers (atria) stop beating rhythmically and quiver uselessly (fibrillate).</td>
</tr>
<tr>
<td>Australian &amp; NZ Intensive Care Society</td>
<td>ANZICS</td>
<td>A bi-national research centre that assists with design, funding and execution of clinical trials as well as a collection agency for research and projects.</td>
</tr>
<tr>
<td>Australian Commission on Safety and Quality in Health Care</td>
<td>ACSQHC</td>
<td>A Commission established by the Australian, State and Territory Governments to develop a national strategic framework and associated work program that will guide its efforts in improving safety and quality across the health care system in Australia.</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>Australian Institute of Health and Welfare</td>
<td>AIHW</td>
<td>Australia’s national agency for health and welfare statistics and information.</td>
</tr>
<tr>
<td>Australian Orthopaedic Association National Joint Replacement Registry</td>
<td>AOANJRR</td>
<td>A specialist registry that defines, improves and maintains the quality of care of individuals receiving joint replacement surgery by collecting and analysing joint replacement data.</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>Bone morphogenic protein</td>
<td></td>
<td>A natural growth factor used to induce bone formation and heal fractures.</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
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</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>Cardiothoracic surgery</td>
<td></td>
<td>Chest surgery involving organs in the chest cavity.</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>Cellulitis</td>
<td></td>
<td>A type of skin infection.</td>
</tr>
<tr>
<td>Central line associated bloodstream infection</td>
<td>CLAB</td>
<td>An infection of the bloodstream resulting from central lines.</td>
</tr>
<tr>
<td>Charlson index</td>
<td></td>
<td>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</td>
</tr>
<tr>
<td>Chest drain/tube</td>
<td></td>
<td>A tube inserted into the chest cavity for the removal of air or fluid.</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 gallbladder.</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td></td>
<td>Inflammation of the gallbladder, usually caused by infection.</td>
</tr>
<tr>
<td>Cholelithiasis</td>
<td></td>
<td>Gallstones or stone like mass in the gallbladder.</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>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>Confidence interval</td>
<td></td>
<td>A statistical term describing a range (interval) of values within which we can be ‘confident’ that the true value lies, usually because it has a 95% or higher chance of doing so.</td>
</tr>
<tr>
<td>Coronary stent</td>
<td></td>
<td>A tube placed in the arteries that supplies blood to the heart, to keep the arteries open in the treatment of coronary heart disease.</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-DRG). 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>Drug-eluting cardiac stents</td>
<td>DES</td>
<td>A coronary stent that releases a drug to prevent the blockage of the artery.</td>
</tr>
<tr>
<td>Electrocardiogram</td>
<td>ECG</td>
<td>A test that records the electrical activity of the heart.</td>
</tr>
<tr>
<td>Endoscopy</td>
<td></td>
<td>The viewing of internal parts of the body, such as the inside of the lower bowel (the colon) with a colonoscope.</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 homes and a variety of other health care organisations.</td>
</tr>
<tr>
<td>Excision of lesion</td>
<td></td>
<td>Surgical removal of abnormal skin tissues such as melanoma or tumors.</td>
</tr>
<tr>
<td>Femoral head</td>
<td></td>
<td>A prosthesis component replacing the top femur head that connects to the hip cavity.</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>General Ledger</td>
<td></td>
<td>The main accounting record of a business/organisation. It will usually include accounts for such items as revenue and expense, current assets, fixed assets, liabilities, gains and losses.</td>
</tr>
<tr>
<td>Geriatrics</td>
<td></td>
<td>A specialty of medicine that deals with the health care of elderly patients.</td>
</tr>
<tr>
<td>Glucose</td>
<td></td>
<td>A simple sugar. Present in blood. Above average blood glucose levels are indicative of diabetes.</td>
</tr>
<tr>
<td>Gosford Hospital</td>
<td>GH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Greater Metropolitan Clinical Taskforce</td>
<td>GMCT</td>
<td>A taskforce formed to promote clinician and consumer involvement in planning and health service delivery in NSW.</td>
</tr>
<tr>
<td>Haemodialysis</td>
<td></td>
<td>The use of a dialysis machine to remove waste products from the blood due to renal failure.</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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</tr>
<tr>
<td>Haemoglobin</td>
<td>HIE</td>
<td>A protein component of the red blood cell which contains oxygen in the blood stream.</td>
</tr>
<tr>
<td>Health Information Exchange</td>
<td></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>Heart failure</td>
<td></td>
<td>When the heart functions less effectively in pumping blood around the body. It can result from a wide variety of diseases and conditions that can impair or overload the heart, such as heart attack, other conditions that damage the heart muscle directly, high blood pressure, or a damaged heart valve.</td>
</tr>
<tr>
<td>Hemiarthroplasties procedure</td>
<td></td>
<td>A procedure where only a portion of the joint is replaced by artificial material.</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 than provided by an intensive-care unit.</td>
</tr>
<tr>
<td>Hip stem</td>
<td></td>
<td>A prosthetic component attached to the shaft of the femur bone to enhance stability.</td>
</tr>
<tr>
<td>Hospital Standardised Mortality Ratios</td>
<td></td>
<td>A ratio which applies a risk-adjusted model to estimate how many patient deaths would be expected in the hospital over a certain period, adjusting for factors such as the patient’s diagnosis, age, sex, comorbidities, length of stay, admission status (emergency or elective) and whether they were transferred from another hospital.</td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td></td>
<td>A condition where there is a high level of potassium in the patient’s blood.</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td></td>
<td>A low concentration of salts in the body and blood.</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td></td>
<td>Surgical removal of the uterus.</td>
</tr>
<tr>
<td>Implantable cardioverter defibrillators</td>
<td>ICD</td>
<td>A small electronic device installed inside the chest to prevent sudden death from cardiac arrest due to life threatening abnormally fast heart rhythms.</td>
</tr>
<tr>
<td>Imprest medications</td>
<td>IPART</td>
<td>Medications stored and controlled near wards and allocated to patients by nursing staff.</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>Institute of Rheumatology and Orthopaedics</td>
<td>IRO</td>
<td>An orthopaedic surgery centre adjacent to the Royal Prince Alfred Hospital.</td>
</tr>
<tr>
<td>Intensive Care Coordinating and Monitoring Unit</td>
<td>ICCMU</td>
<td>An organisation to monitor intensive care activity as well as research and data collection for benchmarking Area Health Services. The ICCMU provides educational services as well as promoting excellence in standard of care in all NSW intensive care units.</td>
</tr>
</tbody>
</table>
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<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>International Classification of Diseases</td>
<td>ICD</td>
<td>The World Health Organisation's internationally accepted classification of diseases and related health conditions. The 10th revision, Australian modification (ICD-10-AM) is currently in use in Australian hospitals for admitted patients.</td>
</tr>
<tr>
<td>International Normalised Ratio</td>
<td>INR</td>
<td>A comparative rating of a patient's prothrombin time (PT) ratio. It is used as a standard for monitoring the effects of the blood thinning drug warfarin.</td>
</tr>
<tr>
<td>Intraocular lens</td>
<td>IOL</td>
<td>An artificial lens implanted in the eye, usually replacing the existing natural lens because it has been clouded over by a cataract.</td>
</tr>
<tr>
<td>Intravenous</td>
<td></td>
<td>The delivery of liquid substances into the patient's vein.</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>Junior Medical Officers</td>
<td>JMO</td>
<td>Clinicians of the hospital ranging from new medical graduates who are entering training programs to experienced medical staff who may have worked in hospitals for many years.</td>
</tr>
<tr>
<td>Laparoscopic surgery</td>
<td></td>
<td>Laparoscopic surgery is a surgical technique in which short, narrow tubes (trochars) are inserted into the abdomen through small (less than one centimetre) incisions. Through these trochars, long, narrow instruments are inserted. The surgeon uses these instruments to manipulate, cut, and sew tissue.</td>
</tr>
<tr>
<td>Laser capsulotomy</td>
<td></td>
<td>A laser surgery procedure to improve the patient's vision after a lens procedure.</td>
</tr>
<tr>
<td>Length of stay 1</td>
<td>LOS1</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</td>
<td>LOS2</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</td>
<td>LOS3</td>
<td>LOS3 is the total length of stay in study hospitals plus up to 2 other hospitals - one transfer in and one transfer out.</td>
</tr>
<tr>
<td>Liner/insert</td>
<td></td>
<td>A prosthesis component which fits inside the acetabular shell to allow smooth motion of the hip joint</td>
</tr>
<tr>
<td>Malignancy</td>
<td></td>
<td>Cancer</td>
</tr>
<tr>
<td>Mastectomy</td>
<td></td>
<td>Surgical removal of breast tissue, usually for treatment of malignant tumours.</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 structure and limited function of the body.</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>Methicillin-resistant Staphylococcus Aureus</td>
<td>MRSA</td>
<td>A bacteria strain that is resistant to beta-lactam type antibiotics.</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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</tr>
<tr>
<td>Methicillin-sensitive Staphylococcus Aureus</td>
<td>MSSA</td>
<td>A strain of the <em>Staphylococcus Aureus</em> bacterium that is sensitive (not resistant) to a number of antibiotics.</td>
</tr>
<tr>
<td>Monoprostheses</td>
<td></td>
<td>An &quot;all in one&quot; prosthesis component rather than individual prosthetic components.</td>
</tr>
<tr>
<td>Multifocal accommodative IOLs</td>
<td></td>
<td>IOLs which are designed to be flexible like a natural lens, changing shape as the distance of an object to the eye changes.</td>
</tr>
<tr>
<td>Multifocal apodized diffractive IOLs</td>
<td></td>
<td>IOLs which have gradual diffractive steps on the intraocular lens implant that creates a smooth transition between focal points. They also bend incoming light to the multiple focal points to increase vision in various lighting situations.</td>
</tr>
<tr>
<td>Multi-resistant <em>Acinetobacter baumannii</em></td>
<td>MRAB</td>
<td>An anti-biotic resistant bacterium that live in the soil, water and skin.</td>
</tr>
<tr>
<td>Myocarditis</td>
<td></td>
<td>Inflammation of the muscular wall (myocardium) of the heart.</td>
</tr>
<tr>
<td>National Antimicrobial Utilisation Surveillance Program</td>
<td>NAUSP</td>
<td>A program dedicated to antimicrobial utilisation and surveillance.</td>
</tr>
<tr>
<td>National E-Health Transition Authority</td>
<td>NeHTA</td>
<td>An authority established to improve electronic collection and exchange of health information.</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 in-patients to be produced.</td>
</tr>
<tr>
<td>National Inpatient Medication Chart</td>
<td></td>
<td>A chart intended to assist with minimising medication errors and related adverse patient outcomes.</td>
</tr>
<tr>
<td>National Partnership Agreement</td>
<td>NPA</td>
<td>An agreement aimed at fulfilling a COAG commitment by all jurisdictions to move to a more nationally consistent approach to activity based funding.</td>
</tr>
<tr>
<td>National Stroke Research Institute</td>
<td></td>
<td>A research institute for the treatment of stroke.</td>
</tr>
<tr>
<td>Non-ST elevation myocardial infarction</td>
<td>NSTEMI</td>
<td>A type of coronary artery disease that is associated with sudden rupture of plaque inside the coronary artery. The blockage may be partial or temporary with relatively minimal damage.</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>NSW Therapeutic Advisory Group Inc</td>
<td>NSW TAG</td>
<td>An independent, not for profit association representing Drug and Therapeutics Committees in NSW hospitals. The goal of NSW TAG is “to promote quality use of medicines by sharing unbiased, evidence-based information about drug therapy”.</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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</tr>
<tr>
<td>Nurse Unit Manager</td>
<td>NUM</td>
<td>A nurse who is accountable at an advanced practice level for the coordination of clinical practice and the provision of human and material resources in a specific patient/client area.</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>Ophthalmology</td>
<td></td>
<td>A medical specialty dealing with eye diseases.</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td></td>
<td>A medical specialty dealing with bones and joints.</td>
</tr>
<tr>
<td>Pacemaker</td>
<td></td>
<td>A small device that is placed in the chest or abdomen to help control abnormal heart rhythms.</td>
</tr>
<tr>
<td>Palliative care</td>
<td></td>
<td>Medical care to alleviate symptoms of life threatening and complex as well as terminal medical conditions.</td>
</tr>
<tr>
<td>Percutaneous coronary intervention</td>
<td>PCI</td>
<td>See angioplasty.</td>
</tr>
<tr>
<td>Peripherally inserted central catheter</td>
<td>PICC</td>
<td>A central line inserted at the elbow.</td>
</tr>
<tr>
<td>Platelet</td>
<td></td>
<td>The smallest of the formed elements of the blood, it is involved in the formation of blood clots.</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>Punctured lung/Pneumothorax</td>
<td></td>
<td>A condition where there is an accumulation of gas in the chest cavity resulting in the collapse of the lung.</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>Renal failure</td>
<td></td>
<td>A medical condition where the kidneys fail to adequately remove waste products from the blood.</td>
</tr>
<tr>
<td>Royal Newcastle Centre</td>
<td>RNC</td>
<td>The Royal Newcastle Centre is a health facility, which opened on Rankin Park campus next to John Hunter Hospital.</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>Section 100 drugs</td>
<td>s 100</td>
<td>Highly Specialised Drugs (HSD) for the treatment of chronic medical conditions under section 100 of the National Health Act 1953 (Cth).</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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</tr>
<tr>
<td>Selected primipara (for this case study)</td>
<td></td>
<td>The ‘selected primipara’ is defined as a woman who is 20-34 years of age, giving birth for the first time at between 37-41 weeks gestation and with a singleton pregnancy (pregnancy with only one baby) and cephalic presentation (head-first).</td>
</tr>
<tr>
<td>Senior medical officers</td>
<td>SMO</td>
<td>Senior clinicians of the hospital that have the right to perform a certain amount of private practice.</td>
</tr>
<tr>
<td>Separations</td>
<td></td>
<td>A hospital separation occurs whenever a patient is admitted to hospital (including a day-only admission) and is then discharged, transferred to another hospital or dies while in hospital.</td>
</tr>
<tr>
<td>ST Segment Elevation Myocardial Infarction</td>
<td>STEMI</td>
<td>A heart attack caused by a prolonged period of blocked blood supply, affecting a large area of the heart muscle.</td>
</tr>
<tr>
<td><em>Staphylococcus Aureus</em> bloodstream infections</td>
<td></td>
<td>An infection derived from a bacterium that is commonly found on human skin and mucosa.</td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td>When an artery supplying blood to the brain suddenly becomes blocked or bleeds. Often causes paralysis of parts of the body normally controlled by that area of the brain, or speech problems and other symptoms.</td>
</tr>
<tr>
<td>Sub-acute care</td>
<td></td>
<td>Clinical services provided to patients suffering or recovering from illnesses.</td>
</tr>
<tr>
<td>The National Health and Hospitals Network Agreement</td>
<td></td>
<td>An agreement between the Commonwealth and the States that sets out the reform framework to the health system.</td>
</tr>
<tr>
<td>Tissue Plasminogen Activator</td>
<td>tPA</td>
<td>A drug used to dissolve blood clots after a stroke so as to mitigate damage to the patient’s brain.</td>
</tr>
<tr>
<td>Toric lens/IOLs</td>
<td></td>
<td>A type of corrective lens where its surface's shape is both spherical and cylindrical.</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>Trainee Enrolled Nurses</td>
<td>TEN</td>
<td>A person who is training to become an EN in a facility approved by the Nurses and Midwives Board NSW for enrolled nurse education, and is involved in full time paid work and structured training which may be on or off the job.</td>
</tr>
<tr>
<td>Troponin T</td>
<td></td>
<td>A protein that is released into the bloodstream by the heart muscle only when it is damaged or dead.</td>
</tr>
<tr>
<td>Variable-life-adjusted-display</td>
<td>VLAD</td>
<td>A type of statistical process control charting, which allow hospitals to monitor their performance against a range of outcome indicators (eg, re-admissions, long stays, mortality).</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</td>
</tr>
<tr>
<td>Term</td>
<td>Abbreviation</td>
<td>Definition</td>
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</tr>
<tr>
<td>Visiting medical officers</td>
<td>VMO</td>
<td>A medical practitioner appointed by the hospital board to provide medical services for hospital (public) patients on an honorary, sessionally paid, or fee for service basis.</td>
</tr>
<tr>
<td>Warfarin</td>
<td></td>
<td>A medication that thins the blood, preventing blood clots from forming or growing larger in blood and blood vessels.</td>
</tr>
</tbody>
</table>