Case study 8 – Tracheostomy, or ventilation for greater than 95 hours

Hospital costs and outcomes study for NSW Health

Other Industries
July 2010
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1 Introduction and executive summary

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

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

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

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

To do this, we analysed management practices at the hospital-wide level, and did detailed case studies of 11 specific clinical areas. As costs, configurations of care and relevant indicators of outcome vary significantly depending on the condition of the patient and/or the procedure undertaken, these case studies allowed us to compare the hospitals on a more like-with-like basis. This document discusses our findings in one of these 11 clinical areas – tracheostomy, or ventilation for greater than 95 hours. (See Box 1.2 for the full list of clinical areas we examined, how they were selected, and how we conducted the case studies.)
Introduction and executive summary

Box 1.1 NSW Health project

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

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

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

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

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

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

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

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

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

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

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

For further information on our methodology and broad findings on costs, outcomes and configurations of care, see our main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*. Our detailed findings on the other case study areas can be found in our reports on each area.
1.1 Why did we select tracheostomy, or ventilation for greater than 95 hours as one of the case studies?

This diagnostic related group (DRG) contains patients with a very wide range of clinical conditions that frequently require prolonged mechanical ventilation in an intensive care setting. Tracheostomy or ventilation for greater than 95 hours was selected as one of the clinical areas for detailed study because it involves:

- very high costs, with significant differences in reported costs between hospitals
- a very diverse mix of clinical conditions among the patients of this DRG, and
- large differences in reported lengths of stay between patients.

1.2 What was the scope of the case study?

This case study compares the costs, configurations of care and outcomes related to:

- patients who received a tracheostomy\(^1\), or
- patients who did not have a tracheostomy but were placed on ventilation for more than 95 hours.

Patients in this case study have varied diagnoses, but would usually be receiving care in an intensive care unit (ICU) or high dependency unit (HDU). There is only 1 single DRG for this case study grouping (see Table 1.1).

**Table 1.1 DRG included in the scope of this case study**

<table>
<thead>
<tr>
<th>DRG</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A06Z</td>
<td>Tracheostomy or ventilation &gt;95 hours</td>
</tr>
</tbody>
</table>

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

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\(^1\) 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.
1.3 What were the key findings of the case study?

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

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

Our key findings are summarised below.

1.3.1 Number and mix of patients

Across the study hospitals there were 841 patients in 2008/09 who had a tracheostomy or were placed on ventilation for more than 95 hours. The average age of patients was 60 years. The 3 larger hospitals (RPAH, RNSH and JHH) had the majority of patients, with 83% of all patients. The patients in this group had a wide variety of medical diagnoses, including lung, liver, vascular, cardiac, intestinal and neurological diseases as well as trauma, infections and rehabilitation care.

The specialist roles at the hospitals influenced the types of patients in this DRG at the hospitals. For example, RPAH has a specialist liver unit and is the liver transplant centre in NSW. It had more than 20 patients with principal diagnosis codes related to liver failure. RNSH has the NSW spinal unit and was the only hospital with patients with a principal diagnosis code relating to major cervical spinal cord damage.

For this case study, we have considered the DRG grouping as a whole. For some other clinical case studies we were able to identify key subgroups of patients with similar costs, lengths of stay and outcomes (eg, for the hip joint replacement case study, we identified two main subgroups of patients - those with a diagnosis of arthritis and those with a diagnosis of a fracture). However, the tracheostomy or ventilation group included such a very large number of possible sub groupings, the resultant cases per subgroup would be too low and the confidence intervals too large to draw meaningful conclusions. This would reduce the reliability of the statistical analysis. For this reason, we have analysed data for the group as a whole.

2 Diagnoses codes in the range K70-K74.
3 Diagnosis code S14.
If more meaningful comparisons are to be done, a much larger data set with the capacity to identify like patients would be required.

1.3.2 Average length of stay

Our analysis indicates that the measure often used in the National Hospital Cost Data Collection (NHCDC) and DRG benchmarking – the average ‘acute episode length of stay’, which is the length of an acute episode – is not a consistent basis for comparing length of stay for patients in this case study. This is because of differences in the way hospitals reclassify patients’ care from ‘acute’ to ‘rehabilitation’ care and because of differences in access to other rehabilitation facilities. Our analysis also indicates that for such comparisons to be meaningful, the length of stay needs to include all consecutive episodes (acute, rehabilitation and other) at the study hospital, plus the length of related stays at other hospitals.

For our analysis, we have included 3 alternative measures of length of stay:

- LOS1 – acute episode length of stay in study hospital
- LOS2 – total stay in study hospital including acute episode and other consecutive episodes for DRG A06Z
- LOS3 – total stay in study hospital (LOS2) plus length of stay for one prior hospital stay (transfer in) and one subsequent hospital stay (transfer out).

For this particular case study, we found that the average length of stay was high in absolute terms, regardless of whether we are looking at LOS1 or LOS3. But given the diversity of patient types, and range in individual patient length of stay, the variation in the average length of stay is surprisingly small. RNSH had the longest length of stay on all measures: 32 days (LOS1) and 43 days (LOS3), which was largely affected by their spinal injury patients who had extremely long stays. JHH on the other hand has the shortest length of stay using LOS1, 24 days. Using LOS3, both GH and JHH had short length of stays of around 33 days.

1.3.3 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. Based on the NHCDC, half of the cost of care for these patients is the care provided in ICU. The direct cost per day based on the NHCDC ranges from $2,362 to $3,643 (see Table 1.2).
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Table 1.2  NHCDC cost per day in ICU

<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>Total Cost (excl depreciation)</td>
<td>$116,114</td>
<td>$98,164</td>
<td>$99,017</td>
<td>$119,326</td>
<td>$92,076</td>
</tr>
<tr>
<td>Direct ICU</td>
<td>$47,503</td>
<td>$46,858</td>
<td>$38,190</td>
<td>$42,287</td>
<td>$40,438</td>
</tr>
<tr>
<td>Total ICU</td>
<td>$57,883</td>
<td>$60,896</td>
<td>$49,330</td>
<td>$53,096</td>
<td>$52,187</td>
</tr>
<tr>
<td>Average LOS in ICU/HDU</td>
<td>15.7</td>
<td>13.8</td>
<td>15.5</td>
<td>17.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Direct cost/day in ICU</td>
<td>$3,026</td>
<td>$3,395</td>
<td>$2,464</td>
<td>$2,362</td>
<td>$3,643</td>
</tr>
</tbody>
</table>

Source: Final cost data 2008/09, NHCDC.

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. In light of this issue, and the different mix of patient types at each study hospital, the following comparison of costs should be interpreted with caution.

To compare the costs related to the case study areas at the study hospitals, we examined the management and use of a selection of clinical resources used directly for patient care in that area. For patients in this case study, the main clinical resources we examined were nursing staff in wards, imaging and pathology. The costs that we calculated from direct nursing costs and diagnostic costs (imaging and pathology) represent less than 20% of the total cost of treating these patients, when compared to cost reported in the NHCDC.

We had aimed to estimate medical staff costs and pharmacy costs for this case study, 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.

For this particular DRG, many high cost medications or consumable items are not costed directly to patients, so little patient level data is available on many significant expense items. If patient level direct costs were collected in a consistent way and these were able to be linked with a data set like that held by the ANZICS (Australian & NZ Intensive Care Society) registry, then more meaningful comparative costing may be possible.

Cost of nursing staff in wards

Nursing is one of the largest expenditure areas in hospital budgets and is also a significant part of the cost of the acute care of patients in ICU, who are frequently receiving one-to-one nursing care. Some hospitals have some high dependency patients on the ICU ward, and they may change these beds between ICU and HDU nurse staffing levels depending on clinical demand.

4 Medical staffing and pharmacy are discussed in the main report, NSW Health costs and outcomes study by IPART for selected NSW hospitals, Chapters 9 and 14.
We estimated nursing costs for the acute episode only. Therefore results need to be interpreted taking into account differences in LOS1 and LOS3 for each hospital. This is particularly important for patients in this case study, as there is a large difference between the measures of LOS1 and LOS3. By only accounting for LOS1, nursing cost for such patients will be understated.

We found that average length of stay and nursing hours per patient day (ie, the nursing staff-to-patient ratio) are the main drivers of nursing costs at the study hospitals. 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. The majority of the nursing was provided by registered nurses, 80% to 84%, and a further 10% to 16% provided by clinical nurse specialists.

The hospitals use inpatient fractions (IFRACs) to allocate staff time to acute care and other staff responsibilities. We found that nursing costs at RNSH and GH are highly sensitive to the IFRACs the hospitals apply. When all nursing costs are attributed to inpatient care (ie, IFRAC=1), the variation in nursing costs across the study hospitals is smaller.

Imaging and pathology costs

We found that imaging and pathology costs varied between the study hospitals.

- JHH had the lowest imaging expenditure ($1,538) while RNSH had the highest ($2,852). The largest component of imaging costs, across all the study hospitals relates to CT and MRI scans.

- The average expenditure on pathology was lowest at JHH ($2,518) and greatest at RNSH ($6,958). However, given the diversity of patients and a lack of detail on the types of pathology tests performed, we were unable to draw out more meaningful comparisons of pathology use.

National Hospital Cost Data Collection

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

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

the provisional costs. For this case study we used the final NHCDC costs only for pathology and total costs.

We found that comparing our calculated costs for direct nursing, imaging and pathology to the study hospitals’ NHCDC estimates was not appropriate, because the cost buckets in the NHCDC contain a main ICU bucket and then separate ICU cost buckets for pathology, imaging, drugs and allied health. Simply comparing our diagnostic costs to the ICU-pathology and ICU-imaging costs is not possible, because a portion of diagnostic costs are also included in the main ICU cost bucket. Similarly, nursing costs cannot be compared, as these are also included in the main ICU cost bucket. We were not able to further break down this main ICU cost bucket into its components.

1.3.4 Configurations of care

We identified the following 3 differences in the way the study hospitals managed and provided care for patients in this case study:

- role delineation in NSW ICUs
- provision of other services by ICU teams, and
- approaches to performing tracheostomies and ventilating patients.

Role delineation in NSW ICUs

In NSW, there are role delineation levels for different ICU which correspond to the level of service that they are expected to provide. The 3 major hospitals in the review have a role delineation level of 6, which is the highest level, while GH and BLH have a role delineation level of 5. The types of services that the ICUs offer will vary depending on their role delineation level, hospital casemix and how each hospital defines an ICU and HDU patient.

Provision of other services by ICU teams

All of the ICUs provided some other services to the hospital and sometimes to a network of hospitals. These services included retrieval, consultative advice and rapid response and resuscitation teams.

Approaches to performing tracheostomies and ventilating patients

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 as they can only be done on 2 days of the week.

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7 Percutaneous means to be performed through the skin via needle puncture.
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)). There was no data available on the use of these technologies.

1.3.5 **Outcome, safety and quality indicators**

The terms of reference for this study required us to analyse available data on differences in clinical outcomes across the 5 study hospitals. However, we found that few data on indicators of clinical outcomes are collected consistently across hospitals, or on a state-wide (or national) basis. Further, 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.

Therefore, we worked with clinical experts to establish an initial 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. However, further work is required to develop standard indicators for measuring care and/or outcomes in ICUs.

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.

1.4 **What are the key implications of these findings?**

**DRGs are not uniform groupings**

Benchmarking studies of the performance of individual hospitals and the public and private hospital sectors often use DRGs as the basis for comparing length of stay and cost. This assumes that patients whose condition or procedure has been coded with the same DRG are relatively similar. Models for casemix or episode-based funding are based on similar assumptions.

However, our analysis clearly indicates that such assumptions are not valid for all conditions/procedures. For this particular case study, our patient data shows that there are 390 different principal diagnosis codes that fall within this single DRG for the study hospitals, covering many clinical conditions including lung, liver, vascular, cardiac, intestinal and neurological disease as well as trauma, infections and rehabilitation care.
To develop a methodology for comparing hospitals on a reasonable basis it will be necessary to ‘drill down’ into some DRGs – for example, to the principal diagnosis codes – to identify sufficient similar subsets of patients. For DRGs such as tracheostomy, or ventilation for greater than 95 hours, drilling down into subgroups may not be statistically viable due to the low number of cases. However, the wide variation in the type of patients that can come under this DRG needs to be accounted for.

Moreover, episodes are not measured consistently and episode length of stay may be measured in different ways for DRGs where patients receive rehabilitation/transfers. Different practices in patient reclassification and access to other facilities like rehabilitation or step-down units will affect the reported LOS for the acute episode.

As such, for this case study a single DRG of A06Z does not provide a reasonable basis for comparing hospitals’ cost performance or setting episode funding levels. In NSW, ICUs are separately funded on a statewide basis, not an episode basis. Until there are better methods for comparative costing of ICU patients the block funding of ICUs is appropriate.

Opportunities for improvement

The large diversity of patients in this DRG and relatively small number of patients will make benchmarking of costs extremely difficult regardless of the quality of information available. The ANZICS data registry currently provides an excellent data set to compare case types and outcomes on a level that is far more refined than the casemix system. National data provides a larger data set to enable better quality performance comparisons.

Linkage of costs like staff, consumables and medications at the patient level with the ANZICS registry data has greater potential to provide meaningful comparisons on costs and outcomes.

Developing standard indicators

We consider there is a case for NSW Health and other clinical expert groups to undertake further work to develop a set of standard indicators for measuring care and/or outcomes in ICUs.

1.5 List of 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.
1.6 What does the rest of this report cover?

The rest of this report discusses the findings of the tracheostomy or ventilation for greater than 95 hours case study in more detail:

- Chapter 2 compares the number and mix of these types of patients at the study hospitals.
- Chapter 3 compares the length of stay for the different types of patients at the study hospitals, and describes the method we used to compare length of stay on a consistent basis.
- Chapter 4 describes how we analysed the costs for each patient by identifying the main clinical resources used to provide inpatient care, then estimating and comparing the level of each resource used at the study hospitals. It also compares our cost estimates with estimates based on the preliminary or final data reported to NSW Health as part of the NHCDC.
- Chapter 5 compares the configurations of care for patients at the study hospitals and highlights key differences.
- Chapter 6 discusses the indicators of outcome, safety and quality we identified as clinically meaningful and for which data was readily available. It then compares the available data on these indicators across the study hospitals.
- The appendices contain the complete list of recommendations for our hospital costs and outcomes study and provide more detailed information on staff rostering. A glossary is also included at the end of this report.
2 The type, number and mix of patients across the study hospitals

To meaningfully compare data on the costs, configurations of care and outcomes for a particular condition or procedure, the patients to which the data relate must be reasonably similar – to allow ‘like with like’ comparisons. However, this DRG contains patients with a very wide range of clinical problems that frequently require prolonged mechanical ventilation in an intensive care setting.

These patients are associated with a high cost, reflecting the prolonged time in ICU and a wide range of procedures, diagnostic services and medications and intensive support from highly skilled clinical staff. Although the nature of these patients varies widely, for statistical reasons, we have analysed them as a single group where possible.

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

We found that the 3 larger hospitals (RPAH, RNSH and JHH) had the majority of patients. As BLH and GH have lower numbers of cases, their results need to be interpreted with care.

The sections below discuss our analysis of patient numbers and mix in more detail.
Table 2.1  Tracheostomy or ventilation for greater than 95 hours cases at study hospitals, DRG A06Z

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>258</td>
<td>87</td>
<td>216</td>
<td>57</td>
<td>223</td>
<td>841</td>
</tr>
<tr>
<td>Ventilated &gt;95hrs (no.)</td>
<td>227</td>
<td>79</td>
<td>197</td>
<td>55</td>
<td>190</td>
<td>748</td>
</tr>
<tr>
<td>Ventilated &gt;95hrs (%)</td>
<td>88</td>
<td>91</td>
<td>91</td>
<td>96</td>
<td>85</td>
<td>89</td>
</tr>
<tr>
<td>Transfers in (%)</td>
<td>35.7</td>
<td>46.0</td>
<td>43.1</td>
<td>21.1</td>
<td>30.0</td>
<td>36.1</td>
</tr>
<tr>
<td>Transfers out (%)</td>
<td>23.6</td>
<td>19.5</td>
<td>36.1</td>
<td>17.5</td>
<td>20.6</td>
<td>25.2</td>
</tr>
<tr>
<td>Emergency admissions (no.)</td>
<td>126</td>
<td>40</td>
<td>122</td>
<td>36</td>
<td>105</td>
<td>429</td>
</tr>
<tr>
<td>Emergency admissions (%)</td>
<td>48.8</td>
<td>46.0</td>
<td>56.5</td>
<td>63.2</td>
<td>47.1</td>
<td>51.0</td>
</tr>
<tr>
<td>Planned admission (no.)</td>
<td>40</td>
<td>4</td>
<td>22</td>
<td>6</td>
<td>37</td>
<td>109</td>
</tr>
<tr>
<td>Planned admission (%)</td>
<td>15.5</td>
<td>4.6</td>
<td>10.2</td>
<td>10.5</td>
<td>16.6</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Note: See Boxes 2.1 and 2.2 for details on how we calculated the number of cases, and identified emergency and planned admissions and transfers.

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

Box 2.1 provides more detail on how we calculated the number of cases at each hospital

Box 2.1  How we calculated the number of tracheostomy cases

To calculate the number of patient cases in study hospitals, we:

- used patient episode data for 2008/09
- counted adjoining episodes as part of the same stay (ie, adjoining episodes counted as one case)
- only included patient data where the whole patient stay occurred within 2008/09 (ie, all episodes and adjoining episodes had to start on or after 1 July 2008 and end on or before 30 June 2009 to be counted)
- only included patient data where the first episode in the year in the study hospital was coded as a DRG for a tracheostomy, or ventilation for greater than 95 hours (ie, episode sequence number had to be 1).

The approach prevented double counting. It excluded cases where the patient was admitted for a different procedure and later reclassified. This may occur, for example, if the patient was admitted for another condition and developed complications requiring a tracheostomy or ventilation, or where there is miscoding.

Note that our approach means that the number of cases we identified will be less than the number of separations in 2008/09.
There is a large transfer component in this case study group with an average of 36% of patients coming from another facility and 25% of these patients being transferred out to another facility. GH has the highest proportion of patients that are transferred in from another facility (46%) and it also has one of the lowest transfers out rates among the study hospitals (19.5%).

All major ICUs are state wide resources. They do not only provide high level support for the hospital in which they are located, but need to take in patients from all over the state. This is because critically ill patients can and will be transferred from anywhere in the state.

Emergency admissions are generally high for this DRG. RNSH and BLH have the highest percentage of emergency admissions (although BLH’s result is affected by their low numbers). The other 3 study hospitals have a similar emergency admission ratio of around 46% to 49%. Conversely, planned admission numbers are much lower in this case study group. Box 2.2 describes the method we used to identify planned and emergency admissions and transfers.

### Box 2.2 How we identified emergency admissions, planned admissions and transfers

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

Emergency admissions were identified by linking emergency department attendance data with admitted patient data where the time of arrival and departure in the emergency department matched with the admission time.

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

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

### 2.1 Comparison of casemix at the study hospitals

There are 390 different principal diagnosis codes that fall within this DRG for the study hospitals, covering many clinical conditions including lung, liver, vascular, cardiac, intestinal and neurological disease as well as trauma, infections and rehabilitation care. Within the hospitals patients in this DRG also vary widely in the types of diagnosis costs (see Figure 2.1).
The type, number and mix of patients across the study hospitals

The casemix of patients in this DRG is influenced by the specialist role of the hospital. For example, RPAH had over 20 patients in this DRG with principal diagnosis codes related to liver failure. RPAH has a specialist liver unit and is the liver transplant centre in NSW. RNSH was the only hospital with principal diagnosis code relating to cervical spinal cord damage. RNSH had 9 patients in this DRG and 5 with a complete lesion of the cervical spinal cord with an average length of stay of 171 days.

Figure 2.1 Comparison of the number of cases and diagnosis codes

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

2.1.1 Average age of patients

The average age of patients across all the study hospitals for this group is 60. JHH has the lowest average age of all the study hospitals (57 years). This is because 12% of its patients were under 25 at the time of admission. This is high compared to the other study hospitals where the percentage of patients under 25 is 5% or less. This reflects the fact that JHH also have a children’s hospital, whereas the other study hospitals do not. The age distribution of patients indicates that the population cohort in this case study tends to be older (see Figure 2.3).
2 The type, number and mix of patients across the study hospitals

Case study 8 – Tracheostomy, or ventilation for greater than 95 hours

Figure 2.2 Average Age of patients, 2008/09

![Average Age of patients, 2008/09](image)

**Note:** Age at date of admission.

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

Figure 2.3 Age distribution of patients, 2008/09

![Age distribution of patients, 2008/09](image)

**Note:** Age at date of admission.

**Data source:** HIE inpatient statistics, 2008/09 and IPART analysis.
3 Length of stay across study hospitals

We examined the average length of stay of patients because it is one of the factors that influence the cost of an individual’s hospital care. As the staffing levels for patients are much higher in ICU than in other wards, the time in ICU is a dominant factor in the cost of these patients. 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 this case study using 3 different measures:

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

Box 3.1 provides more detail on these measures. The section below sets out our analysis of length of stay.
**Box 3.1 The 3 measures of length of stay we used for this case study**

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

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

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

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

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

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

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

   We consider that LOS3 is a more consistent basis for comparing average length of stay for certain conditions/procedures because it takes account of differences in hospital:
   - administrative practices for reclassifying patients between their acute care and other phases of care (type changes)
   - access to rehabilitation facilities (transfers out)
   - patterns of referral from other hospitals (transfers in).

---

**3.1 Comparing length of stay for all tracheostomy patients or patients on ventilation for more than 95 hours**

Patients in this DRG spend on average between 10 and 14 days in ICU and around 1 to 4 days in HDU. In ICU patients normally have a dedicated nurse 24/7. In HDU, the nursing intensity is slightly less with 1 nurse caring for 2 patients.
Table 3.1 Average length of stay by LOS1, ICU and HDU beds

<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>LOS1</td>
<td>29.7</td>
<td>27.8</td>
<td>32.1</td>
<td>29.8</td>
<td>23.8</td>
</tr>
<tr>
<td>Time in ICU</td>
<td>12.8</td>
<td>10.4</td>
<td>14.0</td>
<td>14.7</td>
<td>10.1</td>
</tr>
<tr>
<td>Time in HDU</td>
<td>2.9</td>
<td>3.4</td>
<td>1.5</td>
<td>3.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Note:* ICU and HDU beds measured by HIE Data using bed types 15 and 34.
*Source:* HIE inpatient statistics, 2008/09 and IPART analysis.

Table 3.2 compares the length of stay between the hospitals using the LOS1 and LOS3 measures and Figure 3.1 presents the distribution of patients by their LOS1. Generally, the length of stay for these patients is long in absolute terms whether looking at LOS1 or LOS3. This reflects the fact that many of these patients require a period of rehabilitation that is provided at the initial hospital or after a transfer to another hospital for rehabilitation.

Table 3.2 Average length of stay by LOS1 and LOS3

<table>
<thead>
<tr>
<th></th>
<th>RPAH</th>
<th>GH</th>
<th>RNSH</th>
<th>BLH</th>
<th>JHH</th>
<th>All Study hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases</td>
<td>258</td>
<td>87</td>
<td>216</td>
<td>57</td>
<td>223</td>
<td>841</td>
</tr>
<tr>
<td>LOS1 (days)</td>
<td>29.7</td>
<td>27.8</td>
<td>32.1</td>
<td>29.8</td>
<td>23.8</td>
<td>28.6</td>
</tr>
<tr>
<td>LOS3 (days)</td>
<td>37.1</td>
<td>33.2</td>
<td>43.2</td>
<td>35.1</td>
<td>33.4</td>
<td>37.2</td>
</tr>
<tr>
<td>Diff btw LOS3 and LOS1 (%)</td>
<td>25.0</td>
<td>19.5</td>
<td>34.5</td>
<td>17.9</td>
<td>40.3</td>
<td>30.1</td>
</tr>
</tbody>
</table>

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

With such great diversity of patient types and individual variation in length of stay the average length of stay is surprisingly similar. The longer average length of stay at RNSH is significantly influenced by their spinal cord injury patients.
Figure 3.1 Distribution of patients by LOS1

Data source: HIE inpatient statistics, 2008/09 and IPART analysis.
4 Costs of providing inpatient care

Caring for a patient in intensive care is very expensive. Patients in this DRG spend about half of their time in ICU. Based on the NHCDC half of the cost of care for these patients is the care provided in ICU. The direct cost per day based on the NHCDC ranges from $2,362 to $3,643 (see Table 4.1).

Table 4.1 NHCDC cost per day in ICU, 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>Total Cost (excl depreciation) ($)</td>
<td>116,114</td>
<td>98,164</td>
<td>99,017</td>
<td>119,326</td>
<td>92,076</td>
</tr>
<tr>
<td>Direct ICU ($)</td>
<td>47,503</td>
<td>46,858</td>
<td>38,190</td>
<td>42,287</td>
<td>40,438</td>
</tr>
<tr>
<td>Total ICU ($)</td>
<td>57,883</td>
<td>60,896</td>
<td>49,330</td>
<td>53,096</td>
<td>52,187</td>
</tr>
<tr>
<td>Average LOS in ICU (days)</td>
<td>15.7</td>
<td>13.8</td>
<td>15.5</td>
<td>17.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Direct cost/day in ICU ($)</td>
<td>3,026</td>
<td>3,395</td>
<td>2,464</td>
<td>2,362</td>
<td>3,643</td>
</tr>
</tbody>
</table>

Source: Final cost data 2008/09, NHCDC.

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. In light of this issue, and the different mix of patient types at each study hospital, the following comparison of costs should be interpreted with caution.

GH clinicians note that it is important to distinguish between ICU and HDU bed days in the units, especially in view of the fact that the ICU funding formula tracks ICU bed days.

Analysis of the use of ward nursing, imaging, pathology and theatre time that we have done in the other case studies can assist in understanding variations in practice where the patients being examined share a reasonably common clinical condition. However, for this DRG, given the wide diversity of clinical conditions, any analysis is only going to reflect that diversity in the use of these resources. If more meaningful comparisons are to be done, a much larger data set with the capacity to identify ‘like patients’ would be required. If patient level direct costs were collected in a consistent way and these were able to be linked with a data set like that held by the ANZICS ICU registry, then comparative costing may be possible.
Notwithstanding the above, this chapter presents our analysis of the major clinical resources used to provide inpatient care for patients that receive a tracheostomy or are on ventilation for more than 95 hours. The main clinical resources we examined were:

- nursing staff in wards
- imaging, and
- pathology.

The costs that we calculated for direct nursing costs and diagnostic costs (imaging and pathology) represent less than 20% of the total cost of treating these patients, when compared to the NHCDC costs for 2008/09.

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

For this particular DRG, many high cost medications or consumable items are not costed directly to patients so little patient level data is available on many significant expense items. If patient level direct costs were collected in a consistent way and these were able to be linked with a data set like that held by the ANZICS registry, a significant part of the cost of the acute care of patients in ICU, who receive one-to-one or sometimes even two-to-one nursing care, can be more accurately costed.

### 4.1.1 Methodology

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

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

Our methodology for estimating nursing costs and its limitations are briefly described in Box 4.1 and in more detail in Chapter 8 of the main report, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*. Further, these estimates should therefore be considered in light of the discussion in Chapter 3 on the limitations of using LOS1 relative to LOS3 (the length of stay for the acute plus other episodes plus up to one transfer in and one transfer out).
Box 4.1 How we estimated nursing costs

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

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

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

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

Qualifications

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

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

At RPAH, JHH and BLH the applied IFRACs are 1 or close to 1. At GH and RNSH the IFRACs vary by ICU ward ranging from 0.6 to 1 and 0.8 to 1, respectively. These IFRACs may be valid, because ward nursing staff may spend time on non-inpatient activities (eg, performing duties relating to other services which the ICU may provide - see Chapter 5 on Configurations of Care). However, the purpose of our analysis is to show how sensitive the nursing cost estimates are to IFRACs. IFRACs also underlie the NHCDC estimates of ward costs.

4.1.3 Ward nursing costs per acute episode

Table 4.2 contains comparisons of our estimates of the average ward nursing costs for the 5 study hospitals. Our estimates indicate that the nursing costs that should be attributed to this DRG using the existing IFRACs range from $8,995 for GH to $14,999 for BLH. When all nursing costs are attributed to inpatient care (ie, IFRAC = 1), it leads to a smaller variation in nursing costs across the study hospitals, ranging from $11,879 for GH to $14,998 for BLH.

<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>No. of cases</td>
<td>258</td>
<td>87</td>
<td>216</td>
<td>57</td>
<td>223</td>
</tr>
<tr>
<td>LOS1 (days)</td>
<td>29.7</td>
<td>27.8</td>
<td>32.1</td>
<td>29.8</td>
<td>23.8</td>
</tr>
<tr>
<td>LOS3 (days)</td>
<td>37.1</td>
<td>33.2</td>
<td>43.2</td>
<td>35.1</td>
<td>33.4</td>
</tr>
<tr>
<td>Acute episode nursing cost ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFRAC = 1</td>
<td>14,820</td>
<td>11,879</td>
<td>14,449</td>
<td>14,998</td>
<td>13,573</td>
</tr>
<tr>
<td>With IFRAC</td>
<td>14,654</td>
<td>8,995</td>
<td>10,366</td>
<td>14,999</td>
<td>13,471</td>
</tr>
<tr>
<td>Impact of IFRAC (%)</td>
<td>-1</td>
<td>-24</td>
<td>-28</td>
<td>0</td>
<td>-1</td>
</tr>
</tbody>
</table>

Note: Episode nursing cost calculated using acute episode LOS measure (LOS1).

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

8 Setting IFRACs to 1 means that we allocated 100% of the nursing time to inpatient care.
4.1.4 Main factors affecting nursing costs

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

- IFRACs
- length of stay
- nursing hours per patient day (i.e., nursing staff-to-patient ratio)
- nursing staff mix.

IFRACs affect both the nursing costs per acute episode and the nursing costs per patient day (i.e., per day of the acute episode). See Table 4.2 and Table 4.3. Setting IFRACs to 1 increases the costs at all the hospitals (except BLH), but has the biggest impact on RNSH and GH because the IFRACs used at these hospitals are the lowest.

Although one might expect a clear relationship between nursing cost and length of stay, this is not so apparent in the figures presented in Table 4.2. The highest nursing cost per acute episode is at BLH and yet RNSH’s LOS1 is the longest. To understand these differences we need to look further into the nursing staff mix and nursing hours per patient, leaving aside the impact of IFRACs.

The number of nursing hours per patient day and the staff mix affect the nursing cost per patient day. In principle, a hospital with a high staff-to-patient ratio is likely to have higher costs per patient day than a hospital with a lower staff-to-patient ratio. But the higher number of hours can be offset by lower cost per nursing hour if there is a high proportion of Enrolled Nurses (ENs) and Assistants in Nursing (AINs) in the staff mix. In the case of ICUs, the skills required of the nursing staff means that the majority of nursing is provided by Clinical Nurse Specialists (CNSs) and Registered Nurses (RNs). At the study hospitals, around 93% to 95% of nursing hours are provided by RNs and CNSs. JHH has the highest percentage of CNS, 16%, as a result, it also has the highest nursing cost per patient day.

The total nursing hours per patient day over the whole inpatient episode varies widely among the study hospitals. Nursing hours per patient day is a measure reflecting the ratio of nurses to patients. Therefore, where nursing hours per patient day are low, this implies that there is a relatively high number of patients given the number of nurses. Nursing hours per patient day is lowest at RNSH and GH and highest at JHH. This is a key factor contributing to the variation in the cost for the acute episode in this case study. At JHH, although they have the shortest LOS1, they have the highest nursing cost per patient day and the highest nursing hours per patient day, as a result their nursing cost per acute episode is not the lowest.

A further complication is that some of the study hospitals have the flexibility to change beds between ICU and HDU depending on the patient load. This will influence the nursing staff-to-patient ratios, making it difficult to compare the ICUs directly. Therefore the figures presented in these nursing data tables need to be interpreted with care.
Table 4.3 Nursing costs and hours per patient day, with and without IFRACs

<table>
<thead>
<tr>
<th></th>
<th>Nursing costs per patient day</th>
<th>Nursing hours per patient day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With IFRAC</td>
<td>IFRAC=1</td>
</tr>
<tr>
<td>RPAH</td>
<td>493</td>
<td>499</td>
</tr>
<tr>
<td>GH</td>
<td>324</td>
<td>427</td>
</tr>
<tr>
<td>RNSH</td>
<td>323</td>
<td>450</td>
</tr>
<tr>
<td>BLH</td>
<td>504</td>
<td>504</td>
</tr>
<tr>
<td>JHH</td>
<td>565</td>
<td>569</td>
</tr>
</tbody>
</table>

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

Table 4.4 provides a detailed breakdown of the nursing costs components that we have modelled, based on actual payroll data for the year 2008/09 and including the hospital’s IFRACs.

Table 4.4 Nursing costs and hours by award category, with IFRACs

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>CNS</th>
<th>RN</th>
<th>EN</th>
<th>AIN</th>
<th>Student/ trainee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing hours by award category (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAH</td>
<td>100</td>
<td>10</td>
<td>84</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>GH</td>
<td>100</td>
<td>11</td>
<td>81</td>
<td>7</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>RNSH</td>
<td>100</td>
<td>11</td>
<td>83</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BLH</td>
<td>100</td>
<td>13</td>
<td>81</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>JHH</td>
<td>100</td>
<td>16</td>
<td>80</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Nursing cost per hour ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAH</td>
<td>39</td>
<td>45</td>
<td>39</td>
<td>30</td>
<td>23</td>
<td>21</td>
</tr>
<tr>
<td>GH</td>
<td>40</td>
<td>47</td>
<td>40</td>
<td>30</td>
<td>23</td>
<td>21</td>
</tr>
<tr>
<td>RNSH</td>
<td>39</td>
<td>47</td>
<td>39</td>
<td>30</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>BLH</td>
<td>41</td>
<td>44</td>
<td>42</td>
<td>29</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>JHH</td>
<td>40</td>
<td>43</td>
<td>40</td>
<td>30</td>
<td>23</td>
<td>19</td>
</tr>
</tbody>
</table>

Note: There is no significant change to these figures with IFRAC=1.

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

Although we are able to compare the our estimated costs to that reported in the NHCDC for the other case studies, such a comparison for this particular case study is not possible. This is because the cost buckets in the NHCDC have a separate single category for ICU which includes nursing, medical, pharmacy, imaging, pathology, and other ICU related costs.
4.2 Imaging costs

Table 4.5 shows the average cost for all imaging tests during the period of the patient’s acute episode. Our methodology for calculating imaging costs is explained in Box 4.2.

We found that the average expenditure on imaging varies between the hospitals, although imaging costs in general make up a small component of the total cost of a case. RNSH has the highest imaging expenditure at $2,852, while JHH has the lowest expenditure, $1,538. We found that only a relatively small proportion of imaging costs are incurred on the day of admission.

In the NHCDC, there is a separate cost bucket for ICU imaging. Although the ICU cost bucket also includes some imaging costs, we have presented the costs here as an indicative comparison for the relativities in expenditure between the hospitals. Surprisingly our estimated imaging costs and that reported in the NHCDC for ICU Imaging is very close.

Table 4.5 Average imaging cost per patient

<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>Acute episode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All imaging tests</td>
<td>2,130</td>
<td>1,741</td>
<td>2,852</td>
<td>2,102</td>
<td>1,538</td>
</tr>
<tr>
<td>CT/MRI</td>
<td>744</td>
<td>666</td>
<td>1,102</td>
<td>897</td>
<td>617</td>
</tr>
<tr>
<td>NHCDC direct and indirect imaging costs</td>
<td>2,122</td>
<td>1,970</td>
<td>2,823</td>
<td>2,195</td>
<td>2,142</td>
</tr>
</tbody>
</table>

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

Across all the study hospitals, the main driver of imaging expenditure is CT/MRI scans. By volume, over two-thirds of patients in this DRG have CT/MRI scans (see Table 4.6).

Table 4.6 Volume of test undertaken on patients in A06Z

<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>Total cases</td>
<td>258</td>
<td>87</td>
<td>216</td>
<td>57</td>
<td>223</td>
</tr>
<tr>
<td>% of cases having CT/MRI</td>
<td>74</td>
<td>76</td>
<td>77</td>
<td>68</td>
<td>66</td>
</tr>
</tbody>
</table>

*Source*: IPART analysis using data from hospital imaging services.
Box 4.2  Our approach to estimating imaging costs

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

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

4.3  Pathology costs

Figure 4.1 shows average pathology costs for patients in this case study. Our methodology for calculating these costs is explained in Box 4.3.

We found that, similar to imaging, RNSH has the highest expenditure on pathology while JHH has the lowest. However, given the diversity of patient types and the lack of data on the actual types of tests performed, we were unable to draw out more meaningful comparisons of pathology use.

There is a reasonable degree of consistency between our cost and the final NHCDC costs for GH, RNSH and JHH. The NHCDC costs for RPAH and BLH, which are in the Sydney South West Area Health Service, are significantly lower than our costs (see Figure 4.1).

**Figure 4.1  Comparison of average pathology costs per patient**

Data source: IPART analysis using data from hospital pathology services and final cost data 2008/09, NHCDC.
4 Costs of providing inpatient care

Box 4.3 Our approach to estimating pathology costs

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

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

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

4.4 Medical staff and rostering

In Chapter 1, it was explained that because the data on medical costs have many inconsistencies, we have not been able to allocate these costs to the patient level. As a result, unit cost comparisons are not presented here. Instead, comparisons of the ICU teams on a non-financial basis are explored. It should be noted that among the 5 hospitals, 3 are tertiary and 2 are not. This will have an impact on the scope of work each ICU team undertakes.
Table 4.7 summarises the size of the ICU units at the study hospitals and the level of staffing.

### Table 4.7 Summary of ICU beds and medical staff, as reported February 2010

<table>
<thead>
<tr>
<th>Hospital</th>
<th>ICU Beds</th>
<th>Medical Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH</td>
<td>28 ICU</td>
<td>10 FTE Consultants</td>
</tr>
<tr>
<td></td>
<td>22 HDU</td>
<td>6 FTE Advance Trainees</td>
</tr>
<tr>
<td></td>
<td>82% occupancy</td>
<td>4 FTE Trainees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56 FTE Junior Registrars (14 per team)</td>
</tr>
<tr>
<td>GH</td>
<td>10 ICU</td>
<td>4 FTE Staff Specialist (1 FTE for non-clinical)</td>
</tr>
<tr>
<td></td>
<td>4 HDU</td>
<td>(also covers Wyong 4 weeks/yr/SS, after hours service)</td>
</tr>
<tr>
<td></td>
<td>87% occupancy</td>
<td>0.8 FTE VMO</td>
</tr>
<tr>
<td></td>
<td>6 ICU at Wyong</td>
<td>7 FTE Residents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 FTE registrars</td>
</tr>
<tr>
<td>RNSH</td>
<td>23 ICU</td>
<td>11.1 FTE staff specialist (0.5 FTE is non-clinical)</td>
</tr>
<tr>
<td></td>
<td>15 HDU</td>
<td>6 Senior Registrars</td>
</tr>
<tr>
<td></td>
<td>80% occupancy rate</td>
<td>20 Junior Registrars/Residents</td>
</tr>
<tr>
<td>BLH</td>
<td>9 ICU</td>
<td>5 FTE VMO (shared with Fairfield hospital)</td>
</tr>
<tr>
<td></td>
<td>5 HDU un-ventilated</td>
<td>1 Fellow (rotational)</td>
</tr>
<tr>
<td></td>
<td>84% occupancy rate</td>
<td>1 FTE Senior Registrar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 FTE Registrars (+ 2 FTE rotational)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 FTE Residents</td>
</tr>
<tr>
<td>JHH</td>
<td>15 general ICU</td>
<td>6.9 FTE Staff Specialist</td>
</tr>
<tr>
<td></td>
<td>2 cardiothoracic ICU</td>
<td>2 FTE Fellows</td>
</tr>
<tr>
<td></td>
<td>4 general HDU</td>
<td>9 FTE Registrars</td>
</tr>
<tr>
<td></td>
<td>93% occupancy rate</td>
<td>6 FTE Senior Residents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 FTE Junior Residents</td>
</tr>
</tbody>
</table>

Source: Bed numbers relate to available beds (staffed and equipped for immediate use) as per Critical Care Resource management System as at 19 February 2010. Occupancy rate as reported through ICCMU on 22 February 2010.
5 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.

Patients in this case study group are admitted to the ICU at the hospitals. These wards or units can include both intensive care and high dependency care. Not all ICUs are the same. The level of care that an ICU can provide will depend on many factors, including access to specialist equipment, medical and nursing specialities. This will have a bearing on the configuration of care.

We identified the following 3 differences in the way the study hospitals managed and provided care for patients in this case study:

- role delineation in NSW ICUs
- provision of other services by ICU teams, and
- approaches to performing tracheostomy and ventilating patients.

5.1.1 Role delineation in NSW’s ICU

In NSW, there are role delineations for ICUs. The delineation of roles runs on a scale of Level 2 to Level 6, with Level 6 being the highest level of care. Generally, ICUs that are:

- Level 4 or higher are classified as intensive care. Intensive care patients are those with life threatening or potentially life threatening conditions.
- Level 3 or lower are high dependency care. High dependency patients are considered to be at low risk of serious morbidity, but due to the complexity of their condition, still requires intensive care expertise.
All patients, regardless of whether they are intensive or high dependency require a much higher level of nursing care than is available in the general wards. Often ICU patients have a dedicated nurse to provide care, although there are occasions where 2 nurses are required. In HDUs, nursing intensity is slightly lower with 1 nurse caring for 2 patients.

Of the 5 study hospitals, GH and BLH have Level 5 ICUs, while the other 3 larger study hospitals have Level 6 ICUs. Level 5 or Level 6 ICUs are required to have the following services: mechanical ventilation, extra-corporeal renal support services, invasive cardiovascular monitoring and the capability to provide complex, multisystem life support. The major differences between Level 5 and Level 6 ICUs are in teaching hospitals with access to complex support (eg, extracorporeal membrane oxygenation (ECMO), intra aortic balloon pumps etc to support the circulation, interventional cardiology, sophisticated imaging, and complex neurosurgery).

A Level 5 ICU can provide respiratory support, renal replacement therapy. There is access to CT scanning, usually MRI. The Level 5 ICU can manage most intensive care.

At RNSH and JHH, the ICU and HDU are separated. Some hospitals also have specialised ICUs: JHH has a cardiothoracic ICU, RNSH has cardiothoracic and neurosurgery ICUs, RPAH has a cardiothoracic and neurosurgical ICUs.

Although RPAH has funded beds for specialised ICUs, it does have the flexibility to change beds between ICU and HDU depending on the patient load. Consultation with the hospitals and clinicians this field also stress that how the ICUs and HDUs are run will vary between hospitals, that is, what one hospital defines as an ICU/HDU patient may be quite different to what another hospital classifies as an ICU/HDU patient. As a result, direct comparison may not be accurate.

Moreover, the casemix of the hospitals also vary. This will affect the type of patients that come through to ICU, and hence the configuration of care provided. Table 5.1 summarises the study hospitals, their specialty services and ICU role delineation.

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10 At some hospitals where there are separate HDUs, the patients may be managed by non-ICU staff.
Table 5.1 Study hospitals’ ICU role delineation level and specialty services

<table>
<thead>
<tr>
<th>ICU Level</th>
<th>Hospital specialty services</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPAH Level 6</td>
<td>Cochlear implant, complex epilepsy, liver transplant, ECMO retrieval, NICU level 5</td>
</tr>
<tr>
<td>GH Level 5</td>
<td>Regional trauma service</td>
</tr>
<tr>
<td>RNSH Level 6</td>
<td>acute spinal cord injury, severe burn injury, major trauma, renal transplant, NICU level 5</td>
</tr>
<tr>
<td>BLH Level 5</td>
<td></td>
</tr>
<tr>
<td>JHH Level 6</td>
<td>Major Trauma, renal transplant</td>
</tr>
</tbody>
</table>


5.1.2 Provision of other services by the ICU teams

Generally, we found that all the ICUs provided other services to the hospital and sometimes to a network of hospitals. Some of these services will impact on the staff levels at the ICUs. For example, at GH, they provide retrieval services to Wyong Hospital, which only has a HDU. Each retrieval requires 1 nurse and 1 ICU registrar and usually takes around 4 hours. This means that if called, ICU at GH needs to ensure sufficient staff to maintain the ICU service at GH. Similarly, at RNSH, the afterhours NUM of ICU has to attend to all ‘Between the Flags’ calls, which again means that staffing levels need to be sufficient to meet the needs of patients in the ICU ward and allow the NUM to attend to these calls.

---

11 Between the Flags is a program initiated by the Clinical Excellence Commission to improve recognition and response to patients when their clinical condition starts to deteriorate.
A summary of the services that the study hospital’s ICUs provide is presented in Table 5.2.

**Table 5.2 Summary of main services carried out by ICU teams**

<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>Rapid Response or Between the Flags calls</td>
<td>No, but will respond to ICU assist/arrest calls</td>
<td>Yes</td>
<td>Yes, informally</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Central lines</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes, only temporary lines, no PICC line.</td>
</tr>
<tr>
<td>Retrieval service</td>
<td>No</td>
<td>Yes, only from Wyong hospital</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Liaison service</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, informally</td>
<td>Yes, informally</td>
<td>Yes</td>
</tr>
<tr>
<td>Others</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*Note:* PICC - peripherally inserted central catheter – similar to a central line, but inserted at the elbow, while a central line is inserted at the shoulder.

*Source:* Study hospitals.

Details of the services referred to in Table 5.2 are as follows:

- **Rapid Response call** - the ICU team performs as the Rapid Response Team and responds to calls from within the hospital if patients require emergency medical care, such as resuscitation and rapid medical assessment.
  - RPAH is exempt from the ‘Between the Flags’ call arrangements as they are trialling a different system. The hospital has a separate team to respond to medical service calls. The ICU team only becomes involved when the call escalates to an ‘ICU assist’ or an ‘Arrest’ call, following strict guidelines.

- **Central lines** - some ICU units provide central line services for the whole hospital. That is, all patients that require a central line will be attended to by a specialist doctor or nurse from the ICU team, or the procedure will be done in the ICU ward. RNSH and RPAH are the only 2 hospitals of the 5 that don’t provide a specialised central line service. This is likely to be due to the size of these hospitals, which would allow them to have more specialists in this field, given the acuity of their patient mix.

- **Retrieval service** - ICU teams can also take on the role of retrieving patients from within/outside of the hospital who are in a critical condition and need retrieval and/or access to intensive care.

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12 A central line, also called central venous line, is a long thin catheter inserted through the skin into a large vein that feeds into a larger vein just above the heart. This line is used to deliver drugs or fluids.
Liaison service – in some hospitals, ICU nurses follow-up on patients that have been discharged from ICU into a ward, or will visit and review patients in wards that may need to be admitted to ICU.

Other services – depending on the hospital and the facilities available, some unique roles make also be assigned to the ICU teams. For example:

- RNSH’s hospital policy requires the ICU team to provide after hours medical and nursing support to the Cardiac Catheterisation Laboratory, and the after hours ICU NUM must attend to all ‘Between the Flags’ calls.
- GH, due to the resourcing in the Central Coast area, the ICU team (CMOs and registrars) provides after hours, on-call, support to Wyong Hospital, which only has a HDU ward. Each staff specialist at GH also provides on site support at Wyong Hospital for 4 weeks each year.
- BLH’s VMOs provide medical support to Fairfield Hospital’s HDU on the weekend and also after hours on call service.
- RPAH also provides an equipment co-ordination role at the hospital.

5.1.3 Approaches to performing tracheostomy and ventilating patients

The actual cost of performing a tracheostomy is only a small part of the cost of care for these patients. The fact that a patient has required a tracheostomy is partly an indicator of the requirement for prolonged ventilation.

The procedure can be performed surgically in theatre or percutaneously in ICU (or even a procedure room). At the hospitals in this review, tracheostomies are largely performed percutaneously, unless the patient’s condition requires it to be done surgically. The only exception is BLH, where there has been a move to have tracheostomies performed surgically due to the risk of complications. As a result, patients may have to wait longer before they get their tracheostomies due to prioritising of access to the operating theatres.

Models of care can also arise with differences in approaches to ventilation, technologies used and the different levels of usage between the ICUs. Alternative technologies include Continuous Positive Airways Pressure (CPAP) and ECMO. There was no data available on the use of these technologies. Not all patients in ICU require ventilation.

Recommendation

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.

13 RNSH advised that it does the majority of after hours interventional cardiology work in NSW, with around two-thirds of this work being done after hours (ie, post 4pm). The ‘Cath Lab’ operates 24hrs.
6 Outcome, safety and quality indicators

The terms of reference for this study required us to analyse available data on differences in clinical outcomes across the 5 study hospitals. However, we found that few data on indicators of clinical outcomes are collected consistently across hospitals, or on a state-wide (or national) basis. Further, 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.

Therefore, we worked with clinical experts to establish an initial 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. However, further work is required to develop standard indicators for measuring care and/or outcomes in ICUs.

We found that some of the outcome indicators were misleading or difficult to interpret for ICU patients included in the DRG for tracheostomy or ventilation for greater than 95 hours. This is because the reported indicators can be affected by the wide variation in patient mix from hospital to hospital and the variation across the hospitals with respect to the role of the ICU in the hospitals and the relationship with the hospitals’ HDUs and ward beds.

The sections below describe the clinical indicators and consider the performance of the study hospitals against them.

6.1 How we developed a set of clinical indicators

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

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14 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.
Essentially, we aimed to establish a list of indicators that were:

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

Following this clinical consultation, we established the set of indicators discussed in section 6.2 below. Some of these indicators are not true outcome indicators, but are safety and quality or process indicators. We were not able to obtain data for all of these indicators.

### 6.2 Clinical indicators for tracheostomy, or ventilation for greater than 95 hours and their availability

We selected 5 indicators for this case study (see Table 6.1). We analysed data from the study hospitals against these clinical indicators, with the results reported below.

#### Table 6.1 Clinical indicators for tracheostomy, or ventilation for greater than 95 hours and data availability

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Available?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Risk adjusted standardised mortality ratios for:</td>
<td>No – not available from NSW Health</td>
</tr>
<tr>
<td></td>
<td>- ventilated patients greater than 95 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- all ventilated patients</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Replacement of tracheostomy less than 72 hours after initial procedure, for accidental removal or other unforeseen reasons</td>
<td>No – not available from NSW Health</td>
</tr>
<tr>
<td>3.</td>
<td>Rates of Healthcare Associated Infections:</td>
<td>Yes – data provided by NSW Health</td>
</tr>
<tr>
<td></td>
<td>- ventilator associated pneumonia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- central line associated bacteraemia</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Re-intubation within 24 hours of ex-tubation</td>
<td>No – not available from NSW Health</td>
</tr>
<tr>
<td>5.</td>
<td>FASTHUG rates</td>
<td>No – not available from NSW Health</td>
</tr>
</tbody>
</table>

#### 6.2.1 Risk adjusted standardised mortality ratios

Standardised mortality ratios (SMRs) benchmark the ratio of observed to predicted deaths. The predicted death rate for this case study is calculated using the APACHE III scores, which is a measure of the patient’s physical disturbance (see Box 6.1).

Analysis of this indicator could look at different measures including whether the SMR is greater than 1 or if there are statistical outliers.
Although risk adjusting the SMRs is supposed to make them comparable, clinicians pointed out that the adjustment process, using the APACHE III scores is not a perfect measure and does not sufficiently adjust for all relevant factors. For example, it fails to take into account the organisational differences in ICUs and how well patients were treated prior to admission into ICU.

One clinician commented that using SMRs to compare between ICU units is hard because of the very large confidence intervals and small numbers. It will also depend on what gets reported as there is no consistency at present as to reporting requirements.

As an alternative to mortality rates, clinicians at GH suggest that it would be interesting to look at the percentage of patients ventilated in ICU who survived to be discharged from hospital. This is likely to reflect ICU and hospital care and aspects of patient selection for ICU therapies.

NSW Health is currently developing its methodology for measuring risk adjusted mortality and survival rates for different conditions and procedures (see Chapter 16 in the main report15). When this methodology is more refined, we consider it would be useful to calculate these rates for patients ventilated for greater than 95 hours. If this sample is too small for a robust analysis, all ventilated patients could be used instead.

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**Box 6.1 APACHE scoring system**

The Acute Physiological and Chronic Health Evaluation (APACHE) score has a number of different versions. Generally, the APACHE takes the worst variable in the first 24 hours (eg, blood pressure) of a patient’s presentation, adds in points for chronic health conditions and then through an algorithm reduces patients down to a score that reflects how sick they are on admission to ICU. Therefore, APACHE is one way of measuring the degree of physiological disturbance of a patient in the first 24 hours of admission to an ICU. Patients with tracheostomies or requiring long term ventilation will tend to have a higher APACHE score and mortality rate. The APACHE III-J is considered to most closely approximate Australian and New Zealand ICU patients.

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15 IPART, NSW Health costs and outcomes study by IPART for selected NSW hospitals, July 2010.
6.2.2 Replacement of tracheostomy

This indicator measures the need for replacing a tracheostomy less than 72 hours after it being inserted, for accidental removal or other unforeseen reasons.

Comments from all the study hospitals and other clinicians consulted indicate that the need to replace a tracheostomy within 72 hours of it being inserted is unlikely, except in the case of dislodgement, which is rare. Moreover, attending clinicians may want to change tubes because of any number of technical reasons that do not necessarily imply poor care.

On the whole, given the low occurrence of this event and the feedback from clinicians, this indicator was not considered useful and so we have not attempted to gather information on it for reporting.

6.2.3 Healthcare Acquired Infections

Ventilator associated pneumonia (VAP)

The feedback from clinicians regarding this indicator was that the data is not consistent from hospital to hospital and there is no agreed measure of what constitutes a VAP. At present, this indicator is not uniformly collected and recorded.

Central line associated bacteraemia (CLAB)

Infection rates of central lines are not directly related to ventilation, however many patients in ICU will have central lines and so this indicator is more of an indirect marker of the quality of care patients get in ICU. The same also applies to other infection rate measures such as PICC line infection rates as well as MRSA infection rates in ICU.

These infection rates are required to be reported by the hospitals to the NSW Department of Health. They are published in the Health Associated Infection (HAI) reports.

The weakness of these indicator measures lies in the low number of reported cases that arise. Therefore, the reported percentages are highly sensitive to each reported case of infection.

16 Given the severity of the situation, that is when a tracheostomy is unintentionally dislodged, NSW has a policy that focuses on the emergency treatment of the patient when this happens.
However, the requirement to report on these indicators can draw attention to problem areas and encourage more work to be done to improve infection control. For example, over the 2008 calendar year, the reported CLAB infection rates for NSW show a decreasing trend in the number of infections. This was based on a concerted effort to address CLAB infections.\textsuperscript{17} This was the result of a collaborative project between the CEC and the Intensive Care Coordinating and Monitoring Unit (ICCMU).

### Table 6.2 ICU reported infection rates

<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>MRSA (per 1000 ICU bed days)</td>
<td>3.2</td>
<td>2.1</td>
<td>2.2</td>
<td>4.3</td>
<td>1.4</td>
</tr>
<tr>
<td>CLAB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI (per 1000 CI-central line days)</td>
<td>2.0</td>
<td>1.8</td>
<td>2.6</td>
<td>0.0</td>
<td>0.8</td>
</tr>
<tr>
<td>PI (Per 1000 PI-central line days)</td>
<td>2.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Source:** HAI Mandatory data collection – July 2008 to June 2009.

Healthcare Acquired Infections (including CLAB rates) are discussed in further detail in Chapter 16 of the main report.\textsuperscript{18}

#### 6.2.4 Re-intubation within 24 hours of ex-tubation

This indicator measures the proportion of patients needing re-intubation within 24 hours of ex-tubation. It is currently not consistently collected across the hospitals.

Clinicians noted that this indicator could highlight the quality of clinical care, particularly in relation to the clinical judgement to remove the tube in the first place.

#### 6.2.5 FASTHUG

This indicator measures the proportion of patients who get a FASTHUG.

Clinicians noted that this indicator would provide a measure of how well patients are cared for, particularly in regards to these 7 best practices for which FASTHUG is designed (See Box 6.2).

Alternatively, if resources are limited, a point prevalence study could be conducted instead. To go about this, the study could be done as a snapshot audit, say 1 month in every 6, and look at one of the 7 best practices, such as sedation, or head of bed up, or another indicator.


\textsuperscript{18} IPART, *NSW Health costs and outcomes study by IPART for selected NSW hospitals*, July 2010.
Box 6.2 FASTHUG

FASTHUG is a mnemonic designed to remind ICU clinicians to consider 7 best practices in every ICU patient at least once a day. The letters of the mnemonic represent:

- Feeding - early feeding significantly reduces ICU mortality
- Analgesia Assessment - Appropriate analgesia ensures patient comfort and decreases ICU mortality from pneumonia and sepsis.
- Sedation Assessment - Appropriate sedation ensures patient comfort and decreases ICU mortality from pneumonia and sepsis.
- Thromboprophylaxis - DVT prophylaxis reduces the risk of DVTs and potentially fatal pulmonary embolism.
- Head of the Bed - elevating the head of the patient’s bed by 30 degrees or more reduces the chance of pneumonia and death.
- Ulcer Prophylaxis - GI ulcer prophylaxis significantly reduces GI bleeding.
- Glycemic Control - Controlling a patient’s blood sugar can significantly reduce infectious complications and decrease mortality.

Originally developed by Jean Louis Vincent in Brussels, the intention is that every time an ICU clinician sees a patient they do a FASTHUG. That is they check on these 7 factors. Although there is debate about the FASTHUG as the best care and there is no consistency in its application, it is supported by guidelines for best practice.

6.3 Indicators currently used by study hospitals

NSW Health requires the hospitals to report on various general ICU outcome indicators (eg, infection rates, length of stay, and exit block from ICU). However, clinicians at the study hospitals indicated that, although they collect various data for such reporting purposes, some are more useful than others. Some study hospitals also collect data for their own indicators in order to measure their performance and improve care.

Below is an overview of the indicators collected by BLH, GH and JHH.
6.3.1 BLH

BLH collects a range of indicators themselves, including:

▼ Refusals – this data looks at the number of requests for admission to ICU that have been refused. The data is divided into resources and medical reasons including inappropriate referrals.

▼ Exit block – this indicator measures the time from discharge till the time the patient actually leaves the unit as this does affect efficient patient flow into the unit. However, they were not sure how good an indicator it is because the other consideration is that patients may be held in ICU until a ward bed is available or until the morning when they tend to do better when moved.

▼ Unintentional extubation – this indicator is used to measure the quality of care, particularly nursing care.

▼ Timeliness of having a tracheostomy – this measures the time between the clinical decision to insert a tracheostomy and the actual procedure being done. Delays in getting a tracheostomy can delay a patient’s progress through treatment and also show up in LOS and patient recovery measurements. However the correct timing of a tracheostomy is still debated. Arguments have been made for earlier (day 2 or 3) or late (up to 21 days).

6.3.2 GH

GH collects the standard outcomes data required for the ANZICS database along with the ACHS indicators and the required data for reporting to the NSW Health Quality unit. In addition periodic reviews of compliance with important processes of care are also undertaken.

6.3.3 JHH

JHH collects the standard outcomes indicators that are required for reporting to the NSW Health Quality and Safety Unit: MRSA infections, CLAB infections, LOS, access block into ICU, and exit block out of ICU. However, they question the usefulness of these indicators. They consider access block to ICU as one of the few indicators which can provide some measure of the effectiveness of treatment and safety, but also concede that measuring this would be difficult.
6.4 Issues for further consideration

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. For example, some clinicians noted that indicators measuring process rather than outcome may be better for this case study. Further, we found that there were conflicting opinions regarding the quality of the data available to provide meaningful comparisons on outcome.

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

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

A related issue raised in our meetings with the hospitals and clinicians was the lack of resources to go about collecting the required data for measuring indicators. Moreover, there is a lack of organisational structure and process to measure, collect data, and analyse data on indicators. As this issue is relevant to several case studies, it is discussed in further detail in Chapter 16 of the main report.19

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

IPART

Case study 8 – Tracheostomy, or ventilation for greater than 95 hours
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 protheses 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:
  o Note that separation of planned and emergency cases may reduce lengths of stay for planned (arthritis) cases.
  o 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:
  o Note the different clinical pathways and high day of surgery admission rates for thoracic surgery patients at RPAH compared with other study hospitals.
  o Consider whether aspects of the model of care at RPAH are suitable to be used in other hospitals.

- Breast surgery:
  o Note the early discharge models at RNSH for breast surgery patients having mastectomies and
  o 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:
  o Note the variation in the proportion of patients with cholelithiasis or cholecystitis who are operated on acutely as emergency admissions.
  o Consider whether this variation has significant quality of care implications.
  o 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.
  o 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.
- **Appendicectomy**
  - Consider the relative costs and benefits of cholecystectomies with and without the use of fluoroscopy.
  - Note the variation in the use of imaging tests for diagnosing appendicitis.
  - Consider establishing standard protocols for diagnosing appendicitis, indicating when it is appropriate to use CT scans, MRIs and ultrasounds.
  - As part of establishing standard protocols for diagnosing appendicitis, consider whether CT scans, MRIs and ultrasounds should only be used for certain patient groups (e.g., older patients who are more likely to be suffering from other conditions with symptoms similar to appendicitis).
  - Consider the relative costs and benefits of laparoscopic versus open surgery for appendicitis.

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

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

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

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

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

**Improving outcome, safety and quality indicators**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Time Out audits

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

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

Next steps - wider application of this study

40 That NSW Health refines and develops useful aspects of this study for application more widely to other hospitals, other health settings and other clinical conditions.
B  Staff rostering

In this section, a summary of the way ICU medical teams are rostered is presented. Details here are based on discussions with the medical teams at the study hospitals. Given the different patient mix at the study hospitals and the level of resourcing, differences in the way work is structured is not unexpected. The definitions that classify a patient into ICU and HDU can vary between the hospitals and so a direct comparison is not always possible. These factors need to be borne in mind when comparing how the various teams are managed at the study hospitals.

RPAH

The ICU team at RPAH has 10 full time equivalent (FTE) Staff Specialists (SS) and no visiting medical officers (VMO).

In terms of junior staff, they have 6 FTE advanced trainee registrars, 4 FTE trainees and 56 FTE registrars (14 per team). The advance trainees and trainees specialise in ICU while the SRMOs are part of the pool of junior staff that rotate between different disciplinary areas in the hospital.

There are 2 consultants and 1 advanced trainee on duty 24/7. During the day, there are 4 consultants on the floor.

RPAH notes that its nursing arrangements are different to the norm. Nurses are organised in 12 hour shifts, which usually takes 12.5 hours due to handover time. All 12 hours of the shift are regarded as normal time.

Gosford Hospital

GH has 4 FTE SS together with funding for 0.8 VMO. VMO cover is used to cover leave, Staff Specialists Training, Education & Study Leave (TESL) and administrative commitments etc.

There is roughly a 4 week rotating roster with SS rostered on for: one week on call 24/7; the second week is HDU, liaison and retrieval; the third week is training, research, and non-clinical portfolios; and the fourth week is free or on Wyong HDU cover.
In terms of junior staffing, GH has 7 FTE junior registrars and 7 FTE junior residents working 12-hour shifts (night and day) week on week off. There are 2 residents during the day and 1 resident on duty at night.

One of the 7 ICU registrars is nominated as the retrieval registrar who works from 10am – 6pm and is on-call outside of these hours. This position is on a 7 days on and 7 days off roster. For each retrieval, there will be 1 ICU nurse and the registrar. The average time it takes to complete a retrieval is around 4-4.5 hours. Retrievals usually are confined to retrieving patients from Wyong’s HDU that need ICU care.

In addition, Gosford ICU funds an anaesthetist ICU relief registrar position at Wyong Hospital. The anaesthetic position helps attract trainees as anaesthetic experience is difficult to come by for ICU trainees.

It should be noted that 2 of Wyong Hospital’s HDU beds were commissioned on the Gosford campus for about 5 months in the review year of 2008/09, thereby increasing the direct ICU operations for GH in that period. This was due to delays in opening the unit at Wyong Hospital, yet the staff had already been recruited.

RNSH

RNSH has 10.6 FTE senior staff to cover the clinical load and a 0.5 FTE for research. All senior staff members are staff specialists. RNSH has 6 senior registrars and 20 junior registrars.

RNSH has 3 ICU units and medical staffs are rostered into 4 teams from Monday to Friday. Each team has 1 SS, 1 senior and 1 junior registrar. Therefore, there will be 4 seniors and 8 junior medical staff on site at any one time. There is also 1 extra staff to help with transfers, ward rounds and so on.

Staff from the 3 ICUs meet every morning to determine the nursing dependency for the day and categorise patients as ICU or HDU level. Unlike RPAH which has 12 hour shifts for their nurses in ICU, RNSH’s nursing roster is based on 3 shifts per day.

Bankstown-Lidcombe Hospital

The senior medical staff at BLH are all VMOs rather than SS. Their VMO model is relatively complex as staffing covers a network between BLH and Fairfield Hospital. In total, there are 5 FTE VMOs but only 2 VMOs are on duty at any one time. Other VMO staff are on-call.

The teams at Fairfield Hospital are responsible for that hospital’s patients so BLH’s staff are not on their roster formally. But BLH’s staff provide after hours on-call support during the week and on the weekend staff cover Fairfield Hospital as well.
Bankstown-Lidcombe Hospital has 1 FTE fellow (rotational) and 1 FTE senior registrar, 2 FTE junior registrars, 2 FTE junior registrars that are rotational, and 4 FTE residents. A JMO is on duty 24 hours a day. There are some days when there is no senior registrar. But there is a registrar on 16 hours a day.

From 12 midnight to 8am in morning, the anaesthetic registrar covers the unit. The hospital is examining changing the system so that the anaesthetic registrar does not need to cover ICU after hours.

**John Hunter Hospital**

General ICU at JHH is split into 2 separate units: 1 ICU which has 15 beds, and 1 HDU which has 4 beds. There is also a cardiothoracic ICU, but this unit has its own specialist staff and so the general ICU medical staff have limited involvement.

The general ICU at JHH has 6.9 FTE senior staff members that cover the clinical load, and another 0.5 FTE for the Director of ICU to cover the non-clinical work, all are SS. The SS also cover the HDU and Retrieval Service.

During the week, there are 3 shifts per day. The day shifts start at 8am to around 5pm-6pm and is covered by 2 SS. The evening shift has 1 SS who picks up from when the day shift ends and goes to around 8pm-10pm, after which they are on-call and must be within 30 minutes access to the hospital. The night shift is also covered by 1 SS starting from 8pm-10pm to 8am the next morning. On weekends, one intensive care specialist covers all inpatient and on-call work.

Junior staffing is made up of 9 FTE registrars, 6 FTE SRMO, 2 FTE resident medical officers (RMO) – 1 looks after HDU, and 2 FTE fellows (similar to senior registrars). There is 1 registrar on duty 24hrs a day. The fellows are usually rostered on during the day and do some evenings until midnight and sometimes they also are on-call. The rest of the 24hr roster is covered by the SRMO and RMO who do 6 days in a row: 4-5 of the days they will be rostered on in the day and 2-4 days they are rostered on at night. The HDU RMO does 7 days on, 7 days off.

JHH has a separate roster for the Retrieval Service, which is operated on an on-call basis.

JHH noted that staff are called back quite often after midnight and attend the next day if they are rostered on. Often that staff is placed on non-clinical duties for that day.
<table>
<thead>
<tr>
<th>Term</th>
<th>Abb.</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>95% confidence interval</td>
<td></td>
<td>A statistical term describing a range of values within which we are 95% certain that the true population value lies.</td>
</tr>
<tr>
<td>Activity-based funding</td>
<td>ABF</td>
<td>Funding that is based on the projected amount and type of work of a facility, where standard prices are set for similar work undertaken. This has also been referred to as casemix or episode funding.</td>
</tr>
<tr>
<td>Acute care</td>
<td></td>
<td>Clinical services provided to admitted or non-admitted patients, including managing labour, curing illness or treating injury, performing surgery, relieving symptoms and/or reducing the severity of illness or injury, and performing diagnostic and therapeutic procedures. Most patients have acute or temporary ailments. The average length of stay is relatively short.</td>
</tr>
<tr>
<td>Acute Physiological and Chronic Health Evaluation</td>
<td>APACHE</td>
<td>A scoring system which measures the degree of physiological disturbance of a patient in first 24 hours of admission to an intensive care unit.</td>
</tr>
<tr>
<td>Admission</td>
<td></td>
<td>The process by which a person commences a period of residential care in a health facility.</td>
</tr>
<tr>
<td>Admitted Patient Data Collection</td>
<td>APDC</td>
<td>A database that covers all inpatient separations (discharges, transfers and deaths) from all Public (including Psychiatric), Private, and Repatriation Hospitals, Private Day Procedures Centres and Public Nursing Homes in NSW.</td>
</tr>
<tr>
<td>Agency for Clinical Innovation</td>
<td>ACI</td>
<td>A board-governed statutory health corporation that reports to the NSW Minister for Health and the Director-General of NSW Health.</td>
</tr>
<tr>
<td>Appendicectomy</td>
<td></td>
<td>Surgical excision of the patient's appendix.</td>
</tr>
<tr>
<td>Assistant In Nursing</td>
<td>AIN</td>
<td>An employee that is not a registered nurse, enrolled nurse or trainee nurse, who assists the Enrolled Nurses and Registered Nurses by providing basic nursing care, working within a plan of care under the supervision and direction of a Registered Nurse.</td>
</tr>
<tr>
<td>Australian &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 Council on Healthcare Standards</td>
<td></td>
<td>An independent organisation dedicated to improving the quality of health care through performance reviews, assessment and accreditation.</td>
</tr>
<tr>
<td>Average length of stay</td>
<td>ALOS</td>
<td>The average number of days each admitted patient stays in hospital. This is calculated by dividing the total number of occupied bed days for the period by the number of actual separations in the period. (DOH)</td>
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**Glossary**
<table>
<thead>
<tr>
<th>Term</th>
<th>Abb.</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Bankstown-Lidcombe Hospital</td>
<td>BLH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Bureau of Health Information</td>
<td>BHI</td>
<td>An independent, board-governed organisation established by the NSW Government to be the leading source of information on the performance of the public health system in NSW.</td>
</tr>
<tr>
<td>Casemix</td>
<td></td>
<td>The range and types of episodes of care of patients (the mix of cases) treated by a hospital. This provides a way of describing and comparing hospitals and other services for planning and managing health care. Casemix classifications put patients into DRGs with similar conditions that use similar health-care resources, so that the activity and cost-efficiency of different hospitals can be compared.</td>
</tr>
<tr>
<td>Casemix funding</td>
<td></td>
<td>See Activity-based funding.</td>
</tr>
<tr>
<td>Central line associated bloodstream infection</td>
<td>CLAB</td>
<td>An infection of the bloodstream resulting from central lines.</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td></td>
<td>Excision of 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>Continuous positive airways pressure</td>
<td>CPAP</td>
<td>A method of positive pressure ventilation used with patients who are breathing spontaneously. It is done to keep the alveoli open at the end of exhalation and thus increase oxygenation and reduce the work of breathing.</td>
</tr>
<tr>
<td>Diagnosis Related Group</td>
<td>DRG</td>
<td>A system used to classify hospital admissions into groups with similar clinical conditions (related diagnoses) and similar resource usage (hospital services). There are approximately 500 coding classes. In Australian acute hospitals, Australian refined DRGs are used (AR-DRGs). The classification categorises episodes into groups with similar conditions and similar usage of hospital resources, using information in the hospital morbidity record such as the diagnoses, procedures and demographic characteristics.</td>
</tr>
<tr>
<td>Enrolled Nurse</td>
<td>EN</td>
<td>A person holding an Enrolled Nurse qualification who works under the supervision of a Registered Nurse to provide nursing care for patients in hospitals, nursing homes and a variety of other health care organisations.</td>
</tr>
<tr>
<td>Episode funding</td>
<td></td>
<td>See Activity-based funding.</td>
</tr>
<tr>
<td>Term</td>
<td>Abb.</td>
<td>Definition</td>
</tr>
<tr>
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</tr>
<tr>
<td>Extra-Corporeal Membrane Oxygenation</td>
<td>ECMO</td>
<td>A technique of providing respiratory support; the blood is circulated through an artificial lung consisting of two compartments separated by a gas-permeable membrane, with the blood on one side and the ventilating gas on the other.</td>
</tr>
<tr>
<td>FASTHUG</td>
<td></td>
<td>A mnemonic outlining the 7 best practices in every ICU patient at least once a day. This involves - feeding, analgesia assessment, sedation assessment, thrombo-embolic prophylaxis, head of the bed, ulcer prophylaxis and glycemic control</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td></td>
<td>An imaging technique that provides real-time moving images of the internal structures of a patient through the use of a fluoroscope.</td>
</tr>
<tr>
<td>Gosford Hospital</td>
<td>GH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Health Information Exchange</td>
<td>HIE</td>
<td>A database maintained by the NSW Department of Health that contains a range of financial, patient and clinical information from hospitals and area health services.</td>
</tr>
<tr>
<td>High dependency unit</td>
<td>HDU</td>
<td>An area or environment in a hospital that provides a higher level of critical care and monitoring than is provided in a general ward, but a lower level of care provided by an intensive-care unit.</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td></td>
<td>Surgical removal of the uterus.</td>
</tr>
<tr>
<td>Independent Pricing and Regulatory</td>
<td>IPART</td>
<td>The independent economic regulator for NSW that is undertaking this hospital study.</td>
</tr>
<tr>
<td>and Regulatory Tribunal of NSW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient fraction</td>
<td>IFRAC</td>
<td>A measure used in casemix costing. The proportion of total (or operating) costs that are attributed to admitted patients.</td>
</tr>
<tr>
<td>Intensive Care Coordinating and Monitoring Unit</td>
<td>ICCMU</td>
<td>An organisation that monitors 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>
<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>Intubation</td>
<td></td>
<td>The insertion of a tube, as into the larynx or gastrointestinal tract; the purpose varies with the location and type of tube inserted; generally it is done to allow drainage, to maintain an open airway, or to administer anesthetics or oxygen</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>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 hospital plus up to 2 other hospitals - one transfer in and one transfer out.</td>
</tr>
<tr>
<td>Medical resonance imaging</td>
<td>MRI</td>
<td>A medical imaging technique most commonly used in radiology to visualise detailed internal structures of the body using a magnetic field.</td>
</tr>
<tr>
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</tr>
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</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-sensitive Staphylococcus Aureus</td>
<td>MSSA</td>
<td>A strain of the Staphylococcus Aureus bacterium that is sensitive (not resistant) to a number of antibiotics.</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>NSW Health</td>
<td></td>
<td>The broad term encompassing operational and other structures including the NSW Department of Health, Area Health Services, the Agency for Clinical Innovation, the Clinical Excellence Commission and a range of clinical taskforces.</td>
</tr>
<tr>
<td>Odds ratio</td>
<td>OR</td>
<td>The odds of an event occurring. This is equal to the probability that the event occurs divided by the probability that it does not occur.</td>
</tr>
<tr>
<td>Open Surgery</td>
<td></td>
<td>An invasive medical procedure where an incision is required for direct surgical access to the organs.</td>
</tr>
<tr>
<td>Principal referral hospital</td>
<td></td>
<td>Hospital within peer group (principal referral hospitals 1b) classified as an acute hospital, treating 25,000 or more acute casemix weighted separations per annum, with an average cost weight greater than 1 and 1 or fewer specialty services.</td>
</tr>
<tr>
<td>Principal tertiary referral hospital</td>
<td></td>
<td>Hospital within peer group (principal referral hospitals 1a) classified as an acute hospital, treating 25,000 or more acute casemix weighted separations per annum, with an average cost weight greater than 1 and having more than 1 specialty service.</td>
</tr>
<tr>
<td>Prophylaxis</td>
<td></td>
<td>Disease prevention, also called preventive treatment.</td>
</tr>
<tr>
<td>Registered nurse</td>
<td>RN</td>
<td>A qualified nurse who provides care for patients in a variety of healthcare settings. These include public and private hospitals, community and home-based services, nursing homes and industry.</td>
</tr>
<tr>
<td>Royal North Shore Hospital</td>
<td>RNSH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Royal Prince Alfred Hospital</td>
<td>RPAH</td>
<td>One of the study hospitals included in the review.</td>
</tr>
<tr>
<td>Thoracic surgery</td>
<td></td>
<td>Surgical treatment of conditions inside the thorax such as the chest wall, lungs and diaphragm.</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td></td>
<td>A surgical procedure to cut an opening into the trachea (windpipe) so that a tube can be inserted into the opening to assist breathing.</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>VTE</td>
<td>The process by which blood clots occur and travel through the veins. It is the collective term for deep vein thrombosis (the formation of a blood clot in one of the deep veins within the body, such as in the leg or pelvis) and pulmonary embolism (condition in which the arteries leading from the heart to the lungs becomes blocked).</td>
</tr>
</tbody>
</table>
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
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<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Ventilator associated pneumonia</td>
<td>VAP</td>
<td>A frequently fatal type of pneumonia seen in patients breathing with a ventilator; it is the most common type of nosocomial pneumonia and may be bacterial, viral, or fungal.</td>
</tr>
</tbody>
</table>