Comparing National Public Hospital Cost Data Collections for use in Performance Reporting

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Table of Contents

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Synopsis

Hospital cost data are collected and analysed by two bodies in Australia, the AIHW and the NHCDC. The methodologies employed to identify unit costs differ. The AIHW collection was set up to collect hospital summary statistics (including expenditure) for all public hospitals and essentially uses a 'top down' procedure which allocates total expenditures according to defined rules. The NHCDC was established to produce annual updates of national DRG cost weights and associated data. To achieve this the NHCDC uses disaggregated costing data collected from a sample of hospitals to report DRG average costs.

This paper first describes these differences in greater detail and identifies weaknesses or problems with each of the methodologies.

The adequacy of each database and of the resulting methodology depends upon the questions which each seeks to address. Secondly, therefore, the paper considers the possible uses of the data and concludes with a comparison of the relative advantages of the two databases for addressing a range of issues.

1. Introduction

1.1 Measuring Hospital Costs

Measures of technical efficiency describe the relationship between costs and outputs, usually in terms of the cost per unit of output. In order to measure the technical efficiency of hospital care, costs need to be reported both comprehensively and consistently across hospitals, and output needs to be described in a meaningful way. Hospital costing data can be used to measure the cost side of technical efficiency, but a suitable measure of the outcome of hospital care is also required. Measures of performance such as cost per casemix-adjusted separation or average cost per DRG, when used as measures of technical efficiency, implicitly assume that outcomes of hospital services, such as clinical outcomes, patient satisfaction, quality of service and accessibility of hospital services, are constant and of a broadly equivalent standard, both over time and across institutions.

This paper describes and reviews the two national methods for calculating hospital efficiency. The focus is on the costing methods, and is not concerned with the measurement of outcome.

The development of Diagnosis Related Groups (DRGs), described by Fetter in 1980, provided a clinically meaningful measure of hospital output, which has allowed hospitals of different types and sizes to compare their caseload and complexity. This development has permitted the comparison of hospital output using a weighting by DRGs to adjust a hospital's aggregate casemix (casemix-adjusted separations). Thus a meaningful measure of technical efficiency can now be used, viz, the cost per casemix-adjusted separation. The DRG also provides for a more micro-level comparison of hospital efficiency at the DRG or clinical level.

The second important development has been the advent of hospital computerised costing systems, which have enabled hospitals to provide more easily costing at a unit rather than at an aggregate level, with the DRG or the patient as the unit of analysis. In Australia this is still in its early stages, with DRG-level analysis and DRG cost weights being first used in the early 1990s. Current participation in the National Hospital Cost Data Collection (NHCDC), however reflects the fact that DRG-level costing and analysis are still very much in their early stages. While 64% of cases

nationally are represented, only 29% of hospitals participate in the data collection (Commonwealth Department of Health and Aged Care, 1999).

Currently there are two methods in use for measuring the performance of inpatient services delivered by hospitals across Australia. The approach taken by the Australian Institute of Health and Welfare (AIHW), in its publication *Australian Hospital Statistics* (AHS), reports the average cost of a casemix-adjusted separation for a subset of hospitals, based on expenditure data supplied by state and territory health authorities for public hospitals. The second approach undertaken by the National Hospital Cost Data Collection (NHCDC) reports both the average cost per DRG and the average cost per casemix-adjusted separation, from data provided by a smaller sample of hospitals. This paper provides an analysis of the two methods including the likely sources of error or inconsistencies in data collection.

Both methods have strengths and weaknesses, which will be explored below. In addition some of the more general theoretical issues surrounding measurement and reporting of hospital efficiency and costs are considered. The analysis of the two methods involves consideration of the patient population that is included, the institutions providing data and the quality of the data for both the reporting of costs, and the calculation of cost weights. This is followed by a consideration of the requirements for, and the uses of, the reported efficiency and cost measures.

1.2 The Problem

In general terms the problems addressed in this paper are as follows:

- There is prima facie evidence that the two systems produce different estimates of unit costs (see Table 1).
- Identification of the acute inpatient population presents difficulties for both data sets. The NHCDC attempts to identify the acute inpatient population, whereas the AIHW only attempts to identify inpatient separations (both acute and non-acute).
- Some categories of hospital costs, for example capital and medical costs for private patients, are dealt with inconsistently between the two data sets.
- Some expenditure categories reported by both collections may be grouped differently, for example labour on-costs.

2. Current Measures of Hospital Costs

2.1 Overview of the Two Data Systems

As discussed in Sections 2.2 and 2.3 below, the AIHW uses expenditure and separation data provided by the state and territories to report the average cost per casemix-adjusted separation for all public and private patients in Australian public hospitals. In contrast, the NHCDC uses a sample of public and private hospitals, namely those with reliable hospital DRG-level costing data, who volunteer to report both the average cost per DRG_i and the average cost per DRG for all DRGs.

Although both the AIHW and the NHCDC report the average cost per casemix-adjusted separation, the cost categories and activity covered by each are different. For example, in 1997-98 the AIHW reported a higher average cost ($2,575) than the NHCDC ($2,412). Table 1 compares the average cost per casemix-adjusted separation in each data set at both the national and state/territory levels. The difference arises from the sample, methodology and the type of data provided. Across states and territories, the NHCDC data provides lower costs for all states except the Northern Territory. The magnitude differs, ranging from -$240 in the Northern Territory to $444 in Tasmania, with the difference nationally being $163.

Table 1: Comparison of average cost per casemix-adjusted separation between AIHW and NHCDC data, by state/territory, for 1997-98 data

Method	State/Territory								Total
	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	
	$	$	$	$	$	$	$	$	$
AIHW	2,637	2,462	2,354	2,966	2,458	2,739	3,623	3,363	**2,575**
NHCDC	2,539	2,226	2,239	2,639	2,243	2,295	3,365	3,603	**2,412**
Difference ($)	**98**	**236**	**115**	**327**	**215**	**444**	**258**	**-240**	**163**

There are various possible explanations for the apparent discrepancy. These include the following:

- both sets of data may be correct and the NHCDC sample of hospitals may operate at a lower cost per casemix-adjusted separation, possibly because of economies of scale in the larger hospitals;
- differences in methodology, particularly with respect to identifying acute inpatient separations (see Section 3.6);

- the exclusion of depreciation from the AIHW average costs;
- differences in the treatment of private patient medical costs in public hospitals (see Section 3.3 for further discussion);
- the different treatment of labour on-costs, including superannuation and retrospective salary adjustments, with expenditure recorded across financial years (see Section 3.4);
- inappropriate "top down" allocation rules and/or "bottom up" aggregation rules (see Section 3.5);
- inappropriate weighting of rehabilitation, palliative care and "nursing home type" patients (see Section 3.6);
- consistency in the treatment of teaching and research; and/or
- expenditure offsets supported by revenues for semi-commercial activities.

2.2 AIHW Methodology

Sample

All public hospitals are required to report aggregate expenditure annually to the AIHW according to the National Health Information Agreement (NHIA), arising from the Australian Health Ministers Advisory Committee (AHMAC) in 1993. The National Health Information Management Group, reporting to AHMAC has agreed on a minimum data set. Hospital participation is thus encouraged at the state level through these agreements, though there are no formal penalties for the non-provision of data.

The AIHW excludes small community non-acute hospitals, psychiatric hospitals, rehabilitation facilities, hospices and dental hospitals from the cost per casemix-adjusted separation calculation. An estimated 96.5% of total acute and non-acute separations nationally are captured by the system[1]. The AIHW, in its *Australian Hospital Statistics,* do not make clear the number and proportion of hospitals included in the average cost per casemix-adjusted separation calculation. Costing data are reported at the national and state/territory levels.

[1] AIHW. (1999). *Australian Hospital Statistics 1997-98, p.223*

Data Type

The AIHW methodology requires individual hospitals to disaggregate total expenditure to input expenditure categories of interest, as shown in Table 2. Hospitals are required to report data for these input expenditure categories according to definitions in the *National Health Data Dictionary*. In addition the AIHW requires hospitals to report capital expenditure and depreciation. However the reliability and validity of this data is under question due to inconsistent reporting by hospitals. (see Section 3.2 below)

Table 2: Expenditure categories reported by the AIHW, 1997-98

Non medical labour costs

- Nursing
- Diagnostic/Allied Health
- Administrative
- Other staff
- Superannuation
- Other recurrent costs

Medical labour costs

Public patients

- Salaried/sessional staff
- VMO payments

Private patients (estimated)

Other recurrent costs

- Domestic services
- Repairs/maintenance
- Medical supplies
- Drug supplies
- Food supplies
- Administration
- Other

Methodology/Calculation

The formula used for the calculation of average cost per casemix-adjusted separation by the AIHW is straightforward, viz

$$\textbf{Cost per casemix-adjusted separation} = \frac{\textbf{Recurrent expenditure}^{(1)} \times \textbf{IFRAC}^{(2)}}{\textbf{Total separations}^{(3)} \times \textbf{Av. cost weight}^{(4)}} + \textbf{Estimated private patient medical costs}^{(5)}$$

Issues that arise with respect to the validity of the data relate to the consistency of the definition and attribution. These issues apply to each of the five components of the formula and are as follows:

1. **Recurrent expenditure** is reported at the institutional level and includes both direct and indirect costs[2]. The required expenditure data are defined in the *National Health Data Dictionary* (NHDD). Both a comprehensive data dictionary and collection manual are necessary to ensure data consistency with other government data collection processes, between states and territories and across hospitals. In addition an audit process is necessary to ensure the consistent use of definitions and format, and it is not clear from the AIHW *Australian Hospital Statistics* that a satisfactory audit process takes place. Anomalies with respect to recurrent expenditure are thus likely to arise from undetected inconsistent coding where an audit process does not exist. The expenditure categories most affected are likely to be the treatment of capital expenditure (also acknowledged by the AIHW), superannuation and other labour on-costs, and expenditure relating to teaching and research (which is not separately reported).

   The difficulty with depreciation arises from the difference in accounting methods used by hospitals. Accrual accounting methods report depreciation whereas cash accounting methods do not report depreciation. It is unclear whether some states (or individual hospitals) are continuing to use cash accounting methods. Due to possible differences between states, the AIHW does not include depreciation in the cost per casemix-adjusted separation. However aggregate depreciation expenditure is reported in a separate table for those states using accrual accounting methods. The assumption from this table is that, for states where depreciation is not reported, that the accrual accounting method is not used, although this is not explicitly confirmed in the AIHW Report. However the *Report on Government Services 2000* reports that the majority of public hospitals reported in accrual terms for the 1998-99 reporting period[3]. Even for states reporting depreciation expenditure there are differences in reported depreciation expenditure. For example, NSW hospitals report an average depreciation at 4.5%, and Tasmania 1.0%, of total expenditures. This possibly reflects different definitions of capital or treatment of assets by jurisdiction. (see Section 3.2)

   Another inconsistency is likely to arise from the differentiation of expenditures relating to capital improvement and the maintenance of existing equipment.

[2] Direct costs are those which reflect services provided to individual patients. Indirect costs or overheads, in general are those costs that cannot be directly attributed to individual patients. They are allocated using various allocation formulas.
[3] see Productivity Commission, (2000), Table 1.1, p.19

Although differences are mentioned in the NHDD it is often difficult to distinguish between the two without clearly defined guidelines.

Superannuation expenditure and labour on-costs are similarly likely to be applied inconsistently due to the accrued entitlements for superannuation and long service leave, treatment of redundancy packages, retrospective pay adjustments (where back-dating occurs over the financial year) and worker's compensation claims.

Expenditure relating to teaching and research is a major issue and is not addressed in the NHDD. The area is complicated, due to problems in identifying the actual resource inputs relating to research/teaching. It is likely that reported expenditure relating to research and teaching activities will match the revenue source, rather than the actual costs of undertaking these activities.

2. The **IFRAC** (**I**npatient **FRAC**tion) is reported at the provider level, and is the estimated proportion of total hospital costs related to all admitted patients, including mental health, rehabilitation, nursing home type and other non-acute patient types. It is calculated as:

$$\textbf{IFRAC} = \frac{\textbf{Inpatient cost}}{\textbf{Total cost}}$$

Hospitals are asked to estimate the IFRAC given their individual circumstances. The IFRAC is estimated for the entire hospital, and the same fraction is applied to each expenditure category, implying that the IFRAC is consistent across categories of expenditure, which is unlikely to be the case.

When the IFRAC is not reported, the AIHW resorts to a standardised methodology known as the Health and Allied Services Advisory Council (HASAC) method. This calculates a proxy for IFRAC based on the ratio of patient days and an estimation of the ratio of costs between inpatients and non-admitted patients. The AIHW states that there are only a small number of hospitals not reporting IFRAC. However it is not known how many hospitals base their estimation on an historic basis, originally based on the HASAC method, rather than upon knowledge of their own circumstances regarding actual inpatient and outpatient activity.

As there is no national patient level reporting of non-admitted patients to date, the incidence and types of services provided to them are unknown. National reporting would provide a means of auditing these services, and distinguishing between inpatient and non-admitted patient use of hospital resources. As it has implications for both the AIHW and NHCDC data sets, the inpatient fraction is discussed more fully in Section 3.6.

3. **Total separation** data are obtained from the National Hospital Morbidity Database (NHMD), with both acute and non-acute separations included, as defined by the NHDD definition for "type of episode of care". The definition of acute inpatients includes sameday cases, for example day procedures. Non-acute patients include psychiatric, rehabilitation, palliative care and nursing home type patients and are included if they are treated in the acute hospital. Although the AIHW method identifies acute separations, and thus the proportion of total separations, it makes no attempt to identify the proportion of total expenditure relevant to acute separations. The average cost weight is calculated for acute separations only, but applied to total separations.

   The AIHW reports that 92% of separations are defined as acute. However it is likely that this is an overestimate. Problems in identifying acute separations relate to "statistical discharges", that is, identifying the point at which a patient is no longer defined as an acute inpatient admission, even when they are not physically discharged from the institution. This is particularly relevant for patients requiring rehabilitation or nursing home care, where this occurs in the same institution. The episode type may not be changed in the hospital's admission, transfer and discharge database. It is also difficult to know the size of this across institutions and its impact on costs.

   Issues surrounding the identification of the acute inpatient population are further discussed in Section 3.6, in the context of the increasingly complex task which will arise in the future because of the changing role of hospitals and their integration with other services.

4. The **average cost weight** for a hospital provides a relative measure of case complexity treated within the given hospital, based on resource use. For

example, as a cost weight of 1.0 is defined as the national average, an average cost weight of 1.1 means that a hospital has a 10% more costly casemix than the national average. This enables performance to be compared across hospitals with differing caseloads.

The average cost weight is reported by provider and is calculated as follows:

$$\textbf{Average cost weight for hospital} = \frac{\sum[(\text{Cost weight}_i) \times \text{Separations}_i]}{\textbf{Total number of acute separations}}$$

where i represents each ANDRG from 1 to 667.

Although the average cost weight is calculated at the hospital level for acute separations only, it is applied to total separations (acute and non-acute) in the formula to calculate the average cost per casemix-adjusted separation. Cost weights for acute separations are unlikely to reflect weights for non-acute separations. Non-acute patients are more likely to have a longer length of stay, but a lower cost per bed day, compared to acute separations. Thus the assignment of acute cost weights will not be representative of the hospital's casemix.

The source data for DRG cost weights is based on the most recent cost weights produced by the NHCDC. Thus the AIHW method is also dependent on the quality of the DRG-level costing data provided by the NHCDC.

5. **Estimated private patient medical costs** are included in the AIHW formula, as medical costs for private patients do not appear in the hospital's expenditure data.

The formula used to estimate private patient medical costs is:

$$\frac{\sum\textbf{(Salary/sessional + VMO payments)}}{\textbf{No. of public patient days}} \times \textbf{No. of private patient days}$$

The underlying assumptions in this formula are that medical costs are the same for both private and public patients throughout their length of stay, based on an average cost per day, and that all of the salaried medical costs are attributed to public patients. Although these are unlikely to be realistic assumptions,

establishing the actual costs of medical care for private patients is a difficult task, complicated by issues of cross-subsidisation and whether the price (fee-for-service payment) reflects the cost. (see Section 3.3)

2.3 NHCDC Method for Calculating DRG Average Costs

Sample

The NHCDC reports the average cost per DRG using data provided by both public and private hospitals with computerised costing systems. These are not a representative national sample. Rather, the individual institution's ability and willingness to provide data determine participation. Hospital participation is encouraged at the state level, with a coordinator appointed in each state/territory. Some incentives are provided to hospitals to encourage participation, such as the provision of "grouper" software and detailed costing reports. Table 3 shows the number and proportion of cases and hospitals represented in the data set.

Table 3: Total separations and hospitals reporting costing data to the NHCDC, 1997-98

DRG Version	Hospitals		Separations	
	N of hospitals	% of Total	N of cases	% of Total
ANDRG V3.1	154	29%	Not Reported[1]	69%
ARDRG V4.0	150	29%	2,295,301	64%

[1]NHCDC only reports the number of separations reported for hospitals coding according to ARDRG 4.0. The proportion of total separations is reported for both ARDRG 4.0 and ANDRG 3.1.

Large metropolitan hospitals are likely to be the most represented in the sample in terms of the proportion of cases, although only 29% of hospitals contribute to the sample nationally, 69% are a significant proportion of total separations. It should be noted that the number of hospitals and cases would vary across individual DRGs and at a state/territory level.

Private and public hospital data are reported separately, with public hospital data also reported by state/territory and according to hospital type. Comparisons between public and private institutions need to take account of differences in reported costs (for example medical, imaging and pathology).

Data Type

Four means of calculating the average cost per DRG are used by the NHCDC, depending on the type of costing software used by the institution. However they can be described under two broad headings: cost modelling and patient level clinical costing data. Cost modelling means that costs are allocated to each DRG, whereas patient level clinical costing means that costs are attributed to individual patients.

Hospitals using cost modelling report in the format shown in Table 4. Costs are reported at the DRG level and hospitals calculate an average total cost and the average component cost for each DRG. The allocation of component costs is determined by service weights[4], which reflect the average resource use for a given DRG. A study to derive a set of national service weights was commissioned by the Commonwealth government in 1992. These service weights were reviewed in 1995 and 1998. Both reviews were undertaken using a representative clinical panel.

Table 4: Format for reporting costing data at the DRG level for hospitals using cost modelling

ANDRG 3.1/ ARDRG 4.0	N of separations in DRG	Total cost for DRG ($)	DRG average (weighted) total cost	DRG average (weighted) component costs				
1 2 3 4 : 667								

Hospitals using patient level clinical costing report individual patient data in the format shown in Table 5. Using their clinical costing systems, hospitals are able to track activity data to individual patients, and costs are thus allocated to the patient on the basis of resources actually used. However, hospitals vary with respect to the allocation rules they apply. Some may use actual utilisation while others may allocate costs on the basis of a series of service weights, for example patient

4 Service weights are used to distribute costs to DRGs on the basis of expected resource utilisation. For example, the distribution of pathology costs to a given DRG.

dependency[5] to distribute ward nursing costs. The differences between patient level clinical costing and cost modelling are discussed fully in Section 3.5.

Table 5: Format for reporting costing data at the DRG level for hospitals using patient level clinical costing

Patient identifier	ANDRG 3.1/ ARDRG 4.0	Patient total cost ($)	Component costs per patient ($)				
1	1						
2	1						
3	2						
4	2						
5	2						
:	:						
:	:						

Definitions for component costs are contained in the NHCDC Reference Manual, and include both direct and overhead costs for the following categories:

- Allied Health
- Ward nursing
- Medical
- Pathology
- Imaging
- Pharmacy
- Critical care
- Operating rooms
- Emergency department
- Prostheses
- Specialised procedure suites
- Other

In addition the following cost categories are separately reported:

- Hotel
- Depreciation
- On-costs
- Supplies

5 Patient dependency is a weight applied to an individual patient or diagnostic type, based on the expectation of nursing resource use. High dependency patients are allocated higher weights and thus are allocated a higher proportion of total nursing/ward costs.

Possible sources of error with respect to these cost categories, include:

- Comparability of cost categories, for example different treatment of cost categories. That is comparison of direct ward costs between hospitals, whether cost categories are separately defined, or whether there is some crossover between two or multiple categories. For example on-costs could be included with ward nursing by some hospitals and not by others, or the definition of critical care areas may differ by hospital or across jurisdictions.
- Which intermediate products are included in each.
- How the total costs identified in each category are allocated to the DRG (cost modelled sites) or to the patient (patient level clinical costing sites).

Care should be taken when interpreting and comparing cost categories, both across jurisdictions and across institutions, as definitions and allocation rules are likely to differ. Participating hospitals are expected to provide input files, descriptions of cost categories and allocation rules. However it is not clear from the NHCDC Report that these are routinely subject to an audit process. Jackson, Watts et al (1999), describe a tool enabling hospitals to describe their cost allocation and patient identification method for separate cost categories.

Methodology

Hospitals provide a summary data file reporting activity data for each DRG, such as the number of discharges and the total number of days (length of stay), and costing data, such as direct and indirect component costs and total cost. Average cost is defined simply as:

$$\textbf{Average Cost per DRG}_i = \frac{\textbf{Total Cost of DRG}_i}{\textbf{N of Seps in DRG}_i}$$

An estimation process is used by the NHCDC to stratify the sample, weighting the sample data to reflect national population figures in order to derive a national set of DRG weights. To do this the sample data is weighted to reflect the population for each sector according to the following variables:

- Hospital type (eg specialist, acute)
- State
- Location (eg major urban, non-major urban)
- Number of separations, where:

$$\textbf{Number of separations} = \frac{\textbf{Population separations}}{\textbf{Sample separations}} \times \textbf{Sample hospitals}$$

Hospitals are also asked to report costs for the following products, over and above cost data relating to acute inpatients:

- Non-admitted patients
- Rehabilitation
- Non-acute admitted patients
- Outreach/community
- Staff education
- Research
- Other

This requires a similar estimation process to that described for IFRAC above, that is each hospital is required to estimate the proportion of costs to be allocated to these products or activities. This effectively occurs in 2 steps: (i) the proportion of total costs not allocated to acute inpatient services and; (ii) of this, the proportion to be allocated separately to each activity. The degree of estimation involved in this process will depend on the type of costing system in use by the hospital. Hospitals using cost modelling need to estimate the proportion of costs at each level for each cost category. Whereas patient level clinical costing sites are required to make an estimate for cost categories where there is no patient level activity data recorded, and perhaps for the allocation of overheads costs. The issue is further addressed below in Section 3.6.

2.4 Strengths and Weaknesses of the Two Models

The following is a brief overview of the strengths and weaknesses of the two data collections and methodologies:

- The AIHW provides national coverage of acute public hospitals and reporting is a requirement of the National Health Information Agreement (NHIA) arising from AHMAC. In contrast, data provided to the NHCDC is voluntary. Thus the NHCDC is a non-representative sample of public and private hospitals, where separations from large metropolitan hospitals are likely to make-up a high proportion of the sample.

- *Australian Hospital Statistics* reports expenditure data by public hospitals to state/territory health departments. Expenditure data and factor inputs are recorded according to defined input categories. Where input factor prices may differ across jurisdictions or over time, this can be compared by quantity data. In contrast the NHCDC methodology is based on the hospital's allocation of costs to individual DRGs or patients. Where costs differ across jurisdictions or over time, it is difficult to distinguish whether this has resulted from changes in factor prices or factor quantities.

- The AIHW methodology is based on reported total expenditure by public hospitals to state/territory health departments for both acute and non-acute separations and uses a hospital-estimated inpatient fraction to allocate expenditure to inpatient separations. In contrast, the NHCDC methodology is based on the hospital's allocation of costs to individual DRGs or patients, and how this occurs depends upon their particular costing system and allocation methods and definitions between individual hospitals.

- Estimation of the IFRAC, acute separation fraction and other hospital product fractions are an issue for both data sets, with the possible exception of some patient level clinical costing data for the NHCDC. The AIHW approach costs all inpatient separations, therefore the IFRAC is used to differentiate admitted and non-admitted patients, but not acute and non-acute separations or other hospital products. The NHCDC approach costs acute separations, therefore uses fractions to allocate costs between acute and non-acute separations, inpatient and non-admitted separations, and other hospital products, for example teaching

and research. The method may differ depending on the sophistication of the costing system. At the very least the fraction can be applied at the Cost Centre level, at the other end of the spectrum products can be costed to individual patients within Cost Centres, with no need of estimating a fraction.

- Both sets of data are likely to be affected by variations in accounting methods, for example the threshold value for capitalisation of assets, depreciation methods and where expenditure adjustments occur across financial years. In addition anomalies with respect to the NHCDC relate to inconsistent reporting of costs attributed to capital.

- The AIHW and NHCDC differ in their approach to depreciation. The NHCDC includes depreciation, despite reporting inconsistencies across states and territories, whereas the AIHW excludes depreciation due to inconsistent reporting by states and territories.

- Cost component definitions in the NHCDC may vary by hospital and jurisdiction which will affect comparison of costing data, particularly at the DRG level.

3. Other Issues in Data Consistency

3.1 Introduction

Costing data needs to be both consistent and of an acceptable quality, in order that comparisons of hospital efficiency and performance can be made. There are some inconsistencies in the hospital costing data that are of particular importance for one or both data sets, and six of these are discussed below. Namely:

(i) the complex issue of capital, its inclusion in hospital costing data and whether it should be included when comparing hospital performance and efficiency;
(ii) the treatment of private patient medical costs in each of the data sets and implications for hospital costing generally;
(iii) the treatment of superannuation and/or labour on-costs in each of the data sets;
(iv) the differences between cost modelled and patient-level clinical costing data which are of specific relevance to the quality of the NHCDC data

and DRG-level costing data. Particularly important is the type of costing data used in the calculation of DRG average costs and the likely impact on measures of technical efficiency and hospital performance;

(v) the identification of both acute separations and the inpatient fraction (IFRAC), and the possible effects of this estimation in both data sets; and

(vi) the inclusion of costing data from small rural hospitals for efficiency comparison.

3.2 Capital/Depreciation

The issue of how to include capital in hospital costing data is not straightforward. There is inconsistency in the definition of capital, the type of accounting methods used by hospitals, and how capital expenditure is captured on an annualised basis. More complex issues relate to the actual inclusion of capital in measures of hospital efficiency and performance.

The AIHW excludes depreciation expenditure in *Australian Hospital Statistics*, Table 2.1, which shows the cost breakdown per casemix-adjusted separation. However the AIHW's Table 3.8 shows depreciation expenditure data reported for each state. The reason the AIHW gives for not reporting in the former case is the inconsistency between states in reporting depreciation. The *Report on Government Services 2000* provides a summary of the treatment of assets by states/territories. From their Report it appears that the Northern Territory is the only state/territory reporting on a cash basis. Other differences across states/territories include:

- the revaluation method used for land, buildings and other assets;
- the threshold values for capitalisation of buildings, IT equipment and other assets (ranges between $500 and $5,000);
- the useful life of assets; and
- the frequency of revaluation for land/buildings and other assets[6].

For the four states reporting depreciation to the AIHW, total capital expenditure is reported. This is shown in Table 6 below, where capital (and interest) expenditure is added to the total recurrent expenditure and the proportion of capital to total expenditure shown. From this table the range of depreciation reported is from 1% (Tasmania) to 6% (Western Australia when interest is added, or 4% when not

[6] Report on Government Services 2000, Table 4A.22, p.339

included) and 5% in New South Wales. Interest payments may be either for capital borrowings or to cover overdrafts for operating cost deficits. It is not clear from the reported interest expenditure whether both definitions apply, however the only state where interest expenditure appears to be relevant is Western Australia.

Table 6: AIHW cost breakdown by state for depreciation and interest, based on aggregate reported expenditure, 1997-98

	NSW		WA		Tas		ACT	
Expenditure category	$'000	%	$'000	%	$'000	%	$'000	%
Total recurrent expenditure excl depreciation	4,702,381	95	1,321,371	96	285,980	99	256,009	96
Depreciation[1]	222,508	5	52,731	4	2,843	1	10,528	4
Interest[2]	*210*	*0*	*25,456*	*2*	*0*	*0*	*4*	*0*
Total interest & depreciation	222,718	5	78,187	6	2,843	1	10,532	4
Total including depreciation	4,924,889	100	1,374,102	100	288,823	100	266,537	100

[1] Where depreciation, defined in the NHDD, is the expensing of a long term asset over its useful life and attributes a proportion of the expense to the relevant period.

[2] Interest payments are those made by hospitals in respect of borrowings.

The NHCDC reports capital expenditure separately in their Report (Table 4) showing the average cost per DRG. In addition capital expenditure is also reported for individual DRGs, showing that some procedures use equipment more intensively. The NHCDC has a similar problem to the AIHW as some states/hospitals use cash accounting, rather than accrual accounting. Reported depreciation is also affected by the non-reporting of capital in 18 larger Victorian hospitals, although some of the smaller Victorian hospitals report capital depreciation in their cost modelled data according to the NHCDC guidelines. The differences in threshold capitalisation values for assets that are reported in *Report on Government Services 2000* would also affect the NHCDC data. Table 7 shows the depreciation amount and percent of DRG total cost (not casemix-adjusted) in each state, ranging from 0% (Vic, Tas) to 5% (ACT, NT) for the NHCDC.

Table 7: NHCDC cost breakdown by state and cost categories for average cost per DRG showing the proportion of total costs for 1997-98

Cost Category	NSW		VIC		QLD		WA		SA		TAS		ACT		NT		Average	
	$	% of total	$	% of total	$	% of total	$	% of total	$	% of total	$	% of total	$	% of total	$	% of total	$	% of total
Ward medical	352	14%	392	17%	224	10%	326	13%	249	10%	485	21%	186	6%	252	9%	325	13%
Ward nursing	646	26%	793	35%	535	24%	841	34%	516	22%	384	16%	674	21%	763	27%	644	27%
Pathology	110	4%	104	5%	90	4%	99	4%	92	4%	60	3%	102	3%	116	4%	101	4%
Imaging	79	3%	73	3%	49	2%	57	2%	59	2%	62	3%	61	2%	47	2%	67	3%
Allied health	60	2%	61	3%	53	2%	55	2%	54	2%	57	2%	91	3%	49	2%	58	2%
Pharmacy	98	4%	135	6%	96	4%	84	3%	115	5%	88	4%	117	4%	0	0%	105	4%
Critical Care	174	7%	170	7%	156	7%	150	6%	184	8%	136	6%	275	9%	251	9%	170	7%
Operating rooms	307	12%	374	16%	255	11%	313	13%	254	11%	242	10%	533	17%	175	6%	310	13%
Emergency dept	78	3%	23	1%	39	2%	53	2%	43	2%	75	3%	52	2%	0	0%	50	2%
Supplies	140	6%	84	4%	96	4%	133	5%	224	9%	227	10%	286	9%	400	14%	134	6%
Specialty Procedural Suites	16	1%	1	0%	25	1%	32	1%	43	2%	23	1%	39	1%	11	0%	18	1%
Prostheses	54	2%	26	1%	36	2%	41	2%	48	2%	41	2%	44	1%	3	0%	41	2%
On-costs	141	6%	24	1%	241	11%	68	3%	147	6%	313	13%	352	11%	333	12%	135	6%
Hotel	41	2%	20	1%	211	9%	142	6%	188	8%	112	5%	196	6%	187	7%	97	4%
Depreciation	112	4%	8	0%	100	4%	67	3%	93	4%	6	0%	163	5%	131	5%	78	3%
Other	120	5%	4	0%	32	1%	38	2%	71	3%	21	1%	13	0%	63	2%	61	3%
Average Total Cost per DRG	**2,528**	**100%**	**2,292**	**100%**	**2,238**	**100%**	**2,499**	**100%**	**2,380**	**100%**	**2,332**	**100%**	**3,184**	**100%**	**2,781**	**100%**	**2,412**	**99%**

Thus, comparing the two methods for those states/territories reporting depreciation, there are some inconsistencies in reporting. Tasmania, NSW, WA and the ACT each report capital expenditure. However there is a difference of 1% in the proportion of total expenditure and proportion of DRG average cost reported to the AIHW and NHCDC respectively. With the exception of the ACT, a lower proportion is reported to the NHCDC. Hospitals in Queensland, South Australia and the Northern Territory are all able to report the proportion of total DRG costs relating to capital to the NHCDC. However they are not able to report aggregate capital expenditure to the AIHW, suggesting an inconsistency in reporting and/or recording.

The proportion of total costs relating to capital remains fairly low, probably around 5%, and at this level is unlikely to have a major impact on costs. It should be noted however that this is likely to reflect the lower end of reported capital expenditure. For example it is difficult to know in a single reported measure of capital expenditure whether all capital is included, ie buildings, major medical equipment, information technology and other equipment. In addition, for comparisons of efficiency, an economic definition of the cost of capital (the annualised loss of capital value), rather than an accounting definition of capital expenditure is required. That is, an economic definition is the opportunity cost of capital, and any measure of capital would reflect this. An accounting definition is more concerned with allocating actual capital expenditure, according to a chosen accounting method (for example accrual or cost).

The NHCDC also reports depreciation expenditure at the DRG level. This method provides potentially valuable information with respect to variation in capital operating costs due to different clinical settings, particularly for major medical equipment. At the DRG level the cost of depreciation for major medical equipment would be expected to vary, particularly in those DRGs where treatment predominantly occurs in critical care areas. This analysis would only be relevant if the data are sensible in terms of an economic definition of the cost of capital.

Analysis of NHCDC 1997-98 data at the cost per DRG level finds that there are only 36 DRGs (ANDRG 3.1) for which the proportion of capital depreciation is greater than 5%, from a total of 667 DRGs. In general the reported proportion of depreciation is fairly narrow at the DRG level (for ANDRG 3.1) varying from 1% to 9%, with the average proportion of total expenditure at 3%. However, Table 8 shows that for 14 DRGs, depreciation expenditure is greater than $1,000. These DRGs are

predominantly treated in intensive care or neonatal intensive care units. The amount of depreciation varies from $1,194 to $12,348 for these DRGs. However the proportion of total costs only varies from 3% to 6%; that is, depreciation does not necessarily form a high proportion of total cost in these relatively expensive DRGs. The low proportion of total costs allocated to depreciation (average 4% to 5%), and the high actual amounts attributed to intensive care DRGs, suggests that hospitals are fairly consistently depreciating capital costs for major medical equipment and technologies, rather than buildings and other general hospital equipment.

Table 8: NHCDC average total costs for 14 DRGs (ANDRG 3.1) for which depreciation expenditure is greater than $1,000, 1997-98 data for public hospitals

ANDRG V3.1 DRG Description		P=Proc M=Med	Std Error	Average Costs per DRG ($)			Av Deprec Cost	% Total Cost	N of Seps	N of Hosps
				Total	Direct	O'head				
007	MULTIPLE ORGANS TRANSPLANT	P	23.99	**236,041**	175,826	60,215	12,348	5%	6	3
921	SEV 3RD DEG BURNS +SKIN GRAFT	P	2.93	**80,645**	59,601	21,044	4,943	6%	50	12
005	LIVER TRANSPLANT	P	1.76	**124,380**	98,150	26,230	3,340	3%	144	7
871	TRACHSTMY MULT SIG TRAUMA A<16	P	1.02	**46,999**	34,304	12,695	2,514	5%	68	21
704	CARDIOTHORACIC/VASCULAR PR NEO	P	1.69	**45,193**	35,151	10,042	2,285	5%	327	14
705	NEONATE,ADMISSION WT <750G	M	1.29	**76,209**	55,926	20,284	1,906	3%	291	36
870	TRACHSTMY MULT SIG TRAUMA A>15	P	0.88	**65,527**	51,933	13,594	1,823	3%	488	38
707	NEO,AD WT 1000-1499G+SG O.R.PR	P	0.51	**55,938**	42,058	13,880	1,796	3%	343	26
706	NEONATE,ADMISSION WT 750-999G	M	1.03	**58,795**	44,064	14,732	1,711	3%	553	42
004	TRACHEOSTOMY OTH DISD A<16	P	0.41	**30,644**	22,862	7,782	1,530	5%	1,367	78
009	LUNG TRANSPLANT	P	6.18	**83,159**	70,654	12,505	1,526	2%	58	4
010	ECMO W/O CARDIAC SURGERY	P	1.25	**39,347**	30,667	8,680	1,458	4%	45	10
003	TRACHEOSTOMY OTH DISD A>15	P	0.37	**49,635**	38,038	11,597	1,355	3%	5,631	69
710	NEO,AD WT 1500-1999G+SG O.R.PR	P	0.85	**35,993**	26,792	9,201	1,194	3%	142	22

Proc – Procedural DRG
Med – Medical DRG
O'Head – Overhead
Deprec – Depreciation
Seps – Separations
Hosps – Hospitals

If costing or expenditure data reported by either the AIHW or the NHCDC are being used for performance measurement or comparisons of efficiency, then there are several aspects to consider with respect to capital inclusion. Firstly, the extent to which decisions about capital are under the control of hospital management, that is how much control in the short and long run do hospitals have over the use of capital. The issues surrounding this are probably dependent on the type of capital under consideration. Capital can be broadly divided into 3 types; land, buildings (including capital improvement) and large medical equipment purchases.

In the short run decisions with respect to land may not be fully under the control of most hospital managers (including private hospital managers). If operational efficiency or performance is being compared, then incorporating factors outside the control of managers may provide no useful insight. However managers do have some control over substitution between land and buildings; buildings can be built to take up less land. The opportunity cost of land and substitution between land and buildings also has policy relevance in the public sector in terms of the initial location or relocation of the hospital, and hospital expansion or contraction. Broader health service comparisons of efficiency also require the inclusion of capital costs. For example, in the context of a comparison of acute care (hospitalisation) with community-based care, then if capital (land, buildings, plant and equipment) is included in the costs of community care, the same should also be included in the costs of acute care. To do otherwise would distort the comparison in favour of the relatively capital intensive acute care. A similar comment is valid for comparisons between the public and private sectors, where there is an imperative in the private sector to fully utilise capital.

To enable a range of comparisons of efficiency between hospitals (by state/territory, size and location), across hospital sectors (public and private) and across health care settings (acute inpatient, outpatient and community), it would help if capital was further standardised, disaggregated and reported. The definitions in the *National Health Data Dictionary Version 8.0* (1999) break capital down to:

1. Land and buildings
2. Computer equipment/installations
3. Major medical equipment
4. Plant and (other) equipment

5. Expenditure in relation to intangible assets
6. Other capital expenditure.

With the exception of separating land from buildings, and buildings to include capital improvement, the other five categories appear reasonable. Disaggregating capital in this way would also provide valuable information at the DRG level for comparisons of efficiency and performance measurement in the NHCDC, however a greater degree of disaggregation for major medical equipment may be required for this level of comparison.

What is primarily of interest for determining efficiency is the factor mix between capital and labour. In this context, the issue of measuring the cost of major medical equipment, and to a lesser extent buildings, is of greater interest than measuring the cost of land. This enables analysis of efficiency, for example with respect to labour capital substitution. Thus this level of analysis across hospitals and jurisdictions requires consistent cost estimates and definitions for the capital that is needed for major medical procedures.

3.3 Treatment of Private Medical Costs

The allocation of medical costs to private patients in public hospitals is likely to be a quantitatively significant source of inconsistency across jurisdictions. The only medical expenditure recorded by public hospitals is for their salaried and sessional medical staff. Fee for service payments to doctors attending private patients in a public hospital are not recorded. Consequently, public hospitals do not capture the full costs of medical care provided in public hospitals and they do not specify how public medical expenditure is allocated between private and public patients. If hospitals attribute medical salaries (expenditure) to the treatment of all public and private patients, then expenditure will understate actual medical costs. However applying medical costs only to public patients is likely to overstate medical resources used on these patients, when services to private patients are also provided by salaried staff (registrars; resident medical officers (RMOs); and salaried specialists, for example emergency department, ICU).

The AIHW formula includes an estimate of these private patient medical costs by assuming that total medical expenditures for public hospitals are entirely attributable to public patients. This assumption is unlikely to be realistic as certain salaried and sessional medical staff also provide services to private patients. A second assumption underlying the adjustment in the formula is that the average medical cost per day is the same for private and public patients. However, financial incentives for providing medical services differ according to the method of payment:- fee-for-service or salaried/sessional rates, and it is likely that more services are provided to private than to public patients. The method of estimation of private medical costs by the AIHW is therefore likely to understate the medical costs attributed to private patients, and to overstate the costs (expenditures) attributed to public patients.

The NHCDC includes private medical patients in its data set. However the allocation of medical costs is likely to differ from hospital to hospital and to both public and private patients, and is not necessarily dependent on the type of costing system in use. Generally, patient level clinical costing sites find the allocation of medical costs to individual patients difficult, as actual resource use (time) is difficult to capture, particularly for ward medical services. Thus, both patient level clinical costing and cost modelling systems tend to use cost modelling in the allocation of medical costs. The allocation rule applied in the cost modelling process will thus affect the quality of the data provided and how closely allocated medical costs reflect actual costs for public and private patients.

The above relates to the allocation of medical costs in the NHCDC data in general, however there is an additional issue underlying the allocation of medical costs to private patients in the NHCDC data. Private patients are usually billed separately for medical services, thus hospitals may not allocate any medical costs to private patients in their clinical costing systems in the belief that they do not constitute a cost to the hospital. An alternative approach is that private patients may be allocated a portion of total medical costs to cover services provided by resident medical staff in public hospitals.

The impact of private medical costs in each of the data sets is therefore dependent on the proportion of private medical patients treated in a specific hospital and, for the NHCDC data set, variation is likely to occur between DRGs according to the ratio of

public to private patients. Thus an error is introduced both across jurisdictions and DRGs. As the proportion of private patients in public hospitals has decreased through time the magnitude of this problem will also have decreased, but the magnitude of the error remains unknown and may be quite significant in some DRGs.

3.4 Labour On-costs/Superannuation

A third potential difference between the two data sets is the reporting of superannuation and labour on-costs. The AIHW separately reports superannuation costs, but does not report other labour on-costs as a separate category. The reported range is from 4% (NT) to 7% (ACT) with an average cost of $131 (5%) for a casemix-adjusted separation. Hospitals reporting to the AIHW are required to include long service leave with salaries, and worker's compensation insurance as an administrative expense. It is not clear where hospitals report recruitment costs and termination payments. As public hospitals are exempt from payroll tax in all states except Tasmania, the AIHW removes Tasmania's payroll tax from the cost per casemix-adjusted separation calculation for comparability purposes.

The NHCDC reports superannuation under labour on-costs, defined as superannuation, termination payments, fringe benefits tax, long service leave, payroll tax, worker's compensation and recruitment costs. The range of on-costs reported by the states is from 1%(Vic) to 13% (Tas) of total costs. However the average cost for a casemix-adjusted separation reported by the NHCDC is similar to that reported by the AIHW at $135 (6%), despite the broader definition. Possible explanations for this difference include the non-reporting of some on-costs by hospitals, or the inclusion of on-costs into labour cost categories such as ward nursing, or allied health. For example patient level clinical costing sites in Victoria include labour on-costs with direct labour costs in ward nursing, allied health and critical care areas.

Without equivalent data from the AIHW it is difficult to draw reliable conclusions concerning the impact of labour on-costs. However it is noted that ward nursing costs in Victoria are higher than the reported average. If the AIHW superannuation cost of $131 or 5% of total recurrent expenditure is accurate, then the 11 to 13% on-costs reported by Queensland, Tasmania, ACT and NT in the NHCDC data set may be closer to the proportion for labour on-costs.

3.5 Cost Modelling and Patient Level Clinical Costing Data

The following discussion is specific to the NHCDC data set, and has little bearing on the AIHW data set. The issue concerns the quality of data reported to the NHCDC at the DRG level, particularly with respect to the differences between cost modelled and patient level clinical costing data. The intent of the discussion is that comparisons of efficiency at the DRG level across jurisdictions are interpreted with caution, as apparent differences may relate to the type of data reported.

The NHCDC method relies on costing data from computerised costing systems which are either based on patient level clinical costing or cost modelled data. In cost modelling, costs are allocated to the DRG using a "top down" allocation method, where the total costs for a cost centre, eg imaging or pathology are allocated to the DRG on the basis of "service weights", rather than actual utilisation. This has the effect that every patient in the same DRG is allocated the same cost. Hospitals using cost modelling only need to report the total costs for the DRG and the number of patients treated in the DRG.

Service weights are used to distribute costs for each cost centre at the DRG level. Thus the basis for these service weights is important as they need to reflect current clinical practice. In Australia there appear to be two main sources: service weights developed in Maryland, US (originally used but now being phased out), and national weights developed in 1992 for the Commonwealth government, with some modifications in 1995 and 1998 through a clinical review panel process. It is important that the Australian National Service Weights be regularly updated if cost modelled data is used in the calculation of DRG average costs, in order to reflect resource use, especially in the context of rapidly changing technology and clinical practice. The development of service weights requires sufficient hospitals, with high quality patient level clinical costing systems, to provide costing data on a regular basis for each of the cost categories.

The implication of cost modelling for hospital costing generally is that every patient in a DRG in a given institution is allocated the same cost. Thus there are no identified outliers, or descriptive statistics such as mean, range, standard deviation and confidence intervals. In addition the impact is that any efficiencies will be dampened. For example, consider pathology costs. If one clinical specialty in a hospital orders

more tests for patients compared to the national average (as reflected by the service weight), then this effect may not be picked up by the individual hospital. Instead the entire hospital may appear inefficient in the delivery of pathology tests. Another consequence is that it would be impossible to detect diseconomies of scale associated with the conduct of a small number of specialised pathology tests. The high cost of these would increase the total cost of the pathology cost centre and this would be allocated to all the hospital's DRGs, according to the national pathology service weights.

In contrast, patient level clinical costing systems use a "bottom up" approach to allocate costs within each cost centre at the patient level. At one end of the spectrum, this includes the allocation of the costs of resources utilised to the individual patient, for example a specific pathology test, or minutes spent in operating theatre. However at the other end of the spectrum, less detailed systems allocate a weighted average cost to the patient, which may be based on a simple weighting formula, such as the length of stay. Nevertheless, in any DRG category the costs allocated to individual patients will be different, and resource use outliers can therefore be identified, and summary statistics reported. This level of clinical costing data obviously provides a greater insight into the range of patients treated in a DRG, in terms of resource use, and is likely to provide more accurate costing at the patient, and thus the DRG level.

The NHCDC collects data from hospitals providing data in both formats. However no summary is provided to indicate the proportion of hospitals using each system, or the proportion of cases in these hospitals. Because of the high installation and maintenance costs of these systems, it is probable that on average, it is the larger hospitals that use patient level clinical costing systems. As the NHCDC sample is dominated by larger hospitals, it is likewise possible that the majority of reported separations are from patient level clinical costing sites. Thus, given the high number of cases from large hospitals represented in the sample, the DRG average costs may reflect actual resource utilisation at the patient level.

3.6 Issues in Identifying the Acute Inpatient Population

The IFRAC is included separately in the AIHW formula, indicating the need to remove expenditure relating to non-admitted patients from the calculation of the average cost per casemix-adjusted separation. Currently the AIHW formula does not require that hospitals similarly report expenditure relating to non-acute patients, although the cost weight adjustment applied in the formula is calculated for acute inpatients only.

The NHCDC requires that hospitals separately identify the number of separations and the proportion of expenditure attributed to the acute inpatient population. This presents an issue for hospitals concerning the amount of estimation necessary in attributing costs, particularly for hospitals providing cost modelled data, and to a lesser extent those providing patient level clinical costing data. Hospitals providing cost modelled data are required to identify the acute inpatient population to which costs in each cost category are allocated. For example, allocating pathology costs to acute inpatient separations requires that only the proportion of total costs used by this caseload should be allocated.

With the NHCDC cost modelled data, the acute inpatient population could be identified by the hospital as a whole and then the ratio of acute to total separations applied across the cost categories. Alternatively the proportion of acute inpatients could be calculated individually for each cost category. Although the latter method is likely to be more accurate, it is not clear that this is commonly applied. For patient level clinical costing data the above may apply for the allocation of indirect costs. However with these more sophisticated systems, hospitals are able to allocate direct costs to individual patients (regardless of patient type). This is particularly the situation where there are clearly defined products, eg pathology and imaging; where products are relatively homogeneous, eg special care areas; or where a time basis for resource allocation is recorded, eg operating theatres. Poorly defined cost centres in terms of identifying resource use at the patient level include medical, ward nursing (especially where wards have a mix of patient types) and allied health (where services are provided to both inpatients and non-admitted patients).

As acute hospitals are increasing the number of treatments they provide and the mix of their patient populations is changing, the issue of defining acute inpatient separations is likely to become more difficult and has implications for both data sets. Although the AIHW reports the acute inpatient population as 92% of the total, this is likely to be overstated due to the increasing number of non-acute patients treated in acute hospitals (particularly psychiatric, nursing home type and rehabilitation). The definition of the inpatient population may also be inconsistently applied in areas such as dialysis, chemotherapy and radiotherapy. In Victoria patients treated for at least four hours in the emergency department are defined as an admitted patient for payment purposes, whereas some other states/territories define these patients as non-admitted patients.

Defining the number of acute inpatient separations has implications for the allocation of costs, where the actual resource use is not attributed at the patient level, that is this may be less of an issue for patient level clinical costing. Thus, identifying this population will have implications for costing in both the AIHW and NHCDC data sets.

3.7 Provision of Costing Data by Small Rural Hospitals

The casemix of small rural hospitals is likely to be different to the casemix of larger regional and metropolitan hospitals, with an over-representation of non-acute separations. This is likely to result from exogenous factors, such as location and availability of rehabilitation and nursing home beds, and other community resources.

Small hospitals are less likely to have costing systems therefore limiting their ability to provide costing data to the NHCDC. The limitations in costing small rural hospitals arise from the considerable investment required to install costing systems, both in terms of equipment and personnel; small numbers of cases in DRGs; a limited set of DRGs represented; and the possibility of non-representative cases in these DRGs (ie non-acute separations). Incorporating the output costs of these facilities into a measure of technical efficiency for comparison purposes will not be particularly meaningful.

Although it is important for smaller hospitals to understand their cost structures as an indicator of performance, and particularly in an output-based funding environment, whether this means the installation of sophisticated and expensive costing technology requires further investigation.

4. Purpose of Hospital Efficiency and Costing Data

The adequacy of data must be assessed in relation to the possible purposes of the data. These are briefly discussed below. There are several potential uses of hospital costing data, some which can be met by the current data collections and others which may require some modification. It is probably true at present that any use of the current data collections requires some qualifications. Uses of hospital costing data can be broadly categorised at three levels: for policy development (Commonwealth and states/territories); at the institutional level (management information, "best practice", benchmarking); and at the clinical level (research, including cost effectiveness analysis).

At the policy level, costing data can be used for service planning and delivery. Technical efficiency arising from economies of scale or scope can, for example, be investigated along with the broader issues of access and equity. It can also be used to inform pricing policy at the DRG level for state-based funding systems, and nationally for cross-border pricing. At the Commonwealth level hospital costing data can also be used as an input into the budget setting process and/or health service agreements.

At the institutional level costing data can be used for benchmarking both between hospitals or across similar services. That is, aggregate measures of hospital costs can be used for comparison across similar institutions. For example, peer grouping by hospitals provides a mechanism for benchmarking at the hospital level. However hospitals may also need to benchmark at the DRG-level (or by groups of DRGs). This provides additional information to managers in the context of local service delivery and best practice. Clinical pathways can also be developed and costed from these comparisons to enhance internal efficiency.

At the clinical level national costing data can be used as a secondary data source in economic evaluations for pharmaceutical agents and healthcare technologies. This serves as an input into clinical practice changes and measures of allocative efficiency

arising, for example from service substitution, or between the acute care and community sectors.

When evaluating the adequacy of data systems it is important to note that data may be sufficiently accurate for one purpose but not for another. This is particularly true when considering the use of cost data for a comparison of efficiency and when using costing data to inform pricing policies for public hospitals. If costing data are to be used for an analysis of efficiency both within the public hospital sector and between sectors, (for example to inform decisions concerning the provision and organisation of health services), then all economic costs should be included. Issues concerning the inclusion of capital and medical costs for private patients are thus relevant in this context.

In contrast, when hospital costs are only being used to inform pricing policy for public hospitals, then only the costs of services that are government funded are relevant. Costing in this context would only involve the identification of publicly funded activities. Non-clinical services such as car parking and the staff cafeteria generate revenue for the hospital and do not rely on government funding. Users of the data would need to determine if these costs should be included for pricing purposes.

In summary, at the DRG level, costing enables:

- Consideration of technical efficiency; scope and scale economies at the DRG (or group of similar DRGs) level;
- Comparison of costs at the DRG level by hospital type to assist policy, planning decisions, particularly in service delivery;
- Benchmarking by hospitals at the DRG level;
- DRG price setting as an input into payment policy (output-based) or to assist in budget setting negations, ie commonwealth-state agreements, cross-border pricing.

A measure of aggregate hospital costs (casemix-adjusted) enables:

- Comparisons of technical efficiency by jurisdiction (state, hospital type, hospital location, etc);
- International comparisons of hospital costs (casemix-adjusted).

Table 9 provides a summary of the purposes of hospital costing data and the ability of the current data collections to meet these objectives. The table provides a brief description of the purposes of the costing data, which summarises the discussion in Section 5. The

second column, marked “data requirements” briefly describe the type of data needed to undertake each analysis, and the database most likely “in principle” to provide this data is identified in column 3. The reason why it is only “in principle” is that in some circumstances the data included are not yet of the appropriate quality to provide an accurate analysis.

Table 9: Summary of the purposes of hospital costing data, data requirements and the ability of current data collections to meet these objectives

Purpose	*Data Requirements*	*Source*	*Comments*
Comparisons of technical efficiency by jurisdiction: • **State/territory** • **Hospital type** • **Hospital location** • **Regional**	• Average cost of casemix-adjusted separation. • Reported acute inpatient separations (NHMD). • Average cost per DRG. • Average cost by hospital/jurisdiction type. • Full economic costs should be included.	AIHW NHCDC	**In the short term the AIHW provides the most appropriate data for interstate comparisons, due to its national coverage.** However the AIHW is not able to provide average cost per DRG and relies on NHCDC cost weights to undertake the casemix adjustment. In the longer term, subject to an expansion of the numbers of hospitals submitting data, NHCDC data will enable more micro level comparisons of efficiency between states, particularly at the DRG level.
Service planning and delivery, ie as a basis for: • **the optimal size of units** • **location of specialty services, for example cardiovascular intensive care, trauma centres, neonatal intensive care**	• DRG average cost by hospital/jurisdiction type. • Patient level costing data for DRGs predominantly managed in specialty areas. • Inclusion of statistical, cost and/or LOS defined outliers. • Outcome studies at clinical level, incorporating economic evaluation. • Full economic costs should be included.	NHCDC AIHW	**The NHCDC is the most appropriate data source.** The main impact of using costing data in service planning relates to the organisation and location of specialty services. Studies at the institutional level to determine if economies of scale and/or scope occur in the delivery of acute hospital services. Allocative efficiency in service delivery taking account of where economies of scale may be achieved and population health outcomes maximised, incorporating issues of access and equity. Requires some additional data analysis to that currently undertaken by the NHCDC. AIHW data is of less use at this level of analysis, particularly in the planning and delivery of specialist hospital services, because costing data cannot be provided at the specialty level.

Purpose	*Data Requirements*	*Source*	*Comments*
Pricing, ie as a basis for: • **Output-based funding systems (state/territory)** • **Cross-border pricing**	• Average cost of casemix-adjusted separation. • DRG weights. • Reported acute inpatient separations (NHMD). • Average cost per DRG. • Identification and exclusion of outliers. • All costs supported by government funding should be included.	AIHW NHCDC	**Both data sets are acceptable, however the NHCDC has the additional advantage of being able to provide DRG costs as a basis for prices.** Average cost per casemix-adjusted separation assumes that DRG weight equals 1. Multiply by DRG weight (NHCDC) for payment at the DRG level. Dependent on quality data re source weights and identification of acute inpatient separations. DRG costing (NHCDC) relies on representative hospital samples, if this is to be the sole funding basis. Adjustments for regional areas and remoteness could be incorporated at the DRG level (peer groupings of hospitals, for example incorporating clinical, size and geographical similarities). This requires additional analysis to that already undertaken by the NHCDC. Identification and exclusion of outliers in costing data to establish a base price at the DRG level with additional funding policy for outliers. The quality of costing data from both the AIHW and NHCDC are not adequate for costing of non-acute and non-admitted patient services. **In using either collection for pricing and funding purposes, the costs met by government are the relevant consideration. Neither collection adequately addresses this issue at present.**

Purpose	*Data Requirements*	*Source*	*Comments*
Budget setting, Health Service Agreements	• Case level activity data for separation types; acute inpatients, rehabilitation, non-admitted patients, and other caretypes. • Average cost per casemix-adjusted separation for acute inpatients. • DRG cost weights. • Average cost per DRG. • Identification and exclusion of outliers. • All costs supported by government funding should be included.	AIHW NHCDC	**Both data sets are acceptable for acute inpatients, however the NHCDC has the additional advantage of being able to provide DRG costs.** Similar to above comments for pricing with respect to acute inpatients. Neither data set is adequate for the costing of non-acute or non-admitted patient services. As with pricing, the costs met by government are the relevant consideration.
Benchmarking	• Average cost per casemix-adjusted separation. • Average cost per DRG. • Patient level clinical costing data. • Patient level outcomes.	AIHW NHCDC	**Both data sets are acceptable, however the NHCDC has the additional advantage of being able to provide DRG costs.** Only useful at hospital level, for state/territory or within peer group comparisons. More widely useful for: • Comparison at the DRG level across institutions or groups of hospitals as it enables performance measurement including “best practice” at the DRG or clinical specialty level. • Weighted average with cost modelled data dampens the true picture of internal hospital efficiencies within clinical specialties. Patient level data enables comparisons across institutions in terms of actual resource utilisation at the case level.

Purpose	*Data Requirements*	*Source*	*Comments*
International comparisons of hospital performance	• Average cost per hospital separation. • Average cost per procedure.	AIHW NHCDC	**AIHW is the most appropriate data source.** The average cost per hospital separation is not casemix-adjusted due to differences in coding. Average cost per procedure may be based on ICD-9/10 comparisons. Comparison of individual DRGs would be less meaningful due to international differences in DRG coding.
Research/economic evaluation, ie as a basis for: • **cost of illness studies** • **cost analysis such as the effects of state, location, hospital type** • **cost effectiveness analysis**	• Average cost per DRG. • Patient level costing data will contribute additional information for some clinical specialties. • Full economic costs should be included.	NHCDC AIHW	**NHCDC is the most appropriate data source, but also has some limitations.** Data requirements depend on the nature of the evaluation. For example evaluation of some clinical specialties may require patient level clinical costing data to compare actual resource utilisation in specialty areas, test ordering etc. Clinical costing data has some limitations, especially where changes relate to specific areas, in this situation “time and motion” studies may be warranted. AIHW data may be used in conjunction with NHCDC data to model cost of illness.

5. Summary

The type of hospital costing data required to measure efficiency and to make comparisons across hospitals and jurisdictions is a complex issue. The two methods currently undertaken nationally have both similarities and differences. The AIHW reporting by aggregate expenditure and adjusting for inpatient separations, enables a comparison of national hospital performance through time and across jurisdictions. Although the NHCDC provides a smaller sample of hospital costing data, it enables a more accurate comparison of performance at the DRG level.

Both costing data sets contain data limitations, and a comment regarding the implementation of data quality audits could be made for both. Interpretation of the NHCDC data is unnecessarily complicated by the failure to identify the proportion of hospitals and cases represented by patient level clinical costing sites and the proportion of hospitals complying with cost category definitions.

However the NHCDC provides a potentially rich source of data at the DRG level for future comparisons of technical efficiency, particularly where this may be achieved through scale and scope economies. Comparisons of efficiency at this level can take account of any effect that clinical similarities might have on efficiency. The ability to price at the DRG level also has policy relevance for the commonwealth as an input into state budget setting and for cross-border pricing.

In the long run the NHCDC has the potential to provide a far more complete data set. However at present this potential has not been fully realised. The likelihood of sample bias with respect to the NHCDC is of concern, but without an adequate external data validity check it is difficult to determine the extent of this problem.

6. Recommendations

The following recommendations arise from this report and are aimed at improving the quality of the costing data reported in both data sets:

- that a survey be taken of potential users of the hospital data to identify the questions that are of concern to them and concerns with respect to the quality of the data;
- that the AIHW conduct an analysis of the sub-sample of hospitals that are in the NHCDC survey; identify any aggregate level differences and provide this information on a regular basis;
- that the NHCDC identify the hospitals that are employing cost modelling and patient level clinical costing data;
- that an analysis be undertaken using NHCDC data to replicate the methods of the AIHW and, by comparison, identify precisely the effect of the methodologies; and
- that a survey be undertaken (possibly through the NHCDC) to identify precisely the type of costs employed and the basis for modelling where this is used.

More general recommendations include an exploration of the theoretical issues concerning the:

- consistent treatment of capital across hospitals with respect to its inclusion in a general measure of hospital efficiency; and
- from a policy perspective the construction of performance indicators for acute hospitals which are suitable for use in aggregate efficiency measures, and benchmarking by hospitals.

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