
OVERVIEW

Key points

- The Commission recently completed a Research Report on the performance of public and private hospitals which compared costs, infection rates and other indicators (PC 2009). That report also considered rates of, and impediments to, informed financial consent; and assessed potential indexation factors for the Medicare Levy Surcharge income thresholds.
- A part of that study used multivariate techniques which estimated that hospital output was typically around 20 per cent below best practice. This was based on preliminary analysis of just a single year of data because of significant delays in accessing data.
 - The modelling in this supplement draws on three additional years of data, as well as improved data quality and estimation methods, and finds that hospitals are operating around 10 per cent below best practice. While this estimate is more reliable, it remains an estimate given the limitations to the data.
- In this supplement, the Commission has compared hospital performance in terms of:
 - hospital-standardised mortality ratios — as a measure of the effectiveness and ‘quality’ of hospital care
 - efficiency — measured by the extent to which hospitals made best use of their resources to provide services.
- Hospital-standardised mortality ratios were estimated to be generally similar between very large public and private hospitals. However, smaller private hospitals had noticeably better mortality ratios than similar-sized public hospitals.
 - While this might indicate differences in management and clinical competence, it could also indicate the tendency for smaller public hospitals to be the only major source of clinical care in remote and very remote areas.
- Australian acute hospitals were estimated to have scope to improve their efficiency by about 10 per cent under the existing policy environment.
 - For-profit and ‘public contract’ hospitals were estimated to be more efficient than public hospitals on average, in terms of their potential to increase output for a given set of inputs.
 - However, for-profit, not-for-profit and public hospitals were found to be similarly efficient with respect to their potential to economise on input use for a given level of output.
- Smaller public hospitals, many of which are located in more remote communities, were found to be less efficient than similar-sized private hospitals, possibly due to lower occupancy rates.
- The Commission also sought to measure the determinants of hospitals costs, but the available financial data, such as capital and medical costs, were inadequate.
- There are various other shortcomings in data quality and availability. These would need to be overcome if policy analysts and other researchers are to produce improved estimates of efficient costs of providing hospital care.

Overview

The Commission recently completed a Research Report on the performance of public and private hospitals which compared hospital and medical costs, infection rates and other indicators; considered rates of, and impediments to, informed financial consent; and assessed potential indexation factors for the Medicare Levy Surcharge income thresholds (PC 2009). The report also reported the estimates from a preliminary multivariate analysis of the efficiency of public and private acute hospitals. Due to a lack of timely access to data, however, that analysis had to be based on a single year of data (2006-07) and examined only one aspect of efficiency. The Research Report noted that the Commission would be revisiting the multivariate analysis in early 2010.

This supplement improves on the multivariate analysis in the Research Report by:

- including three additional years of data (2003-04 to 2005-06)
- addressing the poor quality of some of the data
- improving the measurement of effectiveness and quality of hospitals
- considering alternative approaches to modelling hospital efficiency
- addressing the under-representation of not-for-profit hospitals in the dataset.

Overall, these enhancements have yielded more reliable estimates of the relative effectiveness and efficiency of public and private hospitals, but should still be understood as estimates produced using the best available data and modelling techniques at this time. However, a number of data limitations persist.

Measuring hospital performance

In this study, hospital performance is examined in terms of both quality and efficiency. Hospital quality is proxied by the hospital-standardised mortality ratio (HSMR) for each hospital. The relative performance of hospitals in reducing mortality is a potentially useful measure, as it represents the basic tenet of a hospital — to heal the sick and provide for their safety. Nonetheless, HSMRs are only one of a range of quality indicators.

The second measure of performance, hospital efficiency, relates the services a hospital provides to its input use or costs incurred. Hospital efficiency is important, because improvements can free up resources for use elsewhere, either within the hospital or broader health care sector, to improve the community's wellbeing.

Hospital efficiency in this study is principally concerned with the activities within hospitals. The study does not seek to consider the issue of *allocative efficiency* — the efficiency with which the health sector as a whole is providing the appropriate mix of hospital and other healthcare services. Such a study would need to focus on the way a hospital's services are priced, and account for the operation of public and private health insurance and the asymmetries of information within the health sector. These are beyond the scope of this analysis.

The data made available for this study contain 1806 observations for 459 acute overnight hospitals between 2003-04 to 2006-07. These comprised:

- public hospitals — 343 hospitals contributing 1354 observations
- for-profit private hospitals — 75 hospitals contributing 295 observations
- not-for-profit private hospitals — 24 hospitals contributing 94 observations
- public contract hospitals — 17 hospitals contributing 63 observations.

As noted in the Commission's Research Report (PC 2009), permission to access public hospital data was obtained from the health departments of each state and territory. Permission to access private hospital data was obtained from a number of hospital owners and operators. The Australian Institute of Health and Welfare (AIHW) was the source of morbidity data for both public and private acute hospitals, and establishment data for public hospitals. The Australian Bureau of Statistics (ABS) was the source of establishment data for private hospitals. For commercial-in-confidence reasons, the analysis was undertaken by the ABS under the direction of the Commission.

The sample of public hospitals includes all public acute hospitals in Australia. According to the AIHW, there were 768 public hospitals in 2007-08. However, many of these were sub-acute, non-acute and psychiatric hospitals. To ensure maximum comparability, these were excluded from the sample. Other observations were also removed because of concerns about the quality of the data, leaving 343 public acute hospitals in the dataset.

A distinction is made between for-profit and not-for-profit hospitals. Not-for-profit hospitals include both religious and non-religious charitable hospitals. For-profit and not-for-profit hospitals operate under different taxation arrangements, and are likely to have different profit and pastoral care motivations. Those arrangements

and other factors may sufficiently influence their relative performance and justify explicitly testing for such differences.

A distinction is also made between public and ‘public contract’ hospitals. Public contract hospitals are managed by non-government entities to provide public hospital services either under contract or, if they are deemed to be public health organisations (for example, as under the *Health Services Act 1997* (NSW)), with a subsidy. Public contract hospitals are operated by for-profit and not-for-profit organisations. The Commission made this distinction to test whether ownership or management structure affects the performance of hospitals.

Hospital-standardised mortality ratios

There are a number of potential indicators that describe different aspects of the effectiveness and quality of a hospital’s care. Some of the more notable indicators include the rates of hospital-acquired infections, adverse events, unplanned readmissions and in-hospital mortality.

The Commission used the rate of in-hospital mortality as a measure of effectiveness and quality for two reasons. First, it is relatively accurately measured. Second, it is a reasonable proxy for some other aspects of hospital quality. Some of the underlying factors that contribute to unplanned re-admissions, for example, may also influence a hospital’s incidence of mortality. That said, in-hospital mortality is only a partial measure of a hospital’s effectiveness and quality, and may not fully reflect variations in other quality dimensions such as hospital-acquired infection rates and adverse events in hospitals.

In-hospital mortality rates vary substantially according to the ownership and size of hospitals. Rates were over two-and-a-half times higher for public hospitals (1.48 per cent of separations) than for private hospitals (0.54 per cent of separations) (table 1).

In-hospital mortality, however, is influenced by a number of observable factors that are outside the control of hospitals, such as the characteristics of patients and the role of the hospital itself. Patients in public hospitals were reported to have more comorbidities than in private hospitals (with an average Charlson comorbidity score of 0.58 compared to 0.54) (table 1). Significantly, more of a public hospital’s patient workload also comes from the most disadvantaged socioeconomic quintile (40.5 per cent of separations compared to 15.2 per cent of separations for private hospitals).

Table 1 Selected patient characteristics, by owner and hospital size, 2003-04 to 2006-07^a

	<i>Very large</i>	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Very small</i>	<i>All sizes</i>
<i>In-hospital mortality (per 100 separations)^b</i>						
Public hospitals	1.22	1.12	1.17	1.45	1.81	1.48
Private hospitals	0.70	0.48	0.47	0.47	0.78	0.54
Public contract hospitals	0.73	1.54	np	np	np	1.40
<i>Average patient comorbidity (Charlson score)^c</i>						
Public hospitals	0.75	0.62	0.63	0.56	0.47	0.58
Private hospitals	0.77	0.49	0.42	0.48	0.61	0.54
Public contract hospitals	0.91	0.65	np	np	np	0.70
<i>Most disadvantaged socioeconomic status (percentage of patients)^d</i>						
Public hospitals	21.3	28.0	35.3	46.3	51.9	40.5
Private hospitals	11.6	13.8	15.0	20.9	16.8	15.2
Public contract hospitals	9.3	18.3	np	np	np	18.4

^a Very large hospitals have 20 001 or more casemix-adjusted separations per year, Large hospitals have between 10 001 and 20 000, Medium hospitals have between 5001 and 10 000, Small hospitals have between 2001 and 5000, and Very Small hospitals have up to 2000 separations per year. ^b In-hospital mortality is the percentage of separations that involved an in-hospital death. ^c Patient comorbidity is based on the Charlson comorbidity score calculated at admission, and is an odds-ratio of the probability of dying within a year from admission. Thus a score of 0.50 indicates a 0.50:1 or 33 per cent chance of dying within a year. ^d The percentage of a hospital's separations from a geographic area rated as the most disadvantaged socioeconomic quintile. **np** Not published due to ABS confidentiality concerns.

To ensure that the comparisons between different hospitals reflect their underlying performance, as distinct from their roles, functions and characteristics of their patient population, the Commission risk-adjusted each hospital's mortality rate.

The process of risk adjustment involved undertaking a multivariate analysis of in-hospital mortality. In-hospital mortality rates were found to increase where hospitals offered palliative care services, treated more patients that were aged 70 and over, treated more patients with the most number of comorbidities, treated more medical rather than surgical cases, and treated more patients for circulatory, respiratory, digestive diseases and disorders and burns.

Conversely, in-hospital mortality rates decreased where hospitals offered rehabilitation services, treated more patients aged between 5 and 19 years, provided relatively more surgical than medical cases, and specialised in a narrower range of services. Furthermore, in-hospital mortality was also found to increase as hospitals decreased in size, and to decline over the four years of the data.

The Commission then calculated the HSMR for each hospital in the dataset. The HSMR is the ratio between the observed and predicted in-hospital mortalities. It reflects unobservable characteristics of the hospital — including management and clinical competence. Hospitals with HSMRs below 100 perform better than

predicted, and those with HSMRs above 100 have mortality outcomes worse than predicted. A score of 90, for example, indicates that the incidence of mortality of that hospital is 10 per cent below what would be expected for a hospital with the same observable patient and hospital characteristics.

The estimated mean HSMRs of private hospitals are lower than those of public hospitals by almost 12 percentage points (table 2). This overall difference was statistically significant in aggregate. There was no statistically significant difference, however, between the estimated HSMRs of very large public and private hospitals.

Table 2 Estimated mean hospital-standardised mortality ratios, by owner and hospital size, 2003-04 to 2006-07^{a,b}

	<i>Very large</i>	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Very small</i>	<i>All sizes</i>
Public hospitals	101.1	106.6	99.2	99.6	104.2	102.5
Private hospitals	100.3 ^c	81.8	98.5	83.9	63.4	90.8 ^d
For-profit hospitals	97.2	73.3	105.6	91.6	80.3	92.7 ^e
Not-for-profit hospitals	104.9	115.7	65.6	45.3 ^f		85.0
Public contract hospitals	83.3	106.5	np	np	np	109.2 ^g
All hospital types	100.1	99.1	99.1	95.8	103.8	100.2

^a Very large hospitals have 20 001 or more casemix-adjusted separations per year, Large hospitals have between 10 001 and 20 000, Medium hospitals have between 5001 and 10 000, Small hospitals have between 2001 and 5000, and Very Small hospitals have up to 2000 separations per year. ^b The hospital-standardised mortality ratio is equal to the actual (observed) mortality rate divided by the predicted mortality rate, multiplied by 100. ^c There is no statistical difference in the scores of 'very large' hospitals, but there is a relatively small group of not-for-profit hospitals. ^d Statistically different from public hospitals of 'all sizes'. ^e Not statistically different from not-for-profit hospitals of 'all sizes'. ^f Results combined for small and very small hospitals because of ABS confidentiality concerns. ^g Not statistically different from public hospitals, but there is a relatively small sample of public contract hospitals of 'all sizes'. **np** Not published due to ABS confidentiality concerns.

These findings suggest that the differences between very large public and private hospitals are largely explained by their observable factors — that is, there is little to distinguish them in terms of their underlying HSMR performance. However, the divergence in HSMRs between smaller public and private hospitals suggests the presence of unexplained factors. These might include management performance, though they could also reflect other factors. For example, smaller public hospitals tend to be predominant sources of clinical care in remote and very remote areas, and other factors such as the availability primary care may also be important. It might also reflect differences in the ability of hospitals to specialise in a narrow range of procedures. Even though the Commission sought to take into account the effect of specialisation, this effect may still be present in the data. Since private hospitals have greater scope to specialise, they may better able to reduce in-hospital mortality rates as procedures become more routine.

Hospital 'efficiency'

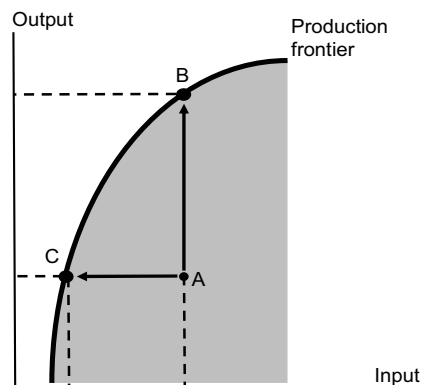
The Commission sought to estimate both the technical efficiency and the determinants of hospital costs. Technical efficiency is the extent to which hospitals make best use of their resources to achieve a desired output or outcome. It is an attractive approach to measuring efficiency because it does not require data on prices or costs, reliable estimates of which can be difficult to obtain.

Hospitals are also commonly compared in terms of their costs. However, hospital costs, at least in Australia, are dogged by incomparable and poor quality financial data, which limit the ability to produce robust estimates of the influences on costs. The remaining discussion accordingly focuses on technical efficiency.

Technical efficiency represents the gap between a hospital's actual output and its potential output, without changing input use or quality (the output-orientation approach). It can, conversely, be measured as the gap between its actual resource use and its potential input use, without changing outputs or quality (the input-orientation approach).

While the two approaches are expected to yield similar estimates of efficiency in aggregate, they need not yield the same estimates of efficiency for individual hospitals, as in figure 1. Technical efficiency in the output-orientation approach is the distance between a hospital at *A* and its potential output at *B*, while technical efficiency under the input-orientation approach is given by the distance between a hospital at *A* and its potential input use at *C*.

Figure 1 **Illustration of the measurement of technical efficiency**



The choice between the output and input-orientation approaches to measuring efficiency in part depends upon which approach best reflects the operational practices of hospitals. The output-orientation approach assumes that hospitals have the flexibility to increase their outputs, whereas the input-oriented method assumes

that hospitals have little or no flexibility to change their output but seek to minimise their input use.

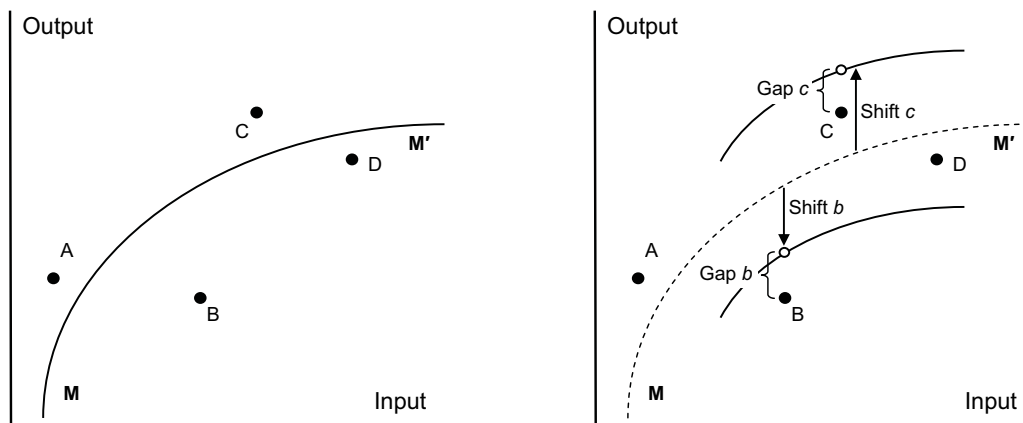
A variant of stochastic frontier analysis (SFA), stochastic distance functions, was used to determine each hospital's best-practice frontier (box 2).

Box 2 The Commission's approach to measuring hospital frontiers

The Commission used stochastic frontier analysis (SFA) to determine the best-practice frontiers against which hospital technical efficiency was measured. SFA is an econometric technique, similar to ordinary least squares (OLS). As with OLS, a variety of factors that are thought to determine hospital production are included in the model.

A lack of data means that hospital efficiency cannot be measured directly and must be inferred. If there is a strong a priori expectation that efficiencies differ across hospitals, it is possible to use the information contained from the residuals of a regression estimation to distinguish between genuine random error and unobservable hospital efficiency.

SFA can be graphically represented as a two-step regression. In the first step, a regression equation is estimated to pass through the mean of the data, much like OLS (in this example, between hospitals A, B, C and D). This gives the production function MM' .



The curve MM' is then shifted for each hospital by the amount that reflects the genuine random error. For example, the curve MM' is shifted by amounts *Shift b* and *Shift c* for hospitals B and C. The distances between the actual positions and projected frontier are the efficiency gaps *Gap b* and *Gap c* for hospitals B and C.

SFA represents a significant improvement on earlier techniques, such as data envelopment analysis, for benchmarking hospitals. By explicitly accommodating for random error, the technique is less prone to overstating the presence of inefficiency. Moreover, as an econometric technique, it allows for the statistical relationships between variables to be estimated and tested.

Determinants of technical efficiency

Hospital technical efficiency is influenced by the variety of inputs used by hospitals and the diversity of services they produce. A detailed description of the differences in the services provided by hospitals can be found in the Commission's Research Report on public and private hospitals (PC 2009). For example, there are significant differences between public and private hospitals with their inpatient, accident and emergency department, and occupancy rates (table 3).

Table 3 **Selected hospital characteristics, by owner and hospital size, 2003-04 to 2006-07^a**

	<i>Very large</i>	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Very small</i>	<i>All sizes</i>
<i>Inpatient productivity^b</i>						
Public hospitals	25.9	27.9	26.5	25.3	19.9	23.7
Private hospitals	67.1	65.4	66.0	67.0	33.8	64.7
Public contract hospitals	30.4	33.6	np	np	np	65.9
<i>Accident and emergency productivity^c</i>						
Public hospitals	27.6	48.2	56.4	74.4	79.8	62.7
Private hospitals	17.7	6.8	0.4	–	–	5.5
Public contract hospitals	17.6	49.0	np	np	np	100.9
<i>Occupancy rate^d</i>						
Public hospitals	96.7	87.4	80.5	67.2	49.4	69.3
Private hospitals	95.0	77.4	74.6	74.4	62.7	77.5
Public contract hospitals	88.6	84.8	np	np	np	82.3

^a Very large hospitals have 20 001 or more casemix-adjusted separations per year, Large hospitals have between 10 001 and 20 000, Medium hospitals have between 5001 and 10 000, Small hospitals have between 2001 and 5000, and Very Small hospitals have up to 2000 separations per year. ^b Number of casemix-adjusted separations per non-medical staff member. ^c Number of accident and emergency department visits per non-medical staff member. ^d Defined as (the number of patient days) divided by (the number of staffed beds multiplied by 365). **np** Not published due to ABS confidentiality concerns.

To ensure that the estimated hospital technical efficiency results actually report efficiency rather than some other factor, measures of hospital efficiency should also take into account the influence of factors outside the control of hospitals — such as the average severity of patient illness or injury, and the quality of services provided by hospitals. The Commission took into account an extensive range of inputs, outputs and control variables (box 3).

Box 3 Factors included in the measurement of hospital technical efficiency

A large number of variables were included to control for the differences between hospitals, including:

- *admitted patient outputs* — the number of casemix-adjusted separations for acute diseases and disorders, pregnancy and births, mental disorders and drug and alcohol cases, and other separations (including mostly rehabilitation and long-term aged care)
- *non-admitted patient outputs* — most categories of non-admitted services such as accident and emergency services, diagnostic services, allied health and dental services, district nursing and community outreach services, and dialysis and endoscopy services
- *output control variables* — such as the percentage of separations that were surgical rather than medical, the relative ratio of emergencies to admitted patients, the extent to which a hospital's admitted patients have been transferred to or from another hospital
- *hospital quality* — as measured using the hospital-standardised mortality ratio
- *inputs* — including the number of full-time equivalent nurses, diagnostic and allied health staff, and other staff, as well as the number of staffed beds, and the expenditure on medical and surgical supplies, pharmaceutical supplies, and other hospital costs
- *patient characteristics* — such as the patient's age, acuity of illness, number of comorbidities, socioeconomic status, and gender
- *financial incentives* — such as the patient's public patient status
- *hospital characteristics* — such as the hospital's remoteness, teaching status, complexity of its work, as well as whether it was part of a network, and whether it had a number of specialist units, such as palliative care and level III intensive-care units.

Medical staff (doctors) were not included in the determination of technical efficiency, and medical costs were excluded from the attempts to estimate the determinants of hospital costs, because data were not readily available for the majority of doctors in private hospitals or for doctors exercising rights of private practice in public hospitals (box 4).

Box 4 Medical workforce and hospital beds: selected data issues

What is the effect of excluding medical staff?

Care needs to be taken when interpreting the efficiency scores since medical staff are not included in the estimation of technical efficiency in this supplement. The exclusion of medical staff may influence the estimated efficiency scores of hospitals, depending on the use of doctors across hospitals.

If, however, the intensity of use of doctors is the same across hospitals, then the resulting efficiency scores are expected to be reasonably representative of hospitals and the medical workforce. Information is not available to allow a firm conclusion to be drawn on this matter.

How was capital measured?

For the calculation of technical efficiency, a hospital's capital stock should ideally be represented in terms of the physical units of capital in the hospital — such as the number of operating theatres, birthing suites, acute and non-acute beds and so on.

Such data are not available on a consistent basis nationally. Instead, the number of staffed beds was used as a proxy for capital. Since public and private hospitals counted beds differently, the Commission estimated the number of staffed beds for private hospitals.

Since using the number of beds does not adequately distinguish between the different types of hospital capital (for example, between acute and non-acute beds) and the presence of particular facilities (such as operating theatres), a number of other control variables were included. These variables represented the presence of particular units or functions (such as whether the hospital is a teaching facility, or has level III intensive care, rehabilitation and palliative care units) or represented the relative differences in the complexity of a hospital's workload.

There were also limitations with the measure of capital employed in this study. In the absence of detailed and robust capital data, the number of beds was used as a proxy for a hospital's capital stock. Furthermore, private and public hospitals report their beds differently. Public hospitals report the number of *staffed* beds while private hospitals report the total number of *available* beds, whether they are staffed or not. The Commission endeavoured to overcome this discrepancy by estimating the number of staffed beds for private hospitals and by introducing a range of variables to account for the different roles and functions of hospitals (box 3).

Factors that were estimated to be significant in influencing hospital output and input use included:

- the complexity of cases provided by the hospital
- the extent to which the hospital treated medical rather than surgical cases

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- the degree of comorbidity in the patient population
 - the age profile of patients (particularly the presence of more older patients)
 - the presence of level III intensive care and other specialist units
 - the remoteness of the hospital
 - the extent to which a hospital treated public patients
 - whether the hospital was a recognised medical teaching hospital
 - whether the hospital was part of a network.

The estimation results also showed a strong relationship between a hospital's quality and its efficiency. The most efficient hospitals were also those with the lowest in-hospital mortality. This was apparent with both the output-oriented and input-oriented efficiency approaches. This suggests that the factors that contribute to a well-managed hospital also improve health outcomes.

Estimates of technical efficiency

After accounting for the range of observable factors, the remaining unobserved differences in performance can be interpreted as measuring a hospital's efficiency — the potential for management to improve hospital performance under the existing policy environment.

Across the hospital sector, output-oriented efficiency was estimated to be 90 per cent, suggesting there was scope to improve output, on average, by 10 per cent (for a given level of input use). Input-oriented efficiency was estimated, on average, to be just below 90 per cent of the estimated potential, suggesting that input use could be reduced by just over 10 per cent (for a given level of output) (table 4).

The results also indicate that for-profit and public contract hospitals had the highest *output-oriented* technical efficiency among Australian hospitals, and not-for-profit hospitals the lowest. These differences were statistically significant.

Public contract hospitals were estimated to have the highest *input-oriented* technical efficiency. There was no statistically significant difference between public, for-profit and not-for-profit private hospitals. Public and not-for-profit hospitals had similar scope to for-profit hospitals to reduce their input use while still producing the same level of outputs.

The differences in estimated efficiency between private and public hospitals were most noticeable between smaller for-profit private and public hospitals. There also

appeared to be considerable scope for large and medium-sized not-for-profit hospitals to improve their efficiency.

Table 4 Summary of estimated technical efficiency scores, by ownership and hospital size, 2003-04 to 2006-07^a

	<i>Very large</i>	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Very small</i>	<i>All sizes</i>
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<i>Output-oriented</i>						
Public hospitals	91.4	90.1	89.5	89.7	87.5	89.1
Private hospitals	92.5	93.0	91.8	94.2	89.9	92.6 ^b
For-profit hospitals	95.7	94.2	94.8	94.9	94.2	94.8 ^c
Not-for-profit hospitals	87.8	88.1	77.9	88.0 ^g		85.6
Public contract hospitals	90.7	93.1	np	np	np	92.4 ^d
All hospital types	91.6	91.4	90.5	90.8	87.6	90.0
<i>Input-oriented</i>						
Public hospitals	90.1	89.6	88.5	88.5	89.0	89.1
Private hospitals	92.4	90.2	90.6	92.8	92.9	91.4 ^e
For-profit hospitals	93.1	90.7	91.2	92.9	92.5	91.8 ^f
Not-for-profit hospitals	91.2	88.2	87.9	92.7 ^g		90.2
Public contract hospitals	94.6	93.3	np	np	np	93.6 ^d
All hospital types	90.8	90.3	89.5	89.6	89.1	89.8

^a Very large hospitals have 20 001 or more casemix-adjusted separations per year, Large hospitals have between 10 001 and 20 000, Medium hospitals have between 5001 and 10 000, Small hospitals have between 2001 and 5000, and Very Small hospitals have up to 2000 separations per year. ^b Statistically significantly different from public hospitals, "all sizes". ^c Statistically significantly different from public hospitals and from not-for-profit hospitals, "all sizes". ^d Statistically significantly different from other public and private hospitals, "all sizes". ^e Not statistically significantly different from public hospitals, "all sizes". ^f Not statistically significantly different from not-for-profit hospitals, "all sizes". ^g Results combined for small and very small hospitals because of ABS confidentiality concerns. **np** Not published due to ABS confidentiality concerns.

Overall assessment

In weighing up both HSMRs (as a quality measure) and technical efficiency, for-profit hospitals were estimated in the model to be the best performing among very large hospitals, followed by public contract hospitals. For-profit hospitals had among the highest estimated technical efficiency (whether using the output or input-oriented approaches) and among the lowest estimated HSMRs.

Very large public hospitals were estimated to be the best performing public hospitals. They recorded relatively high technical efficiencies (under the output-oriented approach) and comparatively low HSMRs. Very small public hospitals were estimated to be the worst performing among public hospitals, having

both very high HSMRs and lowest technical efficiency (under the output-oriented approach).

The best performing for-profit hospitals were estimated to be the smaller hospitals — these had consistently high technical efficiency scores (under both output and input-oriented approaches) and comparatively low HSMRs. Very large for-profit hospitals were estimated to have similar levels of efficiency but slightly worse HSMRs. The best-performing not-for-profit hospitals were estimated to be the smaller hospitals (under the input-oriented approaches). Their technical efficiency was similar to that of public hospitals, and they had comparatively low HSMRs.

Smaller private hospitals were estimated to outperform smaller public hospitals, in terms of HSMRs and output-oriented technical efficiency. The observed lower efficiency performance of very small public hospitals might simply be due to their comparatively low occupancy rates. If there is a minimum size for a hospital, and there is comparatively low demand for hospital services in more remote communities, this would contribute to lower observed occupancy rates, and therefore lower comparative efficiency. For example, the occupancy rates for small and very small public hospitals (most of which are outside major cities) were 67 and 49 per cent respectively. In contrast, the occupancy rates for small and very small private hospitals (most of which are inside major cities) were 74 and 63 per cent respectively (table 3).

Limits to estimating hospital costs

As noted, the Commission also sought to estimate the determinants of public and private hospital costs. Hospitals are commonly compared in terms of their costs, so estimating the performance of hospitals in managing the costs of providing patient care is an attractive performance measure.

Even though this study made some advances in developing an appropriate methodology for the estimation of hospital costs, particularly through the use of factors explaining patient and hospital characteristics, the Commission lacks confidence in the results because of data deficiencies:

- First, there was an absence of capital costs (including both the depreciation cost of building, plant and equipment, as well as the opportunity cost of capital) for public hospitals. The Commission was unable to estimate the capital costs for individual hospitals.
- Second, medical costs were not included in the cost analysis. Such data are readily available for public hospitals. Though they are, in principle, available for

doctors in private hospitals through the Commonwealth's *Hospital Casemix Protocol*, the Commission could not obtain access to private hospital medical costs data.

- Third, there were limited data on the prices paid by hospitals for their inputs. The prices for pharmaceutical supplies, medical and surgical supplies, and other hospital costs were unavailable for individual hospitals and therefore needed to be estimated using nation-wide deflators. There was, as a result, no price variation between states and territories, within states and territories, and between hospital sectors. The absence of capital costs also meant that it was not possible to obtain estimates on the cost per unit (that is, price) of capital for public hospitals.

How do these results compare with other studies?

The results in this supplementary analysis differ somewhat from those reported in Chapter 8 of the Commission's Research Report (PC 2009). In that report, the model estimates suggested that — based on one year's data — there was little to separate private and public hospital efficiency, and that hospitals could on average increase their outputs by 20 per cent given their current set of inputs. While the results reported in this supplement are likely to be more reliable, they remain estimates, and could be improved further with more comprehensive and accurate data.

There are very few other Australian studies with which these results can be directly compared. There has been no study, to the Commission's knowledge, that directly compared public and private hospital HSMRs using a common method and dataset. Jensen, Webster and Witt (2007) found that Victorian private hospitals had significantly better outcomes at treating acute myocardial infarction than did Victorian public hospitals, although Chua, Palangkaraya and Yong (2008) using the same dataset, found that better health outcomes were achieved among larger hospitals. There is no study comparing public and private hospital technical efficiency at a national level. A study by Webster, Kennedy and Johnson (1998) found that for-profit hospitals were technically more efficient than not-for-profits, although the authors did not account for casemix differences and the patient and hospital characteristics of each hospital.

There are few overseas studies that compare the performance of public and private hospitals. Among those that are available, there are differences in the modelling techniques employed, datasets, variables used, including the treatment of quality, and hospital and patient-risk characteristics. Some of the more notable studies

include Herr (2008), Grosskopf, Margaritis and Valdmanis (1995), Burgess and Wilson (1995) and Zuckerman, Hadley and Iezzoni (1994). The average gaps in efficiency range between 10 and 20 per cent. In two of these studies, public hospitals were found to be more efficient than private hospitals. Differences in these findings can be explained in part by methodological differences of the studies and institutional differences of the countries being studied.

Areas for further work

The Commission found a number of challenges in undertaking this study as well as the analysis in the preceding Research Report.

First, there was reluctance among a number of parties to grant access to data needed for the analysis. Reasons put forward included protecting the privacy of individuals, and commercial-in-confidence arrangements for individual hospitals and owners of hospitals. This has led to an under-representation of not-for-profit hospitals in the dataset.

In the Commission's view, these impediments to accessing data were greater than would reasonably be expected to address legitimate privacy and confidentiality concerns. Making data more accessible could help drive improvements in health care, especially as competitive markets have a limited role. It could also encourage future improvements in data collections (PC 2009).

Second, to meet the commercial-in-confidence concerns of various parties, the analysis needed to be undertaken by ABS staff under the direction of the Commission. Commission staff were not permitted to observe data items which could identify individual hospitals. This meant that there were delays, as the analysis was necessarily undertaken remotely in a two-step process.

Third, the Commission used HSMRs as a proxy for hospital quality. While HSMRs are a significant improvement on unadjusted in-hospital mortality rates, they are only one measure of quality. Improvements to the reporting of other indicators, such as unplanned re-admission rates, infection rates and adverse events would substantially contribute to our understanding of hospital quality.

Fourth, there are significant limitations to the financial data of hospitals, particularly public hospitals. Efficiency estimates accounting for costs would be substantially improved if:

- both capital costs and capital leasing costs were more accurately reported

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- the medical costs of doctors practicing privately in both private and public hospitals were available and accessible
 - more detailed estimates of the price components of hospital resources, such as pharmaceutical, medical and surgical supplies, were available.

Fifth, there are also deficiencies in certain hospital establishment data. Estimates of technical efficiency would also be improved if:

- the number of doctors practicing privately in both private and public hospitals were made available and accessible
- private and public hospitals counted their beds in the same manner
- there were consistent and detailed estimates of the various types of capital in hospitals (such as level III intensive care unit beds and non-acute beds).

Finally, there are well known deficiencies in the quality of hospital outpatient data. Both cost and technical efficiency estimates would be improved if there were greater consistency in the reporting of outpatient services and if these estimates were adjusted for differences in casemix.

Each of these areas for data improvement would greatly assist in any future work seeking to measure efficient costs of providing hospital care.