Submission to the Productivity Commission

by

The Melbourne Institute of Applied Economic & Social Research

The University of Melbourne

on

Hospital Performance Study

Background

To move towards a nationally consistent system of performance reporting for public and private hospitals, the government has requested the Productivity Commission to examine the relative performance of public and private hospitals and related data issues.

In economics, the productivity and efficiency of hospitals have been customarily examined using a production framework. It thus forms the natural starting point for the investigation and comparison of the performance of public and private hospitals.

Microeconomic Production Framework

At a conceptual level, hospital performance may be examined under the microeconomic theory of production, which relates to the conversion of inputs into outputs. Hospitals are modelled as a production system, which links inputs to outputs and outcomes. Hospital performance includes issues of efficiency in the conversion of inputs into outputs as well as how the conversion impacts on quality of care.

It is important that, in making use of this production framework, all major inputs and outputs of hospitals are accounted for. Categories of inputs include the health workforce of various types, medical equipment, technologies, pharmaceuticals, and capital equipment in the form of building and fixtures. These input categories are

conceptually easy to understand and can be readily measured provided relevant data are available (which is often a problem, especially with staff and capital inputs).

Measuring hospital outputs, however, is more complicated. Hospitals are involved in 'producing' or restoring health. Unfortunately, health as a concept is not easily defined, let alone measured with real-world data. Even if one can agree on a health outcome measure such as Quality Adjusted Life Years (QALYs), data collection for this purpose is both costly and time consuming.

Instead of attempting to measure health improvement, of which there are no routinely collected data, existing research has relied on hospital administration data to construct measures of hospital outputs and volume of activity by grouping relatively homogeneous admission episodes into classes using diagnostic-related groups (DRGs). DRGs are a system of classifying hospital in-patient admissions into one of approximately 500 categories that require similar hospital resource use.

The use of DRGs as output measures thus treats each DRG group as a unique output and hence calls for a multi-output production model. In the theoretical multi-output model, hospitals are thought of as a complex production system that transforms various inputs into numerous outputs. The traditional production function is replaced with a production transformation function, whose arguments contain all inputs used and all outputs produced.

However, even though it allows for multiple outputs, this approach suffers from a major limitation as outputs are defined simply in terms of volume of care provided—it does not reflect quality of care or account for intermediate measures of health outcome.

It should be pointed out from the outset that measuring hospital quality is not a trivial issue. The existing literature uses intermediate outcome measures that include mortality rates, readmission rates and in-hospital safety events as proxies for quality of care. In theory, accounting for these quality indicators in a multi-output production framework is straightforward. However, in empirical implementation, there are many practical issues to be overcome. Several key issues are outlined below.

Empirical Issues

1. Accounting for multiple outputs

Classical production theory assumes that firms produce a single homogenous product. In the context of hospital production, this assumption is obviously unrealistic. Hospital

admission episodes vary in complexity, severity and medical treatment given. It would be a gross simplification to aggregate different admission episodes (or separations) into a single aggregate output. A viable alternative is to classify hospital admission episodes into distinct output categories.

A convenient classification scheme is the Diagnosis-Related Group (DRG), which is a system that classifies admission episodes by diagnoses, procedures, age, sex, discharge status, and the presence of complications or co-morbidities. In principle, admission episodes in the same DRG are expected to use similar amount of hospital resources.

In theory one could treat each DRG as a distinct output and analyse the production of DRGs in a multiple-output production framework. In practice, however, a straightforward empirical application is problematic, given that there are about 500 DRG groups in the current version of the DRG classification system. A regression system of 500 output equations would present an insurmountable dimensionality problem even for the most advanced computing facilities. To overcome the dimensionality problem, the literature has proposed two approaches.

The first approach is to restrict the analysis to a manageable subset of DRGs. For example, one can conduct the analysis by focusing on DRGs that are related to acute myocardial infarction (AMI). In so doing, however, one implicitly assumes that the production of AMI-related DRGs is separable from other non-AMI-related DRGs in the sense that the substitutability between AMI-related DRGs is independent of the substitutability between other DRGs. Whether this assumption holds true or not is an empirical question that has yet been investigated in the literature.

The second approach to overcome the dimensionality problem is to aggregate admission episodes (or separations) across DRGs using some credible aggregation rules. A popular aggregation rule is using DRG cost weights (i.e., the cost weights attached to each DRG for the purpose of reimbursing hospitals) to arrive at a weighted aggregate output, either in terms of admission episodes or separations. A viable alternative to using DRG cost weights is to use the length of stay of each admission episode as the aggregation weight. Both aggregation rules belong to a broader class of linear aggregation rules. The main disadvantage of linear aggregation is production substitution between different DRGs is not permissible (the elasticity of substitution is zero).

A variant of this second approach is to aggregate DRGs up to some subgroups. A natural way to proceed is to use the Major Diagnostic Categories (MDC), which are formed by dividing principal diagnoses into 23 or so mutually exclusive diagnosis areas. By identifying the MDC that each DRG belongs, one can aggregate all DRGs in each MDC using either DRG cost weights or length of stay. The strength of this approach is

production substitutability between different MDCs can be introduced via the multiple-output production function specification. The disadvantage, as before, is that the use of linear aggregation within each MDC rules out production substitutability between DRGs in each MDC. However, considering the need to keep model specification parsimonious in empirical analysis, this approach probably represents a reasonable compromise.

2. Interdependence of hospital efficiency and quality

Although there exists a substantial body of literature investigating the relationship between efficiency and competition, efficiency and hospital ownership structure, and efficiency and quality (see the review by Gaynor 2006), few studies examine these relationships while at the same time taking hospital quality into account in a manner that is consistent with theoretical predictions.

A proper treatment of quality is paramount in any attempt to measure and compare hospital efficiency. Theoretical considerations suggest that the relationship between quality and efficiency is far from straightforward. There are factors that tend to make the relationship complementary, i.e., an improvement in these factors tend to improve both quality and efficiency. Examples are hospital management practices, technological advancements, quality and training of workforce. Changes in these factors are likely to affect quality and efficiency in the same direction. On the other hand, there are other factors that tend to trade quality off efficiency and vice versa. Examples are hospital budget constraints, hospital capacity, workforce size and so on. Changes in these factors can potentially have opposing effects on quality and efficiency.

Studies that exclude hospital quality in estimating hospital efficiency in effect assume either that quality is constant across hospitals and time, or that there is little complementary or trade-off relationship between quality and output. Neither assumptions appears to be realistic.

On the other hand, studies that focus entirely on aspects of hospital quality without accounting for efficiency ignore differences in resources availability, which is an important consideration in comparing public and private hospitals. Recent studies conducted at the Melbourne Institute using Victorian hospital administration data have found that private hospitals generally perform better than public hospitals in the treatment of cardiac disease (see Jensen, Webster and Witt 2007 and Chua, Palangkaraya and Yong 2008). The reasons accounting for this performance difference is a topic of active research at the Melbourne Institute.

Several hypotheses are being investigated. They include: (i) Patients admitted to private hospitals, most of whom are privately insured, are perhaps healthier than public patients. This better health could be related to income since it is known that private health insurance take-up in Australia is closely linked to income. (ii) Patients in private hospitals may receive more treatment than public patients. These treatments could take the form of, for example, expensive technologies and newer drugs. (iii) Hospital ownership may play a role in affecting service delivery which in turn affects health outcomes—private hospitals may have greater financial incentives in providing higher intensity of care than private hospitals, and this higher intensity of care may lead to better health outcomes. (iv) Patients in private hospitals may be cared for by the same specialist in the hospital and outpatient setting, leading to greater continuity of care, which has been associated with better health outcomes.

An important consideration in testing these hypotheses is an understanding of how certain health outcomes are achieved with given levels of resources. However, few Australian studies take into account the interdependent relationship between quality and efficiency. So far as we are aware, the only study on this topic and that uses Australian data is a recent Melbourne Institute study by Chua, Palangkaraya and Yong (2009), which endogenously accounts for quality by treating quality as an additional dimension of hospital output in estimating the efficiency measure. The paper finds that the performance of public hospitals is affected in an adverse manner by the competition posed by private hospitals. Importantly, the paper demonstrates that a different conclusion could have been reached if hospital quality were not accounted for in assessing the competition effects.

The importance of quality is recognized in recent international studies of hospital efficiency. Some studies adopt a two-stage approach, where measures of efficiency are estimated in a first-stage production model (e.g., via DEA, stochastic production function, index number approach, and so on), and in the second stage the constructed efficiency measure is used as the dependent variable in a regression that relates hospital efficiency to various hospital characteristics. Often measures of hospital quality are included in the second stage as potential explanatory variables. Although quality is accounted for in this approach, its treatment will not be appropriate if quality is endogenous to efficiency, i.e., quality is dependent on or affected by efficiency.

A obvious difficulty in this type of research is to construct suitable empirical measures of hospital quality. Data and modelling considerations often limit studies to include only one or two measures of quality. Common measures of quality include risk-adjusted mortality rates, in-hospital adverse events and to a lesser extent, unplanned

readmission. None of these measures, however, is ideal and it is unlikely that a single measure would be able to capture all quality dimensions of the hospital production process.

In principle, one could construct a large number of quality indicators to account for different quality dimensions. However, a large number of quality measures by themselves creates a dimensionality issue that is difficult to deal with in empirical studies using the microeconomic production framework. Thus a systematic way of aggregating different quality measures is needed. This dimensionality issue is addressed in the next point below.

3. Hospital quality and the curse of dimensionality

Measuring hospital quality of care is an important topic in health research. Besides informing health policy and enhancing patient choices, hospital quality measures are also instrumental in investigating the relationships between quality and efficiency.

However, hospital quality is a multifaceted concept that covers aspects such as effectiveness of treatment, timeliness of service delivery, quality of amenities, technological sophistication, incidences of in-hospital adverse events and so on. Constructing, comparing and synthesizing measures across different quality dimensions are a challenging task in health economic research.

The difficulty is compounded by the fact that often within a given quality dimension there exist multiple measures and/or outcomes. For example, in the case of in-hospital adverse events, there are more than 20 common measures covering four different aspects: hospital-acquired infections, operative and post-operative complications, sentinel events, and obstetrics (see Drösler 2008).

Likewise, many mortality-based measures of hospital quality have been proposed and constructed using hospital administrative data. Examples are in-hospital death, death within 30 days of discharge from a hospital, death within 90 days of discharge and so on. In principle, one can define any number of mortality-based measures by varying the number of days of discharge from a hospital.

Having a large number of quality indicators obviously present a dimensionality problem in studying the relationship between efficiency and quality since the latter is often included alongside output measures in empirical estimation. A large number of quality measures not only take up degrees of freedom but also increase the analytical and computational complexities of the empirical model.

Moreover, quality measures are useful only to the extent that they convey quality information about the hospitals. That is, interests are not centered on these quality measures per se but the quality information embedded in them. However, not all quality measures provide equally reliable quality information — the noise in some measures are higher than in others.

In view of the computational difficulties of dealing with a large number of quality measures, a recent project at the Melbourne Institute by Chua, Palangkaraya and Yong (2008) develop a two-stage method of aggregating different quality measures while taking into account their precision and correlation. The method provides a systematic approach of aggregating a large number of quality measures into a handful of composite indicators, which will greatly facilitate the comparison of hospitals along particular quality dimensions.

4. Effects of competition on hospital efficiency

The effect of competition on hospital efficiency is a topic of particular relevance to Australia, given the important role private hospitals play in the health care sector. The competition between private hospitals, and between private and public hospitals has important policy implications, since the intensity of competition can be affected through various policy initiatives such as funding of private patients and numerous regulatory requirements on hospitals.

Microeconomic theory predicts that in most industries, productive efficiency is positively correlated with competition. A large volume of empirical studies exists to support such a relationship. However, the healthcare industry seems to provides mixed evidence for this relationship. Sometimes an inverse relationship is found and the literature offers an explanation in the form of non-price competition, also known as the 'medical arms race,' which states that more competition among hospitals may lead to higher costs of care, hence lower efficiency (e.g., Propper, Burgess, and Green 2004).

This inconclusive and sometimes contradictory evidence makes health policymaking in relation to hospital competition a difficult task. It is not clear whether a government who is interested in improving the efficiency of the hospital sector should promote or restrict hospital competition. In the Australian context, for example, policy initiatives that provide greater levels of public subsidy to private patients may intensify competition between public and private hospitals, yet its effects on efficiency and quality are largely unknown. Existing Australian studies tend to focus on the efficiency aspects of hospitals, but do not attempt to link measures of efficiency to hospital competition.

Two recent studies conducted by researchers at the Melbourne Institute, Chua, Palangkaraya and Yong (2009) and Palangkaraya and Yong (2009), represent the first attempt to link competition, efficiency and quality using Australian hospital data. These studies find some tentative evidence that competition posed by private hospitals has an adverse effect on the quality and efficiency of public hospitals. It should, however, be cautioned that their results are constrained by limited availability of data, particularly of relevant input measures of private hospitals.

5. Constructing appropriate counterfactuals

It should also be pointed out that the comparison of private and public hospitals with respect to their quality and efficiency performance is not only hindered by the lack of data, but also by the difficulty of finding suitable counterfactuals. For example, it is well known that private hospitals dominate the day surgery segment, while public hospitals are more likely to cater to complex surgery cases. Comparing these hospitals with respect to their efficiency and quality without adjusting for the very different output mix (and by deduction the different input mix) will potentially be very misleading.

Conceptually, to compare a public hospital using a particular input mix to produce a given output mix, the correct reference is a private hospital producing a similar output mix using a similar input mix. Unfortunately, finding a match in the Australian context like this is difficult if not impossible. Public and private hospitals in Australia face different budget constraints, have different government structure and carry different community responsibilities. Certain functions, e.g., teaching, are only provided by a small number of hospitals.

A way forward is to construct artificial references or counterfactuals. There is, unfortunately, no definitive methods of constructing counterfactuals. In regression analysis, for example, one could use the mean or median hospitals of a certain characteristics (e.g., non-teaching regional hospitals) as counterfactuals, or one could construct counterfactuals by ‘‘removing’’ certain characteristics from hospitals, e.g., removing the impact of teaching status on costs.

Regardless of how counterfactuals are constructed, its choice matters when making comparisons. For example, in assessing the performance of public versus private hospitals, one could construct a counterfactual of private hospitals, with which public hospitals' performance is assessed. Alternatively, one could construct a counterfactual of public hospitals, with which private hospitals' performance is compared. In most cases the results would be different. The experience of Melbourne Institute researchers working

in this area suggests that the choice of counterfactuals will make a considerable difference to the results.

Data Issues

The empirical topics outlined above are of considerable policy importance and more research should be encouraged. For researchers to make headway into these topics, however, a critical precondition is the availability of quality data and in particular, the availability of unit-record data at the patient level.

Unfortunately, patient-level data that linked to data about the hospital (staffing and other inputs etc) are difficult to come by. While hospital administration records are kept by states and territories, these records are often available at the episode, not patient level. Linking episodes by patient identifiers is an exercise that takes time and resources.

More importantly, administrative data on the usage of non-hospital health resources such as general practices, allied health and pharmaceutical drugs are kept by the Commonwealth in the form of Medicare and PBS records. Linking of non-hospital health service usage to hospital admission data at the national is a massive undertaking that is still at an early stage. Although some successes have been achieved in linking the Western Australian hospital admission data with Medicare records, the availability of the linked data is still however severely restricted.

A complete history of health records and health care utilization is important in understanding the efficiency and substitutability of hospital production, given that health care resources in most cases can be shifted from the non-hospital sector to hospitals, and vice versa. Likewise, hospital production is but one of the component of the health care system, there is a strong degree of complementarities between the hospital and non-hospital sectors.

A complete analysis of the role of hospitals in the health care system and the efficiency of hospitals, whether public or private, cannot be easily carried out under the current situation of fragmented data with virtually no possibility of linking patient information between the non-hospital and hospital sectors. It is, for example, impossible to examine demand for various hospital and non-hospital health care services unless one makes the rather implausible assumption that the two sectors are independent of each other with zero degree of substitution or complementarity. Likewise, it is impossible to examine supply bottlenecks unless one assumes that the hospital and non-hospital sectors are isolated and resources used in one sector have no repercussion on the other sector.

Final Remarks

This submission outlines a potentially useful microeconomics-based framework for the study of hospital productivity and efficiency. In implementing this framework for the study of private and public hospital production in the Australian context, we feel that five topics deserve further research. These are: accounting for multiple outputs, allowing for the dependence of hospital efficiency and quality, reducing the dimensionality of quality measures, evaluating the effects of hospital competition, and construction of appropriate counterfactuals.

The data problem is a key issue for researchers to make any progress in these topics. In particular, the availability of patient level data that cover utilisation of all health resources, and which are linked to hospital inputs, will be of immense value in advancing applied research and policy analyses in this area.

While the effort to link hospital admission data with ambulatory care and PBS data is ongoing, the progress to date has been slow. Not only are there IP, legal ownership, confidentiality issues involved, the high volume of data to be linked also presents numerous logistical and computing problems. These issues, however, can be better managed if we keep in mind that most applied research problems and policy analyses could be investigated by using a much smaller subset of the population data, e.g., a one per cent random sample. For research purposes, it is unnecessary to conduct a complete enumeration of every patient in the system. With this in mind, perhaps it is useful to consider setting up an auxiliary institutional arrangement in relation to linked data depository and specifically for research purposes.

A starting point is perhaps to set up an agency that acts as custodian for a small subset of de-identified data that are available for research and policy analyses. This agency may exist within a government department such as AIHW or be attached to a university or research institute. Since only de-identified records are kept, confidentiality concerns can be more easily managed. Moreover, since only a small subset of the data is maintained and updated, logistical and computing issues are drastically reduced.

Over time, this data set can be extended in several directions. A useful extension is to link users with service providers, e.g., GPs and hospitals. At a minimum, basic information about providers could be gathered from administrative records maintained by government agencies. This provider information will be invaluable in studying, e.g., referral patterns and competition between providers, among other topics.

Another potential extension of the data concerns obtaining supplementary information about users and possibly providers in the sample. For the former, their health

status and socio-economic circumstances, while for the latter their practice characteristics such as financial status would be extremely useful additional components to the data. This additional information could be collected via surveys in much the same way as the Medical Expenditure Panel Survey (MEPS) of the United States. In this way, a rich data set that contains complete health utilisation and socio-economic information, with provider information, could be made available and this data will be an invaluable resource for health economists and health services researchers in Australia and overseas.

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