Clinical analysis of coded data and the effect on quality of care

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Abstract
Having an indication of the cost of healthcare is the first step in achieving an activity-based funding (ABF) environment. While the best value for money in the delivery of healthcare services must be ensured, service delivery decisions cannot be based on cost alone. This paper outlines the importance of the role of the clinical analyst in the review of costed patient level data from ABF systems. It reviews the impact that these data can have on ensuring the maintenance of quality clinical care within an era of fiscal regulation through the identification and measurement of care delivery patterns against best practice. It also outlines a system maturity model for healthcare services using ABF systems and relates these milestones along a data-to-wisdom continuum.

Key Words (MeSH): Quality Assurance, Health Care; Quality Indicators; Documentation; Health Care Quality, Access, and Evaluation; Information Systems; Direct Service Costs, Automatic Data Processing, Cost-Benefit Analysis

Introduction
Having worked as a nurse in oncology, obstetrics and neonatal intensive care for 13 years, followed by a further 5 years in nursing management, the author joined a team at the Royal Women’s Hospital in Brisbane who were implementing a clinical costing system. This change from a clinical to a health informatics role was in recognition of the potential of activity-based-funding (ABF) systems to provide accurate, valid and objective data to underpin quality-of-care decisions.

A nurse’s main concern is to ensure patients receive the best possible care with the least degree of intervention, and that they be discharged as soon as possible. It is not necessarily clear to a practitioner (such as a nurse) that these clinical outcome aims also result in a lower cost of healthcare and more efficient service delivery. With the application of clinical, financial, and healthcare provision business knowledge to data in a healthcare system, positive clinical and fiscal outcomes can be achieved simultaneously. However, this is predicated upon the availability of high quality data as well as staff with the analytical skills to interpret data at a local hospital level.

The first step in establishing the ABF environment is to have an indication of the cost of healthcare. While the best value for money must be ensured, service delivery decisions cannot be based on cost alone. It has been apparent for a number of years that the value of information contained in ABF systems is significantly under-utilised. Most facilities with ABF systems do not appreciate the wealth of information contained within these systems, which could be used for clinical and business analysis, and which could in turn not only improve clinical outcomes for the organisation, but through implementation of more efficient and effective clinical practice, costs of the organisation in providing the services will also be reduced. Another scenario is an organisation with a few local experts, who are so under-staffed that they do not have time to provide the organisation with the real benefits of their systems information.

Recent Australian Federal Government announcements regarding the introduction of ABF associated with a significant number of quality outcome indicators will lead to greater public scrutiny of the cost and quality of healthcare service delivery. In association with other major changes in healthcare reform with the introduction of local health networks, (locally managed and to a greater extent federally funded), there will be a shift in emphasis of accountability and responsibility to local health care service providers. In future, they will have to be concerned with the cost
of the care they provide, not just the quality. In an era of escalating healthcare costs and diminishing fiscal resources, the challenge is to ensure that healthcare organisations survive in this new paradigm. Efficiency and effectiveness must be maximised, with fewer human resources than ever before. Organisations need to review skills of staff to establish a baseline of where they stand in relation to the business of health service delivery. Working from this baseline, they can look at implementing support and training where it is needed, which will continue to maximise outcomes of services provided to communities in the long term.

Types of activity costing
The following discussion includes a brief comparison between cost modelling and patient level (clinical or patient-centric) costing.

Cost modelling
Cost modelling has been in use for a number of years. It still has a place in our current environment in that: it is a top down approach; it uses assumptions and averages; it is useful for small stable patient populations; it is a simple system to operate and maintain; and there is a low cost to setting it up. However the ability to drill down to a level of data that can provide accurate clinical analysis, which will in turn assist in the review of clinical practice, is missing in a cost modelling based system. It simply does not have the granularity of data required.

Costed patient-centric clinical data
Patient-centric costing came into vogue in the late 1980s when facilities began to realise that they did need a lower level of costing in order to gain a better understanding of cost components that contribute to every aspect of delivery of health care services. Most systems follow industrial costing concepts of products created and products consumed. While there may still be some modelled elements in these systems, they do have the following advantages over pure modelling systems:

Financial advantages
Patient-centric costing is a ‘bottom up’ approach. Costs are based on actual consumption of human and material resources at a ‘product’ level. For the purposes of this discussion a product can be considered a unique health care intervention or service that is produced by a department and then consumed by the patient. For example a chest x-ray is produced by the Diagnostic Imaging Department. In some ABF systems the term ‘activity’ is used to describe the same unique service. From a costing perspective we need to account for each human and material resource associated with the production of this product; the more accurate this is the better our costing information reflects actual practice and expenses.

Patient-centric costing also provides data for clinicians to assess the cost of patient care against current clinical practices; allows for tracking of actual services used in the treatment of individual patients or groups of patients; provides detailed costed data for analysis at multiple levels of the organisation; and allows for trending of changed practice and the review of cost and clinical outcomes.

Clinical advantages
Patient-centric costing enhances quality management through variance analysis of care profiles against clinical protocols. It also provides an improved basis for setting and monitoring performance indicators and benchmarks, and a platform for modelling costs and activity against workload. It assists in identifying causes of variances to best practice outcomes, and it is useful for research.

Why do we need to move away from modelled costing?
Modelled costing may help in the management of finances, but of itself it does not help to identify opportunities for improvement at a level low enough to facilitate objective decisions to be made in organisations while still meeting the requirements of ABF that is planned for introduction across Australia in 2012 as the major model for health care funding.

In her speech to the Australian Health Insurance Association Conference on 11 November 2009, the Hon Nicola Roxon MP, the then Minister for Health and Ageing, stated: ‘We will be choosing the options that are best for the Australian people – to improve health outcomes, health equity and the cost effectiveness and sustainability of the very large amounts of taxpayers’ funds that are spent on health’ (Roxon 2009).

In his Better Health Better Hospitals Speech, the then Prime Minister of Australia, the Hon Kevin Rudd MP stated:

To strengthen accountability within the health system, the Australian Government will develop strong national standards for patient care and publish performance statistics for the nation’s hospitals – leveraging its increased funding responsibility to deliver a better standard of care.

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1 A planning approach that begins with the data collected and systematically combines data into broader and common categories and themes; also called inductive reasoning (The University of Texas at Austin 2007).
For the first time, Australians will also have access to information about how hospitals and health providers are performing - including safety and quality measures, such as the level of adverse events and hospital acquired infections’ (Rudd, Swan & Roxon 2010).

In these related statements we can see that while funding is an important aspect the Federal agenda, there is an equal emphasis on the quality of the care actually delivered and the effectiveness of that care.

What skills does a clinical analyst need?

If there is a need to review not only cost of care but quality of care, which staff members in an organisation are best able to provide this service? Before looking at skill sets required for outcomes reporting, it is timely to review two related key concepts: data analysis and variance.

Data analysis can be defined as systematically identifying patterns in the information gathered and deciding how to organise, classify, interrelate, compare, and display it. These decisions are guided by the central questions, the types of data available, and by input from stakeholders.

Variance can be defined as: discrepancy (an event that departs from expectations); and variation (an activity that varies from a norm or standard) (Miller 2009).

What is the role of a clinical analyst?

The staff member in this role:
- demonstrates a detailed understanding of the clinical side of health care delivery
- is focused on the quality of clinical service activity outcomes
- actively identifies opportunities for improvement
- will have had five or more years in a clinical role
- is actively involved in the identification and management of appropriate relative value units for clinical service costing and reporting
- makes extensive use of the encounter reporting functionality, to analyse clinical practice patterns against best practice outcomes
- provides advice on the options for managing emerging and known clinical practice trends affecting the organisation from a cost and a quality perspective.

The data-wisdom continuum

Before we can analyse our service delivery outcomes as an organisation, we need to establish a baseline of the analytical skills of our team. The accurate analysis of data does require analytical skills, detailed practical experience and in-depth organisational knowledge. The collective ability of an organisation is a sum of the abilities of the team, so we can look at the growth of an organisation’s ability in data analysis as a journey both at an individual and an organisational level. The question then for each individual is: ‘where are you as an individual on this journey and where is your organisation?’ A baseline can be established by reviewing the data-wisdom continuum.

There is differing opinion as to the original author of the data-wisdom continuum model, and indeed there are a number of like models described. The original models in the early 1990s only described data to knowledge as a continuum with wisdom being added as the next step a few years later. This model is common in knowledge management texts (see, for example, Bellinger 2004, cited by Harsh 2008; Yolles & Moores 2005: 104) and does serve to illustrate this discussion.

The next step is to move to the stage where we are not just doing the right things, but ‘doing things right.’ The steps to this process can be reviewed as follows.

What are data elements?

Data elements are just groups of numbers and letters; they do not have any context. When we see data the first thing we do is to attempt to find a way to attribute meaning to them. For example, DRGs are just data but as soon as the acronyms’ definition
‘Diagnostic Related Group’ is added we are already moving past the data stage.

**What is information?**
Information relates to description, definition, or perspective (what, who, when, where). While information entails an understanding of the relations between data, it generally does not provide a foundation for why the data are what they are, nor an indication as to how the data are likely to change over time. Thus if DRG AO6Z, a patient ID, a date of discharge and a hospital are added to the initial piece of information, data comes together as information.

**What is knowledge?**
Knowledge comprises strategy, practice, method, or approach (how). When a pattern relation exists amidst the data and information, the pattern has the potential to represent knowledge. It only becomes knowledge, however, when one is able to realise and understand the patterns and their implications.

To illustrate the step of building knowledge from information, consider a tertiary referral hospital. We have the information that identifies the volume of patients admitted. This is one piece of information. Once the admission episode is coded we have another piece of information, In this case a DRG and for our discussion AO6Z. Further we have information that identifies the location of referral and also an increase in the volume of those referrals. We may also note that the referrals are coming from one service provider. So here by putting the information together we are building a pattern and transforming that information into knowledge.

**What is wisdom?**
Wisdom embodies principle, insight, moral, or archetype (why). Wisdom arises when one understands the foundational principles responsible for the patterns representing knowledge being what they are. Thus in the above example, the reason for increasing numbers of patients with AO6Z from a specific facility can be identified.

**Activity-based funding (ABF) systems**
To assist in reviewing the data available from this type of system it is important to first look at the types of systems that may be termed ABF systems. These systems differ markedly in their features, cost and complexity. To maximise the outcomes of a health care organisation it is important that HIMs understand the features and functionality of the ABF system, if one has been implemented. When seeking to purchase or upgrade the system, knowledge of the capabilities of the system should be linked to the level analysis required. The following model illustrates the link between system capability and analysis of the data elements contained within or available to the system.

**Data analysis dimensions**
What information can be reviewed from ABF systems? The answer to that question lies in both system design and function. In Queensland, the Eclipsys Corporation product Sunrise Decision Support (previously known as Transition II) has been used since 1997 for ABF. This system is based on an integrated costing and clinical data warehouse design. It is a very stable system that provides all of the necessary functions, which will be described below.

One of the key issues in managing a complex information system over a long period of time is in the succession of staff. To assist the new ABF team members in Queensland, the following model describing the functional ability of our ABF system and the relationship of these functions to the analysis of the systems information was created.
**ABF dimension 1: service cost**
The analysis of service cost is the first dimension of ABF system data analysis. Typically this type of analysis is undertaken by a cost analyst whose role it is to answer the questions: ‘How much did a service cost?’ and: ‘How much will we be paid for this service?’ The complexity of service costing in ABF systems varies greatly. ‘What’ the costs were can be identified, it might be possible to identify where they were incurred, but details of ‘what was done’, ‘who did what to whom’, or more importantly, ‘why it was done’ will be unknown.

**Advantages of service cost analysis**
Service cost analysis can be done on a simple system on rolled-up data; even a spreadsheet will do. It is a good solution where activity types are simple and low volume; it provides an aggregated cost-of-service delivery; it can provide a quick answer to simple questions; and if done on a more complex ABF system it underpins the other dimensions of analysis (and it is critical to get this right!).

**Disadvantages of service cost analysis**
Simple cost modelling provides a service cost but does not lend itself to further in-depth analysis. Because it is cost focused it might have little meaning to a clinical audience. The control level is volume of service only; drill down is finance/hour-based or may not be available at all; and it assumes that services are the same everywhere and therefore their costs of are also assumed to be constant (service type grouping is too high).

**ABF dimension 2: service quantity**
The analysis of service quantity is the second dimension of ABF system data analysis. Typically this type of analysis is undertaken by a business analyst whose role it is to answer the questions: ‘What services were provided and how did that compare with what was planned?’ and: ‘Who provided these services, how many and at what cost?’

The complexity of service quantity reporting in ABF systems varies greatly. The more data available at a lower level improves service quantity costing, but at the same time increases the data transformation management effort.

**Advantages of service quantity analysis**
Service quantity analysis takes into account activity (volume) variance when calculating cost variance; it can take activity complexity (mix) variance into account when calculating cost variance; it can provide flexible budgeting (what it should have cost) given volume and mix variance; it should be patient centric and add clinical service descriptions recognised by clinicians; and it should include clinically meaningful resource homogenous groups (e.g. DRG, ICD) and allow drill down through these groups.

**Disadvantages of service quantity analysis**
Because it is product focused it may have little meaning to a non-ABF audience. The control levels are volume of service and type of service only; and it assumes that services are provided at the same level of quality in the same amount and at the same time and therefore service delivery is the same.

**ABF dimension 3: service quality**
The analysis of service quality is the third dimension of ABF system data analysis. Typically this type of analysis is undertaken by a clinical analyst whose role it is to answer the questions: ‘What was the outcome of services provided and how did that compare with best practice?’ and ‘What is needed to change to ensure quality and efficiency whilst improving cost effectiveness?’

A number of ABF systems do not have the ability to undertake service quality analysis in detail, yet it is here that the real value for investment lies in order to truly meet customer expectations and be cost effective.

**Advantages of service quality analysis**
Service quality analysis takes into account best practice when identifying variance in service delivery volumes, frequency of service, length of stay and cost. It triggers sentinel events that may affect cost and quality outcomes. Applying variance analysis to clinical pathways identifies ‘what should have been done and when’ to ensure effective clinical outcomes at the most efficient cost; and could provide outcomes reporting (with patient satisfaction and clinical incident information); and allow reporting across the continuum by linking multiple healthcare intervention episodes for all settings.

**Disadvantages of service quantity analysis**
Detailed clinical practice knowledge is essential for service quantity analysis. It requires complex data and requires data integrity from each lower dimension for conclusions to be accurate. Building best practice data against which to trigger encounters is initially time consuming.

**Quality documentation = quality analysis**
In order to undertake any reasonable level of clinical analysis, there must be high quality source data. This applies to all healthcare information systems, but is especially relevant in any system that has decision support functions.
Analysis documentation requirements

To analyse clinical documentation the following key items must be recorded:

- **Detailed clinical planning**: what interventions were required, who ordered the intervention, who did the intervention, what date what time?
- **Detailed clinical observation**: what was the effect of intervention?
- **Detailed review of outcomes**: if the outcome was not as expected what change was made to the plan of care and why?
- **Accurate coding of clinical documentation**: leading to correct grouping allowing cost comparison within resource homogenous groups.

Good documentation is:

- **deliberate**: it supports what we did, when and why we did it
- **organised**: it relates care given to planned care in a chronological order
- **reflective**: it uses both objective and subjective observations of the patient/client and records variance against planned clinical pathways
- **complete**: it includes all the information required to describe the patient journey including incidents adverse reactions as well as positive outcomes.

Good documentation requires:

- **Documentation standards**: outlines how and what we should document.
- **Mandatory elements defined**: ensures that the care elements, critical for later care analysis are collected and recorded.
- **Agreed data sets**: ensures that a common language is used to describe care and to collate care elements into appropriate definitive groups.
- **Personal accountability**: ensures that each care provider will accurately record the care they plan, what they actually provide and the observed outcome of that care.

Documentation-analysis continuum: reviewing outcomes

In modern healthcare settings it is critical to the viability of a service that opportunities for improvement are continually sought and then evaluated against best practice. This process is a cycle that follows a continuum from documentation through to analysis and then back to ongoing documentation. To help illustrate this process each of the key steps that should be taken to achieve this service review goal have been outlined.

ABF outcomes or outputs?

In conclusion, and in light of recent Federal Government announcements regarding healthcare policy, some key differences between reporting outputs and outcomes are briefly reviewed.

Outputs have:

- the volume of what was done
- the cost of what was done
- they might include who received what was done
- they might include variance of cost to revenue.

Outcomes include all of the above plus:

- quality dimension for variance analysis against best practice
- the ability to review the effectiveness and relative costliness of clinical practice change decisions.

Outcomes reporting is possible provided that the following are present:

- electronically available patient centric costing systems
- quality clinical documentation and coding
- detailed best practice care plans
- patient-centric variance analysis tools.

It can be further improved with:

- electronically available patient centric Incident reporting
- electronically available patient centric satisfaction data.

Conclusions

The management and funding of health services is becoming increasingly complex. As we continually seek to lower the cost of health care service delivery, while maintaining the principles of equity, quality and efficiency of resources the use of the data that are available to us must be maximised. In association with complex integrated e-health systems, which in most of Australia is yet to be realised, the use of the data contained in existing systems such as ABF systems needs to be maximised. We cannot afford to limit information analysis to financial information. We must have clinicians, and the staff supporting clinical practices and documentation, actively involved in the

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**Figure 4: Documentation-analysis continuum**
detailed analysis of all available data. If this structure is not in place, the outcomes for the healthcare system in an ABF environment cannot reach their full potential.

**References**


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The Council of Australian Governments (COAG) signed a revised health reform package on 13 February 2011, which will form the basis of a new National Health Reform Agreement to replace the existing National Health and Hospitals Network (NHHN) Agreement. However, activity-based funding (ABF) remains a fundamental component of the agreement and references to ABF in the various articles throughout the current issues of *HIMJ* and *HIM-I* remain relevant for the health information workforce.