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Quality costs and electronic adverse incident recording and reporting system

Is there a missing link?

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Abstract

Purpose – The purpose of this paper is to examine the usability and potential of incorporating quality costs into an electronic adverse incident recording system within a healthcare sector.

Design/methodology/approach – The paper is a general review and a discussion of an electronic adverse incident-recording system into the potential benefits and restrictions was undertaken. Articles containing both information systems and quality costs were reviewed in order to explore the potential of linking information against patient safety issues.

Findings – The paper finds that quality costs is a valid and useful approach for measuring the impact of individual adverse incidents or trends in order to support managers and clinicians to develop appropriate action plans to reduce levels of patient harm and thereby improve patient safety. The paper also shows that quality costs can be used to support managers and clinicians and are commercially designed to improve the detection, investigation and action planning to improve service quality and patient safety.

Practical implications – Quality costs can be used as a driver for identifying potential high impact quality and patient safety projects within a healthcare setting.

Originality/value – This paper provides useful information for designers of electronic adverse incident-reporting systems to support managers and clinicians to utilise the benefits of quality costing in order to strengthen and re-focus patient safety issues in healthcare.

Keywords Quality costs, Information systems, National Health Service

Paper type Research paper

Introduction

Quality is now seen by any organisation as an important strategic competence and key element, which no institution can ignore. The implementation of quality improvement systems could result in savings and improve current processes for the benefit of customers and staff in the delivery of services. A key technique in quality is quality costs, which has been developed from the manufacturing industry to identify excessive cost and non-value added systems, activities and steps in business processes.

Quality costing systems have evolved from industry, which focused predominately on defect cost reporting systems. Measuring and reporting on the cost of quality has predominately been seen as an accounting function such as inventory valuation, overhead measurement, reduction and income requirements for internal and external reporting and the cost of rework and the costs of internal failures (Wen-Hsien, 1998;

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Eldridge and Balubaid, 2006; Carson, 1986; Israeli and Fisher, 1995; Johnson and Kleiner, 1993).

A number of studies have shown that medical adverse incidents represent a significant cost on international health care systems. In 1989 the US spent $161 million, the Australian Government in 1995 over $900 million and in the UK in 2001, £2,400 per adverse incident (Johnson and Kleiner, 1993; Wilson, 1995; Vincent *et al.*, 2001).

Foster (2003) looked at the incidence and severity of adverse events affecting patients after discharge. The research determined the rate of adverse incidents and severity of adverse events affecting patients after discharge from hospital to home. Foster (2003) found that nearly one in five patients experienced an adverse incident. These injuries varied from serious laboratory abnormalities to permanent disabilities. Foster (2003) concluded that discharge care would benefit from system design to improve patient safety.

The World Health Organization (2005) in their report, draft guidelines for adverse event reporting and learning systems, reinforced this view that healthcare organisations should investigate and review adverse incidents which can reveal unrecognised trends requiring organisational attention and generate recommendations for best practice and solution.

NHS Quality Improvement Scotland (2006), *Safe Today – Safer Tomorrow*, reviewed incident and near miss reporting systems across Scotland. The report noted that all Health Boards sampled during the research indicated that reporting systems were, "either paper or web-based, and backed software tools of varying sophistication to record aggregated and report on data gathered". This report emphasised the lack of standardisation of approach of collecting and presenting data collection in the commitment of patient safety and quality.

What are quality costs?

Quality costing is a quality management technique that provides the management of the organisation with a mechanism to facilitate program and improvement activities. Quality costs have a direct link with the expression of the "economics of quality" and reflect the importance of quality to the business and financial value of quality management. Poor quality can cost an organisation and good quality can assist organisations to save money by doing the right thing at the right time (Campanella, 1990, 1999; Harrington, 1999).

Dale and Plunkett (1999) take the view that there is no clear definition being used on quality costs to describe and communicate a common understanding on the subject. Feigenbaum (1951, 1991) first presented the concept of quality costs, in which he argued that quality costs are generated throughout the total life cycle of the product in service and use. Feigenbaum (1951, 1991) argues that the cost of quality can be measured in importance to labour costs, engineering costs, selling costs, operating costs, major capital investment decisions as part of modern companies drive to improve quality and a competitive position. Feigenbaum (1951, 1991) reflects that quality cost data can provide a mechanism to evaluate and assure an organisations performance against the goals and objectives of the company. Feigenbaum (1951, 1991) argues that quality cost information can be a positive evaluation of a product or service performance, which could include repairs, replacements, product-recall or liability such as complaints and the cost of litigation.

Campanella (1999) based on Feigenbaum (1951, 1991) work, stated that quality costs are the measure of the costs with the achievement or non-achievement of the product or service. Thus according to Feigenbaum (1951, 1991) and Campanella (1990) quality costs can be summarised as follows:

Prevention costs
The costs of all activities specially designed to prevent poor quality in products or services, e.g. costs of product review, quality planning, costs invested in quality improvement projects, cost associated with education and training.

Appraisal costs
The costs associated with measuring, which is associated with evaluating or auditing systems and processes. This is in order to assure conformance to quality standards and performance requirements. Examples are costs of process auditing, measuring and testing of equipment and the cost associated stock evaluation of parts and material.

Failure costs
The costs resulting from products or services not conforming to requirements to customer/user needs. Failure costs are divided into categories of internal and external failure cost.

Internal failure costs
Costs occurring prior to the delivery of shipment of the product, or the furnishing of a service, to the customer. Examples are the costs of unsatisfactory quality within the organisation, the cost of reworked material, re-inspection and retesting of the product or service.

External failure costs
Costs occurring after delivery of the product, and during or after furnishing of a service, to the customer. Examples are the cost of processing customer complaints, customer returns, warranty claims and product recall.

Campanella (1999) argues that the main purpose of any quality costs system is to facilitate quality improvement activities with the aim to drive down or eliminate quality related issues or problems. Feigenbaum (1951, 1991) argues that operating quality costs, which included key costs associated with quality, which will embrace the achievement of:

- attacking and minimising on failure costs and possibly bring them down to zero;
- investing on appropriate prevention activities;
- bring down appraisal costs accordingly; and
- continuously improve redirect and prevention efforts through constant monitoring of quality costs.

Quality improvement systems and quality costs have been introduced to service industries which have raised the importance of both quality, as part of organisations key objective to meet customer care and value for money with limited resources. Quality cost information can be used to direct organisations attention for corrective action and provide a focus to develop methods for quality improvement. Dale (2003)

and Wen-Hsien (1998) view is that improving the process would lead to reducing quality costs. This is supported through the work of Crosby (1979); Feigenbaum (1991); Groocock (1986) in that investment in quality will reduce quality costs, increase business performance and customer satisfaction.

In order to evaluate the effect of quality costs, management of organisations predominately manufacturing industry have compared quality costs with sales where quality costs are evaluated as a percentage of sales for the purpose of determining their effect on the profits. Organisations have to make comparisons between how it spends on quality aspects on systems and processes. Appraisal costs generally represent the largest part of quality costing due to inspection and sorting out good work from bad. Organisations have to introduce quality assurance programmes for prevention and reduce failure and appraisal costs. A key requirement is that the measurement of quality in terms of quality costs must be linked to management to evaluate and implement quality assurance programmes in order to respond to problem areas or issues. In order to change the emphasis from quality inspection to quality assurance it requires all members of the organisation to embrace quality costs as a mechanism for improvement (Kohl, 1976; Feigenbaum, 1991).

Poor quality and the need for corrective action have been highlighted and brought into focus within health care, in that we are providing patient services, which have vulnerable processes, which provide both poor evidence of quality and patient care. The healthcare service cannot ignore the expense of delivering poor quality care and increased quality costs (Brennan, 1991; Leape, 1991; Bates, 2000).

Quality costs in health care services

Adverse incidents can be defined as, "an event of omission arising during clinical care and causing physical or psychological injury to patients and even death". Quality costs in health care fall into the costs of control and the cost of failure of control. These costs could be seen as the evaluation of patient safety issues linked to individuals or system failure. Prevention costs can be seen in adverse incidents as defects and non-conformities from occurring and to keep unsatisfactory systems and procedures from taking place in the first instance. Appraisal costs within health care includes the costs of maintaining the organisations mechanisms of formal evaluation of the public service, such as the cost of quality audits, external peer review and maintain systems to evaluate service quality.

These adverse incidents and quality costs can lead to distress to patient, family and carers. Internal failure quality costs in health with comparison with industry can be linked to disruption of the patients care, handling of patients' complaints, handling of patients' claims, and the increased level of investigations in order learn from events and the increased importance of audit and training (Department of Health, 2001; Carson, 1986; Katz and Green, 1992)

The development of risk management and the use of technology for reporting and recording of adverse incidence in healthcare have expanded against the rising incidence and cost of litigation for clinical negligence. The Department of Health (2001b), *Organisation with a Memory* report, has estimated the negligence cost of adverse incidence to be running at approximately £400 million a year, with a estimated liability of around £2.4 billion for existing and future claims. The report also highlighted that hospital-acquired infection was estimated about 15 percent of which

could be avoided with an estimated cost to the National Health Service nearly £1.0 billion a year.

Health care is a managed system of cost containment programmes, which includes systems and mechanisms to direct access to a wide range of services and control costs within the health care delivery service. The quality costs are predicted to rise on an annual basis across health care with the knowledge that adverse incidents are occurring across all sectors of the health environment (Katz and Green, 1992; Mullahy, 1995; Walsh, 2001; Dingwall and Fenn, 1995; National Health Service Executive, 1996).

Reports such as the Kohn *et al.* (2000), Institute of Medicine (2002), To Err is Human: Building a Safer Health System (2000); and Crossing the Quality Chasm: A New Health System (2001), emphasised that patients should not be harmed by the care that is intended to help them, nor should harm come to those who work in healthcare. There is a growing body of evidence that patients are harmed, which can be demonstrated by the rising quality cost with litigation. An estimated £400 million is being paid in clinical negligence claims, and adverse events result in approximately £2 billion per annum, resulting in patients having extended inpatient stay, with an effect of increasing quality costs (Department of Health, 2001a,c; Milligan and Robertson, 2003).

Crouch *et al.* (1981) attempted to estimate the cost associated with adverse incidents. A one-year prospective study of 5,612 surgical admissions to one US hospital, identified 36 adverse incidents during the patient's surgical care. A total of 11 patients were found to have died due to these incidents and a further five patients who had been discharged from hospital had suffered from a serious physical impairment. The total cost of the 36 adverse incidents incurred was estimated around $2 million.

A retrospective review was under taken by Schneider (1995) to assess additional costs linked with medication related problems, which were found in 109 patients at another US hospital. These patients were found to have clinical consequences from a medication reaction or medical error. Clinical outcomes were assessed from increased length of hospital stay; increased laboratory testing, additional treatments and intensive care intervention. It was estimated that a total of 349 outcomes per patient were recorded, with a quality cost of $95 for additional laboratory investigations to $2,640 for intensive care. The review of the medical records of patients according to Schneider (1995) of whom had experienced an adverse incident or medication error showed that there was a high cost of these events to the organisation, with the cost varying with each clinical outcome. Schneider (1995) argued that this research showed an opportunity for pharmacists to intervene to save money and improve patient safety.

Vincent *et al.* (2001) demonstrated as part of a UK pilot study that all health care systems have additional or excess quality costs. Of the 119 adverse incidents, the researchers estimated that 999 extra beds were linked to each adverse incident. A total of 460 bed days (46 percent) were estimated to be preventable. It was estimated that each adverse incident had incurred an average of 8.5 additional days in hospital, resulting in additional quality cost of £290,268 to the two hospitals in the pilot study. The conclusion was that each year approximately 5 percent of the total of 8.5 hospital admissions would experience a preventable adverse incident. This could be equal to 3 million additional beds days and an additional cost of approximately £1billion to the National Health Service. Vincent *et al.* (2001) argued that this figure was in addition to the cost of litigation, staff time, impact on patients and staff, and the wider economic consequences.

Department of Health (2001b), "An Organisation with a Memory", reflected that a no "blame culture" and a lack of national system for shared lessons were key obstacles to identifying the number of patient safety incidents. Despite this endeavour the House of Commons Committee of Public Accounts: A Safer Place for Patients: Learning to Improve Patient Safety (2006) found that 2004-2005, 974,000 patient safety incidents and near misses had been recorded by the National Health Service reporting systems. Despite this level of adverse incident reporting the National Audit Office (2005) have reported that the National Health System still has limited information on the extent and impact of clinical and non-clinical incidents and that the key criteria is for healthcare to understand the underlying reasons so that systems and processes could be improved in the name of quality and patient safety. For example any harm to a patient such as the removal of a wrong kidney is both tragic to the patient and family, consultant, theatre team, ward nursing team and the time associated with the investigation on behalf of the organisation and is costly in emotion, time for reporting, recording, potential litigation and corrective action to system and processes. Each element caries varying degrees of quality costs.

The quality cost associated with individual adverse incidents combined in the rising health care quality cost needs to be further understood and prioritised. In order to provide the healthcare service with a totality of the costs associated with adverse incident, then the measurement of the adverse incident and the quality action plans, which needs to be strengthened in the pursuit of patient safety. The focus now is to improve the process and quality outcomes across organisations such as health care. Harrington (1999) argues, "this represents today's biggest opportunity for improvement".

Dale (2003) argues that quality costs can be linked to a variety of activities such as design, planning and control, operational delivery, installation and evaluation of how an organisation manages quality and the improvement process. Dale (2003) states that if organisations could reduce failure costs (harm to patients) and eliminate the underlying factors of failure that would lead to "substantial reduction in appraisal costs".

Allinson (2004) argues that electronic information systems and communication through information technology can be used to introduce "new efficiency and services". This would support Carson (1986) view that specific quality costs are the language most Chief Executives know best and would be meaningful to support quality improvement. Current adverse incident information systems claim to provide extensive benefits to collecting and analysing adverse incident information. There is no national specification of requirements or adverse incident categories for collecting adverse incidents that should include the importance of quality costs. This would change the focus of collecting risk-based aggregated data as outlined by the House of Commons Committee of Public Accounts (2006) to more proactive management in partnership with a clinical response in order to reduce specific quality costs of failure. This proactive integrated approach would change the purpose of collecting adverse incident data in order to improve patient safety issues.

Quality healthcare information systems in a complex health organisation should be seen as both complex and challenging to any part of the administration for both clinicians and managers. There is now more focus on replacing paper based reporting systems with electronic based systems in order to improve delays for entry of information, improve outcomes which have been associated with manual based systems (Armondi, 2000; Murray and Lynn, 1996; Wilson, 1992).

The healthcare system has been introducing technology such as electronic adverse incident recording and reporting systems very recently. This is in order to detect clinical and non-clinical incidents within the organisations, so that clinicians and managers will be able to learn and therefore improve systems and processes for the future care of patients. House of Commons Committee of Public Accounts (2006) reflected that by 2000, "there were more than 30 different reporting routes", thus making comparisons and benchmarking across the healthcare environment difficult and learning lessons restricted. They noted that, "some trusts incident reporting systems recorded few incidents and others recorded many thousands".

House of Commons Committee of Public Accounts (2006) reflected that insufficient progress had been made in relation to "value for money" and the "cost over runs in establishing a National Reporting and Learning System". The Public Accounts Committee (2006) report reflects that this leads to a limited feedback of solutions to reduce serious incidents. A damaging reflection in that the National Patient Safety has failed to evaluate and present national solutions compared to that which have developed at trust level. This situation provides limited evidence of quality improvement and outcomes, as we appear to be collecting data for data only. This will not provide the public with confidence on how safe individual healthcare organisations are in relation to quality and patient safety.

A large amount of information is transferred between healthcare professionals in relation to their patients and other integrated support departments such as laboratories, theatres, wards, etc. (Schneider and Eisenberg, 1998). A detailed and well-designed healthcare system such as adverse incidents can inform directors about potential drug reactions (Huynh and Agnihothri, 2000). In the USA in 1994, 2,216,000 hospitalised patients had suffered from a serious adverse drug reaction, in 106,000 patients the results were fatal making adverse drug reactions around the fourth leading cause of death in hospital (Lazarou, 1998; Jha, 1998).

Research has shown managers and clinicians that patients will suffer permanent disability and some patients will die (Leape, 1994). These incidents can result from therapeutic intervention, which have resulted from system or human error (Wilson, 1995; Leape, 1991; Australian Patient Safety Foundation, 1999).

Huynh and Agnihothri (2000), argue that information systems in healthcare are an important resource of information for knowledge management. An information system needs to be linked to organisational aims and objectives in order to improve performance. The clear role of an adverse incident recording and reporting system is to improve quality and patient safety.

The evidence given to the House of Commons Committee of Public Accounts (2006) noted that the National Patient Safety Reporting System was receiving 60,000 reports per month, but the evidence submitted did not reflect the quality of costs associated with this level of adverse reporting data, could this provide a new focus for managers and clinicians to objectively look at individual adverse incidents with a view to estimating the likelihood and severity, as well as, associated costs for system errors.

Quality costing and its role in electronic adverse incident recording and reporting system

A review of six commercial companies claimed to have developed commercial specific systems to improve patient safety. On evaluation no system included a component of

quality costs as an important method of quality measurement and an indicator of patient safety. Yule *et al.* (2004) reviewed six independent commercial companies with managers and clinicians against a detailed specification document and scoring matrix. The results showed that commercial companies did not include quality costing, and no company argued the importance of this methodology to be developed in the future. All six companies claimed to be working in partnership with the National Patient Safety Agency to provide an adverse incident reporting system.

There is a requirement to work in partnership with clinicians and managers to seek their views in locally developing adverse incident recording and reporting systems in a way that uses a common language and purpose to meet the users' needs in the interest of quality and patient safety.

To link quality costs with adverse incidents there is a requirement to record them in an integrated electronic database approach with claims, complaint activity and adverse incidents. This would assist in further understanding of the quality cost and patient safety issues. Managers and clinicians would have estimated quality costs associated with each adverse incident, which would support local decision-making and prioritisation of limited resources. The prioritisation of critical adverse incidents and devised action plans will potentially prevent them in the future. This would also assist in the reduction of risk, the quality cost in relation to quality and patient safety. Processes and procedures would be improved by learning from systems of individual failure by using adverse incident information and quality costs more effectively and efficiently.

Electronic adverse incident recording and reporting systems have to be developed in line with Bottorf (1997) view of the benefits of using a quality costing system. Then the approach will change so that, "Quality data are more readily accepted because they are gathered and analysed" Roden and Dale (2000) reflect that there remains some confusion in organisations in relation to internal and external failure costs.

In order to support staff using quality costings there is a requirement to standardise risk assessment process by using a risk matrix. Farrow *et al.* (2005) developed a Risk Matrix based on guidance from Keele University (2004) and the Australian and New Zealand Risk Standards (2004) Quality costing were included in the "new" risk matrix and incorporated into the electronic adverse incident recording systems in the author's organisation.

Keele University (2004), Making it Work: Guidance for Risk Managers and the Australian and New Zealand Risk Standards (2004) measured a combination of the probability (or likelihood/frequency of an event occurring and its consequence or impact. This is commonly used to measure and support a value on different risk. It will be based on subjective judgement and it is still too early to see if this risk matrix is used in partnership with the electronic adverse incident recording and reporting system, to measure quality costs and assess organisations response to issues of patient safety and quality.

The Australian and New Zealand Risk Standards (2004) recommended adopting a 5×5 matrix approach to assess the level of risk both at the reactive and proactive stage of the clinical or managerial assessment. This should be adopted on a national basis in order to support local assessment of the classification of adverse incident into high, medium or low incident associated with a proposed quality cost. This would

allow organisational-shared learning in relation to patient safety issues and associated quality costs across international healthcare.

National system of electronic adverse incident and quality costs/risk matrix should be introduced in order to support quality benchmarking as developed and modified by NHS Ayrshire and Arran. Currently this is being considered by NHS Scotland and NHS Quality Improvement Scotland. This would give the foundation for sharing of appropriate data and quality costs in the first instance when an adverse incident has occurred. Quality costs could be reviewed following the local improvement action plans. The potential benefit would be to share quality initiatives and projects across the healthcare system locally, nationally and internationally. Joint action plans could be developed across health boundaries which could reduce the cost of valuable public resources, improve patient care, support clinicians to deliver the care to their patients and support managers to review process and systems in order to be more effective.

Complaints, all clinical risk activity, claims and adverse incidents activity should be integrated using a standardised adverse incident categories and sub categories so that adverse incident and quality costing can be linked. Reports could be generated in the first instance to assess the impact of the adverse incident and then reviewed after the corrective action has been fully completed. If successful, the quality costs should be reduced and the awareness of patient safety raised across the organisation.

Training, education and administration support needs to be fully resourced in order to support the design, planning, implementation, evaluation and management of the electronic adverse incident recording and reporting system.

Adverse incident reports with an emphasis on the associated quality costs will support clinical and managerial accountability in both the reactive and proactive phase of patient safety. This would support the organisations scheme of delegation in order to clarify individual roles and responsibility in the pursuit of quality care and patient safety. Strong committed and sustained leadership at all levels both clinical and non-clinical is required to support the continuation of using quality costs in partnership with information (Pursglove and Dale, 1996).

Clinical leadership should work with general management in order to identify the creation of quality costs associated with adverse incident categorisation within speciality areas such as orthopaedics, surgery, elderly care, paediatrics, gynaecology, radiology and anaesthetics. This allows staff to explore patient safety issues, which the organisation has to manage on a day-to-day basis. This supports the development of the causes, measurement and reporting development of a commercial electronic adverse incident reporting and recording system (Machowski and Dale, 1998).

To improve communication and support partnership working across all levels of the organisation, a users group should be established to support the integration and modification required to implement the electronic adverse incident and recording systems. Membership should be from all clinical and non-clinical areas with clear line accountability to the executive management team.

Conclusion and future work

Health care requires to change focus though not just in collecting adverse incident data, in order to comply with external requirements, but to use the information proactively to improve patient safety. There is a strong link with quality costs, which should be integrated with electronic adverse incident and reporting systems. There is a missing

link in the design, planning and implementing quality-costing component within the electronic adverse incident recording and reporting system. Further research needs to be undertaken in order to obtain views of clinicians and managers in the potential use, modification and development of a holistic approach to electronic adverse incident reporting.

The key to electronic adverse incident recording and reporting system is to use this linkage of quality costs to improve patient care, individual and organisational process by focusing on not just the information of adverse incidents but to integrate the potential cost and saving following action planning. This could be redirected into patient care and improvement of services. The changing approach of being proactive and targeting critical areas of public safety will improve the accountability of managers and clinicians in health care for the public whom we serve.

Health care organisations needs to recognise that implementing electronic adverse incident reporting and recording systems need to be well integrated with other areas, which collect and apply quality costs such as clinical risk and claims activity. There needs to be a common risk matrix which maps out the potential quality cost to the likelihood and severity of each adverse incident and associated action plan so that organisational learning can operate both internally and externally within the National Health Service.

It is too early to say if this would improve the use of information collected by such electronic systems. The key to future development of electronic adverse incidents recording and reporting systems is in relation to how organisations in healthcare will be able to demonstrate clear outcomes and improve patient safety by demonstrating an improvement in their delivery of quality care by using a combination of quality costing and electronic adverse incident recording and reporting processes.

This will be followed by a series of articles attempting to answer these searching questions from a user's point of view in the interest of patient safety and quality in healthcare.

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