

Applying the Quality Loss Function in Healthcare

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INTRODUCTION

Using the quadratic loss function is one way to quantify a fundamental value in the provision of health care service: we must provide the best care and best service to every patient, every time. Sole reliance on specification limits leads to a focus on “acceptable” performance rather than “ideal” performance. This chapter presents the application of the quadratic loss function to quantify improvement opportunities in the health care industry.

The quadratic loss function (QLF), also known as the quality loss function, is a metric developed by Genichi Taguchi, which focuses on achieving the target value rather than focusing on performance within the wider specification limits. Using the quadratic loss function allows the Six Sigma team to quantify improvement opportunities in monetary terms, the language of upper management. The quadratic loss function translates variability into economic terms by calculating the relationship between performance and financial outcome. The general quadratic loss function is shown in Equation 1.

(1)

*Loss at any point (L) = (monetary constant) * (average – target)²*

The quadratic loss function is used to determine the average loss per product or encounter, and it enables Six Sigma teams to focus on performance relative to target and avoid the goal-post mentality. The loss function approximates the long-term loss from performance failures and encourages continuous improvement. The quadratic loss function is helpful both as a philosophical approach and as a quantitative method. Figure 1 illustrates the quadratic loss function.

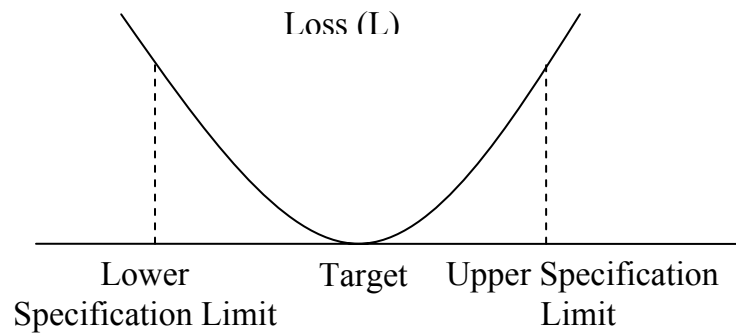
BACKGROUND

Many attempts have been made to make a business case for quality by examining cost, but a thorough review of literature shows no evidence of a sustained cost of quality system implementation in health care. Several researchers have commented on the paucity of information on this topic (Palladoro, 1997; Bozanich White, 1999), and in 2003, a collaborative, including Donald Berwick, M.D., president and CEO of the Institute for Healthcare Improvement, “sought to erase the notion that quality doesn’t pay by setting up five case studies that would establish a ‘business case for quality.’” All five failed to do so (Robeznieks, 2003).

One reason for this failure may be the fragmented information sources from which health care quality data are derived. Campanella (1990) cautions that “a real danger lies in finding and collecting only a small portion of the costs involved and having it represented as the total.” This has likely been the case with previous attempts to cost-justify preventive measures. Getting the resources to collect the right data requires leadership commitment and technical expertise, especially in situations where data must be harvested from several sources and brought together for analysis. When performing a cost of quality analysis, it is preferable to use an activity-based cost (ABC) approach to gathering data because the ABC costs are analyzed in terms of work activities (Cokins, 1997), but hospital accounting is a tangled web of allocations developed to support cost reimbursement and was not designed to assist managers in decision-making (Bozanich White, 1999).

Many models consider the costs and benefits of providing care that is given, but do not address the cost associated with failure to provide care. There is a great deal of work remaining in the comprehensive application and adoption of cost of quality techniques to health care, and there is some indication that the current state

Figure 1. Quadratic loss function



of quality cost thinking in health care is similar to that of industry 60 years ago. The traditional view holds that high quality care costs more because it was seen as doing everything possible for the patient, whether or not the additional tests or extended hospital stays improved the clinical outcome (Burda, 1992).

In order to discuss the cost of quality in measurable terms, one must first have agreement on what is meant by quality. Safety is another aspect of quality, where patient safety is the avoidance of accidental harm to the patient (Kohn, Corrigan, & Donaldson, 2000). Some define safety more broadly to include avoidance of all harm to the patient. David Aquilina (1992) developed a framework for understanding health care quality that looks at health care quality as multidimensional, overlapping concepts. Industry usually defines quality in terms of customer requirements, but this can prove difficult in health care due to the complexity of the customer relationship and the complexity of the service (Aquilina, 1992).

The relationship between health care quality, however defined, is not easily related to the health care industry's bottom line. As in other industries, cost, revenue, and quality are codependent. However, in the current health care environment, even the link between throughput and revenue is indirect. There is a disconnect between the provision of service and payment of service due to a myriad of factors, such as government intervention and ability to pay vs. professional obligation to provide care.

The loss function makes the point that if performance is off-target in any way, there is a loss to society as a result. The loss may be experienced by the provider, the consumer, the environment, and so forth, but there is a

cost associated with imperfection. At the point where total cost is minimized, quality is highest. In other words, the highest quality care is also the care with the lowest overall cost, when all costs are accounted for.

Although there are different opinions as to how quality and cost of quality relate to achieve an optimal level, there is agreement that money spent on prevention yields the highest return compared to any other quality cost component. This may be especially true in health care, where the prevention of an error may be possible, but once made, there is no opportunity to correct the error. An example of this is wrong site surgery, where a surgical procedure may be performed on the wrong limb. As a corrective action, the "right" surgery may be done, but the "wrong" surgery cannot be undone. Unlike other service industries, this "extra" service can cause permanent, irreversible harm to the patient (customer).

Empirical measurement of the care provided in terms of improved patient outcomes on a case-by-case basis is a labor-intensive but accepted method of evaluating the effectiveness of care. Controlling for measures such as type of illness, severity of illness, and other clinical factors on a case-by-case basis and evaluating the cost/risk and benefit of providing the care in each circumstance allows clinicians to develop evidence-based practice patterns. Even when evidence-based medicine is used and clinical outcomes are measured, these pieces of information do not add up to a picture of systemwide performance.

Evidence-based medicine is one standard; "care maps" for certain patient populations developed by interdisciplinary teams, specifications by government, health plans, and the like are growing in number. Stan-

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