

# Addressing Variation in Hospital Quality: Is Six Sigma the Answer?

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## EXECUTIVE SUMMARY

Quality of care has become a focal point in healthcare. Hospitals and health systems continue to produce care that varies in quality. This leads to customer dissatisfaction as well as inefficient processes and output. As a result, administrators face a challenge to improve the quality of care in their organizations. One way to address quality improvement is to use various quality management models.

Six Sigma is an innovative program that uses data analysis to achieve defect-free processes and to decrease variation. The program can provide management with a viable solution to quality improvement. This article presents an analysis of existing quality management tools, encourages consideration of Six Sigma, and outlines the potential benefits of Six Sigma. Finally, the article discusses an organization's capacity to implement a Six Sigma program as well as the possibility for an organization to incorporate Six Sigma into its existing quality management program.

For more information on the concepts in this article, please contact Ms. Woodard at [tanisha.woodard@gmail.com](mailto:tanisha.woodard@gmail.com). Ms. Woodard is the first-place winner of the undergraduate division of the 2004 Hill-Rom Management Essay Competition in Healthcare Administration. Sponsored by the Hill-Rom Company, Inc., the industry leader in hospital beds and patient care systems located in Batesville, Indiana, the competition is intended to stimulate student thinking and writing about important issues and developments in the field of healthcare management. For more information on this competition, please contact Reed Morton, Ph.D., FACHE, at (312) 424-2800.

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**A**s a result of continued variation in quality across hospitals and healthcare systems, quality of care in the United States has received increased attention from the public and governments. According to the Institute of Medicine (IOM), quality is “the degree to which health services for individuals and populations increase the likelihood of desired health care outcomes and are consistent with current professional knowledge” (Rowell 2004, 178). Therefore, quality efforts by hospitals and healthcare systems aim to ensure that healthcare consumers receive care that is appropriate, provided correctly, and effective. These efforts include the use of total quality management or continuous quality improvement, reengineering, and the relatively new Six Sigma. Although these efforts have worked to increase quality, serious quality issues remain in the current healthcare system (IOM 2001). Thus, identifying strategies to better the quality of care should be a continuing priority for hospital administrators.

While various methods do exist to improve quality, their approaches and effectiveness are uncertain. This article discusses the current quality management models, argues for consideration of Six Sigma in hospitals, and lists barriers to the implementation of Six Sigma. Finally, the author suggests a pilot of Six Sigma and examines the capability of a hospital to implement such a program.

## **QUALITY IN HEALTHCARE: AN OVERVIEW**

The evolution of quality improvement efforts in hospitals reflects two broad

concepts: quality assurance and quality management (Table 1). Quality assurance (QA) was one of the first attempts to deal with the variation in quality among different hospitals. The creation of the Joint Commission on Accreditation of Hospitals (now the Joint Commission on Accreditation of Healthcare Organizations) aided in the development of QA efforts, as did the requirements under Medicare (Luke, Krueger, and Modrow 1983). The goal of QA is to develop a formal system that allows hospitals to consistently produce high clinical quality care and service. QA identifies outliers (errors) and then examines ways to eliminate these outliers from the organization’s output.

Quality management (QM) is a more recent philosophy that uses managerial concepts centered on quality improvement and the satisfaction of customers. The present understanding of healthcare quality and quality management methods can be attributed to the work of industrial quality experts W. Edwards Deming and Joseph M. Juran and the work of the distinguished health system researcher and professor Avedis Donabedian, who pioneered quality assessment. Two key elements of QM are technical quality and customer satisfaction. Technical quality focuses on the competency of providers as well as on the accurate and proper procedures and care. This particular type of quality determines requirements for clinical care. Customer satisfaction, on the other hand, is based not only on the technical quality provided but also on attributes such as empathy, reliability,

TABLE 1  
Evolution of Quality Improvement Efforts in Hospitals

Time of Initiation	Quality Effort	Strategy
1950s	Quality assurance	Identify outliers in clinical care to eliminate these outliers from within the organization.
1980s	Quality improvement	Decrease variation to reduce error as well as improve clinical and nonclinical processes.
1990s	Quality management	Use managerial concepts centered on quality improvement to achieve technical quality and customer satisfaction.
Late 1990s	Six Sigma	Achieve defect-free processes and reduce variance through Six Sigma improvement projects.

responsiveness, communication, and caring to define a patient’s perceptions of quality and satisfaction (Bowers, Swan, and Koehler 1994). These two elements are the foundation of the QM theory and are reflected in specific models that have been developed. The specific elements of each quality improvement strategy are discussed in Table 2.

Continuous Quality Improvement/Total Quality Management

Continuous quality improvement in healthcare can be referred to as total quality management (TQM), continuous quality improvement (CQI), or a combination of both (CQI/TQM). The ultimate goal of CQI/TQM is to control variation and eliminate poor quality. CQI/TQM focuses on how to satisfy customer needs and expectations while striving to constantly improve all

organizational processes and activities (Chong, Unklesbay, and Dowdy 2000).

CQI/TQM seeks to better the quality of care and services by first looking at the output quality of the hospital. Output quality determines if healthcare organizations are providing products and services that meet customer needs (Longest, Rakich, and Darr 2000). Outputs that satisfy the desires of customers confirm that organizations are indeed producing quality goods and services. Another aspect of CQI/TQM examines how a hospital can advance its processes to make them more efficient and effective. Consequently, process improvement must address both clinical and nonclinical areas. A process is defined as a series of operations that are linked together to provide a result that has increased value, which may not be possible if each operation were performed

TABLE 2  
Key Elements of Quality Improvement Models in Hospitals

	Continuous Quality Improvement/Total Quality Management	Reengineering	Six Sigma
Purpose	Control variation through analysis and improvement of output and process quality.	Recreate task relationships to achieve more efficient and effective relationships among tasks in a defined process (i.e., to improve quality).	Analyze rigorous set of processes and techniques to measure, improve, and control the quality of care and service based on what is important to the customer.
Focus	Organizationwide framework	Suborganization framework	Organizationwide or suborganization framework
Tools and Techniques	Identifies priorities for process and outcome improvement. Understands processes to reduce variation. Utilizes as many tools as possible when engaging in the process.	Uses multistep process that critically analyzes internal work processes, and plans ways to redesign these processes. Outward focus is on the customer.	Develops improvement projects to achieve defect-free processes and reduce variation. Only uses tools necessary to complete projects.
Training and Preparation	Educate and train staff on CQI/TQM objectives and activities. Use committees and task forces.	Senior management provides direction and education to process teams.	Participants in the process must be trained experts and become certified in Six Sigma techniques (e.g., Green and Black Belt Certifications).

individually (Chong, Unklesbay, and Dowdy 2000). Therefore, process improvement is based on the logic that to improve output quality, the processes that produce the outputs must be

improved as well (Longest, Rakich, and Darr 2000). Process quality includes technical quality (providing technically appropriate care) as well as activities that meet the needs of the healthcare

consumer such as timely care, respect, and providing knowledge about the medical condition. Given that engaging in activities to satisfy customer needs is essential to process quality, employees are an integral part of process improvement; they must not only understand systematic processes but also take advantage of ways to improve their own work and actions when the opportunity arises. Through the analysis of outcome and process quality, CQI/TQM encourages an organization to perfect its processes and outputs to the point that they are completed correctly the first time, every time.

As a quality management model, CQI/TQM can provide many benefits to a hospital, including better output quality, productivity improvement, and an enhanced competitive position (Longest, Rakich, and Darr 2000). An improvement in output quality creates a positive reputation for a hospital, showing healthcare consumers that the organization is aware of and committed to satisfying customer needs. For these reasons, the competitive position of the organization is strengthened as well. Productivity is constantly a concern for hospitals because they must rely on a limited supply of resources. The fact that CQI/TQM can address this concern presents an additional strength of the model. CQI also increases the dignity of staff because it recognizes them as a part of a team and as leaders in improving a process; this results in increased employee morale (McLaughlin and Kaluzny 1994).

Organizations that have adopted the CQI/TQM model can attest to its benefits. Within a single year, Candler

Healthcare System in Savannah, Georgia, was able to decrease patient waiting time by 76 percent, save \$200,831 on clerical usage, and save \$117,000 by changing the formulary for antibiotics based on effectiveness and efficiency (Dowd and Tilson 1996). Similarly, North Valley Hospital (NVH) in Whitefish, Montana, used CQI/TQM principles in its selection process of an information system. Through use of the model, NVH was able to meet management's expectations regarding the duration, cost, and result of its selection process (McConnell and Ciotti 1995). As demonstrated in the examples above, CQI/TQM has proved to be valuable and beneficial to some organizations.

Nonetheless, CQI/TQM does have its drawbacks, falling victim to two common problems in healthcare: determining what quality is and how to define it. Additionally, the process of implementing CQI/TQM is extremely time consuming. It cannot be mastered quickly, and its process needs constant attention (Chong, Unklesbay, and Dowdy 2000). It also relies on gradual negotiation and implementation (Locock 2003). The necessity of gradualism and constant attention make the CQI/TQM process an unappealing approach to hospitals, which need quick yet effective solutions. Time is of the essence for hospitals, because even a mere minute of poor quality could become a matter of life or death.

The literature suggests that CQI/TQM has not been as successful as hoped. Evidence on this model in healthcare shows that improvements in quality after use have occurred

gradually and have been fairly small scale. CQI/TQM techniques can have some success within individual teams or departments, but the resulting changes tend to be limited in scale and impact (Locock 2003). Furthermore, not much evidence supports the claim that CQI/TQM programs can act as a means to achieve organizationwide change (Locock 2003). The model fails to take into account the complexity of healthcare and the nature of professional knowledge of clinicians and other staff. The language and values used in CQI/TQM are often foreign to healthcare and, as a result, cause resistance as it is thought to be a management fad (Locock 2003). Clearly, CQI/TQM lacks the capacity to successfully improve healthcare quality without redesign or the incorporation of other quality improvement programs.

### **Reengineering**

Another approach to quality improvement is reengineering. Reengineering is similar to CQI/TQM in that both models focus on processes and are dedicated to improvement. However, while CQI/TQM starts with output quality, reengineering begins with the customer (Longest, Rakich, and Darr 2000). Walston and Bogue (1999, 456) define reengineering as "the re-creation of task interdependencies to achieve more effective, efficient relationships among tasks." This redesign of tasks occurs through a multistep process in which hospitals critically examine their internal work processes, compare them to those of known healthcare industry leaders, and plan ways to radically redesign

their own processes (Luck and Peabody 2000). One of the main characteristics of reengineering is that it is an outward process, focusing on external forces such as what must be done to achieve customer needs and how to maintain a competitive advantage. Reengineering is radical and requires organizations to disregard existing structures and procedures and develop new ones that work. It involves long and laborious implementation of processes that are developed internally to better serve healthcare consumers (Longest, Rakich, and Darr 2000). Reengineering is commended for its ability to seek breakthrough concepts rather than build off of existing processes—a key difference from CQI/TQM. By focusing on healthcare consumers, the reengineering model presents an additional strength: "... reengineering pushes the CQI philosophy and mindset upstream to the customer and a more macro level—to more quality consciousness that is external to the HSO/HS" (Longest, Rakich, and Darr 2000, 436).

The strengths of reengineering are evidenced by organizations that have used this strategy successfully. For example, the endoscopy unit of a 176-bed teaching medical center in central New Jersey undertook reengineering efforts to increase its efficiency and maintain or reduce costs. Benefits to the unit as a result of reengineering include a reduction in total hours worked per procedure, from 4.52 hours to 3.60 hours; a 23.26 percent decrease in the total salary cost per procedure; and a decrease in the amount of paid hours per procedure, from 4.86 hours to 3.90 hours (Cole 1999). Despite

these strengths, reengineering, just as CQI/TQM, comes with weaknesses that prevent it from being the most favorable solution to improving quality of care and services.

Reengineering was developed in response to the failures of CQI/TQM's incrementalism and to achieve organizationwide change; however, research suggests that reengineering results have not been as great as anticipated. Locock (2003, 56) states that with reengineering "... a particular problem has been its aggressive rhetoric and its failure to engage the staff on whom the organization relies." Because of the belief that reengineering is a brutal and inappropriate technique, clinical resistance has developed, creating a major obstacle to its implementation and success (Locock 2003). Additionally, reengineering requires top management to be personally committed to the effort; lack of this commitment prevents reengineering from being successful. Thus, reengineering fails to effectively better the quality of an organization in the same way that CQI/TQM is also unsuccessful.

## **A NEW PERSPECTIVE: SIX SIGMA**

Six Sigma has recently advanced to address continued variation in hospital quality. Revere and Black (2003) find that the reason many of the initiatives that seek to reduce error are unsuccessful may be the focus on CQI/TQM programs (Revere and Black 2003). "Although TQM encourages data collection and analysis, it is often not implemented so as to

produce the level of detail required to understand process variation" (Revere and Black 2003, 378-79). This leads to a complicated analysis that hinders the ability to create satisfactory quality improvement programs. With the failure of CQI/TQM in mind, how can true quality improvement actually be achieved in an organization that desires to provide better care?

Six Sigma is an innovative and comprehensive management tool that has been in use for many years in manufacturing. Its success has led to its selective adoption by hospitals and health systems. Six Sigma, as a quality improvement plan, uses data analysis and other problem-solving techniques to evaluate the ability of a process to perform defect free, where a defect is anything that results in customer dissatisfaction (Revere and Black 2003). Thus, the primary goal of Six Sigma is to curb and eventually eliminate the number of defects that occur in a given process. To achieve defect-free processes and reduce variation, Six Sigma creates a number of Six Sigma improvement projects. These projects are created through the use of the Six Sigma methodology, DMAIC (define, measure, analyze, improve, control). DMAIC is an analytical process that requires organizations to pursue the following steps (Samuels and Adomitis 2003):

- Define the purpose of a project and its scope, especially the critical-to-quality factors.
- Measure through the creation of a performance baseline to which data that show errors can be compared,

leading to a more precise definition of the problem.

- Analyze the root causes of problems as evidenced by actual data.
- Improve performance through implementation of procedures that will eliminate the root causes of error.
- Control the process by evaluating performance before and after improvement attempts; initiate a monitoring system to reduce future errors.

DMAIC requires a continual effort to optimize processes that affect an organization's critical-to-quality factors and differs from CQI/TQM programs, which are generally aimed at fixing problems periodically (Samuels and Adomitis 2003). Although CQI/TQM claims to be an ongoing process, it does not address issues continuously. Furthermore, the systemic process of DMAIC ultimately leads to a precise identification of the problem, defined methods to appropriately measure and analyze the problem, and concrete performance improvement as well as control of the process.

Six Sigma also uses a detailed statistical analysis in which defects are assigned a sigma value. These sigma values are then compared to a "world class" quality defect rate of 3.4 per million opportunities to determine the quality performance of a service (Johnstone et al. 2003). This analysis provides tangible data for use in the development of Six Sigma improvement projects that address defects. Through perfection of processes

and variation reduction, Six Sigma has produced benefits, such as improved customer satisfaction and stronger financial status, that exceed those that CQI/TQM and reengineering models currently offer (Samuels and Adomitis 2003).

Regardless of the benefits Six Sigma has to offer, the program faces a significant hurdle to being implemented, or even considered, in hospitals. This barrier stems from hospital administrators' reluctance to stray from their CQI/TQM efforts, in which they have invested considerable time and money. However, this is an unacceptable reason to dismiss the Six Sigma program. Six Sigma's creation differs from CQI/TQM and reengineering: "Unlike TQM, Six Sigma was not developed by techies who only dabbled in management and therefore produced only broad guidelines for management to follow" (Pyzdek 2001, 1). Six Sigma is from the minds of talented executives who understand the complexity and importance of management when making adjustments to the organization (i.e., improving quality) (Pyzdek 2001).

The internal organizational infrastructure that Six Sigma presents also sets it apart from CQI/TQM and reengineering. Six Sigma creates new positions in the organization where employees become change agents:

These people [employees] represent organizational slack dedicated not to producing routine work, but to producing change. Their performance is judged by their innovation, which takes the form of tangible improvements that benefit customers, shareholders or employees (Pyzdek 2001).



Additional differences between Six Sigma, total quality management, and reengineering are listed in Table 2.

### **WHY IS SIX SIGMA A GOOD APPROACH?**

Six Sigma has the potential to achieve phenomenal quality improvement, as it reduces variation in systems processes (Revere and Black 2003). The program allows for recognition of error and forces hospital administrators to develop solutions to address this error:

Six Sigma thus discredits the all-too-common excuse of plausible deniability. By focusing on the causes of errors, financial hospital administrators can begin to implement changes early in a process at minimal cost, thereby preventing those errors from becoming much more costly problems later (Samuels and Adomitis 2003).

The accountability aspect of Six Sigma, as well as its timely ability to identify and solve error, presents an asset to hospital administrators. This benefit can indeed be useful to a hospital and to its current CQI/TQM effort.

Six Sigma follows formal quality analysis and process improvement to provide hospital administrators with concrete information that allows them to specifically understand what is contributing to error. This information is discovered through an approach that measures process variance according to the Six Sigma scale. The Six Sigma scale reveals the degree to which a process achieves its objectives, and it measures variance based on the unit defects per million opportunities.

"When an event is performed hundreds or thousands of times, even a small percentage of variance can represent a large absolute number of errors" (Johnstone et al. 2003, 53). The previous statement strikes on a subject that is critical to the survival of hospitals. Healthcare is an industry that is about the lives of human beings. Thus, in healthcare a seemingly small variance could result in a much more harmful effect such as the death of a baby, malpractices charges on a physician, or a misdiagnosis of a patient.

The benefits of Six Sigma are beginning to be seen in hospitals and health systems. Mount Carmel Health in Columbus, Ohio, was one of the first healthcare organizations to implement Six Sigma through its entire organization (Revere and Black 2003). One of its first Six Sigma projects sought to achieve timely and accurate Medicare + Choice claims reimbursement by looking at where claim reimbursement was substandard. For Mount Carmel Health, "Process improvements attained through Six Sigma resulted in an \$857,000 gain in net income" (Revere and Black 2003, 380). Consequently, Mount Carmel Health, through Six Sigma, improved its financial stability.

Similarly, Virtua Health, a healthcare system that provides services in New Jersey and Philadelphia, used Six Sigma to improve clinical care, patient satisfaction, and financial performance. A congestive heart failure team at Virtua Health found that outcomes, lengths of stay, and treatment pathways were highly variable (Revere and Black 2003). The team employed Six Sigma to define the causes of variation, allow-

ing the team to develop solutions that involved both patients and families in the delivery of care. As a result, the team was able to streamline the process of delivery of care, decreasing the length of stay from 6.2 days to 4.6 days (Revere and Black 2003).

These successes by various healthcare organizations not only demonstrate Six Sigma's ability to enhance quality improvement but also justify consideration of the Six Sigma program by healthcare management. Once hospital administrators are able to see how well the Six Sigma program works, they can be encouraged by these successes and become optimistic about its success in their own organizations.

## **CONCLUSIONS AND IMPLICATIONS**

Organizations have chosen a variety of methods to address the issue of quality improvement. This article describes the major methods that have been traditionally employed and introduces the benefits that the more recent Six Sigma model offers. Six Sigma has the capability to successfully reduce error and achieve efficiency in healthcare organizations. Thus, the future of Six Sigma is promising.

The fear of healthcare organizations to completely overhaul their improvement programs often hinders the implementation or even consideration of the Six Sigma program. However, as a quality management tool, Six Sigma does not require a complete transformation and can instead be integrated into an organization's current CQI/TQM program, providing numerous benefits to the organization.

As Revere and Black (2003, 379) state, "Six Sigma is a relatively new quality approach that complements, embellishes, and expands TQM. The work of Six Sigma is not unlike TQM; however, its goals are more aggressive and its methods are better defined." Therefore, Six Sigma deserves the opportunity to be considered and analyzed by hospital administrators in their determination of a quality model that will solve the modern quality issues they face.

After taking into account the points outlined in this article, administrators should consider engaging in a pilot effort of Six Sigma to see how well it fits within their organization and how it can contribute to their current quality management efforts. Administrators must also determine their organizations' capacity to implement the Six Sigma program. "Applying Six Sigma in health care is in some ways more difficult than it is in other industries, because of the complexity of healthcare processes" (Samuels and Adomitis 2003). Nonetheless, Six Sigma, when implemented with vigor and dedication, can be used to effectively eliminate variation of quality in healthcare. Success of Six Sigma is dependent on access to expert knowledge about Six Sigma, commitment from senior management, an environment conducive to change, and thorough knowledge of the areas being evaluated by the Six Sigma program (Samuels and Adomitis 2003). Six Sigma may require some initial effort, but it is sure to provide rewards in the future. Healthcare demands a

better solution to quality improvement, and the time to embrace new methods such as Six Sigma is now.

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