



Positive and Negative Impacts of Six Sigma Programs in Healthcare Safety

What is Six Sigma?

Six Sigma is defined as a limit of 3.4 defects per 1 million opportunities for defects in products or service processes. A defect is defined as any product or service that is not acceptable to the customer. It can take organizations many years to achieve Six Sigma status. To achieve the required defect rate, organizations must make many improvements throughout the process of striving for Six Sigma distinction.

Six Sigma was developed by Motorola and became popular because Motorola won the first Malcolm Baldrige Award, introduced by the Department of Commerce in 1988. The co-author of this article, Dev Raheja, was among the first batch of examiners who visited Motorola and several other companies. These examiners were invited by then U.S. President Ronald Reagan for lunch with him at the White House. The Six Sigma concept was soon adopted by General Electric (GE), with excellent results.

How to Calculate Defects per Million Opportunities (DPMO)

The calculation is simple. Let us assume one week's worth of data in a hospital pharmacy department is a reasonable sample size. Filling each prescription is an opportunity for an error.

Assume there are 1,220 prescriptions filled per day, or 8,540 opportunities for error per week (1,220 x 7). Assume that three wrong medications were sent to patients.

Then, the defects per 8,540 prescriptions is $3/8540 = 0.0003512$

Defects per million opportunities for error (DPMO) then is $= 0.0003512 \times 1,000,000 = 351.2$

This performance is not meeting the DPMO goal of fewer than 3.4 defects per million. Therefore, the pharmacy does not meet the Six Sigma goal.

Positive Impacts of the Six Sigma Methodology

Six Sigma has been used to address many of the most common challenges within a healthcare organization,

including patient safety, technology optimization, market growth, resource utilization and patient length of stay. In some cases, it has been used to focus on a specific department or process, while in other cases, it has been implemented on an enterprise-wide basis to achieve a cultural transformation [Ref. 1]. According to the Aveta Business Institute, a company that provides and certifies Six Sigma qualifications, "In the healthcare industry, the quality of services rendered depends a lot on human skills, which is often difficult to measure and control. Six Sigma is effective as it is based on a comprehensive approach that focuses on improving both human as well as transactional aspects of a process" [Ref. 2].

While implementing Six Sigma concepts in the healthcare industry is a challenging task, this concept achieves long-term results. One example of a significant improvement in a healthcare organization using the Six Sigma approach is the Riverview Hospital Association in Wisconsin. Riverview's Six Sigma team used insights it gathered to improve the hospital's patient satisfaction. The team used the improvement effort to solve key problems identified in the current process for handling patient discharges, which included timing of education, ensuring the involvement of a family caregiver and clarifying outcomes with the patient. The team also redesigned the discharge education process into three simpler phases to address previous issues with timing. Several improvements made were made, including collaboration with primary care physicians to ensure consistency, creation of a process to ensure that a primary family caregiver was identified to provide care management after discharge, and clarified terminology in discharge documentation that was previously considered to be vague [Ref. 3]. This process saved thousands of dollars for both patients and the hospital.

Many hospitals are solving complex problems, and many more have achieved significant improvements in quality of care and cost reduction. Some examples include [Ref. 4]:

- **Mount Carmel Health System:** Two years of Six



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Sigma projects focused on operational issues and business management helped save the healthcare organization \$3.1 million. Employee and physician satisfaction rates also improved.

- **Boston Medical Center:** A focus on diagnostic imaging resulted in improvements that brought cost savings and revenue increases of more than \$2.2 million.
- **Rapides Regional Medical Center:** This healthcare organization used the Six Sigma methodology to reduce defects in its emergency department. Wait times declined, providers saw more patients and the hospital saved more than \$950,000 annually.
- **The Women and Infants Hospital of Rhode Island:** The hospital successfully implemented Six Sigma to standardize its procedures for embryo transfer, which increased implementation rates by 35 percent.
- **Valley Baptist Health System:** By reducing surgery cycle time using the Six Sigma methodology, the hospital added enough capacity to handle 1,100 additional cases per year, increasing potential annual income by \$1.3 million.
- **Yale-New Haven Medical Center:** Various Six Sigma projects implemented in the surgical intensive care unit resulted in a 75 percent reduction in bloodstream infections and an estimated \$1.2 million in annual savings.

Negative Impacts

Typically, hospitals, as well as companies like GE and General Motors, take about 10 years to achieve 3.4 defects per million opportunities for errors. This does not bode well for patient safety: During those 10 years, many patients can die or be affected by mistakes. The National Patient Safety Organization predicts about 440,000 deaths this year from medical mistakes. To look at the number of deaths associated with medical

errors can be frightening. We all go into the hospital or the doctor's office thinking that we will get better. It is unacceptable that these numbers continue to rise at such an alarming rate.

A big reason for the long lead-up for success is that Six Sigma is data driven. Therefore, it is a *reactive* tool instead of *proactive* hazard prevention. It takes a long time to collect data on causes of harm and fatalities. Compounding the problem is that most employees are not fully sold on improving systems and using the right tools. According to a national Gallup poll, engaged employees made up only 29 percent of the work force (an engaged employee is one who is willing to go the extra mile to help the organization do the right things). The remaining employees were either not engaged (56 percent) or actively disengaged (15 percent) [Ref. 5]. Sometimes they are referred to as “warm bodies” that just fill a position. Not-engaged and actively disengaged employees tend to be accident prone.

Organizations, especially the large ones, want inflexible tools, procedures and processes so that everyone thinks the same way, which is the opposite of creativity. In other words, they are asking employees to limit their thinking and work with insufficient knowledge — creating conditions for unsafe work. Managers have often rejected their own intuitive guidance and opted for methods that are popular with other hospitals under the guise of so-called “best practices.”

One thing that may be leading to the increase in deaths is technology. In our recent reading, we learned that unsafe work can be a result of too much dependence on technology [Ref. 5]. Physicians and nurses are depending on technology rather than real-life communications. The technology that is being used in today's medical field is allowing great things to be done, but much of the technology being used is so new that many healthcare professionals are lacking the experience needed to use it correctly. If healthcare professionals are dependent on

technology they do not fully understand, it could lead to errors that might result in the death of a patient. When new technology is introduced, healthcare professionals need to ensure that they receive the training necessary to utilize it properly. The healthcare industry must work at building an environment that supports and encourages people to come forward with their errors.

Information technology advances in the medical world can create some environments that hinder the process of entering and retrieving the health data of patients. This information may be critical to proper treatment, and could lead to accidents and even death if not recorded correctly [Ref. 6]. Sometimes, data centers may become dysfunctional or altered, which can lead to errors in records that may eventually result in harm to the patient.

These are just a few examples of how the many complexities of hospital systems and processes may result in negative performance.

What Can Hospitals Do to Improve Efficiency?

Using “best practices” alone is insufficient. It is

understandable that every hospital tries to follow best practices from other hospitals. Since what was best at one time and in a certain situation may not be good enough today or for a different hospital, the goal should be to constantly use innovative approaches to improve processes.

It would be prudent for hospitals to provide a “structure” that allows using best known practices from other industries. This is the structure in the Pittsburgh regional hospitals that use the Toyota Production System for patient care. Such an example is the Allegheny General Hospital. Often, best practices are considered “best” simply because they are being used by a reputable hospital. If we perform the so-called Healthcare Failure Mode and Effects Analysis (FMEA) covered in the international standard ISO 14971 on risk management for medical devices, we are likely to discover more than 100 flaws — even in a best practice. This standard includes more tools for risk prevention. The Joint Commission requires hospitals to use FMEA at least once a year on a critical process. We recommend this tool be used on all critical processes. There is always room for innovation. ●

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