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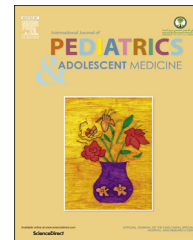


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QUALITY IMPROVEMENT

The application of Lean Six Sigma to provide high-quality, reliable pediatric care



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Abstract Physicians and health administrators face an increasingly competitive practice environment that challenges financial survival. Only through increasing clinical quality and administrative efficiency will practitioners be able to navigate the changes in health care that are sweeping the industry. This paper describes an approach that can prove crucial to improving patient care, reducing costs, and ensuring sustainability.

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1. Background

Health care in the United States has traditionally been a rather provincial endeavor, with most physicians finding practice situations after completing their training and remaining in a single community throughout their careers. Success in practice was measured by the number of people in the waiting room (now a “reception area”) and the number of weeks it took for a patient to schedule an appointment with the doctor. However, medical practice has changed dramatically in the past 20 years, with more

physicians seeking higher levels of practice security as payers change reimbursement models from “piece work” approaches, i.e., payment for each service rendered to the patients, to more global models such as bundling (fixed payment for all care required for a specific procedure or episode of care) and capitation (fixed payment for all of the care required by a population of patients for a period of time). Physicians find that the new models require a much more longitudinal and businesslike approach to practice that was not included in the postgraduate residency training programs that prepared young physicians for practice. Income growth can no longer be achieved by seeing more patients, but rather is based on value provided by the practitioner, which is measured by the quality of services and clinical outcomes, and the cost to provide those services. Payers are rapidly migrating from the older style, fee for service (FFS) payment models, to fixed payment plans that require higher performance in both

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outcomes and cost containment to avoid financial loss and the risk of losing patients. Most other countries throughout the world have either already made this transition or will be changing soon. High quality at an exceedingly high cost is no longer acceptable, and physicians who provide this type of service to patients will suffer economically and likely will no longer be favored by patients and payers.

It is clear to health policy makers that outmoded approaches to practice no longer suffice to sustain either a medical practice or the entire health care industry. Thus, health industry leaders have turned to advanced performance improvement methods such as Lean Six Sigma (LSS) to deal with the new business and clinical milieu. Health care professionals are learning new terms such as “process capability” and “sigma level” to describe the effectiveness of health care services and “turnaround time” and “throughput” to assess the efficiency of practice services. Optimizing the efficiency and effectiveness of work is the focus of LSS.

2. LSS concepts

Other industries have been using LSS approaches for many decades. Toyota developed the Lean approach, sometimes termed the “Toyota Production System”, in the 1950s [1] and has honed the methods in the framework over the past five decades. Six Sigma was developed by two engineers at Motorola in the late 1980s in response to increasing competitive pressures from worldwide markets [2]. Lean targets “non-value added” (NVA) work to make processes more efficient, while Six Sigma focuses on “non-conformities”, or defects, to eliminate errors. Thus, lean and Six Sigma complement each other as shown in Fig. 1.

The Lean approach evaluates a process from the perspective of finding and removing NVA work and promoting improved execution of those steps in the process that do add value. The Lean approach requires thorough understanding of a process, including not just the way that the process is intended to work but also the many variations that have arisen over the life of the process. For example, a hospital may have a standard procedure for nurses to start an intravenous infusion, but because of several factors such as availability of supplies or technical support, the nursing staff may have developed countless variations on the standard process to accommodate individual preferences. The resulting variation may have increased costs or reduced efficiency, e.g., resulted in a longer time to start an IV or increased supply waste. In virtually all work systems,

variation reduces efficiency through increased cost and decreased throughput for the process. One of the tenets of the Lean process improvement is standardization of processes to ensure consistency, which generally lowers costs and increases the reliability of the output of the process, which could be a patient-centered service.

Six Sigma approaches rely on the precise and accurate measurements of process and outcome variables with analyses designed to find those factors that are of greatest importance to meeting customer requirements. The Six Sigma improvement process, known as DMAIC (Define-Measure-Analyze-Improve-Control), starts by studying the Voice of the Customer (VOC) that is used to define Critical to Customer (CTC) and Critical to Quality (CTQ) metrics that serve as the outcome variables for the improvement project. CTC and CTQ variables are influenced by the process variables (critical x-values), which are the targets for intervention during the Improve Phase of the project. Understanding how the outcome variable(s) are related to the critical x-value(s) helps make quantitative predictions about the expected improvements in the outcome variables as the process change is deployed throughout the organization or in a population of patients. For example, a Six Sigma project may focus on the number of errors in medication dosages during hospital discharge with a goal of reducing error rates (patient CTQ) and readmissions (payer CTC). The Six Sigma approach relentlessly pursues error rates to very low levels: a six sigma level error rate is only three errors per one million opportunities. That level of performance is difficult to achieve, but society and payers are requiring these exceedingly low error rates in medical systems.

Lean and Six Sigma are typically combined in health care because they address two related, but separate, issues. Lean’s concentration on cost reduction and efficiency is a perfect complement to Six Sigma’s pursuit of accuracy and precision. Many health care organizations have begun the LSS journey, and some have already achieved significant business results. As the LSS framework is applied in the health care industry, its use in improving clinical processes of care will soon follow.

3. Example: Akron Children’s Hospital

Akron Children’s Hospital created the Mark A. Watson Center for Operations Excellence in 2008, and since that time has trained hundreds of staff members, achieved savings of \$13.4 million, and reduced NVA work time by more than 41,000 h. These efforts have led to reductions in patient wait times in addition to the cost savings. The hospital reports a number of project successes: [3]

- Reconfiguration of the sterile processing department avoided the need for a \$3.5 million expansion, while improving the work environment and reducing surgical instrument turnaround time.
- A 90% decrease in wait times for MRIs in the radiology department led to an increased volume of MRIs that increased revenue and made the service more available to the community. These improvements resulted from the application of LSS to achieve earlier insurance

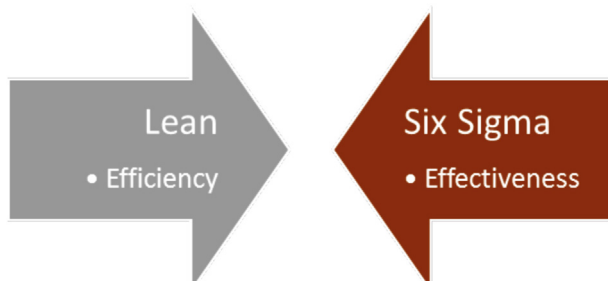


Figure 1 The complementary nature of Lean and Six Sigma.

authorization, more efficient scheduling, and coordination between providers who perform the studies and those who administer sedation for the procedure.

- Improvements in the accuracy of weight determination for pediatric burn patients to reduce medication and fluid administration errors.

These are a few examples of how LSS has changed care at the hospital, with benefits in improving the quality of patient care as well as reducing costs.

Clinical applications will become more prevalent in the future. Medication errors in pediatric inpatient facilities have long been problematic. In a 2001 paper, Kaushal et al. studied medication errors in a pediatric inpatient population [4]. The study found a medication error rate of 5.7%, many occurring at the point of care as the physician ordered the medications. Although computerized order entry systems were expected to reduce errors, other sources of error have arisen as these systems have been implemented [5]. Although increased use of automated systems has not proven to be the panacea for pediatric medication errors, improvement in processes related to drug ordering and administration using LSS could be expected to contribute to the solution.

4. Conclusions

Health care is entering a new phase in the United States and throughout the world. As the pressure to reduce costs increases, the quality of care must also improve to ensure

that the value of health care can be continually enhanced for patients and other stakeholders. Pediatric providers have significant challenges in this new environment, but the approaches and tools of LSS can contribute to the solution.

Conflict of interest

None.

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