APPLICATION OF LEAN-SIX SIGMA TO IMPROVE QUALITY IN HEALTH CARE INDUSTRY

Sumant Kulkarni
ssk7136@louisiana.edu
Dr. Suren N. Dwivedi
Department of Mechanical Engineering
University of Louisiana at Lafayette

Abstract
Using Lean-Six Sigma is one of the best solutions to tackle weaknesses in the U.S. health system. General manufacturing companies have used Lean management & Six Sigma successfully for the last few decades. Lean methodology focuses on removing all waste throughout a given process, so that output efficiency, quality and profit all increase. The main steps in Lean manufacturing involve identifying value-added and non-value-added processes. In order to use this Lean thinking in organizations, all leaders must start thinking in terms of cutting waste and developing an ongoing culture to sustain such habits. In addition, all employees in the targeted organization must be involved in developing and redesigning significant processes to reduce waste and improve quality.
Lean-Six Sigma is the integration of Lean and Six Sigma process improvement methodologies. Six Sigma and Lean are both business improvement methodologies, more specifically business process improvement methodologies

- Six Sigma is a systematic methodology to focus on the key factors that drive the performance of a process, set them at the best levels, and hold them there for all time.
- Lean is a systematic methodology to reduce complexity and streamline a process by identifying and eliminating sources of waste in the process; waste that typically causes a lack of flow.

This paper will discuss the current challenges being faced by health care industry and ways to tackle them using Lean-Six Sigma. It will give information about Lean-Six Sigma, its implementation and challenges faced during its use.

2. Introduction:
The USA spends more than any other country on health care: $7,500 per person per year. Even so, USA ranks lower than 49 other countries in average life expectancy. In 2004, the United States ranked 29th in the world in infant mortality, tied with Poland and Slovakia. USA has an infant mortality rate of around 6.71. The main reason for our country’s health care issues is a considerable shortage of primary care physicians. Many other deficiencies also exist in the U.S. health sector.
Primary care is provided by family physicians, general internists, general pediatricians, nurse practitioners, physician assistants, and others who work in the primary care sector. These clinicians are responsible for delivering accessible first-contact care; providing continuity of care through ongoing relationships; comprehensively addressing the majority of patient needs, whether they are urgent care problems, chronic care needs, preventive care needs, or psychosocial needs; and integrating specialty referrals and ancillary services to provide patient-centered, whole-person care.

Over the past decades, the number of U.S. allopathic medical school graduates entering family medicine residencies has dropped by 50 percent. A decade ago, half of all residents in internal medicine residency programs planned to practice primary care general internal medicine, but today only 20 percent plan to go into primary care. The same trends are apparent when you look at the nurse practitioner workforce and the physician assistant workforce: Fewer and fewer graduates are going into primary care fields.

Our most conservative estimates say that by 2020 USA will be short about 340,000 nurses. The Bureau of Labor Statistics thinks that the number will be as large as 1.4 million. But even if it is 340,000, that shortage number is three times greater than what USA have experienced to date.

This health care issue is bigger in Louisiana State. When compared to other states, Louisiana spends a great deal of money on health care with a very low return. Louisiana has ranked 50 in health care for 15 of the last 17 years, according to the United Health Foundation. The state’s challenge to improve health and health care delivery has only intensified due to the impact of the 2005 hurricanes. The storms caused substantial damage to the private and public health care infrastructure and intensified chronic shortages of health care workers. The migration of people in need of health care compromised access to care for the insured, underinsured and uninsured in those locations.

3. What is Lean?

Lean focuses on reducing waste and increasing customer value. It provides more value to customer using fewer resources. To implement Lean into organization it must understand customer value and focus on to increase it. Using Lean a perfect value can be delivered to customer by developing a perfect value creation. Ideally processes will have zero waste after implementing Lean into them.

To accomplish this, lean thinking gives focus on optimizing flow of products and services rather than focusing on technologies, assets and departments. As waste is eliminated from entire value streams it produces processes which require less effort, resources, less cost and less delivery time. Due to lean thinking companies can keep up to changing customer expectations with high quality, less cost and less time. The workflow in lean process is defined as follows:

3.1 Just-In-Time: In this method product is developed when ever necessary and how much is necessary. This reduces non value added inventory time in a product cycle.
3.2 Kanban: Limited number stock of each product is kept in a specific area of market. When a particular product stock is sold a card will be shown indicating which product has been sold.
3.3 Production leveling: Balance production over a period of time.
3.4 Setup time reduction: Reducing the time to adjust between different processes.
3.5 Standardized work: Having documentation of every process followed so that all processes are followed every time.
3.6 Multi-skilled workers: Workers will be trained in multiple areas so that different jobs can be assigned to each worker.

4. What is six sigma?
Six Sigma is a measure of quality near perfection. It is a method of eliminating defects using disciplined, data driven approach. In Six Sigma all processes are driven towards six standard deviations between the mean and the nearest specification limit, in any process related to any industry like manufacturing, services, health care.
Six Sigma shows the statistical representation of a process and how it is performing. To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. Anything outside customer expectations is called as six sigma defect. Total quantity of chances for a defect is called as six sigma opportunity.
The main objective of the Six Sigma methodology is the implementation of a measurement-based strategy which focuses on process improvement and variation reduction. This is achieved by implanting Six Sigma improvement projects. There are two main sub methods of six sigma

The Six Sigma DMAIC process (define measure, analyze, improve, control) is used for existing processes in an organization.

- Define: the Customer, their quality issues and project goals.
- Measure: the performance of the processes involved
- Analyze: the data collected and process map. Identify root cause of defect and find solution to improve it.
- Improve: the target process by designing creative solutions to fix and prevent problems.
- Control: the processes to keep it improved.

The Six Sigma DMADV process (define, measure, analyze, design, verify) is used to develop new processes in the organization which sticks to six sigma level.

- Define: the Customer, their quality issues and project goals.
- Measure: the performance of the processes involved.
- Analyze: the data collected and process map. Identify process options to meet customer needs.
- Design: Design the process to meet customer needs.
- Verification: Verify the performance and quality of design.

5. Importance of Lean-Six Sigma:
Lean-Six Sigma is the integration of Lean and Six Sigma process improvement methodologies. Six Sigma and Lean are both business improvement methodologies, more specifically business process improvement methodologies

- Six Sigma is a systematic methodology to focus on the key factors that drive the performance of a process, set them at the best levels, and hold them there for all time.
- Lean is a systematic methodology to reduce complexity and streamline a process by identifying and eliminating sources of waste in the process; waste that typically causes a lack of flow.

In simple terms, Lean looks at what should not be done and aims to remove it; Six Sigma looks at what should be done and aims to get it right first time and every time, for all time7. Lean-Six Sigma is all about linkage of tools, and not using tools individually. In fact, none of the tools are new. The strength of the approach is in the sequence of tools.

![Lean-Six Sigma Diagram](image)

There are many versions of the Six Sigma Roadmap, but not so many that fully incorporate Lean in a truly integrated Lean-Six Sigma form. The roadmap follows the basic tried and tested DMAIC (Define, Measure, Analyze, Improve and Control) approach from Six Sigma, but with Lean flow tools as well as Six Sigma statistical tools threaded together throughout10. Lean-Six Sigma approaches sustainable continuous improvement with the goal of improving patient care, safety, and satisfaction while simultaneously reducing costs and increasing revenues2. Using Six Sigma, Columbus Regional Hospital analyzes variation and determines the root causes of that variation. Through Lean, participants eliminate no value added activities and design new processes around steps that add value1. Lean-Six Sigma puts controls in place to sustain the gains and ensure continued success.

6. Importance of Lean-Six Sigma in Healthcare Industry:

Proceedings of the 2010 ASEE Gulf-Southwest Annual Conference McNeese State University
Copyright @ 2010, American Society for Engineering Education
In health care industry patients are considered as customers. So keeping customer satisfied is high priority in health care industry. Traditional concept of health care was that people need health care and will continue to use same health care services out of necessity, though they are not happy with services, are changing rapidly now. Nowadays patients have lots of choices between different health care providers. So quality has become very important in health care industry.

At the same time many hospital administrators have already started using the views and perceptions of their patients to organize their service and staff and for continuous improvement in the overall organizational performance.

Health care industry is different from manufacturing industry. But still there is lot of similarities. If an organization wants to develop a machine or give good treatment to patients, it has to develop good processes. Waste of money, time, supplies, or good will decreases value in every sector. This can be achieved by using Lean-Six Sigma into Health Care industry.

7. Approaches to improve patient satisfaction using Six Sigma

To implement Six Sigma in an organization there should be commitment from management level towards six sigma quality goals. Then a particular area where six sigma needs to be implemented should be selected and all data regarding that should be gathered. This helps to find deficiencies in the processes and measurement of quality.

Six sigma requires huge amount of organizational change and management should be supportive and encouraging for this. Various training program for all employees should be held. After identifying defects, solutions can be found regarding them by changing processes. This implementation should be aimed at continuous improvement of an organization so that best quality can be achieved.
8. Approaches to increase patient satisfaction using Lean:

The main aim of Lean methodology is to eliminate waste. Waste can be of time, resource or many other factors. Any kind of waste in the process or organization should be identified and removed. In addition all the resources should be used in a way that they provide some value to customers.

After identifying waste in process redesign of the process flow should be done such that it should be maintained continuous. All the non value added processes should be removed here. As it results in more resource utilization and less waste, quality is improved.

Then standardization of best practices identified and these should be followed by all employees in organization.

Expertise of Lean-Six Sigma professional should be utilized at various stages of implementation. Various trainings should be given to employees so that they can better understand these concepts and apply them.

9. Challenges in implementation of Lean-Six Sigma in Health Care:
Implementing Lean-Six Sigma in Health Care industry can encounter many challenges as health care industry work differently than other manufacturing industries. Main challenges which can be faced are discussed here.

9.1 Customer satisfaction
Implementing Lean-Six Sigma principles requires different mindset from management as well as employees of organization. Customer satisfaction is of very high importance in health care industry as it involves focus on various customer requirements and the services provided\textsuperscript{25}. Many times there is lack of resources or lack of time due to which poor service may be delivered to customers.

9.2 Changing customer numbers
There are lots of changes in customers who want to receive any kind of health care service. These numbers are not predictable and tend to change according to situation. For

---

Fig 3: Lean-Six Sigma Roadmap\textsuperscript{26}
implementing Lean-Six Sigma getting this data is very important as implementation will be based on previous data.

9.3 Wide number of services
Health care industry offers wide number of services to customers and they vary from customer to customer. It becomes highly difficult to track record and deficiencies in these many services.

9.4 Lack of information
In manufacturing sector data between different processes can be recorded easily. This data does not change much and can be used for similar kind of different process. But health care industry has different information management challenges. Most of these challenges arise from:

1. Less attention to quality
2. Highly variable customer needs
3. Less attention towards data management
4. Lack of resources

9.5 Lack of quality indicators and factors
Due to of lack of information in health care industry, measurement of quality indicators and defects is a big problem. Main causes of these problems are:

i) Difficulty to define quality management program
ii) Rapidly changing strategies
iii) Lack of information

9.6 Lack of established quality program
As information management is very difficult in health care, it becomes very challenging to develop any quality program.

10. Conclusion:
Health care industry is becoming very competitive now and implementing Lean-Six Sigma is very important to improve the quality of health care services. Lean-Six Sigma can be used to identify and rectify many wastes and errors in patient care and improve patient satisfaction.

This method can be applied in various departments of health care facility like emergency, primary care, radiology, information management, prescription errors etc. Also, Lean-Six Sigma uses a data driven approach to fix problems and it creates continuous improvement in industry.

References:
Giffith, J.R., "Championship Management for health care organization", Journal of Health care Management
3. Hansson, J. "Quality in Health care: medical or managerial". Journal of Management in Medicine
5. Lanser E.G. "Effective use of performance indicators"
7. McLaughlin, C.P. "Evaluating the quality control system for managed care in the U.S. Quality Management in Health care
9. Panko, R. "The health care game: cutting cost but not quality" Best's Review (Life/Health),
10. Revere, Lee, Ken Black, Ahsan Huq, "Integrating Six Sigma and CQI for Improving Patient Care"
12. Benefits, obstacles, and future of six sigma approach, Young Hoon Kwaka,* Frank T. Anbarib,
13. Six Sigma and Health care, Andy Ganti, GE Medical Systems, Dr. Anita G. Ganti
14. Lean Six Sigma (LSS) in Healthcare, Christine Corum
15. State of the USA Health Report, Institute of Medicine, December 2008
17. The Richard and Hinda Rosenthal Lecture 2007: Transforming Today's Health Care Workforce to Meet Tomorrow's Demands
20. The Richard and Hinda Rosenthal Lecture 2008: Prospects for Health Reform in 2009 and Beyond
22. http://www.lean.org/WhatsLean/
26. http://www.labautopedia.com/mw/images/LeanSigmaLabFig2.jpg
27. Fundamental elements for the successful performance of Six Sigma projects in service industries
Mohammad Abdolshah, Azad university of Semnan and Rosnah Mohd. Yusuff, UPM University