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# APPLICATION OF LEAN SIX SIGMA APPROACH IN INDIAN HOSPITALS TO IMPROVE PATIENT CARE

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## ABSTRACT

A rapidly growing population, booming economy, increasing urbanization which has expanded the middle class, increasing diseases needs continuous improvement in healthcare services. Increased competition and corporatization in healthcare sector are forcing healthcare organizations to look for alternative ways for improving their processes. Lean six sigma is a problem solving methodology which provides the tools and techniques that improves any existing process by constantly reviewing and re- tuning the process, advance patient care and reducing non- value added work (waste), by streamlining operations and improving both patient and staff satisfaction. To operationalize this problem solving strategy the lean sigma study use DMAC approach. (define, measure, analyze, improve, and control) approach. The well designed process maps DPM (detailed Process Map), SIPOC, HLPM play vital role in standardization of hospital service. An effective performance measurement will help to guide an organization to evaluate key process and effect positive change to improve care. Continuous improvement plan in healthcare systems requires regular monitoring, measurement, assessment and analysis of process parameters, route cause analysis helps in developing process improving plan and control measures. The industrial working strategy and application lean six sigma methodology in healthcare Industry helps for better patient care.

**KEYWORDS:** Problem solving methodology, waste, patient care, route cause analysis, process improvement plan.

## INTRODUCTION

Healthcare service is considered as one of the biggest sector in terms of revenue and workforce employment. A rapidly growing population, booming economy, increasing urbanization which has expanded the middle class, increasing diseases and improved health awareness level has enable the sector to grow at much higher rate. India is second largest populous country (after China) in the world having a population 1.25 billion.[1] Hospital is the most important healthcare service industry.[2]

Challenges in Indian hospitals around access, patient safety,[3] affordability and quality of healthcare contribute to low life expectancy. There is a significant gap in terms of number of beds or number of doctors available which is far below the World Health Organization's (WHO) requirement of 1:250. As per the healthcare federation of India survey in 2014, 0.7 doctors, 1.3 nurses and 1.1 hospital beds Per 1,000 people.[1,4] Many alternative available therapies, increasing elderly people population, increased awareness towards healthcare and as a consequence, the Correct line: cost is also increasing[3].

Today quality of healthcare service is the key issue of the entire private, public as well corporate healthcare organizations. Increased competition and corporatization in healthcare sector are forcing healthcare organizations to look for alternative ways for improving their processes. This process improvement is for improving quality of the hospital's products and services, proper utilization of available facility for better patient care and increasing patient satisfaction. The optimization of work forces with zero (minimal) error strategy is achieved best by applying the Six- Sigma concept to hospitals.[5]

As like other service operations, healthcare sector also requires continuous and systematic innovation for cost effective, efficient service and to deliver high quality services.[6] Health care organizations, especially large health systems, began studying and adopting industrial quality management methods in the late 1980's including Total Quality Management (TQM) and Continuous Quality Improvements (CQI) approaches. Since 2000, there have been a variety of projects applying Lean and Six Sigma strategies to health care quality improvement.[7]

**What is Lean Six Sigma?**

Lean six sigma (LSS) is a disciplined, data driven approach and methodology to help eliminate waste/defects in the process and reduce the process variations.

LSS is a problem solving methodology which provides the tools and techniques that improves any existing business process by constantly reviewing and re- tuning the process.[8] LSS principles used to improve business profitability to remove waste, to reduce costs of poor quality and to improve the effectiveness and efficiency of all operations/services so as to meet or even exceed customer's needs and expectations.[2] This approach is applicable to all healthcare services, both clinical and administrative.[6] Healthcare service providers have begun to adopt LSS tools and techniques which support for operational efficiencies that improve performance, advance patient care and reduce non- value added work. The hospitals those who utilized LSS methodologies had generally reported great success in streamlining operations, reducing waste, and improving both patient and staff satisfaction.[9]

**Role of Lean- Six Sigma in Healthcare Industry**

Continuous improvement in healthcare systems requires the measuring, monitoring and understanding of process variation. It's important to eliminate process variation wherever possible, while moving well- defined metrics toward their target values. The examples of important process variables in healthcare involves laboratory turnaround times, patient waiting time, patient satisfaction scores, medication errors (prescription, dispensing and drug administration), emergency service response times, infection rates, mortality rates, numbers of patient falls, postoperative lengths of hospital stay, "door- to- needle" times, counts of adverse events, as well as many others. Careful monitoring, analysis and study of such variables can lead to significant improvements in quality of healthcare service.[10]

Fundamental of Lean Six Sigma eliminates unnecessary process or task out from service life cycle, as the same time, it tries to minimize or eradicate mistake or error in action processes.[11] The key components of LSS involves the personnel observations to identify value added work and non-value added work, process flow and value stream mapping to determine any process constraints or resource bottlenecks and method change templates to describe and support implementation of proposed changes.[9]

In health care industry keeping patients satisfied is high priority. Now a day patients have lots of choices between different health care providers. So, quality has become very important in health care industry. If an organization wants to give good treatment to patients, it has to develop good processes. Waste of money, time, supplies service will decreases value in every sector. This can be achieved by using LSS into Health Care industry.[12] Lean approach does not focus on large scale investments, but it gives healthcare organizations an alternative methodology for achieving improvement without high investments.[13]

Lean concepts within a healthcare service organization and deliberates aspects such as when and where to start, organization change, process definition, process change, project and programme planning, performance and quality improvement, project implementation, project monitor and control and project evaluation.[11] Healthcare quality can be improved by supportive visionary leadership, proper planning, education and training, availability of skilled resources, effective management of resources, employees and process and cooperation and coordination among service providers.

**Healthcare Performance measurement**

Performance measurement includes a set of tools and techniques which helps in achievement of health system objectives. An effective performance measurement will help to guide an organization to evaluate key process and effect positive change to improve care. Outcome from this performance measurement is useful to establish performance benchmarks, helps to identify the best performance in the industry and assessing the quality, effectiveness and value of healthcare service.

**A. Financial Performance**

Implementation of lean principle in healthcare industry aims to reduce the cost while improving patient satisfaction and outcomes. The unnecessary operational inefficiency (unnecessary investigations/ unnecessary diagnostic procedures, incorrect diagnosis, medication errors, prolongation of hospitalization, post procedural complications etc.) can increase cost in healthcare. The continuous measurement, monitoring at each step of the process, helps in process improvement.

**B. Patient Satisfaction**

Patient Satisfaction is one of the important process output in the healthcare industry. Patient satisfaction assessment provides the evidentiary basis for measuring clinicians and organizational outcomes. Therefore, patient outcome is a major key of performance measurement in healthcare. Besides that, patient's satisfaction from healthcare decides the healthcare system performance and hence needs to be periodically measured to enhance the patient quality of service.

**C. Employee Performance**

Healthcare industry includes multiple employees with special skills from different education backgrounds. E.g Doctors, nurse, pharmacists, technicians, administrative workers, ward boys, sweepers etc. Lean initiative in healthcare industry can influence on employee and work environment. Therefore, employee can increase attention towards waste and more productive attitude to problem solving.[13]

The common areas where the lean six sigma principles can be implemented includes inpatient care, therapeutic support, emergency care, ambulatory care and administrative.[5]

**Table 1: The common areas in hospital service for LSS application.**

| Area | Opportunities |
|---|---|
| Admissions | • Patient Registration time |
| Medical/Surgical | • Correct blood transfusions<br>• Catheters: insertion, infection, UTIs, groin injuries<br>• Double stapling technique (surgical procedure)<br>• Medication errors, timing, compliance, usage<br>• CHF, COPD, Ventilator, Delivery Room LOS<br>• Surgery, Operation Room Turnaround Time and productivity |
| Intensive/critical care | • Ventilator days spent<br>• Patient transfer time to regular unit |
| Discharge service | • Turnaround time (TAT) for bed assignment<br>• Time to complete patient discharge |
| Therapeutic Support Laboratory | • TAT for emergency department laboratory orders<br>• Pneumatic tube system wait/travel time<br>• Laboratory requisition errors |
| Diagnostics/Radiology | • Diagnostic results turnaround time<br>• Defect rate of X- ray films<br>• Test wait time<br>• Report creation time<br>• Radiology scheduling process |
| Pharmacy | • Medication safety, dispensing errors |
| Emergency Care | • Casualty bed turnover<br>• Reduce patient "walk out" rate: improve flow; add capacity, reduce staff turnover<br>• Patient waiting time for treatment, for a bed |
| Ambulatory Care | • Best hospital destination, response time |
| Outpatient/Surgical Clinics | • Medicine dispensing errors<br>• Wait time from lab order placement to specimen collection |
| Administrative Billing/Employee Management | • Billing accuracy<br>• Employee recruitment process time<br>• Develop tool for staff effectiveness |

**The 7 wastes in Healthcare Sector as per Lean**

In healthcare service, waste to be activities that did not contribute to the patient's well- being and process variation as the deviation from set standards.[9]

The defect/waste is a factor that leads to patient dissatisfaction and defect range from the frustrating kind, such as long waiting to see a doctor, to the serious kind such as an incorrect diagnosis or treatment, medication errors leads to serious adverse reaction.[14]

**Table 2: The 7 wastes in Healthcare.**

| The 7 wastes- "Muda" | Health care |
|---|---|
| Overproduction | 1. drugs given early to suit staff schedules<br>2. investigations ahead of time to suit lab schedule<br>3. Treatments done to balance hospital staff or equipment workload.<br>4. Doing unnecessary diagnostic procedures |
| Transportation | 1. Moving patients for testing<br>2. Moving patients for treatment<br>3. Movement patients to and fro<br>4. Moving samples |
| Motion | 1. Searching for patients<br>2. Searching for doctors<br>3. Searching for charts<br>4. Gathering tools<br>5. Handling paperwork |

| | |
|---|---|
| Waiting | Waiting for;<br>1. Bed assignments<br>2. Admission to emergency dept<br>3. Testing, treatment and discharge<br>4. Patient test lab results |
| Processing | 1. Unnecessary procedures<br>2. Multiple testing<br>3. Multiple bed movements<br>4. Retesting<br>5. Excessive paperwork |
| Inventory | 1. Specimens waiting for analysis<br>2. Paperwork in process<br>3. Patients in beds<br>4. Bed assignments<br>5. Pharmacy stocks<br>6. Lab suppliers<br>7. Samples |
| Defects | 1. Wrong procedure<br>2. Missing information<br>3. Redraws<br>4. Poor clinical outcomes<br>5. Wrong patient<br>6. Wrong medication or wrong dose administered to wrong patient |

## METHODOLOGY AND TOOLS

Six Sigma approach is like that of good medical practice used; i.e conducting laboratory investigations/diagnostic procedures, review of patient medical history and current symptoms and followed by diagnosis. After thorough diagnosis is completed, a treatment plan is proposed and implemented. Finally, checks (follow-ups) are applied to see if the treatment was effective.[15] To operationalize this problem solving strategy the lean six sigma study uses DMAIC (define, measure, analyze, improve, and control) approach.[16]

**1) Define Phase:** Define the Customer, their quality issues and project goals. Many hospitals conduct patient satisfaction surveys to understand Voice of the Customer. Recently the leading hospitals have begun using focus groups and other strategies for identifying what customers/patients want.

The following steps were executed in the Define Phase:

1. Develop project charter.
2. Perform stakeholder analysis.
3. Perform initial Voice of Customer (VOC) and Identify Critical to Satisfaction (CTS).
4. Select team and launch the project.
5. Create project plan.

**2) Measure Phase:** The purpose of the Measure phase is to understand and document the current state of the processes and what to be improved. Collect the detailed Voice of the Customer information, baseline data i.e. current process status and validate the measurement system. Develop data collection plan (DCP).

The Measure Phase included the following activities:

1. Define the current process.
2. Gather information regarding current capabilities in possession.
3. Define detailed Voice of Customer (VOC).
4. Define the Voice of Process (VOP) and current performance.
5. Validate measurement system.

**3) Analyze Phase:** The purpose is to analyze the data collected related to the Voice of the Customer and the Voice of the Process to identify the root causes of the process problems and to develop the capability of the process.

This phase falls into 2 categories: Data analysis & Process Analysis.

**Process Analysis:** A detailed look at the key processes that supply customer requirements in order to identify cycle time, rework, down time and other steps don't add value for the customer.

**Data Analysis:** Using the data collected to find patterns, trends and other differences that can suggest, support or reject the factors about the causes of defects at service or production.

**4) Improve Phase:** The improve phase target is to design creative solutions to fix and prevent problems.

The following steps were executed in the Improve Phase:

1. Identify improvement opportunities and plans
2. Perform cost/benefit analysis
3. Design future state
4. Establish performance targets and project scorecard
5. Pilot improvements
6. Train and execute.

**5) Control Phase:** The purpose of the Control Phase is to implement control mechanisms and procedures to ensure that the process maintains the levels of improvements attained during the pilot activities.

The following activities were executed in the Control Phase:

1. Maintain the production process in the ways of continuous improvement
2. Report scorecard data and create process control plan
3. Standardized the production process
4. Integrate all improvements as daily routine
5. Develop future plan.

The common LSS tools used in healthcare system were shown in bellow table:

**Table 3: Lean Six Sigma DMAIC Common Tools.[16]**

| Define | Measure | Analyze | Improve | Control |
|---|---|---|---|---|
| - Project Charter<br>- Stakeholder analysis<br>- SIPOC<br>- Process map<br>- Project Plan | - Critical to Quality (CTQ)<br>- Data collection plan<br>- Pareto Chart<br>- Gauge R & R<br>- Cost of Poor Quality | - Cause & Effect Diagram<br>- Why- Why Diagram<br>- Histograms and Graphical Analysis<br>- Basic statistics<br>- Sampling<br>- Process Analysis<br>- Failure Mode and Effects<br>- Analysis<br>- Hypothesis Tests<br>- Summary of Problems<br>- 7 Wastes<br>- 5S<br>- Kaizen/Fish bone diagram | - Recommendations<br>- Improvement Plan<br>- Action Plan<br>- Cost/benefit Analysis<br>- Future State Process Map<br>- Design of Experiments<br>- Dashboards<br>- Scorecards<br>- Weighted Cause and Effect Diagram | - Hypothesis Testing<br>- Basic Statistics<br>- Graphical Analysis<br>- Sampling<br>- Mistake Proofing<br>- Standard Work<br>- FMEA<br>- Control Plan<br>- Process Capability<br>- DPPM / DPMO<br>- Control (SPC) |

The well designed process maps play vital role in standardization of hospital service. The process map includes, High Level Process Map (HLPM), SIPOC (Supplier, Input, Process, Output and Customer) and Detailed Process Map (DPM).

A SIPOC map is to identify customers, stakeholders, key inputs, processes and key outputs. The following SIPOC diagram describes the in-patient process.[8]

**Table 4: SIPOC diagram describes the in-patient process.**

| Supplier | Input | Process | Output | Customer |
|---|---|---|---|---|
| Patient<br>Front office assistant<br>Nurse<br>Diagnostic staff<br>Surgeons<br>Anesthetist<br>OT staff<br>Technician<br>Ward boys<br>Billing staff | Admission card<br>Ward register<br>Case sheet<br>OT register<br>Post operation log<br>ICU log<br>Discharge advise<br>No dues receipt | Admission<br>Diagnosis<br>Operation<br>Post operation<br>Intensive care<br>Treatment in the ward<br>Billing<br>Discharge | Case sheet<br>Patient is admitted<br>Investigation Report<br>Preparation done before surgery<br>Operation/Surgery done<br>Postoperative observation done<br>Intensive care provided<br>Re-admitted in the ward<br>Discharge advice given by the doctors<br>Payment of bills<br>Patient discharged | Patient<br>Patient's Relatives |

In analysis phase the route cause analysis done by Fish Bone Diagram or Cause and Effect Diagram: E.g. The possible causes for the delay in turnaround time.

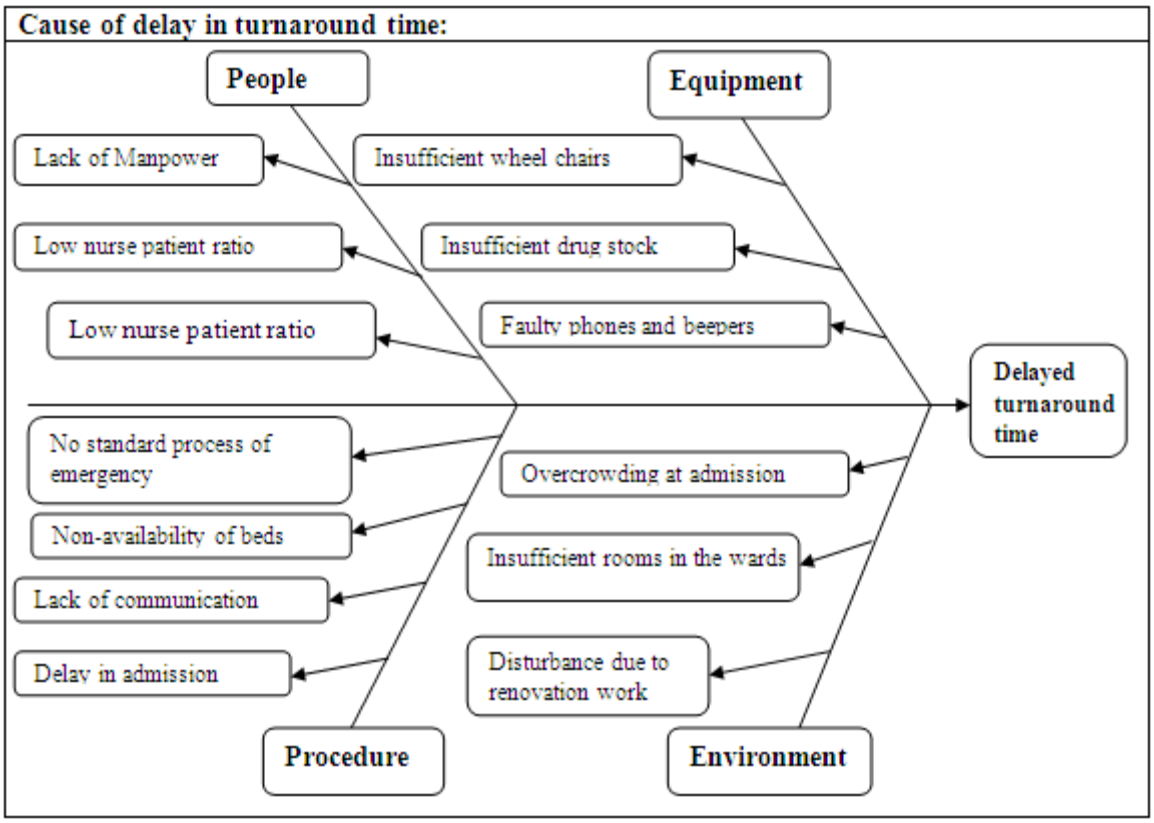


**Figure 1: Fish bone diagram.**[8]

## LITERATURE REVIEW

### Patients discharge process

A research study by Arun Vijay carried out at KG Hospital, Coimbatore, India with an objective to reduce the cycle time of the patients discharge process using Six Sigma DMAIC Model. During the define phase, the problem was defined based on the inputs captured through the patient feedback forms. The patients discharge process was measured and the average cycle time was 234 minutes to handover the discharge summary to the Patients. During the Analyze phase of DMAIC, a root cause analysis was carried out and designed improvement plan. After implementation of the improvement strategies the data shown was a significant reduction in the average discharge time from 234 minutes to 143 minutes demonstrating 61% decrease. The results demonstrated a positive impact on reducing the patient discharge time due to the application of lean Six Sigma methodology.[2]

### Medical process of acute myocardial infarction

A study by Yeh H-L et al, explains the application of LSS to improve the medical process of acute myocardial infarction. The DMAIC methodology used to find critical-to quality factors and draw the value stream map to seek out non-value-added activities. The cause and effect diagram employed to analyze the root causes of waste and generate the improvement project by brainstorming. Eliminating waste raises the process cycle efficiency. Cycle time of the improved door-to-balloon process decreased by 58.4% and even became less than the American college of Cardiology/American Heart Association (ACC/AHA) standard (90 min). Process cycle efficiency increased from 32.27 to 51.81%, and the average days of hospital stay decreased by 3 days. Such effects helped save NT$ 4.422 million in medical resource. The study results indicate that lean Six Sigma not only improved medical quality but also strengthened market competitiveness.[17]

### The linen processes

Furterer SL describes a case study in an acute care hospital that formed a cross-functional team to apply the Lean Six Sigma problem solving methodology and tools to improve the linen processes. The team first defined the project, measured and assessed the current state process, analyzed the root causes, implemented the improvement plans and assessed statistically significant improvement and designed a control plan to further improve the linen loss and ensure that the improved processes maintain their gains. This case study demonstrates the applicability and appropriateness of Six Sigma to hospital support processes, such as management, distribution, replenishment, usage and control of linen. This particular hospital has been extremely successful applying Six Sigma tools in clinical and non-clinical processes to improve throughput, save money, reduce operational costs, improve revenue, improve quality and help to ensure safe patient outcomes. Future applications and research in Six Sigma can focus on better change management tools that can ensure accountability and maintainability of the improved processes. Other areas

can include better linking of the elements of process management, including daily control, planning and analysis, to successful improvement techniques such as Lean Six Sigma.[16]

**Operation time**

Rohini. R and Dr. Mallikarjun conducted a study on the Six Sigma DMAIC approach to improve the process in the operation theatre (OT) of a corporate multi specialty hospital in Bangalore, India. The DMAIC approach showed a wider application and how the healthcare organization can achieve competitive advantages, efficient decision-making and problem-solving capabilities within a business context. The study recommends many OT related solutions for framing policies, for consultants and for supportive staff, engineering and IT services. First cases delay cost was Rs 2, 65, 50,000/- Rs & cancellation of cases cost amounted to Rs. 4, 98, 60,000/-. The overall amount was Rs.7, 64, 10, 000/- . This interventional research study helped the hospital to increase the OT Utilization and also gave annual financial savings of amount 6, 45, 30, 000 Rs.[5]

**Cancellation of operative procedure in operation theatre**

A research study by Dr Kusuma M et all. (2016) on six sigma applications in reducing cancellation of operative procedure in operation theatre of a tertiary care hospital. The study shown an improved efficiency and engagement of all staff, the number of cases being done in the theatre improved by 1 to 2 case per day, it increased to overall performance of cases per day. There was an evident direct and indirect cost savings with application of DMAIC method, cost saving was approximately 2,70,000rs, because ability to do more case in control phase. The overall cancellation rate of operations can be reduced by providing accessories, ready availability of cleaning staff, proper OT scheduling, monitoring postponement and cancellation of surgeries and its evaluation, which in turn lead to saving time and prevent financial loss to organization.[6]

**Medication error**

A study by Miglani Pratima (2015) on reduction of medication errors by application of Lean Six Sigma approach in Medication Administration by nurses in a corporate chain hospital of India. As per the study done on medication administration, the medication error rate found was very high in a ward (most contributing were 31% of missed dose, 21% of wrong dose and 17% at wrong time) due to many interruptions and challenges faced by nurses during drug administration which in turn affecting the safety of care delivered to the patients and total medication delivery time taken by a general nurse was 9 minutes. The lean techniques and six sigma DMAIC methodologies used to study all the non value added tasks performed during medication administration and to eliminate the interruptions faced during the process to give a practical solution for the problem. It was observed the rate of medication errors was decreased, the complexity of the work flow became simple and systematic, the work load on all nurses was decreased and the average time for drug administering was decreased by 55% i.e. to 4 minutes in three months. Thus, it helped in reducing mess up and complexity in the ward with better utilization of other nurses to perform other activities which are needed to be done at the same time and delivering best quality of patient care with high efficiency.[18]

**Needle Sticking**

Chen S et al stated in a research study applies six sigma concepts in dealing with troublesome needle-stick events that occurred in a Taiwan hospital. Upon reviewing retrospective data and route cause analysis, comes up with improvement plan, employee training focusing on needle stick prevention, establishing a standardized needle and sharp item handling procedure, including the procedures in the on-job training materials, establishing an official nursing guideline, procure a sufficient number of intravenous locks, design and manufacture an effective needle-holder, and finally making the needle holders accessible in every nursing area. Improvement in needle stick events via the six-sigma project was satisfactory. Needle-sticking injuries declined from 1.4 times to 0.6 times per 100 nurses, or from 3.96 sigma to 4 sigma.[19]

**Needle Stick Injuries**

A study by Lakhani S et all. (2015) explains the adoption of six sigma methodology in reduction of needle stick injuries (NSI) in tertiary care hospital, Delhi, India. The study helped the hospital to understand the difficulties faced by employees and patients while using the needle / sharp objects. A scatter plot was used to find out the relationship between the experience of the staff and the number of incidents occurred. It was observed that there was a strong negative correlation. Due to high attrition among the staff, as new recruits with less experience were assigned for direct patient care, specific training sessions on waste management, proper handling of sharps were planned for them. By adoption of six sigma approach, there was a reduction in the NSI by 20%. Also, owing to repeated training sessions and periodic competency checks, there was increase in the awareness and knowledge of the nurses by 32%. As a result of awareness, there was 100% reporting of the incidences the same day. This also resulted in timely prophylaxis of the NSI which minimized the transmission of severe blood borne infections. With the reduction in the number of NSI, the cost savings achieved was increased up to 20%.[20]

**Waiting Time in Outpatient Department**

A study by Gijo E. V. and Antony Jiju on reducing patient waiting time in outpatient department using lean six sigma methodology. The process, starting from registration of a patient to dispensing of medicine, was included in the project. The non-value added steps in the

process were identified, and actions were initiated. A cause and effect diagram was prepared for high patient waiting time, and causes were validated with the help of data collected from the process. As a result of this project, the average waiting time reduced from 57 min to 24.5 min and the standard deviation was reduced to 9.27 from 31.15 min. This will help the hospital to serve patients better and faster, which, in turn, will lead to a reduction in delay of treatment and a faster recovery of patients. The productivity loss due to absenteeism of employees from the workplace could be reduced.[21]

**Turnaround time for in- patients**

A study by Bhooma Devi on reduction of turnaround time of in-patients in a private hospital, Chennai, India by using six sigma approach. The major root causes identified were no standards for working procedure and timeframe is not available for every process in in-patient areas, shortage of manpower and lack of communication and co-ordination. The run chart reveals that there are certain cases, which shows continuous 6 points above the average length of stay of the patients. The study came up with improvement solutions as established standard operating procedure for in-patient treatment process; training to all staff, reduce the load on admission staff thus reducing the delay in admission time, increase nurse patient ratio and improve the operation theatre scheduling process. It was also believed that if the suggested improvements are implemented, the defect level would be reduced thus sigma level and customer satisfaction could be improved.[8]

**Delays in blood test results**

A study by Umut B and Sarvari PA describe the use of LSS techniques to reduce delays in blood test results requested for cath lab patients. There were 97 delayed test results out of 324 were resulted as late start because of late blood test results requested by cath lab nurse. Pareto analysis has shown that the biggest (30%) contributor of late starts in the cath lab was late blood test results. Especially creatinine test was varying between 180 to 210 minutes in 2013. Number of blood test delays was 97 before the improvement and reduced to 29 after deploying several improvements. Improving highest rate bottleneck by using impact of lean six sigma methodology effected on improving patient flow, cath lab utilization, capacity freeing up, full time employee utilization, equipment up time, material and staff over time cost in positive way.[22]

## CONCLUSION

Using LSS the process outcomes become more predictable and effective. The LSS targets the efficiency of process, decreasing the wastes, reducing process variation and increasing profitability.

The understanding, meeting and exceeding patient's needs and expectations, healthcare organizations can improve patient outcomes and at the same time can remain competitive by cutting costs and improving quality. In health care industry keeping patients satisfied is high priority. LSS focuses on voice of the customers. It provides different techniques such as customer surveys, perception surveys, analysis of complaints, employee research and competitive benchmarking.

For example, Six Sigma projects looks into minimizing patient length of stay in hospitals after a certain procedure, helps in reducing therapy cost. Some patients wants to go home as soon as possible; however some patients might not be able to take care of themselves or might be in too critical of a condition to risk leaving the hospital. This is where a patient representative on a Six Sigma team could be beneficial.

LSS focus on reducing process variation is particularly important for the healthcare industry, where every physician and nurses deploys the different process. The inherent variation in these processes makes it difficult to achieve consistent standards of care and oftentimes prevents employing scientific thinking to identify the one best way. The sophisticated statistical techniques in the LSS toolbox can help to identify best practices and couples with the ability to manage change, helps achieve substantial improvements when it comes to clinical process.

Statistical process control (SPC) charts are increasingly being used in healthcare to aid in process understanding, assess process stability, and identify changes that indicate either improvement or deterioration in quality.

The hospitals needs an industrial working strategy of continuous monitoring and analysis of process to ensure smooth running of business, the route cause analysis, generation of corrective and preventive actions and its implementation, usage of process control measures like controls charts, streamlining services, creating cost savings and increasing capacity through improved utilization of resources (i.e., beds, equipment and staff), involvement of leadership team in implementation of improvement of plans etc.

By understanding patients need and expectation for quality, LSS in healthcare organizations helps to deliver batter patient care.

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