Optimizing Quality of Hospital Services and Inpatient Satisfaction through Lean Principles

Roshan Bhaladhare[1] and Parag Rishipathak[2,*]

[1]*Symbiosis International (Deemed University), Pune, India*

[2]*Symbiosis Centre for Health Skills, Symbiosis International (Deemed University), Pune, India*

Abstract: *Aim*: The aim of this study is to evaluate the impact of Lean principles on improving hospital service quality and inpatient satisfaction tertiary care hospital in Pune, India. It focuses on reducing key inefficiencies to enhance patient experiences and operational efficiency.

Information & Methods: This quantitative study was conducted at tertiary care hospital in Pune, India, with 110 inpatients who had been admitted for at least three days. Data were collected through a closed-ended questionnaire based on Lean's seven waste categories.

Methods: A cross-sectional design was used, and data were analyzed using SPSS version 20. Descriptive statistics summarized demographics and survey responses, while chi-square tests and multivariate logistic regression assessed the relationships between Lean variables and inpatient satisfaction.

Findings: The findings reveal that Lean principles significantly improved hospital service quality and inpatient satisfaction. Reductions in "waiting" and "motion" wastes were strongly correlated with higher patient satisfaction, highlighting the importance of streamlined processes and reduced wait times. Efficient inventory management also emerged as a key factor in enhancing satisfaction, while "excess processing" and "overproduction" showed less influence on patient satisfaction, indicating areas for further improvement. These results underscore the effectiveness of Lean in optimizing healthcare delivery and improving patient experiences.

Conclusion: The study concludes that Lean principles effectively improve hospital service quality and inpatient satisfaction by reducing key wastes such as waiting, motion, and inventory inefficiencies. Continuous implementation of Lean practices can lead to more efficient and patient-centered healthcare delivery.

INTRODUCTION

Healthcare quality and patient satisfaction are increasingly central to hospital performance metrics, given the rising expectations of patients and the need for efficient service delivery. Lean methodology, a structured approach focused on minimizing waste and enhancing value, has emerged as a valuable tool in healthcare to address these challenges. Originating from manufacturing, Lean principles aim to streamline processes by eliminating non-value-added activities, thereby reducing costs, improving workflow, and enhancing patient outcomes [1].

Improving hospital service quality and achieving high levels of inpatient satisfaction are essential objectives in healthcare management. One effective approach to achieving these goals is the application of its methodology. it is a systematic framework originally developed in manufacturing but has gained significant traction in healthcare due to its potential to reduce inefficiencies and improve patient care. By identifying

and eliminating non-value-added activities, the approach minimizes waste and focuses on continuous improvement, allowing for streamlined operations that enhance patient satisfaction.

In hospitals, common inefficiencies, or "wastes," such as extended waiting times, redundant processes, and unnecessary movement of materials, can detract from service quality and patient satisfaction. Evidence suggests that approaches can significantly improve these areas. For instance, the application of Lean principles in the Veteran Affairs Health Care System at Palo Alto demonstrated a measurable reduction in patient wait times and improvements in workflow [2]. Similarly, Malaysian hospitals have seen quality gains through Lean Six Sigma, although results indicate that management commitment plays a crucial role in sustaining these improvements [3]. Studies indicate that by reducing procedural inefficiencies, hospitals can not only improve patient experiences but also achieve more sustainable and efficient healthcare environments [4,5].

Patient satisfaction is closely tied to service quality in hospitals, as is employee satisfaction. Studies conducted across healthcare facilities in Indonesia

*Address correspondence to this author at the Symbiosis Centre for Health Skills, Symbiosis International (Deemed University), Pune, India; E-mail: director_schs@siu.edu.in

reveal that inadequate waiting room facilities, extended appointment delays, and inefficient information access-ibility are common areas for improvement [6,7]. Addressing these areas can enhance patient satisfaction, enabling hospital administrators to make data-informed improvements to services and management.

This study aims to assess the effect of Lean principles on hospital service quality and patient satisfaction on tertiary care hospital in India. By examining seven types of waste—overproduction, waiting, transportation, excess processing, inventory, motion, and defects—this study explores Lean's impact on improving patient satisfaction in a private healthcare setting. This research contributes to the growing body of evidence on Lean in healthcare by providing insights into waste reduction strategies and their potential to drive continuous improvement in service delivery.

Healthcare quality and patient satisfaction are critical components of hospital performance, driven by the growing expectations of patients and the need for efficient service delivery. Lean methodology, originally developed in manufacturing, has gained significant attention in healthcare for its potential to reduce inefficiencies, enhance operational efficiency, and improve patient care [8, 9]. By focusing on minimizing waste and streamlining processes, principles aim to eliminate non-value-added activities, thereby improving workflow and patient outcomes.

In hospitals, common inefficiencies—such as extended waiting times, redundant processes, and unnecessary movement of materials—can undermine service quality and lead to patient dissatisfaction. The principles have been successfully applied to address these issues. For example, studies in various healthcare settings have shown that Lean methods can reduce waiting times, improve workflow, and lead to better patient experiences. This research aims to assess the impact of Lean principles on hospital service quality and inpatient satisfaction at Treasury Care Hospital in Pune, India. By evaluating the effects o on seven types of waste—overproduction, waiting, transportation, excess processing, inventory, motion, and defects—this study explores the role of Lean in enhancing patient satisfaction in a private healthcare setting [10, 11].

METHODOLOGY

This quantitative research employs a cross-sectional design to assess the impact of Lean principles on hospital service quality and inpatient satisfaction. The study was conducted at Treasury care Hospital in Pune, where Lean principles are being applied to streamline processes and improve patient experience.

Sample and Sampling Method

The study population consisted of inpatients who had been admitted for at least three days between "September 9 to 17, 2024". Using the Rao formula for sample size determination, a sample size of 110 patients was calculated from a total inpatient population of 312, with patients selected through purposive sampling. Inclusion criteria included patients above 18 years of age, admitted for three or more days, and who were cognitively and physically able to complete the questionnaire independently or with minimal assistance.

The sample was selected using purposive sampling. The gender distribution was 63.6% male and 36.4% female. Regarding educational background, 81.8% of participants held a D3 degree, while a minority (1.8%) had completed S2 studies. Inclusion criteria required patients to be over 18 years of age, admitted for three or more days, and capable of completing the questionnaire either independently or with minimal assistance.

Rational

Purposive sampling was chosen for this study because it allows for the selection of specific individuals who meet predefined criteria, ensuring that the sample aligns with the research objectives. In this case, inpatients who had been admitted for at least three days and were cognitively and physically able to complete the questionnaire independently were selected. This ensures that participants have sufficient experience within the hospital to provide meaningful insights into their satisfaction and the impact of Lean principles on hospital services. Purposive sampling is particularly useful in healthcare research where the goal is to target a specific population that can provide relevant data to address the research questions.

Potential Limitations

1. **Selection Bias**: Since purposive sampling focuses on specific individuals who meet certain criteria, it may not represent the broader inpatient population, leading to a potential bias in the results.

2. **Generalizability**: The findings may not be generalizable to all hospital settings or different

patient demographics, as the sample is limited to a specific group of inpatients at one hospital.

3. **Subjectivity in Selection**: The process of selecting participants based on the researcher's judgment may introduce subjectivity, potentially leading to an unrepresentative sample.

Data Collection Instrument

Data were collected through a closed-ended questionnaire developed based on Lean's seven types of waste [1]. The questionnaire included seven main categories corresponding to the types of inefficiencies in hospital management, with questions designed to capture patient experiences and satisfaction related to each Lean waste type:

1. **Overproduction** (4 questions) – Examines redundant tasks and processes.

2. **Waiting** (6 questions) – Assesses delays and scheduling inconsistencies.

3. **Transportation** (3 questions) – Evaluates unnecessary movements of patients or materials.

4. **Excess Processing** (4 questions) – Looks at redundant examinations and procedures.

5. **Inventory** (3 questions) – Relates to overstocking or understocking of supplies.

6. **Motion** (3 questions) – Concerns inefficient movements of staff or resources.

7. **Defects** (10 questions) – Measures errors and patient dissatisfaction with services.

Responses were measured on a 5-point Likert scale, with scores ranging from "Strongly Disagree" (1 point) to "Strongly Agree" (5 points). A score of 10 points or more in each category indicated "Good" quality, while scores below this threshold were categorized as "Not Good."

DATA ANALYSIS

Statistical analysis was conducted using SPSS version 20.0. Descriptive statistics were used to summarize patient demographics and response frequencies. Bivariate analysis was performed using chi-square tests to examine the relationships between each Lean waste variable and inpatient satisfaction. A multivariate logistic regression analysis was then conducted to assess the collective impact of Lean variables on satisfaction, identifying the waste categories with the highest influence on patient satisfaction.

ETHICAL CONSIDERATIONS

The study was conducted with full approval from the Hospitals Ethics Committee. All participants were provided with informed consent, and their responses were kept confidential and anonymized.
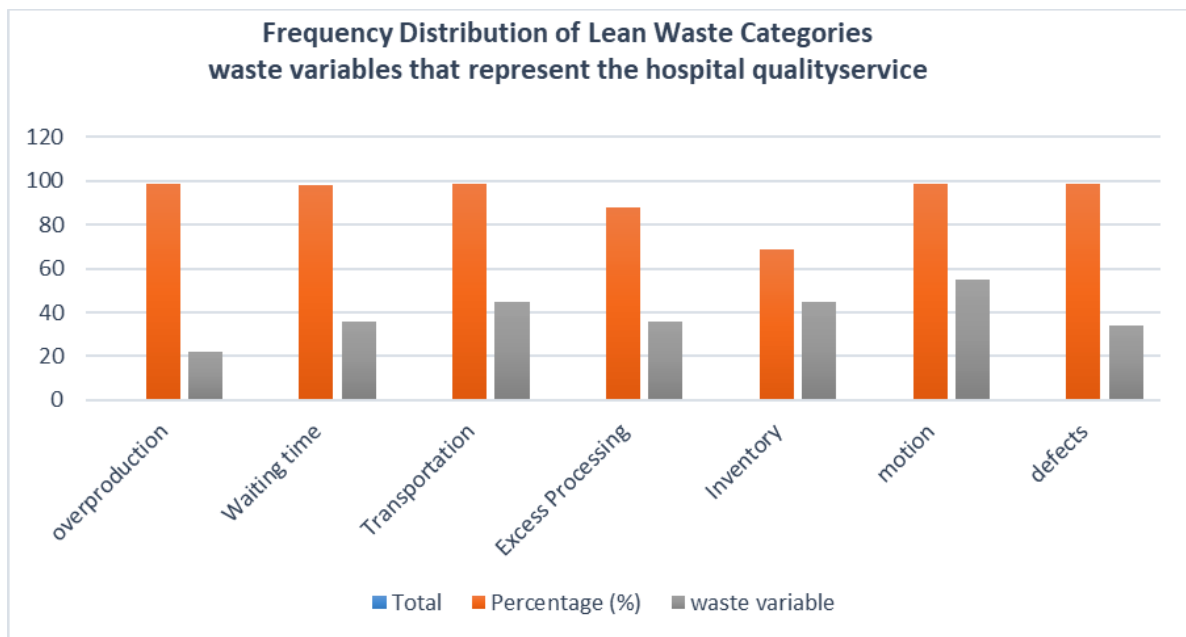
RESULTS

The findings reveal that Lean principles effectively improved hospital service quality and inpatient satisfaction in Hospital. A total of 110 patients participated in the study, with a gender distribution of 63.6% male and 36.4% female. The majority of respondents (59%) were aged between 31 and 40 years. Educational background varied, with 81.8% holding D3 degrees and a minority (1.8%) having completed S2 studies.

Frequency Distribution of Lean Waste Categories

Graph presents respondents' ratings on the seven waste variables associated with Lean principles in hospital management. Among these, the "Waiting" variable received the highest satisfaction ratings, with 96.3% of participants indicating "Good" service quality. This was followed by "Motion" (83.6%) and "Defects" (71.8%), demonstrating that waiting times, efficient staff movement, and minimized errors were positively rated. The lowest satisfaction ratings were recorded for "Excess Processing" (50.9%) and "Overproduction" (59.1%), suggesting areas where improvement is needed in terms of reducing redundant tasks and excessive documentation.

Bivariate Analysis of Lean Variables and Inpatient Satisfaction

The chi-square test results showed statistically significant associations between each Lean waste variable and inpatient satisfaction ($p < 0.05$). The variable with the strongest correlation to inpatient satisfaction was "Inventory" ($p = 0.010$), indicating that efficient inventory management and appropriate stocking levels are crucial for patient satisfaction. Other variables, including "Transportation" ($p = 0.011$), "Waiting" ($p = 0.012$), and "Motion" ($p = 0.015$), also demonstrated significant positive associations with satisfaction levels.

Frequency Distribution of Lean Waste Categories waste variables that represent the hospital qualityservice

Multivariate Logistic Regression Analysis

To evaluate the combined effects of the Lean variables on inpatient satisfaction, a multivariate logistic regression was conducted. Graph provides an overview of the odds ratios for each Lean variable in relation to patient satisfaction:

- **Inventory**: The strongest predictor of satisfaction, with patients experiencing well-managed inventory systems being 4.57 times more likely to be satisfied.

- **Transportation**: Patients who encountered minimal transportation inefficiencies had 2.79 times higher satisfaction levels.

- **Waiting**: Those with shorter wait times were 3.63 times more likely to report high satisfaction.

- **Motion and Overproduction**: Motion efficiency and reduced overproduction also contributed positively to satisfaction but to a lesser extent, with odds ratios of 2.54 and 2.30, respectively.

The Lean approach proved beneficial for enhancing hospital service quality and inpatient satisfaction, with a majority (92.75%) of patients reporting positive experiences at the facility. Areas where Lean principles effectively reduced waste, such as waiting times, motion efficiency, and inventory management, were associated with higher satisfaction levels. However, variables like "Excess Processing" and "Overproduction" were identified as key areas for further improvement to optimize hospital operations and patient care quality [12].

DISCUSSION

Study underscore the effectiveness of Lean principles in enhancing service quality and inpatient satisfaction at Treasury care Hospital. The Lean approach's focus on eliminating waste—specifically in areas such as waiting time, motion inefficiency, and inventory management—demonstrates its utility as a framework for healthcare management. These results align with previous studies indicating that Lean methods not only improve operational efficiency but also contribute positively to patient experiences [1,8].

"Excess Processing" and "Overproduction"

"Excess Processing" and "Overproduction" were found to have less influence on patient satisfaction in this study. One possible explanation is that these wastes are often more internal to the hospital's operations and less directly visible to patients compared to waste categories like waiting or motion. Patients may not always perceive redundant administrative tasks or excessive documentation, which are typically handled by hospital staff rather than patients themselves. Additionally, the nature of these wastes might involve longer-term operational inefficiencies that do not immediately impact the patient's experience during their hospital stay. However, as Lean practices are more deeply embedded, the effects of these inefficiencies may become more noticeable in terms of service delivery, making it essential to continue focusing on these areas [13, 14].

Practical Recommendations for Hospital Administrators:

Beyond implementing Lean principles, hospital administrators should consider fostering a culture of continuous improvement and employee engagement. Lean success depends heavily on staff buy-in, as their participation in identifying waste and implementing solutions is crucial for sustained improvements. Administrators should invest in training programs to ensure all staff members understand Lean principles and their role in driving change. Additionally, regular audits and feedback mechanisms can help monitor progress and address emerging challenges [15, 16].

Challenges in Implementing Lean Principles:

One of the main challenges hospital administrators may encounter is resistance to change. Healthcare staff, especially those accustomed to traditional workflows, may be hesitant to adopt Lean methodologies. Overcoming this resistance requires strong leadership, clear communication of the benefits of Lean, and involving staff at all levels in decision-making. Another challenge is the need for consistent data collection and analysis to identify inefficiencies accurately. Implementing Lean may also require an upfront investment in training and system changes, which can be a barrier for resource-constrained hospitals. Moreover, maintaining the momentum of Lean initiatives over time is often difficult without continued leadership support and periodic reassessment [17].

Waste Variables and Patient Satisfaction

The "Waiting" waste variable received the highest satisfaction rating from patients, highlighting that reduced wait times significantly impact perceived service quality. This is consistent with other studies, which found that long wait times were a major source of patient dissatisfaction [7]. By reducing waiting waste, hospitals can enhance the patient experience, particularly in high-traffic areas like admissions and discharge [18].

Similarly, the "Motion" and "Defects" variables were positively correlated with satisfaction, suggesting that streamlining staff movement and reducing procedural errors significantly improves patients' perceptions of care quality. Prior studies have shown that unnecessary motion can create delays and increase frustration for both staff and patients [9]. Addressing this through Lean interventions has proven effective in increasing operational efficiency and patient satisfaction.

Inventory and Overproduction as Key Focus Areas

The results also highlight inventory management as a key predictor of patient satisfaction. Patients treated in a hospital with well-managed inventory systems had higher satisfaction rates, which indicates that a streamlined supply chain not only improves efficiency but also reduces stress for patients who rely on the availability of medical supplies and resources. This finding resonates with prior studies suggesting that effective inventory management prevents service interruptions and ensures smoother care delivery [10].

Conversely, areas like "Excess Processing" and "Overproduction" received comparatively lower satisfaction ratings. This points to the need for hospitals to focus on minimizing redundant tasks, such as repeated data entry and unnecessary documentation. As indicated in studies on Lean's impact in healthcare, overproduction waste not only consumes valuable time and resources but also diminishes the quality of care by creating bottlenecks in workflows [11].

Implications for Hospital Management

The results underscore the importance of using Lean principles as a continuous improvement framework to optimize healthcare delivery. For hospital management, prioritizing Lean interventions in areas identified as "high waste"—such as inventory, motion, and waiting time—can lead to better patient outcomes and higher satisfaction rates. Additionally, this study highlights the need for hospital management to develop a culture that supports Lean implementation, as the success of Lean initiatives is closely tied to the engagement and commitment of healthcare staff [3].

Limitations and Future Research

While this study provides valuable insights, certain limitations must be considered. The study was conducted in a single private hospital in North Sumatra, which may limit the generalizability of the results to other healthcare settings. Future research could expand on this study by including multiple hospitals and varying healthcare contexts, such as public hospitals or specialized care centers, to validate the findings [19].

Additionally, this study utilized a cross-sectional design, capturing data at a single point in time.

Longitudinal studies would provide more comprehensive insights into how Lean implementation impacts patient satisfaction and service quality over time [20].

CONCLUSION

The application of Lean principles in healthcare can effectively enhance service quality and inpatient satisfaction by addressing key inefficiencies, such as waiting times, motion, and inventory management. This study provides valuable insights into the areas that need attention for improving patient experiences and highlights the need for continuous monitoring and staff involvement. Healthcare managers are encouraged to adopt these actionable recommendations to foster a culture of continuous improvement and achieve more patient-centered, efficient care delivery. By focusing on these areas, hospitals can create better healthcare environments that benefit both patients and healthcare providers.

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