

The Effect of Lean Management Implementing in an Efforts to Improve Operational Efficiency in the Emergency Department and Inpatient Units at Royal Prima Hospital, Medan.

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ABSTRACT

Hospitals face increasing pressure to provide timely and high-quality care amid rising patient demand, limited resources, and complex service pathways. Inefficient patient flow between emergency and inpatient services often results in prolonged waiting times, suboptimal bed utilization, and reduced patient satisfaction. Lean management has been applied in healthcare to improve operational performance through the elimination of non-value-added activities. This study evaluated the impact of lean management implementation on operational efficiency in the emergency department to inpatient care pathway at Royal Prima Hospital, Medan. A quantitative quasi-experimental study with a pre-test and post-test design was conducted. Lean management interventions were implemented across the emergency department to inpatient admission process, including waste identification, workplace organization, value stream mapping, and continuous improvement activities. Data were obtained from hospital operational records and structured questionnaires administered to healthcare personnel. Operational efficiency indicators included patient waiting time, bed occupancy rate, average length of stay, turnover interval, bed turnover, and patient satisfaction. Data were analyzed using descriptive statistics, paired statistical tests, Pearson correlation, and simple linear regression at a 95 percent confidence level. Lean management implementation significantly improved operational efficiency. Total waiting time from emergency department admission to inpatient transfer decreased from 135 minutes to 74 minutes, representing a 45 percent reduction. Bed occupancy rate increased from 78 percent to 82%, average length of stay decreased from 4.8 days to 4.1 days, turnover interval declined from 1.9 days to 1.3 days, and bed turnover increased from 42 to 48 cycles. Patient satisfaction increased from 72 percent to 86 percent. Pre-test and post-test analysis showed a statistically significant improvement in operational efficiency ($p < 0.05$). Lean management significantly enhanced patient flow, bed utilization, and patient satisfaction without additional resource investment. These findings support lean management as a sustainable strategy for improving hospital operational efficiency in high-demand clinical settings.

Introduction

Efficient operations constitute a critical aspect of hospital management, particularly in the context of limited resources, increasing patient volumes, and rising expectations regarding the quality of healthcare services. As complex institutions, hospitals face multiple challenges, including prolonged patient waiting times, suboptimal utilization of resources, and escalating operational costs. Within this context, strategies that promote operational efficiency are



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essential to sustain service quality and optimize overall organizational performance (Safitri et al., 2025).

Operational efficiency challenges in hospitals are also reflected in the condition of healthcare services in Indonesia. According to official data from the Ministry of Health, the number of hospitals in Indonesia has continued to increase, reaching approximately 3,270 hospitals in 2025, comprising various levels of healthcare services in accordance with the national healthcare facility classification system. This growth indicates an increasing administrative and operational burden for healthcare service managers across different regions of the country (Ministry of Health of the Republic of Indonesia, 2025).

Prolonged patient waiting times often reflect inefficiencies in patient flow management, particularly within outpatient care units. Ariotejo (2018) reported that the implementation of continuous improvement strategies at Haji Jakarta Hospital successfully reduced patient waiting times through the optimization of outpatient service workflows, underscoring the importance of operational efficiency in enhancing the patient care experience. Furthermore, suboptimal utilization of resources such as inadequately managed medical equipment and healthcare personnel represents a major barrier to improving hospital service quality (Hasan & Zaky, 2022).

Overall, enhancing hospital operational efficiency through a Lean Management approach not only contributes to cost reduction but also improves patient experience and overall service quality. In the Indonesian context, this strategy has become increasingly critical due to growing patient volumes, heightened expectations for service quality, and persistent limitations in available resources (Arief Sutisna & Triyanto, 2022).

The implementation of Lean Management in hospitals necessitates changes in operational governance and organizational culture. The application of lean principles in outpatient units, for instance, involves optimizing patient flow, improving the management and availability of medical personnel, and eliminating time-consuming administrative processes. A study conducted at Tugu Ibu Hospital, Depok, demonstrated that the Lean Hospital approach significantly reduced outpatient waiting times while simultaneously enhancing patient satisfaction (Muthia, Riandhini, & Sudirja, 2020).

Evidence from multiple studies addressing cost-related waste in hospitals indicates that the application of Lean Management yields substantial efficiency gains. At Virginia Mason Medical Center in the United States, the implementation of Lean Management resulted in a 25–55% reduction in operational costs, a 60–90% decrease in inventory levels, and a 50–90% reduction in space utilization and lead time, demonstrating a significant reduction in waste. In the Indonesian context, findings from Tugu Ibu Hospital, Depok, show that the adoption of the Lean Hospital approach successfully reduced outpatient waiting times, leading to direct improvements in cost efficiency and patient satisfaction.

A study by Muthia et al. (2020) conducted at PKU Muhammadiyah Bantul Hospital identified waste in patient registration, outpatient clinical examinations, and medication dispensing as the primary areas requiring process optimization. Similarly, at Panti Rapih Hospital, Yogyakarta, the implementation of Lean principles in the logistics unit was shown to reduce inventory-related waste and optimize hospital supply chain management. Collectively, evidence from both international and local studies suggests that Lean Management consistently lowers hospital operational costs by eliminating waste across clinical and non-clinical processes without compromising service quality.

Beyond improvements in time and cost efficiency, Lean Hospital implementation has been shown to enhance patient safety and employee engagement (Grabau, 2018). Lean Management promotes a cultural shift toward continuous improvement, which is essential for hospitals facing external pressures such as increasing patient demand, resource constraints, and

escalating expectations for service quality (Arief Sutisna & Triyanto, 2022). Furthermore, a study by Rooslanda (2023) demonstrated that the implementation of Lean Management in hospitals can improve patient satisfaction and reduce conflicts between physicians and patients.

Efforts to improve hospital operational efficiency have generally been carried out through conventional approaches, such as adjustments to standard operating procedures (SOPs), the addition of healthcare personnel, improvements in facilities and infrastructure, and the implementation of hospital information systems. Although these approaches may increase service capacity, they often result in higher operational costs and do not optimally address improvements in service process flows, particularly within the critical pathway from the Emergency Department to inpatient care. As an alternative, quality management approaches such as Total Quality Management and Six Sigma have also been applied to improve service quality. However, these approaches tend to require substantial resources and lengthy implementation periods, making them less flexible for dynamic and complex service processes.

In contrast to these approaches, Lean Management emphasizes process improvement through the elimination of waste and the enhancement of value-added activities without significant additional resource requirements. The novelty of this study lies in the use of pre-intervention operational conditions as a comparative solution to the implementation of Lean Management, with a specific focus on the service pathway from the Emergency Department to inpatient care. Furthermore, this study quantitatively measures the effectiveness of Lean Management using hospital operational efficiency indicators, thereby providing empirical evidence and generating practical, relevant, and sustainable recommendations for the management of private hospitals in urban areas.

The implementation of Lean Hospital has demonstrated positive outcomes in various hospitals, including reductions in patient waiting times and improvements in service flow efficiency. However, to achieve optimal results, hospitals must demonstrate full organizational commitment to comprehensive lean implementation and actively involve all medical personnel and administrative staff in the change process (Widiatama, 2018). The adoption of lean practices in hospitals represents a relevant solution for enhancing operational efficiency amid increasing patient volumes and growing demands for higher service quality.

The urgency of this research is increasing in light of the demands for healthcare system reform in Indonesia, which emphasize efficiency, quality, and patient safety. Hospitals are required not only to deliver high-quality services but also to manage resources efficiently amid budget constraints, rising patient visit volumes, and increasing competition among healthcare facilities.

The implementation of Lean Management is highly relevant, as this approach not only focuses on cost reduction but also on creating added value for patients through the elimination of non-value-added activities. Nevertheless, the implementation of Lean Management in Indonesian hospitals remains largely partial and has not been extensively evaluated using quantitative methods, particularly within critical service pathways from the emergency department to inpatient care, which are characterized by high levels of complexity and risk.

Therefore, this study is crucial in generating empirical evidence regarding the impact of Lean Management implementation on hospital operational efficiency and in supporting the development of data-driven hospital management policies focused on continuous quality improvement.

Royal Prima Hospital Medan is one of the referral hospitals in the city of Medan, with a relatively high volume of patient visits in both emergency and inpatient services. This high service demand has the potential to generate various operational challenges, including increased patient waiting times, inefficiencies in the service flow from the Emergency Department to inpatient care, and suboptimal utilization of available resources. The complexity



of services at Royal Prima Hospital Medan makes this hospital a strategic setting for examining the implementation of Lean Management in efforts to improve operational efficiency. This study is expected to provide a practical and empirical overview of the effectiveness of Lean Management implementation in the context of private hospitals in urban areas, particularly in the city of Medan, and to generate practical recommendations that can be sustainably implemented. The general objective of this study is to comprehensively analyze the implementation of Lean Management and to measure its impact on improving operational efficiency at Royal Prima Hospital Medan.

Methods

This study employed a quantitative quasi-experimental design using a pre-test and post-test approach. The research was conducted at Royal Prima Hospital, Medan, focusing on the patient flow from the emergency department to inpatient wards. The study population consisted of healthcare personnel involved in the emergency and inpatient admission processes, including nurses, physicians, and administrative staff.

A purposive sampling technique was applied, resulting in a total sample of 60 respondents. The sample size for this study was determined using the Slovin formula. The inclusion criteria established by the researchers were as follows: a. Patients admitted through the Emergency Department (ED) and hospitalized for a minimum of 24 hours. b. Healthcare professionals who had worked for at least six months in the Emergency Department or inpatient units. c. Personnel who were willing to participate as respondents and actively engage in Lean activities. The exclusion criteria for this study were as follows: a. Patients referred to other hospitals from the Emergency Department. b. Patients who died before being admitted to inpatient care. c. Healthcare professionals who were on leave during the study period. Lean management interventions were implemented across the study pathway, including identification and elimination of waste, workplace organization, value stream mapping, and continuous improvement activities. Data were collected using structured questionnaires, direct observations, and hospital operational records.

Operational efficiency was measured using key indicators, including patient waiting time, bed occupancy rate, average length of stay, turnover interval, bed turnover, and patient satisfaction. Data were analyzed using descriptive statistics to summarize respondent characteristics and operational outcomes. The statistical test used in this study was the Wilcoxon Signed-Rank Test. This non-parametric test was applied to determine differences in the median values between two paired groups. Statistical significance was determined at a 95% confidence level

Results

1. Respondent Characteristics

Posission	Frekuensi (%)	(n=60)
IGD Nurse	43%	26
Emergency Room Doctor	11%	7
Inpatient Nurse	23%	14
Administration	21%	13
Total	100%	60



Based on Table 1.1, emergency department nurses constituted the largest proportion of the study population (43%). Emergency department physicians accounted for 7 respondents (11%), while inpatient nurses comprised 14 respondents (23%). Administrative staff represented 13 respondents (21%).

Tabel 2.1 Implementation of Lean Management

Category	n	Average (Mean)	SD	Persentase (%)
Waste Slimination	60	3.89	0.54	78%
Application 5S	60	3.75	0.61	72%
Use of VSM	60	3.81	0.57	76%
Kaizen	60	3.68	0.63	69%
Pull & Flow	60	3.72	0.58	70%
Lean Management Total	60	3.77	0.59	73%

Based on Table 2.1, the mean score for waste elimination was 3.89 with a standard deviation of 0.54, and 78% of respondents were classified in the good category. This finding indicates that most units have been able to identify and reduce non-value-added activities (waste). The implementation of 5S demonstrated a mean score of 3.75 with a standard deviation of 0.61, with 72% of respondents in the good category, suggesting that 5S practices have been applied consistently, although several aspects still require further improvement.

The use of Value Stream Mapping (VSM) showed a mean score of 3.81 with a standard deviation of 0.57, and 76% of respondents rated it as good, indicating that VSM has been effectively utilized to map service processes. This suggests that staff are capable of identifying bottlenecks, sources of waste, and areas for improvement within patient flow.

Kaizen (continuous improvement) yielded a mean score of 3.68 with a standard deviation of 0.63, with 69% categorized as good, indicating that a Kaizen culture has begun to be adopted but has not yet been fully optimized. The implementation of the pull system and process flow demonstrated a mean score of 3.72, a standard deviation of 0.58, and 70% in the good category, reflecting a generally favorable application of these principles. Overall, the implementation of Lean Management achieved a mean score of 3.77 with a standard deviation of 0.59, and 73% of respondents were categorized as good. These findings indicate that Lean Management implementation is at a good level; however, there remains considerable potential for further optimization.

Table 2.2 Hospital Operasional Efficiency

Stages	Duration Before lean	Duration After Lean
Administration	42 minutes	25 minutes
Waiting for Transportation	38 minutes	18 minutes
Room preparation	55 minutes	31 minutes
Total Lead Time	135 minutes	74 minutes

Based on the process time analysis of the emergency department-to-inpatient care pathway, a significant reduction in lead time was observed following the implementation of Lean Management, with a decrease of approximately 61 minutes (45%). These findings indicate



that, while Lean Management implementation has reached a good level, it has not yet been fully optimized. Most Lean Management components have been implemented; however, further strengthening is required, particularly in organizational culture, continuous improvement (Kaizen), work standardization (5S), and the optimization of patient flow coordination (Flow).

Table 2.3 Indicators Efficiency RS

Indicators	Before Lean	After Lean
BOR	78%	82%
ALOS	4,8 days	4,1 days
TOI	1,9 days	1,3 days
BTO	42 times	48 times
Patient satisfaction	72%	86%

Based on Table 2.3, the comparative analysis of service performance indicators demonstrates a significant improvement following the implementation of Lean Management in the emergency department to inpatient care pathway.

Table 3.1 (Pre Test – Post Test) The Impact Of Lean

No	Operational Efficiency	N	Mean	SD	Sig. (p-value)
1	Pre Test (Before Lean)	30	2.15	0.402	
2	Post Test (After Lean)	30	3.65	0.518	0.000

Based on the results of the Wilcoxon Signed-Rank Test presented in Table 3.1, a p-value of 0.000 ($p < 0.05$) was obtained, indicating a statistically significant difference in operational efficiency before and after the implementation of Lean Management. The mean operational efficiency score increased from 2.15 prior to the intervention to 3.65 following the intervention.

These findings indicate that the implementation of Lean Management had a significant effect on improving hospital operational efficiency along the Emergency Department–Inpatient Care service pathway at Royal Prima Hospital Medan. Therefore, the research hypothesis stating that Lean Management implementation influences hospital operational efficiency is accepted.

Discussion

1. Pre-Implementation of Lean Management

The pre-experimental phase served as a critical baseline representing the actual operational conditions of the hospital service system prior to the implementation of Lean Management interventions. During this phase, the Emergency Department–Inpatient Care service pathway operated under conventional, function-based procedures, with limited standardization and integration across units.

Pre-experimental assessment revealed that hospital operational efficiency was suboptimal, as indicated by a total lead time of 135 minutes along the Emergency Department–Inpatient Care pathway. The most time-consuming activities included inpatient administrative



processing, delays in patient transportation, and inpatient room preparation. These processes were identified as non-value-added activities, primarily classified as wastes of waiting, transportation, and overprocessing according to Lean Healthcare principles.

From a Lean Healthcare perspective, these findings suggest that the majority of inefficiencies occurred within non-clinical processes rather than clinical care itself. This observation aligns with previous studies by Souza et al. (2021) and Radnor et al. (2022), which reported that over 60% of inefficiencies in Emergency Departments stem from administrative processes and non-standardized cross-unit coordination. Similarly, Royal Prima Hospital Medan exhibited prolonged service pathways, high process variability, and a strong dependence on manual inter-unit communication during the pre-experimental phase.

Operational efficiency indicators further demonstrated suboptimal resource utilization. The Bed Occupancy Rate (BOR) remained at a moderate level, the Average Length of Stay (ALOS) was relatively high, and the Turnover Interval (TOI) indicated substantial bed idle time. These findings suggest a lack of synchronization between bed management systems and patient flow processes. From the researchers' perspective, the pre-experimental condition reflects a reactive service delivery system, in which problems were addressed on an ad hoc basis rather than through systematic process mapping and root cause analysis.

Overall, this pre-experimental phase provided an objective benchmark for evaluating the effectiveness of Lean Management implementation. It enabled a rigorous comparison with post-experimental outcomes, ensuring that observed improvements could be attributed to Lean Management interventions rather than random variation or short-term operational fluctuations.

2. Post-Implementation of Lean Management

The post-experimental phase described the operational conditions of the Emergency Department-Inpatient Care pathway following the systematic implementation of Lean Management at Royal Prima Hospital Medan. During this phase, the hospital applied various Lean principles, including waste elimination, implementation of the 5S methodology, utilization of Value Stream Mapping (VSM), strengthening of process flow coordination, and the development of a culture of continuous improvement (Kaizen). Post-experimental measurements were conducted using the same instruments as those applied in the pre-experimental phase as a post-test, ensuring valid and consistent comparisons.

The post-experimental results demonstrated a significant improvement in operational efficiency. The total lead time of the Emergency Department-to-Inpatient Care service pathway decreased from 135 minutes to 74 minutes, representing a 45% reduction. This time reduction primarily occurred in administrative processing, patient transportation waiting times, and inpatient room preparation, which had previously been identified as major sources of waste. These improvements indicate that Lean Management successfully transformed the service pathway from a fragmented system into a more standardized, value-flow-oriented system.

Statistically, the results of the Wilcoxon Signed-Rank Test yielded a p-value of 0.000 ($p < 0.05$), confirming that the differences between the pre-experimental and post-experimental conditions were statistically significant. This finding reinforces the conclusion that the observed improvement in efficiency was not merely a routine operational change, but rather a direct effect of the implementation of Lean Management.

From a conceptual perspective, these post-experimental findings are consistent with recent studies by Freitas and Resende (2023) and Hussein et al. (2025), which demonstrated that the Lean Healthcare approach is effective in accelerating Emergency Department patient flow, reducing waiting times, and simultaneously improving patient and staff satisfaction. Lean operates not only at the technical process level but also at the system and organizational culture levels by fostering cross-unit collaboration and data-driven decision-making.



From the researchers' perspective, the post-experimental success observed at Royal Prima Hospital Medan was not solely attributable to the application of Lean tools, but also to a fundamental shift in staff mindset toward efficiency and patient value. Process mapping through Value Stream Mapping (VSM) enhanced the visibility of previously unrecognized waste, while the implementation of 5S and Kaizen contributed to process stability and increased staff engagement in continuous improvement efforts.

Nevertheless, the researchers emphasize that post-experimental success must be sustained to prevent it from being temporary. Recent literature highlights that without reinforced discipline (Shitsuke), regular monitoring of performance indicators, and strong top management commitment, Lean outcomes are prone to backsliding (Radnor et al., 2022; Safitri et al., 2025). Therefore, the post-experimental phase should not be viewed as the conclusion of the intervention, but rather as the beginning of the maturation phase of Lean Management within the hospital.

Overall, the comparison between pre-experimental and post-experimental conditions demonstrates that Lean Management is effective in improving the operational efficiency of the Emergency Department–Inpatient Care pathway at Royal Prima Hospital Medan. The observed changes were systemic, measurable, and highly relevant to the operational challenges faced by modern hospitals, thereby reinforcing the role of Lean Management as a strategic approach to enhancing quality and efficiency in healthcare services.

3. The Effect of Lean Management Implementation on the Operational Efficiency of Emergency Department–Inpatient Services

The results of this study indicate that the implementation of Lean Management has a significant effect on improving the operational efficiency of emergency department–inpatient services at Royal Prima Hospital Medan. This effect was demonstrated through a comparison of conditions before and after the Lean Management intervention using the Wilcoxon Signed-Rank Test, which yielded a significance value of $p = 0.000$ ($p < 0.05$). These findings indicate that the observed improvements in operational efficiency were not due to random variation but rather represent a direct impact of Lean Management implementation as the independent variable.

Quantitatively, operational efficiency showed a substantial improvement following the Lean Management intervention. The total service lead time from the emergency department to inpatient admission decreased significantly from 135 minutes in the pre-experimental phase to 74 minutes in the post-experimental phase, representing a reduction of approximately 45%. This reduction primarily occurred in administrative processes, patient transportation waiting times, and inpatient room preparation, which had previously been identified as non value added activities (waste). These results demonstrate that Lean Management is effective in improving service flow through waste elimination and enhancement of the value stream.

In addition to improvements in service time, hospital operational efficiency indicators also showed consistent positive changes. The Bed Occupancy Rate (BOR) increased from 78% to 82%, the Average Length of Stay (ALOS) decreased from 4.8 days to 4.1 days, the Turnover Interval (TOI) was reduced from 1.9 days to 1.3 days, and the Bed Turnover (BTO) rate increased from 42 to 48 times. These improvements reflect optimized bed utilization and better synchronization between emergency department and inpatient care processes following the implementation of Lean Management. Furthermore, patient satisfaction levels increased significantly from 72% to 86%, indicating that improvements in operational efficiency also had a positive impact on patient experience.

Conceptually, these findings are consistent with Lean Management theory, which emphasizes waste reduction, process standardization, and improvement of cross-unit



workflow. Lean implementation through the application of 5S, Value Stream Mapping (VSM), Kaizen, and the strengthening of flow and pull systems facilitated the transformation of service delivery from a fragmented, function-based approach to an integrated, value-oriented system. The results of this study support previous findings demonstrating that Lean Healthcare can improve operational efficiency, accelerate patient flow, and optimize resource utilization without requiring substantial additional investment (Graban, 2018; Souza et al., 2021; Hussein et al., 2025).

From the authors' perspective, the impact of Lean Management on operational efficiency is not solely attributable to the application of Lean tools and techniques, but also to changes in organizational mindset and work culture. The active involvement of healthcare professionals and administrative staff in service flow mapping and continuous improvement processes played a critical role in the success of the intervention. Therefore, the influence of Lean Management on operational efficiency observed in this study can be understood as the result of a combination of technical process improvements and the strengthening of an organizational culture oriented toward patient value.

In conclusion, this study confirms that the implementation of Lean Management has a significant and positive effect on the operational efficiency of emergency department–inpatient services at Royal Prima Hospital Medan. These findings support the research hypothesis and provide empirical evidence that Lean Management is an effective, relevant, and sustainable approach for improving hospital operational performance, particularly in critical service pathways characterized by high complexity and risk.

Conclusion

Lean management implementation significantly improved operational efficiency, patient flow, and bed utilization in the emergency department to inpatient care pathway at Royal Prima Hospital. The approach proved effective in reducing waiting times and enhancing patient satisfaction without additional resources. Lean management represents a viable and sustainable strategy for improving hospital operational performance.

Ethics approval and consent to participate

This study has undergone review and received approval from the ethics committee for health research at the faculty of Medicine, Universitas Prima Medan, with approval number No. 029/KEPK/UNPRI/XI/2025.

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