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The Effect of Lean Management on Patient Satisfaction with Waiting Time Efficiency as a Mediating Variable

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Abstract

This study was motivated by prolonged outpatient service waiting times, which have contributed to lower patient satisfaction. Therefore, lean management, with waiting time efficiency as a mediating variable, is expected to improve patient satisfaction. This study aimed to analyze the effect of lean management implementation on patient satisfaction through waiting time efficiency as a mediating variable in outpatient services. The study used a quantitative approach with an explanatory research design. The population consisted of outpatient patients, with 262 respondents selected using accidental sampling. Primary data were collected through questionnaires, while secondary data were obtained from the hospital's electronic medical records regarding service waiting times. Data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) to examine direct and indirect relationships among variables. The results showed that lean management significantly affected waiting time efficiency, lean management significantly affected patient satisfaction, and waiting time efficiency significantly affected patient satisfaction. Furthermore, waiting time efficiency significantly mediated the relationship between lean management and patient satisfaction, indicating partial mediation. These findings suggest that lean management can improve patient satisfaction directly and indirectly through enhanced waiting time efficiency, providing a basis for hospital service improvement policies and continuous quality improvement.

Keywords

Lean Management, Patient Satisfaction, Service Quality, Waiting Time Efficiency.

1. Introduction

Patient satisfaction has become a critical indicator for assessing the quality of healthcare services globally. In the context of modern healthcare delivery, patient satisfaction reflects not only clinical outcomes but also the overall experience throughout the care process, including responsiveness, environmental comfort, and service timeliness (Ferreira et al., 2023; Rahmaini et al., 2026). Healthcare organizations increasingly recognize that improving patient satisfaction represents a strategic investment with direct implications for institutional reputation, customer loyalty, and long-term organizational sustainability (Wong et al., 2020). However, complex operational challenges, particularly the need to manage efficient patient flow while maintaining service quality, remain major obstacles for many healthcare facilities worldwide.

Lean management, a governance philosophy adopted from the manufacturing sector, has been widely implemented in healthcare organizations to improve operational efficiency and reduce waste. In healthcare settings, the lean approach focuses on identifying and eliminating non-value-added activities within service processes. Through principles such as value stream mapping, process standardization, and continuous improvement, hospitals can optimize resource allocation, reduce waiting times, and improve patient throughput (Zepeda-Lugo et al., 2020). Tlapa et al. (2020) indicate that lean healthcare interventions reduced patient waiting time before meeting healthcare professionals in 24 of 40 analyzed studies and improved staff satisfaction in 80% of the cases examined.

Patient waiting time is another critical dimension of the healthcare experience that significantly influences satisfaction. Zhang et al. (2023) suggest that the relationship between actual waiting time and patient satisfaction is complex and nonlinear, with patients' perceptions of waiting time being more influential. A study of outpatient services found that expected waiting time, reasonable waiting-time thresholds, and perceived waiting time significantly affected patient satisfaction ($p < 0.01$), whereas actual waiting time did not have a significant direct effect. Waiting time efficiency therefore represents an operational manifestation of lean management, reflecting the extent to which healthcare organizations optimize their service processes. Improving this efficiency not only indicates successful lean implementation but also mediates how lean management contributes to higher patient satisfaction (Owad et al., 2020).

Research examining waiting time efficiency as a mediator between lean management and patient satisfaction in Indonesia remains limited (Alolayyan et al., 2022). Waiting time remains a major source of dissatisfaction, with over 60% of patients reporting dissatisfaction, according to Rowe and Knox (2022), while Zhang et al. (2023) report that emergency departments globally face average waits of 2–4 hours before initial care. Evidence by Tlapa et al. (2020) and Kam et al. (2021) shows that lean healthcare reduces waiting times by 15%–35%, while lean six sigma increases clinical capacity and reduces operating time. Waiting time influences patient satisfaction, and digital integration improves patient flow, waiting time, and length of stay (Tlapa et al., 2022; Ferreira et al., 2023). Lean approaches can improve emergency care processes and satisfaction, although outcomes depend on leadership and staff involvement (Owad et al., 2020). Process efficiency may mediate lean management's effects on patient satisfaction (Endalamaw et al., 2024).

Although previous studies have demonstrated that lean management improves operational efficiency and patient outcomes, limited attention has been given to how these effects translate into patient satisfaction. Existing research primarily examines direct effects or operational outcomes, such as waiting time and length of stay, while the role of waiting time efficiency as a mediating mechanism remains underexplored (Tlapa et al., 2020). Moreover, lean management effectiveness varies across

healthcare settings and organizational conditions (Barros et al., 2021). This gap is particularly relevant in Indonesia, where studies integrating lean management, waiting time efficiency, and patient satisfaction within a single structural model remain limited. At Marganingsih Hospital Grobogan, inconsistent waiting times and patient satisfaction further highlight this research need.

This study aims to examine the effect of lean management on patient satisfaction mediated by waiting time effectiveness. This approach provides a more comprehensive explanation of the relationship between operational improvement and patient experience and extends the application of mediation analysis in healthcare management. The study therefore offers both theoretical and practical contributions by clarifying the mechanism through which lean management can generate patient value while providing evidence that can support more targeted operational improvements at Marganingsih Hospital Grobogan.

2. Literature Review and Hypothesis Development

2.1. The Effect of Lean Management on Waiting Time Efficiency

Graban (2018) defines lean management as a set of principles, concepts, and methods designed to maximize customer value while minimizing resource use and optimizing the knowledge and capabilities of individuals involved in work processes. Graban and Prachand (2010) explain that its primary objective is to enhance the value customers receive by eliminating or minimizing activities that do not directly contribute to service value, commonly referred to as waste. In healthcare settings, the application of lean management focuses on identifying and eliminating processes that generate unnecessary delays and inefficiencies. Tools such as 5S (Sort, Set in Order, Shine, Standardize, and Sustain), visual management, and value stream mapping enable hospitals to identify bottlenecks and redesign operational workflows.

Workplace organization and process standardization can reduce non-value-added activities, allowing staff time and resources to be directed toward smoother and more efficient service flow. Empirical evidence supports this relationship. Barros et al. (2021) found that lean management implementation reduced waiting time by 45%, demonstrating its potential to substantially improve service efficiency. Similarly, Tohaga et al. (2025) reported that lean management principles significantly reduced outpatient service lead time. These findings suggest that lean management provides a systematic approach to improving healthcare processes by addressing the root causes of delays rather than merely increasing service capacity.

H1: Lean management has a significant effect on waiting time efficiency.

2.2. The Effect of Lean Management on Patient Satisfaction

Noviati and Yulianti (2020) describe lean management as a continuous improvement approach that hospitals can use to eliminate deficiencies and enhance value across healthcare services. Similarly, Breen et al. (2020) explain that, as a management system, lean management aims to minimize process waiting time, optimize available capacity, and eliminate non-value-added activities or waste. Through this approach, improvements in operational processes can directly influence patients' service experiences. Patient satisfaction is an important indicator of healthcare service quality, reflecting how well the services provided meet patients' expectations. Therefore, the integration of lean management into healthcare operations is expected not only to improve efficiency but also to create greater value from the patient's perspective.

Empirical studies provide consistent evidence of this relationship. Le et al. (2021) found that eliminating non-value-added activities increased patient satisfaction from

22.9% to 76.5%, demonstrating the direct value of process improvement for patients. Similarly, Annisa et al. (2023) reported that lean methods successfully identified waste and improved service performance for BPJS patients. Wang et al. (2025) also found that lean positively affected hospital performance across dimensions, particularly cost efficiency and patient satisfaction, while Sembiring et al. (2025) highlighted its systematic contribution to improving hospital pharmacy service quality. Barros et al. (2021) also demonstrated that lean implementation reduced waiting time by 45% and significantly increased patient satisfaction. Collectively, these findings indicate that lean management can improve patient satisfaction by addressing operational inefficiencies and enhancing service value.

H2: Lean management has a significant effect on patient satisfaction.

2.3. The Effect of Waiting Time Efficiency on Patient Satisfaction

Waiting time in outpatient healthcare refers to the cumulative time spent by patients within a healthcare facility, beginning with arrival at the registration desk and extending through the completion of the final service point, including registration, consultation, emergency care, diagnostic procedures, and receipt of results (Ani et al., 2025). From an operational perspective, Pasaribu et al. (2025) explain that waiting time efficiency is closely related to queuing theory, which provides a mathematical framework for analyzing and optimizing healthcare service systems. Efficient waiting time management is therefore an important component of healthcare service quality, particularly responsiveness, because patients directly experience and evaluate it. When hospital operations minimize unnecessary delays, patients are more likely to perceive the service as comfortable, responsive, and reliable. Conversely, prolonged queues represent a form of waiting waste that may generate anxiety, fatigue, and negative perceptions of service reliability.

Empirical evidence supports this relationship. According to Zhang et al. (2023), a strong negative correlation was found between queue duration and patient satisfaction, indicating that satisfaction declines substantially as waiting time increases. Sari et al. (2023) demonstrated that service speed significantly affects patient satisfaction and may subsequently contribute to long-term patient loyalty. These findings highlight the importance of improving waiting time efficiency as part of efforts to strengthen both service performance and patient experience.

H3: Waiting time efficiency has a significant effect on patient satisfaction.

2.4. The Effect of Waiting Time Efficiency as a Mediator

The indirect effect within this framework indicates that the implementation of lean management may influence patient satisfaction not only through its direct effect but also through improvements in internal operational performance, particularly waiting time efficiency. Lean management provides a systematic approach to restructuring hospital processes by identifying and eliminating non-value-added activities, unnecessary procedures, process interruptions, and other forms of waste that contribute to delays. By applying lean principles, hospital workflows can become more streamlined, coordinated, and predictable, improving patient movement of patients across service stages. Improvements in waiting time efficiency are expected to enhance patients' perceptions of service responsiveness, reliability, and overall quality. Consequently, when patients experience shorter and more predictable waiting times, the operational improvements generated by lean management can be translated into greater patient satisfaction. Xie and Or (2017) suggest that waiting time efficiency may serve as an important mechanism through which lean management creates value from the patient's perspective.

Empirical evidence supports the proposed mediation relationship. Le et al. (2021) reported that eliminating non-value-added activities through lean interventions substantially increased patient satisfaction from 22.9% to 76.5%, demonstrating that improvements in operational processes can generate meaningful benefits for patients. Similarly, Wang et al. (2025), through a systematic review, concluded that lean-based management practices positively influence operational performance and patient satisfaction. These findings suggest that the benefits of lean management may be transmitted through improved service processes, including reduced waiting and smoother patient flow. Therefore, waiting time efficiency is expected to mediate the relationship between lean management and patient satisfaction.

H4: Waiting time efficiency mediates the effect of lean management on patient satisfaction.

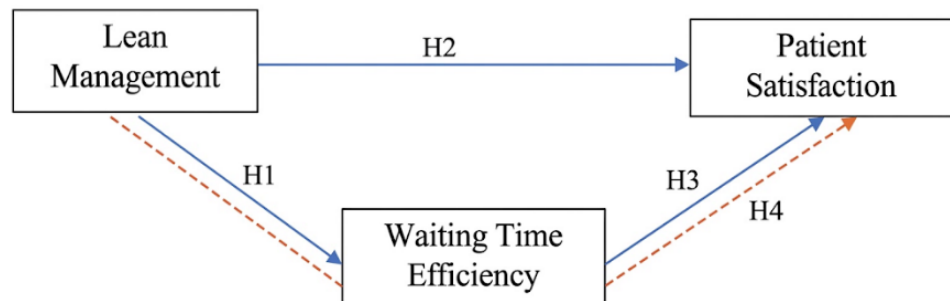


Figure 1. Conceptual Framework

Figure 1 illustrates the proposed research framework examining the relationships among lean management, waiting time efficiency, and patient satisfaction. Lean management is hypothesized to directly affect waiting time efficiency (H1) and patient satisfaction (H2). Waiting time efficiency is also hypothesized to affect patient satisfaction (H3). In addition, waiting time efficiency is proposed as a mediating variable in the relationship between lean management and patient satisfaction (H4), indicating that lean management may improve patient satisfaction indirectly by enhancing the efficiency of waiting time.

3. Methods

This study employed a quantitative approach with an explanatory research design to test the hypothesized relationships between lean management, waiting time efficiency, and patient satisfaction. The study examined the effect of lean management on patient satisfaction, with waiting time efficiency positioned as an intervening variable. The study was conducted at Marganingsih Hospital, Grobogan, with the population consisting of all outpatients who visited and received healthcare services during the study period.

The minimum sample size was determined using the Slovin formula with a 5% margin of error, resulting in a required sample of 262 outpatients. Respondents were selected using non-probability sampling through accidental sampling, in which patients who met the research criteria and were available during data collection were invited to participate. Primary data were collected through a structured questionnaire using a Likert scale. Secondary data were also obtained from hospital records, including outpatient registration waiting time, waiting time at the outpatient clinic from registration to physician examination, and patient handling time, including physician consultation and medical procedures. These secondary

data supported the analysis and provided an objective overview of service conditions at Marganingsih Hospital.

The independent variable was lean management, the dependent variable was patient satisfaction, and waiting time efficiency served as the intervening variable. Lean management was measured through the implementation of 5S (Sort, Set in Order, Shine, Standardize, and Sustain), visual management through directional signs and service-flow information boards, smooth service flow without unnecessary bureaucratic barriers, error-proofing in documentation and patient identification, and a focus on delivering value directly related to patients' clinical needs. Waiting time efficiency was assessed based on registration waiting time, waiting time for physician examination, timeliness of outpatient clinic schedules, and staff responsiveness in processing patient queues. Patient satisfaction was measured through satisfaction with physicians' and nurses' technical competence, friendliness, and communication; accessibility, cleanliness, and comfort of the waiting area; service reliability and accuracy of medical procedures; and overall satisfaction and willingness to recommend the hospital.

Data analysis consisted of descriptive and inferential statistical analyses using Structural Equation Modeling based on Partial Least Squares (SEM-PLS) with SmartPLS software. The outer model was evaluated through convergent validity, discriminant validity, and construct reliability. Convergent validity was assessed using factor loadings and Average Variance Extracted (AVE), while discriminant validity was examined using cross-loadings, the Fornell–Larcker criterion, and the Heterotrait–Monotrait ratio (HTMT). Construct reliability was evaluated using Cronbach's Alpha and Composite Reliability (Hair et al., 2014). The inner model was assessed using R^2 and Goodness of Fit (GoF), while t-statistics and p-values from bootstrapping tested the significance of structural relationships.

4. Results

This study was conducted at the Outpatient Unit of Marganingsih Hospital, Grobogan. Primary data were collected by distributing questionnaires to 262 outpatient respondents. The assessment of respondent characteristics was intended to provide an objective description of the research subjects' profiles, including gender, age, educational level, occupation, clinic visited, highest level of education, and payment type.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency	Percentage (%)
Gender	Female	176	67.18
	Male	86	32.82
Age	<20 years	63	24.05
	20–30 years	47	17.94
	31–40 years	48	18.32
	41–50 years	44	16.79
	51–60 years	53	20.23
	>60 years	7	2.67
Clinic Department	Obstetrics and Gynecology	74	28.24
	Internal Medicine	68	25.95
	Pediatrics	60	22.90
	Surgery	60	22.90
Education	Elementary School	68	25.95
	Junior High School	47	17.94
	Senior High School	76	29.01
	Diploma	39	14.89
	Bachelor	28	10.89

Characteristics	Category	Frequency	Percentage (%)
Occupation	Postgraduate	4	1.53
	Civil		
	Servant/Military/Police	14	5.34
	Private-sector		
	Employee	33	12.60
	Entrepreneur	61	23.28
	Farmer/Fisherman	49	18.70
	Laborer	4	1.53
	Homemaker	13	4.96
	Retiree	15	5.73
	Other	26	9.92
Payment Type	Student	47	17.94
	General/Self-Pay	255	97.33
	Company/Institution	3	1.15
	Private Insurance	4	1.53
Visit Frequency	Visit	51	19.47
	2–3 visits	102	38.93
	4–5 visits	62	23.66
	>5 visits	52	19.85
Length of Patient Status	<1 year	84	32.06
	1–2 years	86	32.82
	3–5 years	61	23.28
	>5 years	31	11.83

Based on Table 1, the majority of respondents were female, comprising 176 respondents (67.18%), while 86 respondents (32.82%) were male. In terms of age, the largest proportion of respondents was under 20 years old, with 63 respondents (24.05%), followed by those aged 51–60 years (53 respondents; 20.23%) and 31–40 years (48 respondents; 18.32%). Regarding the clinic department visited, most respondents were from the Obstetrics and Gynecology Department, with 74 respondents (28.24%), followed by Internal Medicine with 68 respondents (25.95%), and Pediatrics and Surgery with 60 respondents each (22.90%). In terms of education, most respondents had completed senior high school or an equivalent level (76 respondents; 29.01%), followed by elementary school or equivalent (68 respondents; 25.95%) and junior high school or equivalent (47 respondents; 17.94%). Respondents with postgraduate education represented the smallest proportion, with only 4 respondents (1.53%).

Regarding occupation, respondents were predominantly entrepreneurs (61 respondents; 23.28%), followed by farmers/fishermen (49 respondents; 18.70%) and students (47 respondents; 17.94%). In terms of payment type, nearly all respondents used general/self-payment (255 respondents; 97.33%), while 3 respondents (1.15%) were covered by companies/institutions and 4 respondents (1.53%) used private insurance. Regarding visit frequency, the largest proportion of respondents had visited the hospital 2–3 times (102 respondents, 38.93%), while 51 respondents (19.47%) were first-time visitors. In terms of length of patient status, the largest group had been patients at the hospital for 1–2 years, comprising 86 respondents (32.82%), followed by those who had been patients for less than one year, totaling 84 respondents (32.06%). These characteristics indicate that the respondents had diverse demographic backgrounds and levels of healthcare service experience.

Table 2. Convergent Validity Test

Variable	Item	Outer Loading	AVE	Cronbach's alpha	rho_a	rho_c
Lean Management	X1	0.739	0.652	0.946	0.948	0.954
	X2	0.799				
	X3	0.737				
	X6	0.753				
	X7	0.846				
	X9	0.813				
	X10	0.833				
	X12	0.858				
	X13	0.846				
	X14	0.857				
	X15	0.791				
Waiting Time Efficiency	M1	0.852	0.698	0.892	0.899	0.920
	M2	0.871				
	M3	0.785				
	M4	0.847				
	M5	0.82				
Patient Satisfaction	Y1	0.820	0.676	0.920	0.927	0.936
	Y2	0.860				
	Y3	0.880				
	Y4	0.850				
	Y5	0.760				
	Y6	0.790				
	Y7	0.790				

Based on Table 2, all items for lean management, waiting time efficiency, and patient satisfaction achieved outer loading values above 0.70, ranging from 0.737 to 0.858, 0.785 to 0.871, and 0.760 to 0.880, respectively, indicating adequate indicator reliability. The AVE values for lean management (0.652), waiting time efficiency (0.698), and patient satisfaction (0.676) were all above the recommended threshold of 0.50, confirming convergent validity. In addition, Cronbach's alpha, rho_a, and composite reliability (rho_c) values for all three variables exceeded 0.70, indicating satisfactory internal consistency and construct reliability. The measurement model demonstrates adequate convergent validity and reliability for further analysis.

Table 3. Heterotrait-Monotrait Ratio Test

Variable	HTMT
Patient Satisfaction $\leftrightarrow$ Waiting Time Efficiency	0.769
Lean Management $\leftrightarrow$ Waiting Time Efficiency	0.719
Lean Management $\leftrightarrow$ Patient Satisfaction	0.812

Based on Table 3, the HTMT values for all variable pairs were below the recommended threshold of 0.90, ranging from 0.719 to 0.812. The highest value was observed between lean management and patient satisfaction (0.812), while the lowest was between lean management and waiting time efficiency (0.719). Thus, all constructs demonstrate adequate discriminant validity.

Table 4. Fornell-Larcker Criterion Test

Variable	WTE	PS	LM
Waiting Time Efficiency (WTE)	0.835		
Patient Satisfaction (PS)	0.711	0.822	
Lean Management (LM)	0.674	0.769	0.808

Table 4 shows that the square root of AVE for each construct was higher than its correlations with other constructs. The values were 0.835 for waiting time efficiency,

0.822 for patient satisfaction, and 0.808 for lean management, exceeding their respective inter-construct correlation.

Table 5. Cross Loading Test

Variable	Indicator	WTE	PS	LM
Waiting Time Efficiency (WTE)	M1	0.852	0.7	0.682
	M2	0.871	0.539	0.521
	M3	0.785	0.57	0.579
	M4	0.847	0.554	0.474
	M5	0.82	0.574	0.518
Lean Management (LM)	X1	0.541	0.587	0.739
	X10	0.566	0.657	0.833
	X12	0.565	0.631	0.858
	X13	0.601	0.618	0.846
	X14	0.636	0.673	0.857
	X15	0.591	0.616	0.791
	X2	0.51	0.612	0.799
	X3	0.526	0.638	0.737
	X6	0.421	0.563	0.753
	X7	0.493	0.621	0.846
Patient Satisfaction (PS)	X9	0.499	0.599	0.813
	Y1	0.667	0.817	0.758
	Y2	0.606	0.86	0.672
	Y3	0.631	0.876	0.678
	Y4	0.554	0.85	0.647
	Y5	0.475	0.764	0.49
	Y6	0.568	0.793	0.569
	Y7	0.557	0.79	0.556

According to Table 5, each indicator has the highest loading on its respective construct compared with its loadings on the other constructs. The indicators of waiting time efficiency, patient satisfaction, and lean management show primary loadings ranging from 0.785–0.871, 0.764–0.876, and 0.737–0.858, respectively. These results indicate that all indicators adequately represent their respective constructs and support the discriminant validity of the measurement model's discriminant validity.

Table 6. VIF Test Result

Variable	VIF
Waiting Time Efficiency → Patient Satisfaction	1.832
Lean Management → Waiting Time Efficiency	1.000
Lean Management → Patient Satisfaction	1.832

Table 6 presents the VIF values, which ranged from 1.000 to 1.832 and are below the recommended threshold of 5.00. This indicates that the predictor constructs do not exhibit problematic multicollinearity. Therefore, the structural model meets the VIF requirement and is suitable for further analysis.

According to Table 7, waiting time efficiency had an R-square value of 0.454 (adjusted R-square = 0.452), indicating that lean management explained 45.4% of its variance. Meanwhile, patient satisfaction had an R-square value of 0.659 (adjusted R-square = 0.657), indicating that waiting time efficiency and lean management explained 65.9% of its variance. The F-square values were 0.832 for the effect of lean management on waiting time efficiency, 0.451 for the effect of lean management on

patient satisfaction, and 0.200 for the effect of waiting time efficiency on patient satisfaction, while the GoF was 0.613, indicating a strong overall model fit.

Table 7. R Square, F-Square, and GOF Result

Variable	R-Square	R-Square Adjusted	F-Square	GoF Result
Waiting Time Efficiency	0.454	0.452		
Patient Satisfaction	0.659	0.657		
Waiting Time Efficiency → Patient Satisfaction			0.2	0.613
Lean Management → Waiting Time Efficiency			0.832	
Lean Management → Patient Satisfaction			0.451	

Table 8. Hypothesis Testing

Relationship	Original Sample	Sample Mean	Standard Deviation	t-statistics	p-values
Waiting Time Efficiency → Patient Satisfaction	0.353	0.359	0.057	6.195	0.000
Lean Management → Waiting Time Efficiency	0.674	0.678	0.037	18.37	0.000
Lean Management → Patient Satisfaction	0.531	0.525	0.061	8.747	0.000
Lean Management → Waiting Time Efficiency → Patient Satisfaction	0.238	0.244	0.04	6.000	0.000

Based on Table 8, all hypothesized relationships were positive and statistically significant, as all t-statistics exceeded 1.96 and the p-values were 0.000 (<0.05). Waiting time efficiency had a significant positive effect on patient satisfaction ($\beta = 0.353$; $t = 6.195$; $p < 0.001$), while lean management had significant positive effects on waiting time efficiency ($\beta = 0.674$; $t = 18.370$; $p < 0.001$) and patient satisfaction ($\beta = 0.531$; $t = 8.747$; $p < 0.001$). Furthermore, the indirect effect of lean management on patient satisfaction through waiting time efficiency was also positive and significant ($\beta = 0.238$; $t = 6.000$; $p < 0.001$), confirming the mediating role of waiting time efficiency.

5. Discussion

The results show that lean management positively and significantly affects waiting time efficiency, indicating that lean-based work systems can improve service flow by reducing non-value-added activities, simplifying processes, and facilitating patient movement across service stages. This finding supports Lawal et al. (2014), who argued that lean management improves healthcare process flow by removing bottlenecks that hinder service speed. Consistent with this perspective, Hammoudeh et al. (2021) found that implementing lean management in outpatient pharmacy services reduced waiting time through procedure standardization and elimination of unnecessary activities, suggesting that efficiency is better achieved through system improvement than additional resources. Muna et al. (2023) similarly demonstrated through value stream mapping that administrative activities often represent hidden sources of delay, while Waiman et al. (2023) reported that lean six sigma consistently improves flow efficiency, particularly in outpatient units. These findings reinforce that waiting time is often rooted in systemic waste and process interruptions, making lean management a critical approach to improving service efficiency.

The results show that lean management has a positive and significant effect on patient satisfaction, indicating that more efficient, standardized, and coordinated service processes can improve the patient experience. In healthcare, satisfaction is shaped not only by clinical outcomes but also by patients' experience of service flow, speed, consistency, and certainty. This finding supports D'Andreamatteo et al. (2015), who emphasized that lean improves patient value by enhancing the overall service experience. It also aligns with Godley and Jenkins (2019), who found that Lean Six Sigma improves patient satisfaction by reducing wait times and simplifying service processes. McDermott et al. (2022) further identified improvements in service quality, operational consistency, and patient satisfaction as consistent benefits of lean implementation. Shortell et al. (2021) noted that hospitals that implement lean operationally perform better than those that adopt it only formally. Similarly, Moraros et al. (2016) highlighted improvements in patient flow and service consistency, while Alkhaldi and Abdallah (2020) showed that lean improves operational performance, which ultimately influences hospital performance and patient experience.

The results show that waiting time efficiency has a positive and significant effect on patient satisfaction, indicating that more efficient and predictable service increases satisfaction. Waiting time represents a non-financial cost for patients, as prolonged delays can increase psychological burden, uncertainty, fatigue, and perceived loss of productive time, widening the gap between expected and perceived service. From a queuing theory perspective, waiting time reflects the balance between service capacity and patient arrivals, while internal process inefficiencies can also prolong queues. Xie and Or (2017) found that longer waiting times significantly reduce outpatient satisfaction, while Rizany et al. (2021) identified waiting time as a major source of patient complaints in Indonesian public hospitals. Similarly, Amalina et al. (2025) confirmed its consistent effect across healthcare settings, and Lekay et al. (2025) found that longer waits directly reduce satisfaction. Herdiati and Fitriyah (2024) further emphasize the roles of service quality, effectiveness, and communication in shaping waiting experiences.

The findings show that waiting time efficiency positively and significantly mediates the relationship between lean management and patient satisfaction. Because the direct effect of lean management on patient satisfaction also remains significant, the mediation is considered partial. McDermott et al. (2022) similarly emphasized that the benefits of lean healthcare largely emerge through internal process transformation that produces better service quality and patient outcomes. This mediation pattern is consistent with Hammoudeh et al. (2021), who found that reduced waiting time was a key mechanism linking lean management to patient satisfaction, and Godley and Jenkins (2019), who reported that lean six sigma improves satisfaction through faster and more stable processes. Muna et al. (2023) further showed that eliminating waste through value stream mapping can shorten waiting time.

6. Conclusion

The findings demonstrate that lean management has a positive and significant effect on waiting time efficiency and patient satisfaction, while waiting time efficiency also has a positive and significant effect on patient satisfaction. Furthermore, waiting time efficiency significantly mediates the relationship between lean management and patient satisfaction, with the significant direct effect confirming a partial mediation mechanism. These findings indicate that improvements in hospital processes, particularly through the elimination of non-value-added activities, process standardization, and improved patient flow, can enhance patient satisfaction both directly and indirectly by improving waiting time efficiency. The findings have practical implications for hospital management,

particularly in developing continuous service improvement strategies. Hospital managers should strengthen the implementation of lean management by identifying process waste, reducing unnecessary procedures and delays, standardizing workflows, and monitoring waiting time performance as a key indicator of service quality. Such improvements can support more efficient operations while creating a more responsive and satisfactory patient experience.

This study has several limitations. First, the research was conducted at a single hospital, which may limit the generalizability of the findings to other healthcare institutions with different operational characteristics. Second, the study used accidental sampling and questionnaire-based primary data, which may introduce respondent selection and perception biases. Third, the model focused on lean management, waiting time efficiency, and patient satisfaction, without considering other factors that may influence patient satisfaction, such as service quality, communication, clinical outcomes, or perceived value. Future research should therefore involve multiple hospitals and larger, more representative samples to improve generalizability. Further studies could also incorporate additional variables and longitudinal designs to examine how sustained lean implementation affects waiting time efficiency and patient satisfaction over time.

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Data Disclosure Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.



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