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RESEARCH ARTICLE

ENHANCING PEDIATRIC OUTPATIENT PERFORMANCE THROUGH LEADERSHIP AND CONTINUOUS IMPROVEMENT CULTURE: THE MEDIATING ROLE OF LEAN HEALTHCARE

Astri Anindya Sariza, Sri Rochani Mulyani, Rulia, Etty Sofia Mariati Asnar, Vip Paramarta*

University of Sangga Buana, Indonesia

*Correspondence: astrianindyas@gmail.com

ABSTRACT

OBJECTIVE:

This study examines the association of leadership and continuous improvement culture with Lean Healthcare implementation and their subsequent relationship with service performance in a pediatric outpatient clinic.

DESIGN:

A quantitative explanatory study with a cross-sectional design was conducted among 46 healthcare staff selected through stratified random sampling. The hypothesized relationships were tested using Structural Equation Modeling–Partial Least Squares (SEM–PLS).

SETTING:

The study was carried out in the Pediatric Outpatient Clinic of a private hospital in South Sumatra, Indonesia.

MAIN OUTCOME MEASURES:

Self-reported scores for Leadership, Continuous Improvement Culture, Lean Healthcare implementation, and Service Performance, measured using a validated and reliable structured questionnaire with a five-point Likert scale.

RESULTS:

Leadership (β=0.527, $p<0.001$) and Continuous Improvement Culture (β=0.639, $p<0.001$) significantly predicted Lean Healthcare (R^2=0.733). Lean Healthcare (β=0.244, $p=0.021$), Leadership (β=0.477, $p<0.001$), and Continuous Improvement Culture (β=0.507, $p<0.001$) demonstrated direct associations with Service Performance. Furthermore, Lean Healthcare partially mediated the pathways from Leadership (β=0.128, $p=0.039$) and Continuous Improvement Culture (β=0.156, $p=0.031$) to performance.

CONCLUSIONS:

Lean Healthcare was found to partially mediate the relationships between leadership, continuous improvement culture, and service performance. Findings suggest that healthcare managers should integrate leadership development and continuous improvement initiatives to strengthen Lean implementation and service outcomes. However, findings should be interpreted cautiously due to the small sample size and single-site design. The cross-sectional design and reliance on self-reported measures limit causal inference.

KEYWORDS

leadership; continuous improvement culture; Lean Healthcare; service performance; pediatric outpatient clinic; SEM-PLS

INTRODUCTION

Delivering high-quality and efficient health services is a primary priority for healthcare organizations globally to meet community needs and optimize hospital management. High-quality health services must fulfill multiple dimensions, including safety, timeliness, efficiency, effectiveness, patient-centeredness, and equity[1]. A universally recognized performance indicator is outpatient waiting time. Minimizing waiting time is essential to ensure timely and responsive healthcare delivery[1]; however, a persistent gap often exists between these universal quality expectations and actual operational conditions.

In modern healthcare organizations, Lean Healthcare has emerged as a systematic management approach to identify and eliminate non-value-added activities (waste) while improving service quality[2]. Fundamentally, this approach is rooted in the foundational Lean philosophy of maximizing value creation for the end-user by relentlessly banishing waste[3]. This is particularly relevant in pediatric healthcare, where operational inefficiencies are exacerbated by the complexity of services, such as medication compounding[4]. Operational waste and inefficiencies in pediatric clinics frequently manifest as severe service delays, with patient waiting times reaching up to 50 days prior to the implementation of quality improvement interventions[5], with indirect patient care and non-clinical tasks in hospital-based pharmacies accounting for up to 88% of the total time spent[6]. Empirical evidence confirms that Lean models effectively streamline these outpatient processes and reduce non-value-added time by up to 72%[7, 8].

The proposed model is grounded in socio-technical systems theory, which posits that organizational performance emerges from the interaction between managerial practices, organizational culture, and operational processes. This framework was selected over Transformational Leadership or Continuous Quality Improvement (CQI) theories because it uniquely captures the vital interdependence between social elements (leadership and culture) and technical interventions (Lean practices). While alternative theories tend to isolate either human dynamics or process metrics, STS provides a holistic lens to explain how these subsystems must jointly optimize to drive service performance. In modern healthcare settings, operational efficiency and process flow optimization have become strategic issues that significantly influence organizational performance[9]. Leaders who support continuous improvement tend to create a work environment conducive to innovation, staff participation, and waste elimination[10]. Furthermore, establishing a Lean culture relies heavily on daily management systems and Lean leadership to sustain continuous quality improvement efforts[11]. In Indonesian healthcare, waiting-time management remains critical to meeting national quality standards. The rapid expansion of public health insurance coverage in Indonesia has further intensified the demand for efficient outpatient services, underscoring the urgent need for Lean Healthcare applications to optimize hospital operations and improve overall care delivery.

Nevertheless, the successful implementation of Lean Healthcare is not merely a technical initiative; it fundamentally depends on organizational and managerial factors. Weak leadership support has frequently been identified as a major contributor to Lean implementation failure[12]. Furthermore, Lean initiatives often fail when treated as isolated technical tools without deep-rooted top management commitment[13]. Effective leadership is essential for building adaptive, improvement-oriented work environments[10]. Beyond leadership, a culture of continuous improvement, encompassing openness to feedback, structured problem-solving, and a "just culture" encourages learning without fear of punishment, represents another essential foundation[14].

This study was conducted in the Pediatric Outpatient Clinic of a private hospital in South Sumatra, Indonesia. While the clinic serves a steady volume of patients, preliminary findings identified opportunities for optimization in operational and managerial workflows. Observations suggested leadership support could be strengthened, as management must actively serve as a role model to cultivate continuous improvement capabilities in healthcare settings[15]. Additionally, enhancing staff engagement remains crucial, as it is a key pillar of a robust quality culture[16]. Current Lean practices, such as visual management, are still at a developmental stage, providing a pathway for minimizing waste[11]. Consequently, addressing

these gaps is essential, as suboptimal coordination directly impacts waiting time management, which is universally recognized as a critical indicator of perceived service quality in healthcare settings[17].

Although leadership and organizational culture have been individually linked to Lean implementation, empirical studies simultaneously examining their direct and indirect relationships with service performance remain limited, particularly in pediatric outpatient settings within developing countries. Therefore, this study aims to analyze the association of leadership and continuous improvement culture with service performance, both directly and through the mediating role of Lean Healthcare. Based on this framework, the following hypotheses are proposed:

H1: Leadership is positively associated with Lean Healthcare.
H2: Continuous Improvement Culture is positively associated with Lean Healthcare.
H3: Lean Healthcare is positively associated with Service Performance.
H4: Leadership is positively associated with Service Performance.
H5: Continuous Improvement Culture is positively associated with Service Performance.
H6: Leadership has an indirect positive association with Service Performance through Lean Healthcare.
H7: Continuous Improvement Culture has an indirect positive association with Service Performance through Lean Healthcare.

METHODS

STUDY DESIGN AND SETTING

This study employed a quantitative explanatory design with a cross-sectional approach to examine the relationships among leadership, continuous improvement culture, Lean Healthcare implementation, and service performance. Given the cross-sectional nature of this study, the indirect effects were examined using mediation analysis rather than establishing strict causal mediation.

The study was conducted at the Pediatric Outpatient Clinic of a private hospital in South Sumatra, Indonesia. This unit was selected due to the complexity of its service processes, which involve multiple stages, including patient registration, nursing assessment, medical consultation, pharmacy dispensing and compounding, and billing procedures. The multi-stage nature of these processes increases potential operational inefficiencies and non-value-added activities.

PARTICIPANTS AND SAMPLING

The population consisted of 52 professionals and support staff involved in pediatric outpatient service delivery. The study employed a sample size of 46 respondents. While relatively small, PLS-SEM is a nonparametric technique appropriate for exploratory research with limited sample sizes, as model complexity has little influence on the sample size required[18]. A post-hoc power analysis using the Soper calculator (n=46, 3 predictors, R^2=0.878) indicated an observed statistical power of 1.0, exceeding the 80% threshold.

To ensure proportional representation across professional groups, proportionate stratified random sampling was applied. The final sample included pediatricians, nurses, pharmacists, administrative staff, and cashiers, reflecting the multidisciplinary nature of pediatric outpatient services. Participants were required to have at least three months of work experience to ensure sufficient familiarity with operational procedures. Staff who were on leave during the data collection period or who declined to participate were excluded from the study.

DATA COLLECTION AND INSTRUMENTATION

Primary data were collected using a structured self-administered printed questionnaire. The questionnaire was administered in Indonesian to ensure respondents' understanding. The instrument's validity and reliability were evaluated using the Indonesian version. Content validity was qualitatively established via an expert panel review consisting of four experts in healthcare management and pediatrics. Rather than computing quantitative Content Validity Indices (CVI), the panel assessed item relevance, clinical applicability, and contextual clarity. A pilot test involving 15 healthcare staff verified the questionnaire's appropriateness in the local hospital setting, confirming that all items were clearly understood.

Because no substantial modifications to the instrument were required following the pilot test, these initial 15 responses were retained within the final sample (N=46) to maximize statistical power, which is methodologically acceptable in small-population settings. Final empirical validity and reliability were subsequently established through the measurement model evaluation using PLS-SEM. Items presented here were translated into English (Appendix A). The researcher distributed questionnaires directly, providing clarification to ensure accurate completion. Questionnaires were collected immediately upon completion.

The instrument measured four latent constructs: Leadership, Continuous Improvement Culture, Lean Healthcare Implementation, and Service Performance. All items were assessed using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Negatively worded items were reverse coded prior to analysis to ensure consistency in scale direction.

DATA ANALYSIS

Data analysis was conducted using SmartPLS version 4. PLS-SEM was selected due to its suitability for small samples and exploratory models[18, 19], its robustness in handling multiple latent constructs simultaneously, and its appropriateness for predictive research models.

The analysis followed a two-stage approach. First, the measurement model was evaluated to assess construct validity and reliability. Convergent validity was examined using outer loadings and Average Variance Extracted (AVE), while discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability.

Second, the structural model was evaluated to test the hypothesized relationships among constructs. The significance of the path coefficients was determined using a bootstrapping procedure with 5,000 resamples. Statistical significance was determined at a p-value of less than 0.05 and a t-statistic greater than 1.96. The explanatory power of the model was assessed using the coefficient of determination (R^2), while effect size (f^2) and predictive relevance (Q^2) were evaluated to determine the magnitude and predictive capability of the structural relationships.

Finally, given the use of self-reported questionnaires, the potential for Common Method Bias (CMB) was assessed. Harman's single-factor test yielded a variance of 57.2%, slightly exceeding the 50% threshold, indicating the presence of CMB. However, a subsequent assessment of the inner model's collinearity statistics (Full Collinearity VIF) revealed values of 2.043 for Leadership and 2.531 for Continuous Improvement Culture, both of which fall below the strict 3.3 threshold for CMB concern[20]. However, it must be explicitly acknowledged that the VIF for Lean Healthcare (3.740) exceeds Kock's[20] CMB-specific threshold of 3.3. While this value is acceptable under the standard 5.0 threshold for structural collinearity[19], exceeding the 3.3 limit implies that common method variance may partially inflate the variance explained by the Lean Healthcare construct. Consequently, the relationships involving this mediator should be interpreted with caution. These collinearity statistics, combined with the Harman test result, confirm the presence of potential common method bias that must be considered when interpreting the findings.

ETHICAL CONSIDERATIONS

Participation was voluntary. Prior to data collection, respondents were informed about the purpose of the study and assured that their responses would remain confidential and used solely for academic purposes. No personally identifiable information was collected; data were analyzed in aggregate. Formal research permission was granted by the hospital directorate (Reference Number: 2376/DIR/1.4/XI/2025). As a dedicated ethics committee was not available at the site, this directorate approval served as the institutional clearance. An IRB exemption was applied as the study involved minimal risk and no patient-level clinical data.

RESULTS

RESPONDENT CHARACTERISTICS AND DESCRIPTIVE ANALYSIS

A total of 46 staff members directly involved in pediatric outpatient services participated in this study. Table 1 shows the team is predominantly female (87.0%) and mature (71.7% aged 30 or older). Notably, 67.4% possess >3 years of experience, indicating deep understanding of pediatric outpatient workflows and institutional culture, which strengthens the reliability of their assessments. Furthermore, the predominance of pharmacy personnel should be considered when interpreting perceptions of Lean implementation.

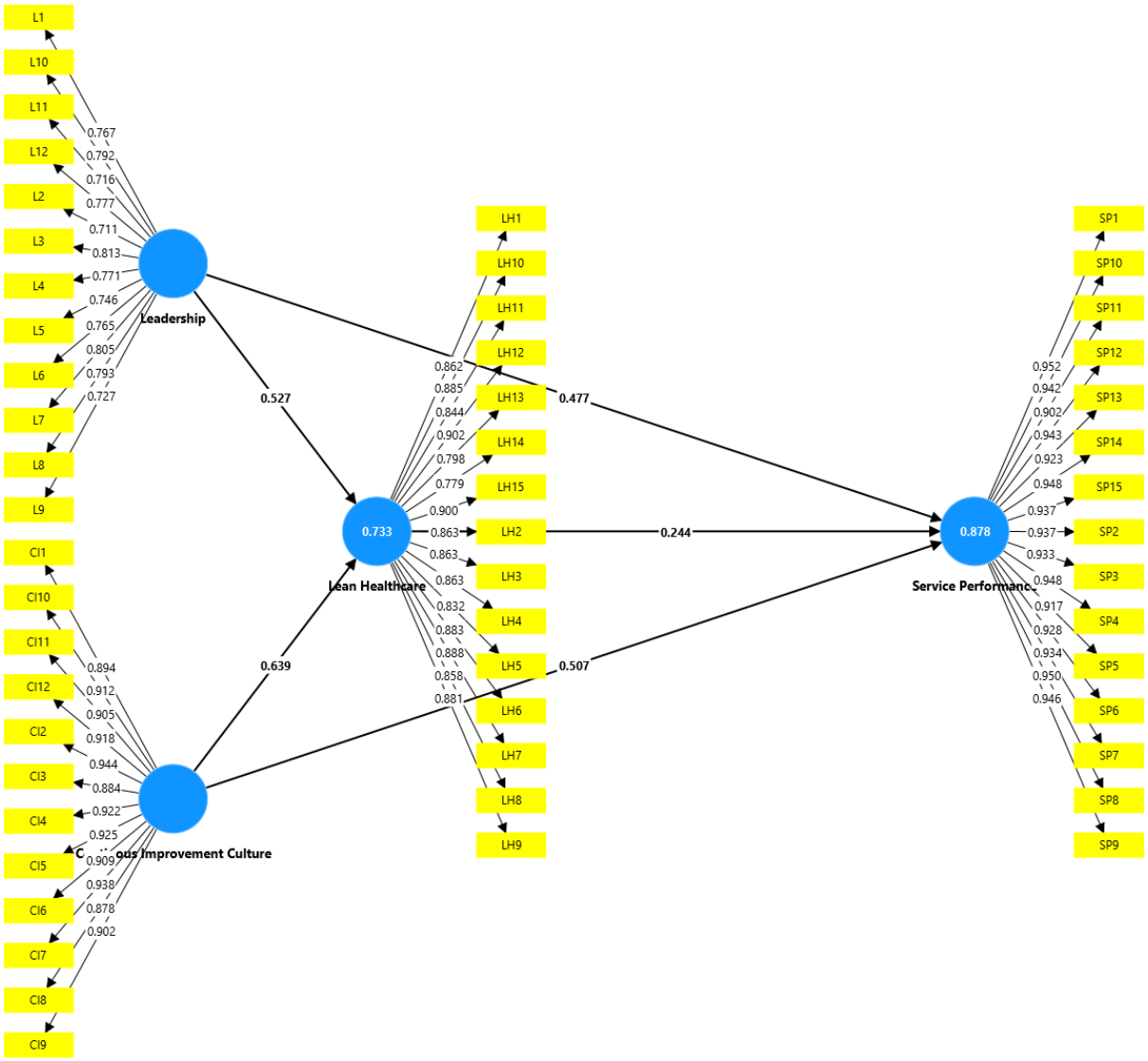
TABLE 1. RESPONDENT CHARACTERISTICS

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	6	13.0
	Female	40	87.0
Age (years)	< 30	13	28.3
	30 – 40	15	32.6
	> 40	18	39.1
Role	Pediatrician	5	10.9
	Pediatric outpatient nurse	4	8.7
	Outpatient administrative staff	8	17.4
	Outpatient cashier	4	8.7
	Outpatient pharmacy staff	25	54.3
Work Experience (years)	< 1	3	6.5
	1 – 3	12	26.1
	> 3	31	67.4

MEASUREMENT MODEL EVALUATION (OUTER MODEL)

Measurement model reliability and validity were evaluated (Figure 1).

FIGURE 1. MEASUREMENT MODEL



This assessment included convergent validity, discriminant validity, and construct reliability using SEM-PLS. As presented in Table 2, all indicators demonstrated strong reliability, with individual loadings exceeding recommended thresholds, confirming the robustness of the measurement model.

TABLE 2. INDIVIDUAL ITEM LOADINGS AND INDICATOR RELIABILITY

Indicator	Loading Factor	Indicator Reliability	Indicator	Loading Factor	Indicator Reliability
Leadership			**Continuous Improvement Culture**		
L1	0.767	0.588	CI1	0.894	0.799
L2	0.711	0.506	CI2	0.944	0.891
L3	0.813	0.661	CI3	0.884	0.781
L4	0.771	0.594	CI4	0.922	0.850
L5	0.746	0.557	CI5	0.925	0.856
L6	0.765	0.585	CI6	0.909	0.826
L7	0.805	0.648	CI7	0.938	0.880
L8	0.793	0.629	CI8	0.878	0.771
L9	0.727	0.529	CI9	0.902	0.814
L10	0.792	0.627	CI10	0.912	0.832
L11	0.716	0.513	CI11	0.905	0.819
L12	0.777	0.604	CI12	0.918	0.843

Indicator	Loading Factor	Indicator Reliability	Indicator	Loading Factor	Indicator Reliability
Lean Healthcare			**Service Performance**		
LH1	0.862	0.743	SP1	0.952	0.906
LH2	0.863	0.745	SP2	0.938	0.880
LH3	0.863	0.745	SP3	0.933	0.870
LH4	0.863	0.745	SP4	0.948	0.899
LH5	0.832	0.692	SP5	0.917	0.841
LH6	0.883	0.780	SP6	0.928	0.861
LH7	0.888	0.789	SP7	0.934	0.872
LH8	0.858	0.736	SP8	0.949	0.901
LH9	0.881	0.776	SP9	0.946	0.895
LH10	0.885	0.783	SP10	0.942	0.887
LH11	0.844	0.712	SP11	0.902	0.814
LH12	0.902	0.814	SP12	0.943	0.889
LH13	0.798	0.637	SP13	0.923	0.852
LH14	0.779	0.607	SP14	0.948	0.899
LH15	0.900	0.810	SP15	0.937	0.878

Furthermore, Table 3 confirms adequate Average Variance Extracted (AVE), while construct reliability was evidenced by high Composite Reliability (CR) scores across all latent variables. While all constructs demonstrated excellent internal consistency, the extremely high reliability coefficients (Cronbach's alpha > 0.97) may indicate potential overlapping item content or redundancy, which should be acknowledged when interpreting the scales. Discriminant validity was rigorously established, as all HTMT values remained below the 0.90 threshold (Appendix B), and all individual item loadings were appropriately higher on their respective constructs than on any competing construct (Appendix C).

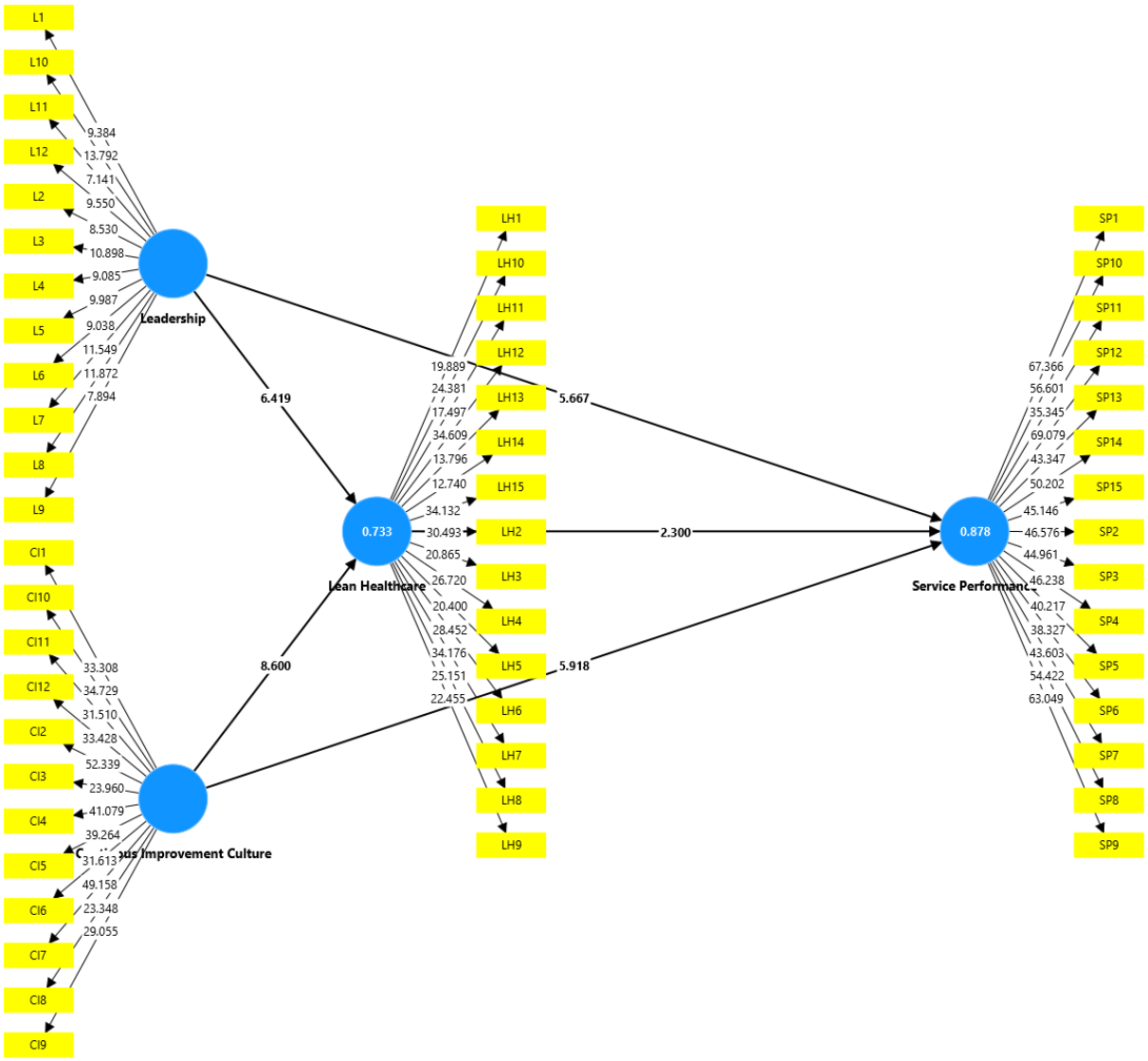
TABLE 3. MEASUREMENT MODEL EVALUATION

Construct	Loading Factor	AVE	Cronbach's Alpha	Composite Reliability
Leadership	0.711 – 0.813	0.587	0.936	0.937
Continuous Improvement Culture	0.878 – 0.944	0.830	0.981	0.983
Lean Healthcare	0.779 – 0.902	0.741	0.975	0.976
Service Performance	0.902 – 0.952	0.876	0.990	0.990

STRUCTURAL MODEL EVALUATION (INNER MODEL)

Following the measurement model validation, the structural model was evaluated to test the research hypotheses. Figure 2 presents path coefficients and R^2 values.

FIGURE 2. STRUCTURAL MODEL



The structural model exhibits substantial predictive capacity and explanatory power (Table 4). The adjusted R^2 values indicate that leadership and continuous improvement culture collectively account for 73.3% of the variance in Lean Healthcare implementation and 87.8% of the variance in Service Performance. The Q^2 values further confirm the model's predictive relevance. The model fit was assessed using the Standardized Root Mean Square Residual (SRMR). The analysis yielded an SRMR value of 0.064, which is well below the recommended threshold of 0.08, indicating a satisfactory model fit[19]. Other fit indices, such as NFI and RMS Theta, were not applicable. Assessment of collinearity (VIF) confirms that the structural relationships are not biased by multicollinearity, as all values remain within acceptable academic limits.

TABLE 4. STRUCTURAL MODEL EVALUATION

Construct	R^2	Q^2
Lean Healthcare	0.733	0.700
Service Performance	0.878	0.849

HYPOTHESIS TESTING

Bootstrapping analysis confirmed that all proposed associations are statistically significant (Table 5). Leadership and continuous improvement culture were identified as powerful predictors of Lean Healthcare implementation. Based on Cohen's[21] benchmarks, where f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects respectively, the observed effect sizes for H1 (f^2 = 1.033) and H2 (f^2 = 1.518) are exceptionally large. These verified values emphasize

that within this specific pediatric outpatient setting, the deployment of Lean practices is heavily and fundamentally dependent on these two structural pillars, which capture a massive portion of its variance. Importantly, Lean Healthcare was found to positively associate with Service Performance, acting as a vital mechanistic pathway.

The mediation analysis further validates that the associations of leadership and culture with service performance are significantly enhanced when operationalized through Lean practices. Specifically, Lean Healthcare serves as a partial mediator, translating managerial and cultural commitment into measurable operational outcomes.

TABLE 5. HYPOTHESIS TESTING RESULT

Hypothesis	β	t	p	f^2	VIF
H1: Leadership → Lean Healthcare	0.527	6.419	< 0.001	1.033	1.005
H2: Continuous Improvement → Lean Healthcare	0.639	8.600	< 0.001	1.518	1.005
H3: Lean Healthcare → Service Performance	0.244	2.300	0.021	0.130	3.740
H4: Leadership → Service Performance	0.477	5.667	< 0.001	0.911	2.043
H5: Continuous Improvement → Service Performance	0.507	5.918	< 0.001	0.828	2.531
H6: Leadership → Lean → Service Performance	0.128	2.070	0.039	—	—
H7: Continuous Improvement → Lean → Service Performance	0.156	2.164	0.031	—	—

DISCUSSION

STATEMENT OF PRINCIPAL FINDINGS

This study examined the relationships among leadership, continuous improvement culture, Lean Healthcare implementation, and service performance in a pediatric outpatient setting. The findings demonstrate that leadership and continuous improvement culture are significantly associated with Lean Healthcare, both individually and simultaneously. Lean Healthcare, in turn, positively relates to service performance. Additionally, leadership and continuous improvement culture exert direct associations with service performance and indirect associations through Lean Healthcare as a mediating variable.

Descriptive findings indicate that leadership was perceived at a moderate level, with strengths in operational involvement but weaknesses in appreciation and recognition practices. Continuous improvement culture was identified as the highest-rated construct among the variables studied, particularly in organizational commitment and routine discussions; however, the problem reporting system and systematic follow-up mechanisms were perceived as less optimal. Lean Healthcare implementation was categorized as moderate, with challenges in standardization and elimination of non-value-added activities. Service performance was also moderate, with waiting time and repeated processes identified as the main concerns. These findings collectively suggest that service performance is significantly influenced by the synergy between managerial behavior and organizational culture[22, 23], establishing the necessary environment for effective Lean implementation and performance outcomes. This study advances current knowledge by empirically demonstrating that leadership and culture are associated with improved operational outcomes through Lean Healthcare.

STRENGTHS AND WEAKNESSES IN RELATION TO OTHER STUDIES

A primary strength of this study is the integration of leadership, organizational culture, and Lean Healthcare into a single empirical model. Unlike previous studies examining these elements in isolation, this study provides a holistic understanding of how managerial factors are operationalized through Lean practices, specifically demonstrating the vital mediating role of Lean Healthcare in a pediatric setting. This theoretical robustness is further supported by the dominant participation of outpatient pharmacy staff, who are directly involved in medication compounding processes that frequently generate waiting time waste. Because pharmacy personnel constituted the largest respondent group, their specific operational perspectives heavily inform the results. From their standpoint, Lean Healthcare is primarily evaluated based on its ability to resolve compounding bottlenecks, streamline prescription clarifications, and manage inventory workflows. Consequently, this underscores that hospital administrators must prioritize pharmacy-specific workflows to effectively alleviate overall pediatric outpatient delays. Having frontline experts as the majority of respondents enhances the operational validity of the findings, as the evaluation comes from the unit most critical to patient flow. Furthermore, the inclusion of experienced staff enhances the credibility of the organizational evaluation.

The results regarding leadership align with previous findings that effective leadership plays a central role in Lean implementation[24]. Leadership that provides clear direction, operational involvement, and consistent communication facilitates Lean adoption[25]. However, this study identified a critical gap: while leaders are operationally involved, their appreciation and recognition of staff remain relatively weak. This is consistent with research emphasizing that a lack of managerial commitment and inconsistent leadership behavior can serve as significant barriers to organizational change and the sustainability of Lean initiatives[24]. Furthermore, leadership functions as a bridge between top management and frontline staff in mobilizing resources and sustaining improvement initiatives[26]. Additionally, the remarkably low HTMT value (0.116) observed between Leadership and Continuous Improvement Culture warrants specific attention. This highly distinct discriminant validity indicates that frontline staff clearly differentiate between individual managerial actions (leadership) and the collective organizational norms (culture). In practice, this suggests that even if overarching cultural commitments are strong, staff still critically evaluate their leaders' specific operational behaviors and recognition practices as an entirely separate entity.

The positive relationship between continuous improvement culture on Lean Healthcare is also consistent with the Kaizen philosophy, which emphasizes incremental improvements embedded in daily routines[27]. Lean is widely described not merely as a productivity tool but as a socio-technical system grounded in continuous improvement culture[28]. Employee engagement and participatory improvement practices are repeatedly identified as essential components of successful Lean transformation[26]. However, this study highlights a "communication bottleneck" in the problem reporting system. While cultural commitment is high, the lack of structured mechanisms for idea integration suggests that cultural readiness alone is insufficient, a challenge also observed in organizations where improvement efforts remain sporadic rather than standardized[29].

Findings support previous studies showing Lean Healthcare contributes to improved operational performance, including reduced waiting times and coordination[9, 10]. Lean aims to eliminate waste, streamline processes, and enhance patient-centered value creation[25]. Although statistically significant, the magnitude of the Lean-performance relationship was moderate, suggesting that additional organizational factors, such as staffing levels, workload distribution, and available technology, may also contribute to service performance. Nevertheless, the mediation analysis reveals that Lean Healthcare serves as a vital mechanism; managerial factors (leadership and culture) are more effective when channeled through systematic Lean practices. This nuance adds to the existing literature by emphasizing the systemic interaction among leadership, culture, and Lean implementation[24].

PRACTICAL IMPLICATIONS FOR MANAGERS AND POLICY MAKERS

Based on the findings, healthcare organizations should prioritize specific actions to foster Lean implementation. Healthcare managers are encouraged to initiate Lean leadership training, conduct daily huddles, and establish continuous quality improvement teams. Specifically, empowering nursing leadership to act as Lean champions at the unit level is highly recommended. Nurse managers should be equipped to actively lead daily huddles and mentor frontline

nursing staff in identifying workflow inefficiencies, thereby bridging the gap between clinical care and operational improvements. Furthermore, to overcome communication bottlenecks and bridge the gap in problem-reporting, the implementation of visual management boards, staff recognition systems, and electronic incident reporting is highly recommended. These practical interventions can help standardize pediatric outpatient workflows and effectively minimize waiting times.

LIMITATIONS AND FUTURE RESEARCH

Despite its contributions, this study has several limitations that should be critically acknowledged. First, the sample size of 46 respondents is relatively small and originates from a single-site pediatric clinic, which may limit the generalizability of the findings. However, PLS-SEM is methodologically robust and effective for analyzing models with smaller sample sizes[19]. Future research should involve multi-center studies across different hospital types to validate these relationships further. Second, the cross-sectional design of this study captures data at a single point in time, which limits the ability to draw definitive causal inferences between the variables. Longitudinal studies are needed to examine how leadership behavior and improvement culture evolve over time and sustain performance outcomes. Third, service performance was measured using self-reported questionnaires, which inherently carry a risk of response or social desirability bias. To enhance methodological robustness, subsequent studies should incorporate objective performance indicators, such as actual patient waiting time data or clinical outcome metrics. Finally, future studies could explore additional mediating or moderating variables, such as digital health integration, to enrich the understanding of pediatric outpatient efficiency.

CONCLUSION

This study confirms that leadership and continuous improvement culture are critical factors associated with Lean Healthcare implementation and service performance in pediatric outpatient services. Findings demonstrate that Lean Healthcare functions as a partial mediator, bridging the gap between managerial commitment and operational outcomes. While leadership and culture are directly associated with performance, their relationship is notably enhanced when operationalized through systematic Lean practices.

However, the study also reveals that the current implementation level remains moderate. Despite high staff commitment, challenges persist regarding inconsistent leadership appreciation and the lack of user-friendly problem-reporting mechanisms. This suggests that technical Lean tools alone are insufficient without the foundational support of responsive leadership and a structured improvement culture.

For healthcare organizations seeking enhanced performance, Lean initiatives must be integrated with leadership and cultural strategies. Future efforts should focus on institutionalizing bottom-up communication to ensure long-term sustainability. These findings reinforce the importance of aligning leadership, culture, and process innovation to achieve sustainable healthcare performance.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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APPENDIX A

MEASUREMENT ITEMS

Construct	Item Code	Dimension	Measurement Item
Leadership	L1	Role Modelling	Leaders serve as role models in discipline and work ethics.
	L2		Leaders demonstrate genuine commitment to improving service quality.
	L3		Leaders consistently apply more efficient work methods in daily activities
	L4	Support & Empowerment	Leaders provide the necessary time, effort, and facilities to support service improvement.
	L5		Leaders encourage staff to share ideas or suggestions for service improvement.
	L6		Leaders rarely give rewards or appreciation for staff contributions to service improvement.*
	L7	Communication & Vision	Leaders clearly explain the direction and goals of service improvement to the staff.
	L8		Leaders provide opportunities for staff to express their opinions or feedback.
	L9		Leaders communicate information regarding changes in service processes openly and clearly.
	L10	Involvement in Problem Solving	Leaders are directly involved in helping to resolve work obstacles in the service unit.
	L11		Leaders actively monitor the implementation of improvement efforts in the service unit.
	L12		Leaders are routinely involved in work evaluation and improvement activities.
Continuous Improvement Culture	CI1	Staff Engagement	Staff actively propose ideas to improve services.
	CI2		Staff are routinely involved in service improvement activities.
	CI3		Staff feel responsible for the quality of services provided.
	CI4	Organizational Commitment	Management shows tangible support for continuous service improvement efforts.
	CI5		Staff suggestions and feedback are followed up by management.
	CI6		Evaluations of service improvement outcomes are conducted routinely in the service unit.
	CI7	Problem Reporting System	The service problem reporting system is easy for all staff to use.
	CI8		Service problems are handled quickly by superiors.
	CI9		The results of service improvement activities are rarely recorded or documented properly.*
	CI10	Learning & Standardization	Routine discussions or briefings are held to evaluate staff work experiences.

Construct	Item Code	Dimension	Measurement Item
	CI11		Work errors are considered learning opportunities rather than occasions to blame individuals.
	CI12		New work methods are established as standards after process improvements.
Lean Healthcare	LH1	Standardized Work	Existing work procedures are easy for staff to understand.
	LH2		Work procedures are applied consistently in daily services.
	LH3		There are still differences in work methods among staff when performing tasks.*
	LH4	Waste Reduction	Efforts to reduce unnecessary work are carried out continuously.
	LH5		Staff are able to identify parts of the work that waste time or effort.
	LH6		There are tangible efforts to reduce patient waiting times.
	LH7	Value Stream Mapping & Flow Optimization	Service flows are reviewed and improved to be simpler and more efficient.
	LH8		Patient service flow has become smoother after process improvements.
	LH9		Unnecessary movement of patients or staff still occurs frequently.*
	LH10	Visual Management	Information about service flow is displayed clearly and is easy to understand.
	LH11		Visual cues (such as information boards or signs) help staff in their work.
	LH12		Work process non-conformities can be easily identified through visual cues.
	LH13	Continuous Improvement	Performance evaluations are conducted routinely to encourage service improvement.
	LH14		Staff are involved in activities to improve or enhance work methods.
	LH15		Work standards are updated after process improvements are made.
Service Performance	SP1	Waiting Time	Service waiting times meet the established standards.
	SP2		Current patient waiting times are shorter than before.
	SP3		Service delays still occur frequently.*
	SP4	Accuracy & Responsiveness	Services are provided on time according to the designated schedule.
	SP5		Healthcare workers respond to patient needs quickly.
	SP6		Service errors still occur frequently.*
	SP7	Work Efficiency	Work coordination among staff goes well.
	SP8		Patient and staff movements occur efficiently.
	SP9		Repetitive and unnecessary work is reduced.

Construct	Item Code	Dimension	Measurement Item
	SP10	Waste Minimization	Wasted time in the service process is minimized.
	SP11		Equipment and documents are available on time so as not to hinder services.
	SP12		Work errors that cause waste rarely occur.
	SP13	Service Quality	The services provided meet quality standards.
	SP14		Staff provide services in a consistent manner.
	SP15		The clinic quickly adapts its services to meet patient needs.

* Indicates reverse-coded items

APPENDIX B

DISCRIMINANT VALIDITY (HTMT)

Construct	Leadership (X1)	Continuous Improvement Culture (X2)	Lean Healthcare (Y)	Service Performance (Z)
Leadership (X1)				
Continuous Improvement Culture (X2)	0.116			
Lean Healthcare (Y)	0.592	0.687		
Service Performance (Z)	0.673	0.712	0.873	

APPENDIX C

DISCRIMINANT VALIDITY (CROSS-LOADINGS)

Indicator	Leadership	Continuous Improvement Culture	Lean Healthcare	Service Performance
Leadership				
L1	0.767	0.056	0.354	0.539
L2	0.711	0.140	0.499	0.494
L3	0.813	0.000	0.365	0.428
L4	0.771	0.025	0.375	0.501
L5	0.746	0.025	0.506	0.472
L6	0.765	0.092	0.478	0.549
L7	0.805	0.010	0.365	0.528
L8	0.793	0.132	0.480	0.572
L9	0.727	0.132	0.511	0.502
L10	0.792	-0.035	0.467	0.479
L11	0.716	-0.097	0.365	0.405
L12	0.777	0.104	0.428	0.477
Continuous Improvement Culture				
CI1	0.047	0.894	0.568	0.625
CI2	-0.020	0.944	0.578	0.595
CI3	0.036	0.884	0.542	0.601
CI4	0.076	0.922	0.675	0.691
CI5	0.028	0.925	0.601	0.614
CI6	0.088	0.909	0.684	0.650
CI7	0.055	0.938	0.612	0.668
CI8	0.022	0.878	0.575	0.553
CI9	0.107	0.902	0.615	0.652
CI10	0.157	0.912	0.681	0.709
CI11	0.043	0.905	0.608	0.633
CI12	0.099	0.918	0.617	0.684
Lean Healthcare				
LH1	0.476	0.548	0.862	0.734
LH2	0.509	0.599	0.863	0.763
LH3	0.471	0.579	0.863	0.740
LH4	0.419	0.589	0.863	0.681
LH5	0.471	0.549	0.832	0.683
LH6	0.524	0.564	0.883	0.728
LH7	0.567	0.504	0.888	0.740
LH8	0.600	0.475	0.858	0.757
LH9	0.497	0.619	0.881	0.760
LH10	0.422	0.726	0.885	0.785
LH11	0.392	0.656	0.844	0.740
LH12	0.506	0.622	0.902	0.780
LH13	0.508	0.479	0.798	0.734
LH14	0.476	0.575	0.779	0.673
LH15	0.542	0.619	0.900	0.776

Indicator	Leadership	Continuous Improvement Culture	Lean Healthcare	Service Performance
Service Performance				
SP1	0.684	0.667	0.850	0.952
SP2	0.624	0.672	0.828	0.937
SP3	0.593	0.654	0.798	0.933
SP4	0.554	0.694	0.806	0.948
SP5	0.531	0.741	0.841	0.917
SP6	0.646	0.597	0.771	0.928
SP7	0.574	0.664	0.763	0.934
SP8	0.634	0.644	0.779	0.950
SP9	0.612	0.695	0.827	0.946
SP10	0.613	0.651	0.778	0.942
SP11	0.633	0.537	0.812	0.902
SP12	0.635	0.673	0.823	0.943
SP13	0.609	0.654	0.804	0.923
SP14	0.614	0.639	0.805	0.948
SP15	0.599	0.703	0.770	0.937