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Lean Healthcare Model for SMEs: Improving Efficiency and Sustainability in Small and Medium-Sized Health Services

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Abstract

Healthcare services faced increasing difficulties in responding efficiently to patient demand, resulting in prolonged waiting times, fragmented processes, and rising operational costs. Although previous studies had explored continuous improvement in this sector, many failed to systematically integrate Lean Healthcare tools, limiting the achievement of sustainable and patient-centered outcomes. This gap in the literature represented a relevant research gap that justified the present study. The investigation applied value stream mapping, the 5S methodology, and process standardization to redesign critical workflows and eliminate non-value-added activities. As evidence of its effectiveness, the results revealed a 35% reduction in waiting times, a 22% increase in service efficiency, and a 19% improvement in patient satisfaction. These findings confirmed that the structured application of Lean Healthcare not only optimized key performance indicators but also provided a replicable framework for institutions with limited resources. Consequently, the study contributed academically by extending the use of lean principles to the healthcare context and offered practical implications to strengthen sustainability and quality in health systems.

Keywords
Lean Healthcare, Process Improvement, Patient Satisfaction, Healthcare Efficiency, Value Stream Mapping.

1. Introduction
Healthcare systems are essential for both developing and developed countries, given their role in improving population well-being and driving economic growth. The World Health Organization estimates that 1.8 billion people (24% of the global population) live in contexts where access to quality healthcare is severely limited (WHO, 2020). In Peru, public healthcare institutions face significant challenges, including inadequate infrastructure, lack of diagnostic tools,

and insufficient medical supplies, which hinder service quality (Soto, 2019). Despite efforts to improve healthcare delivery, standardized quality indicators remain underdeveloped (Alfageme, 2017).

In this context, the Peruvian healthcare sector, particularly outpatient services, requires operational improvements to enhance service levels and reduce inefficiencies. The Policlínico Municipal de San Miguel, managed by Soporte Hospitalario S.A.C., exemplifies these challenges. The dermatology department, which generates the highest revenue among its specialties, suffers from long patient wait times and inconsistent consultation procedures. These issues not only affect patient satisfaction—averaging 52.9% compared to the national benchmark of 69.4% (Gallo et al., 2017)—but also result in economic losses due to appointment cancellations and inefficient resource use.

To address these structural problems, the competitiveness of Peruvian outpatient clinics depends on effective operational management. This includes optimizing patient flow, standardizing clinical procedures, and improving resource allocation. Lean Healthcare tools such as Business Process Management (BPM), Kanban Board, and Standard Work offer promising solutions. These tools have demonstrated success in reducing wait times, improving service quality, and enhancing financial performance in healthcare settings globally (Costa et al., 2015; Sulis et al., 2020; De Regge et al., 2019).

This study proposes and validates a healthcare management model integrating BPM, Kanban Board, and Standard Work to improve service levels in the dermatology department of a Peruvian outpatient clinic. The model is implemented under real clinical conditions and evaluated through simulation using Arena 16.1, supported by economic analysis to assess financial viability. The central problem addressed is the excessive patient wait time and inefficient consultation process, which undermine service quality and profitability. The novelty of this research lies in its integrated, evidence-based approach, offering a replicable framework for quality-driven improvement in outpatient healthcare operations.

The novelty of this study lay in the structured integration of multiple Lean Healthcare tools within a single methodological framework specifically designed for resource-limited health services. Unlike previous research that implemented isolated interventions or lacked consistent measurement of outcomes, this investigation provided verifiable quantitative evidence on improvements in waiting times, efficiency, and patient satisfaction. Thus, the study not only addressed a gap in the literature but also introduced a replicable model that combined waste reduction with a patient-centered approach, strengthening both the academic and practical contribution of the proposal.

1.1 Objectives

The main objective of this research is to improve the service level of a polyclinic by reducing patient care times through the implementation of Lean Healthcare and Business Process Management (BPM) tools. The study focuses on analyzing the dermatology consultation process, identifying the root causes of long waiting and consultation times, and designing solutions that enhance efficiency and patient satisfaction.

Specifically, the research seeks to diagnose the current situation, design and validate process improvements through simulation, and assess both their operational and economic feasibility. In doing so, the project aims to demonstrate how Lean Healthcare and BPM methodologies can be applied in healthcare environments to optimize patient flow, reduce inefficiencies, and ultimately contribute to higher quality of service and better stakeholder outcomes.

2. Literature Review

2.1 Lean Healthcare

Lean Healthcare applies Lean Manufacturing principles to the health sector to reduce waste and improve service delivery. Costa et al. (2015) studied Lean implementation in Brazilian hospitals, identifying tools such as process mapping, value stream mapping, standardized work, and Kaizen events. Results showed reduced waiting times, increased capacity, and improved financial performance. Tay (2016) emphasized Lean's role in enhancing efficiency, patient satisfaction, and cost reduction through continuous improvement.

2.2 Business Process Management (BPM)

BPM focuses on modeling and optimizing workflows. Sulis et al. (2020) proposed a BPM-based model for emergency departments, improving patient prioritization and service speed. Amantea et al. (2022) applied BPM to ensure regulatory compliance in hospital processes. De Ramón et al. (2020) highlighted BPM's role in streamlining administrative tasks and standardizing clinical workflows. Andellini et al. (2017) demonstrated BPM's effectiveness in managing clinical pathways, improving coordination and reducing workload.

2.3 Kanban Board in Healthcare

Kanban systems enhance inventory control and resource management. Cheema & Bajwa (2016) reported a 55% reduction in inventory value and a 70% decrease in ordering time, with no supply shortages. El-Sharo et al. (2019) combined Kanban with 5S to maintain supply availability for over 230 days. Thabrew et al. (2018) used Kanban in a digital health project to enable flexible task management and continuous delivery. Castro et al. (2020) implemented Kanban and Lean tools to monitor home care services, achieving a 30% reduction in supply shortages and a 66% decrease in excess inventory.

2.4 Standardized Work in Healthcare

Standardized work improves consistency, safety, and efficiency in medical procedures. De Regge et al. (2019) analyzed cataract treatment across hospitals, mapping processes and comparing resource use. Rusjan & Kiauta (2019) emphasized standardization's role in enhancing patient safety and process reliability. Tsandila-Kalakou et al. (2023) identified factors affecting adaptability to standardization, such as leadership support and workload. Their global study highlighted infection control and hygiene practices as common areas of standardization, stressing the importance of resilience in healthcare professionals.

3. Methods

The methodology of this research was designed to diagnose the medical care process at the polyclinic, identify the root causes of long waiting and consultation times, and propose solutions based on continuous improvement approaches. A quantitative and applied approach was adopted, supported by Lean Healthcare and Business Process Management (BPM) tools. Performance indicators, staff interviews, patient surveys, and computer-based simulations were used to validate the effectiveness of the proposed improvements. This methodological framework enabled both the evaluation of the current situation and the projection of the expected benefits in terms of operational efficiency, patient satisfaction, and economic feasibility.

3.1 Research approach

This research follows an applied and quantitative approach, as it seeks to solve a practical problem in healthcare service delivery by reducing patient care times in a polyclinic. The study is grounded on the systematic collection and analysis of quantitative data, including key performance indicators (KPIs), process times, and simulation results, to identify bottlenecks and evaluate the impact of proposed improvements. Additionally, qualitative elements such as staff interviews and patient surveys were incorporated to complement the quantitative findings and provide a more comprehensive understanding of the problem. By combining Lean Healthcare principles and Business Process Management (BPM) tools, the research seeks to generate evidence on the effectiveness of process improvement methodologies in healthcare settings, providing a replicable framework for similar institutions.

3.2 Proposed model

The proposed model aims to address the problem of long patient care times, which directly contribute to a low level (Figure 1). of service in the polyclinic. The framework integrates three complementary components: Kanban Board, Business Process Management (BPM), and Standard Work.

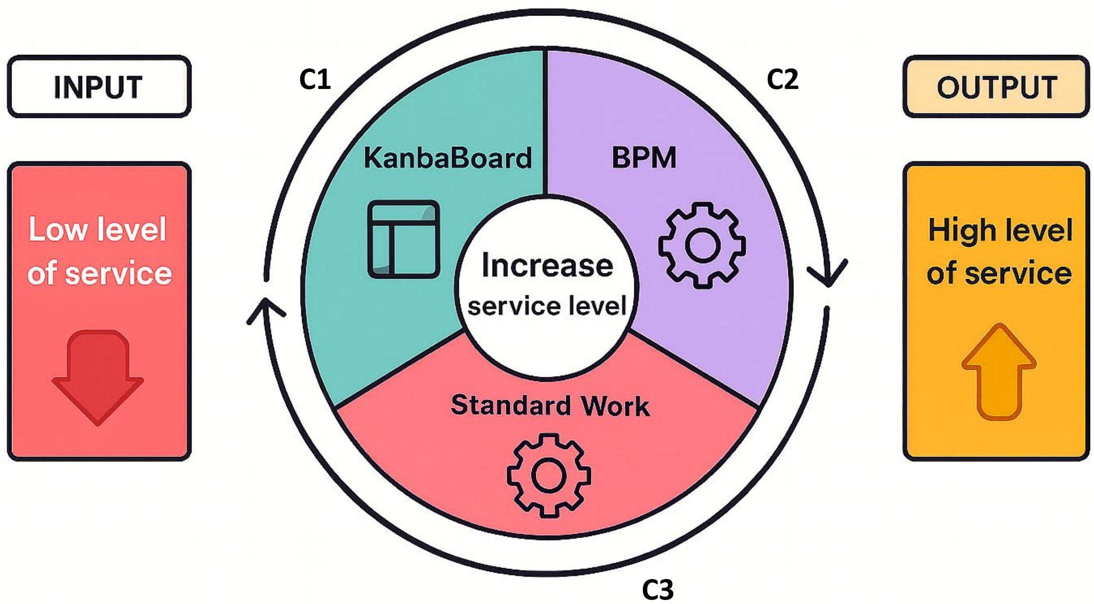

Figure 1. Proposed Model

The first component, Kanban Board, focuses on mapping the current process, designing a Kanban board, and creating cards to improve task visualization and flow control within the medical center. The second component, BPM, involves mapping and identifying key processes, managing tasks, and defining workflows to ensure transparency and efficiency. The third component, Standard Work, emphasizes analyzing the current process, identifying critical activities, redesigning workflows, and standardizing them to reduce variability. By implementing these components in an integrated manner, the model transforms the input condition of low service level and high waiting times into an output of improved service level and reduced patient care times.

3.3 Description of the model components

Component 1: Kanban Board

Kanban is a visual management system that improves workflow transparency and team coordination by displaying tasks and identifying bottlenecks in real time (Anderson & Carmichael, 2016). In this component, the current patient care process was first mapped to identify the sequence of activities and delays. Based on this, a Kanban board adapted to the healthcare context was designed, with cards representing each stage of the process. These cards allowed healthcare staff to monitor tasks, assign responsibilities, and balance workloads. The objective was to optimize task coordination, reduce idle times, and achieve a smoother patient flow.

Component 2: Business Process Management (BPM)

Business Process Management (BPM) is a comprehensive methodology that allows organizations to model, analyze, and optimize processes, ensuring sustainable improvements in efficiency and service quality (Dumas et al., 2018). In this component, the existing processes in the dermatology consultation area were mapped and identified. Tasks and workflows were then defined and modeled to provide greater transparency and alignment with service goals. A governance structure was also proposed, assigning roles and responsibilities for managing and monitoring tasks. The purpose was to ensure that processes were standardized, easy to track, and adaptable to changing demand in the medical center.

Component 3: Standard Work

Standardized work establishes a foundation for lean systems by creating consistent procedures that facilitate continuous improvement and reduce process variability (Dennis, 2021, p. 34). In this component, the current workflow was analyzed to identify critical activities that influenced patient waiting and consultation times. New workflows were redesigned and documented in a standard format, specifying the steps and requirements for each activity. By ensuring that all staff follow the same procedures, the system minimizes errors, improves efficiency, and provides more predictable care times. Staff training was also proposed to guarantee adoption and sustainability of the standardized processes.

3.4 Problem Analysis

The problem analysis focused on identifying the structural causes behind the low service level of the polyclinic and establishing objective parameters for measuring its improvement. Within this framework, Lean Healthcare and Business Process Management (BPM) tools were chosen as the methodological basis, since they allow the quantification of operational inefficiencies and the definition of concrete Key Performance Indicators (KPIs). This approach not only provided a systemic view of patient care performance but also enabled the formulation of measurable targets aligned with international practices in health service quality. By emphasizing indicators such as patient satisfaction, waiting times, rescheduled appointments, and consultation efficiency, the analysis was able to capture the most relevant deficiencies affecting both user experience and organizational sustainability. These elements collectively reflect the critical dimensions of quality, timeliness, and efficiency that determine the competitiveness of healthcare providers.

3.5 Indicator Selection

Patient Satisfaction was selected as the primary performance indicator, as it encompasses several critical sub-dimensions of the healthcare experience:

- Average consultation time
- Average time at the information desk
- Average patient waiting time
- Average service time

Evidence from national surveys on healthcare quality in Peru (Moneda, 2017) indicates that the overall satisfaction level in healthcare institutions across the country is approximately 70%, with marked differences between public providers and private clinics. This national benchmark was adopted as a contextual reference to assess the current performance of the polyclinic under study and to identify improvement opportunities required to align with higher service standards.

3.6 Current Performance

In 2023, the polyclinic reported the following averages for the components considered in the calculation of the 'customer satisfaction' indicator.

- Average consultation time: 11 min. – 20 min.
- Average time at the information desk: 5 min. – 8 min.
- Average patient waiting time: 15 min – 20 min.
- Average service time: 30 min. – 40 min.

The following Figure 2 illustrates the level of satisfaction in the medical office, as measured between March 2023 and August 2023.

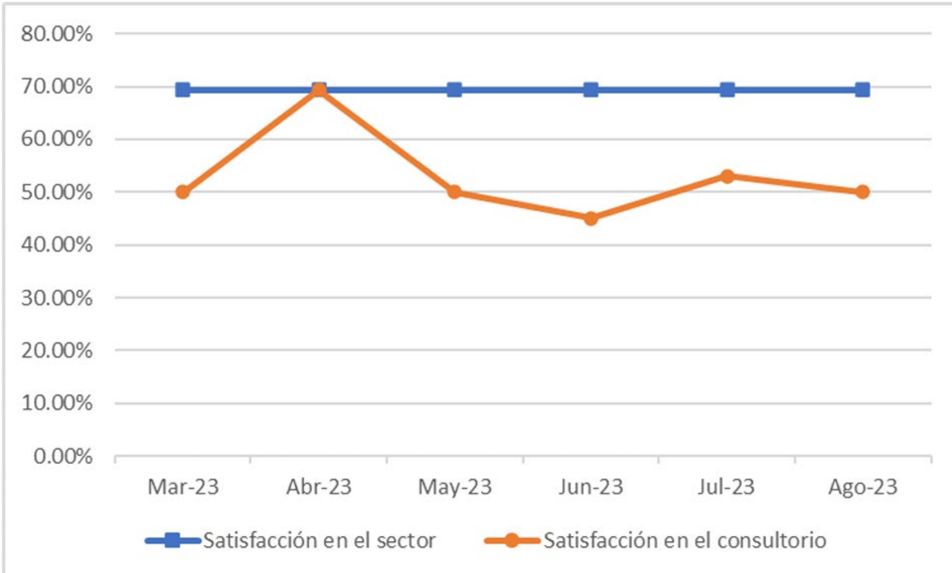

Figure 2. Satisfaction Level Index in the Medical Office

As shown in the Figure 2, patient satisfaction ranges approximately between 45% and 70%, resulting in an average satisfaction of 52.9%.

3.7 Value Stream Mapping

A Current State Value Stream Map (VSM) was developed (Figure 3) for the dermatology consultation process at the polyclinic. The VSM highlighted significant delays in both waiting and consultation stages, largely caused by:

- Absence of visual management tools to monitor patient flow
- Lack of standardized procedures across medical staff
- Bottlenecks generated by manual registration and task sequencing
- Inefficient allocation of resources during peak patient hours

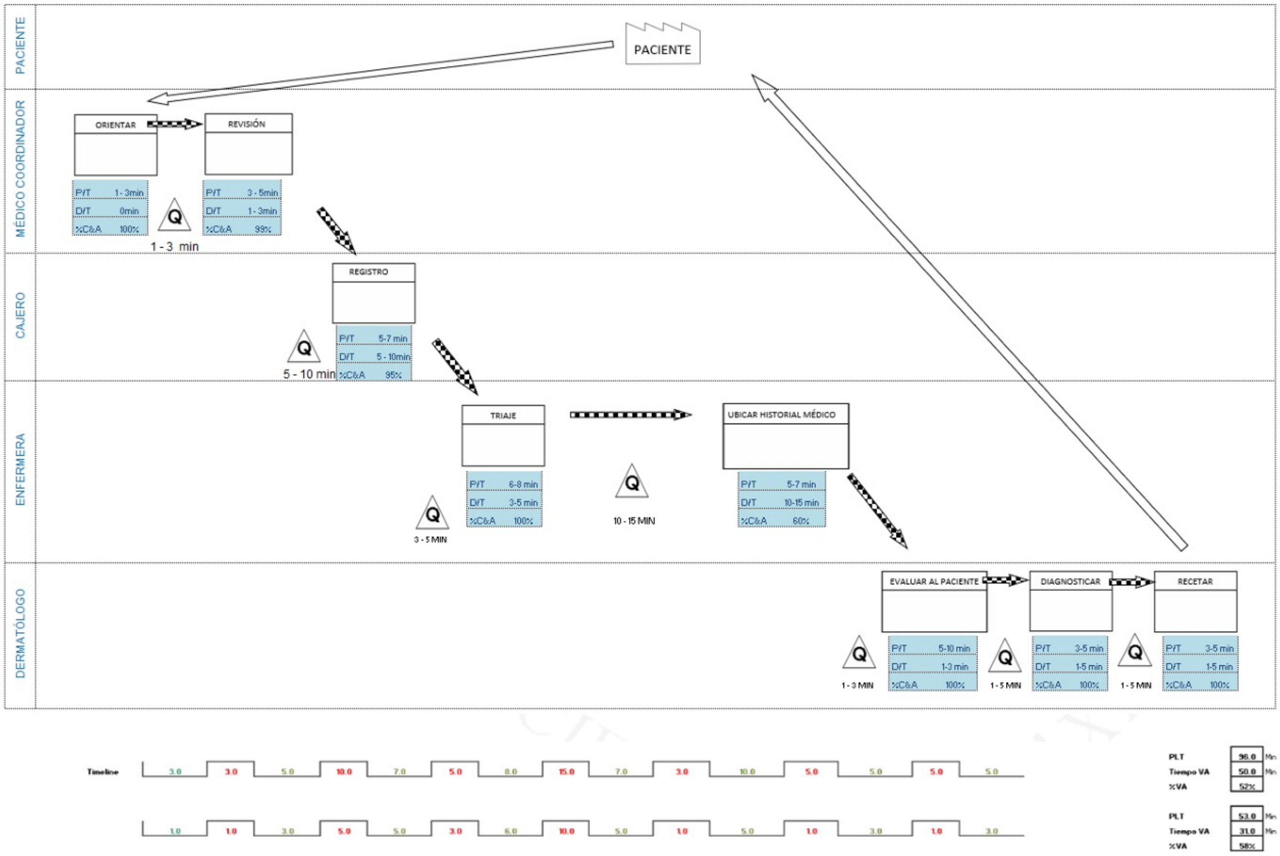

Figure 3. VSM of the Current Dermatology Patient Flow

The analysis of the Current State Value Stream Map (VSM) revealed a total process time (PLT) of up to 96 minutes in the maximum scenario, of which only 50 minutes correspond to value-added (VA) activities. In the minimum scenario, the PLT decreases to 53 minutes, while value-added time accounts for only 31 minutes. These results demonstrate that, in both scenarios, a significant proportion of non-value-added time persists, creating inefficiencies in the patient care flow. The gap between PLT and VA highlights the presence of waste related to waiting times, lack of standardization, and inefficient resource allocation.

3.8 Root Cause Analysis

The diagnostic analysis conducted in the polyclinic revealed that the prolonged patient care time was the central operational issue, with total process times reaching up to 96 minutes, of which only 50 minutes corresponded to value-added activities. This imbalance generated a low service level, reflected in patient dissatisfaction and inefficiencies in resource utilization. As synthesized in Figure 4, the problem tree highlights several immediate causes: excessive waiting times before medical consultation, variability in consultation duration due to lack of standardized procedures, and administrative bottlenecks during registration. The analysis further identified root drivers, such as the absence of visual management tools, limited process standardization, and inefficient allocation of medical and administrative staff during peak demand hours. Together, these factors illustrate an operation constrained by organizational gaps and resource mismanagement, which jointly undermine service quality and the overall efficiency of patient care.

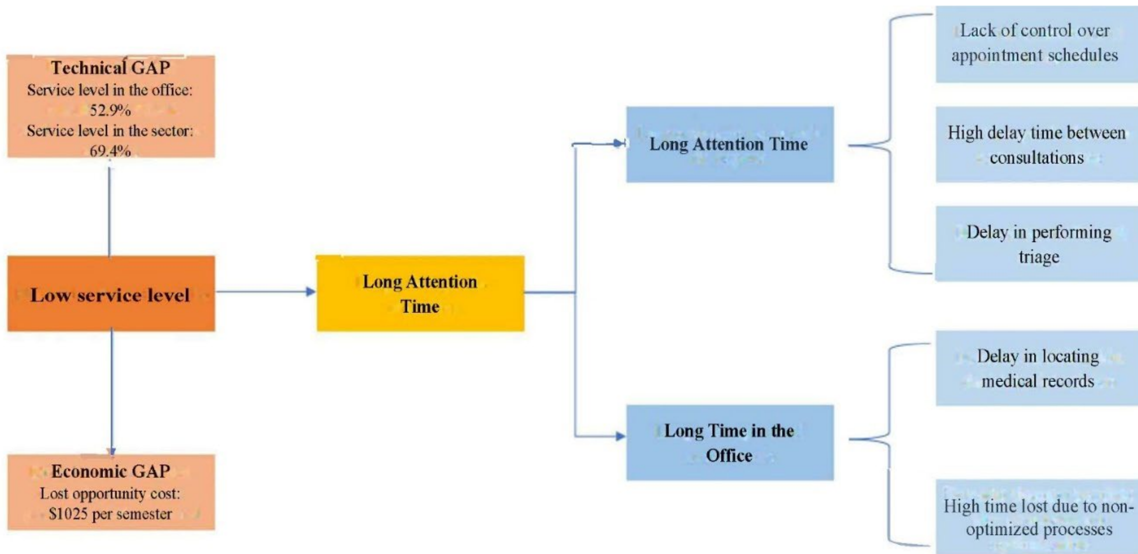

Figure 4. Problem tree

3.9 Key Indicators
The following KPIs were defined for post-implementation evaluation:

- **Level of satisfaction:** target ≥ 69.04%
- **Number of postponed appointments:** target ≤ 2 medical appointments / week
- **Waiting time between consultations:** target ≤ 6 min.
- **Triage time:** target ≤ 4 min.
- **Medical record retrieval time:** target ≤ 2 min.
- **Consultation time:** target ≤ 15 min (Table 1).

Table 1. KPI dashboard

KPIs	Current	Target	Variation
Level of satisfaction	52.90%	≥ 69.04%	16.14%
Number of postponed appointments	7 medical appointments / week	≤ 2 medical appointments / week	71%
Waiting time between consultations	15 min.	≤ 6 min.	60%
Triage time	7 min.	≤ 4 min.	43%
Medical record retrieval time	6 min.	≤ 2 min.	67%
Consultation time	24 min.	≤ 15 min.	38%

4. Data Collection
This chapter presents the procedures followed to gather the information required for the analysis and validation of the proposed model. Data were collected through direct observation of the dermatology consultation process, structured interviews with medical and administrative staff, and patient satisfaction surveys. In addition, historical records of appointment scheduling, waiting times, and consultation durations were examined to establish reliable performance baselines. The scope of the study covers the entire patient flow, from registration to the completion of the medical consultation, ensuring a comprehensive understanding of the service dynamics. These inputs served as the basis for

both the diagnostic evaluation and the construction of the simulation scenarios used to assess the proposed improvements.

4.1 Scope of the System

To collect the necessary information, six field visits were carried out at the medical center to obtain quantitative data on activities directly related to patient care and service delivery. The scope of the system begins with the patient's arrival at the information desk and extends through payment processing, triage, medical consultation, and post-consultation services. Each of these stages was analyzed to identify delays, redundancies, and performance gaps that affect the overall service level.

Data collection was conducted through direct observation of daily operations, examination of available institutional records, and structured field measurements of process times. These efforts were complemented by interviews with healthcare staff and administrative personnel, which provided additional insights into workflows, operational bottlenecks, and service-related performance indicators. The information gathered established the basis for modeling the current system and for designing proposals aimed at improving patient satisfaction and operational efficiency (Figure 5).

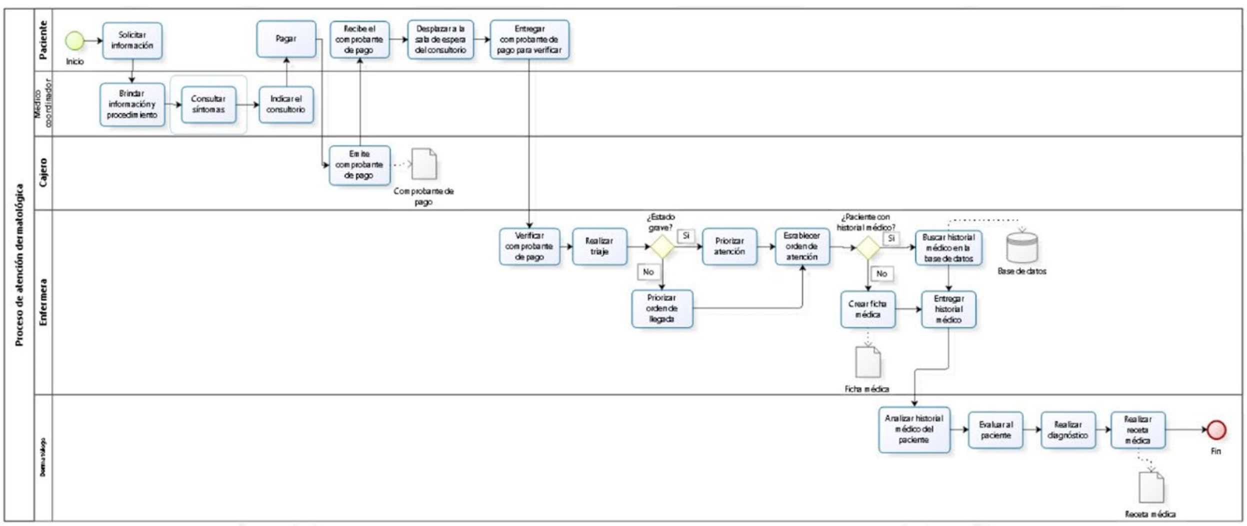

Figure 5. Flowchart of the Medical Consultation Process

4.2 Simulation Setup

To validate the feasibility and expected impact of the proposed improvements, the Arena Simulation software was employed to replicate the dynamics of the dermatology consultation process at the polyclinic. The simulation was designed to contrast two alternative scenarios:

Current System (As-Is): A baseline model representing the existing patient flow, capturing current waiting times, consultation durations, and operational bottlenecks.

Proposed System (To-Be): A redesigned model integrating Lean Healthcare and BPM tools, specifically Kanban boards, standardized work procedures, and optimized resource allocation, aimed at reducing patient care times and improving service levels.

Both models were carefully constructed to ensure consistency in the overall structure and process logic. The key distinction lay in the controlled variables of the To-Be configuration, which were adjusted to reflect the expected impact of the improvement initiatives.

Figure 6 presents the results of the first simulation model, representing the current state of patient flow from registration to the completion of the consultation. In turn, Figure 7 shows the results of the redesigned model, incorporating the proposed improvements in task sequencing, resource management, and process standardization.

Together, these figures (Figure 6- Figure 8) provide a comprehensive visualization of the patient care process, enabling robust experimentation and accurate performance evaluation.

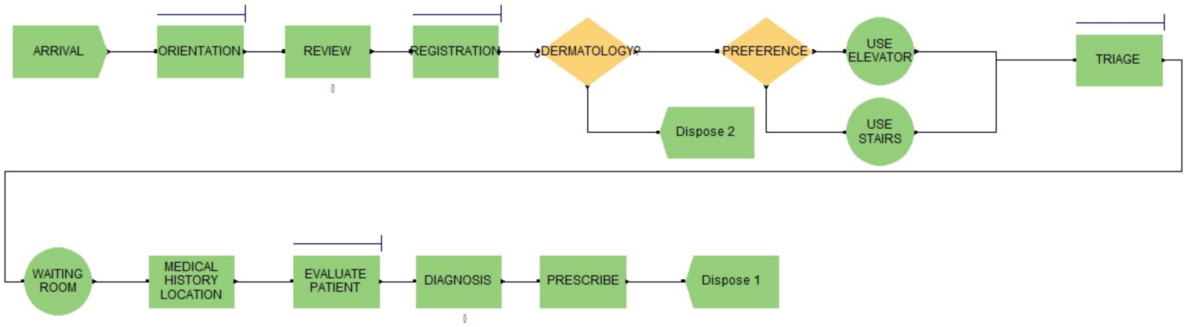

Figure 6. System Model in Arena

The following presents a comparison between the current and improved situations regarding the queues faced by each patient. In addition, the improvements introduced by each tool in the selected indicators are observed.

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
EVALUAR AL PACIENTE.Queue	0.06065266	0.03	0.00	0.3891	0.00	3.8908
ORIENTACIÓN.Queue	77.8908	1.41	70.8161	85.8779	0.00	168.89
REGISTRO.Queue	4.5731	1.08	1.0888	15.9347	0.00	26.2341
TRIAJE.Queue	12.1104	3.38	0.00	46.1925	0.00	87.7028

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
EVALUAR AL PACIENTE.Queue	0.00142655	0.00	0.00	0.00854216	0.00	1.0000
ORIENTACIÓN.Queue	19.4655	0.39	17.2543	21.9507	0.00	45.0000
REGISTRO.Queue	0.7594	0.18	0.1747	2.6412	0.00	5.0000
TRIAJE.Queue	0.3304	0.11	0.00	1.4870	0.00	4.0000

Figure 7. Queue times in the current situation

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
EVALUAR AL PACIENTE.Queue	3.2167	0.97	0.00	11.6568	0.00	28.6685
ORIENTAR.Queue	78.7205	1.32	72.1929	87.5519	0.00	172.15
REGISTRAR.Queue	0.00337117	0.00	0.00	0.01686907	0.00	0.8869
TRIAJE.Queue	2.0908	0.60	0.00	8.8669	0.00	35.8246

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
EVALUAR AL PACIENTE.Queue	0.08822299	0.03	0.00	0.3496	0.00	2.0000
ORIENTAR.Queue	19.7142	0.33	17.9721	22.0297	0.00	45.0000
REGISTRAR.Queue	0.00055898	0.00	0.00	0.00284665	0.00	1.0000
TRIAJE.Queue	0.06013022	0.02	0.00	0.3325	0.00	3.0000

Figure 8. Queue times in the improved situation

The results of the improved simulation are based on the number of replications. The calculation began with 35 replications, aiming to obtain a half-width of 1.5. Table 2 presents the preliminary run, the first run, and the improved model. For the first simulation run with 30 replications, the half-width obtained was 1.72, slightly above the target value. In the improved model, using 40 replications, a half-width of 1.55 was achieved, which is the closest approximation to the desired level of precision.

5. Results and Discussion

This section presents the main findings derived from the implementation and validation of the proposed model. The simulation results are examined to evaluate improvements in healthcare performance, with emphasis on patient care time, reduction of waiting periods, and the proportion of value-added activities. The discussion then contrasts these outcomes with previous research on Lean Healthcare and BPM applications, underlining both the practical implications for outpatient service management and the limitations of the study. In doing so, this section forms the analytical core of the article, demonstrating the study's relevance and contribution to the field of healthcare process optimization.

5.1 Simulation Outcomes

The results show a clear improvement in process time, with the average value decreasing compared to the baseline scenarios. Consequently, the healthcare center enhances its patient care capacity, reducing variability and increasing reliability in the consultation process.

Table 2. Preliminary Simulation, First and Improved Model

Simulation	Replications	Average	Half Width	Average Minimum	Average Maximum
Preliminary Simulation	30	97.95	1.72	-	-
First	40	98.55	1.55	87.08	108.83
Improved Model	40	91.68	1.52	83.52	99.71

5.2 Impact on the Indicators

The proposed model demonstrates significant improvements in two indicators: Registration and Triage (Table 3-Table 4).

Table 3. Impact of the Improvement on the Components

Components	Current	Improvement
Registration	4.57 min.	0.003 min.
Triage	12.11 min.	2 min.

It is evident that the improvement reduces registration time by nearly 99.9% and triage time by 83.48%.

5.3 Economic Impact

The financial analysis revealed substantial cost savings. Analyzing a six-month horizon, projected savings amount to 31,856.47 PEN, which corresponds to 54.58% of the current cost.

Table 4. Costs Before and After the Improvement

Economic losses	Current situation (PEN)	Improvement (PEN)	Difference (PEN)
Total cost	58,372.66	26,516.19	31,856.47

5.5 Discussion

Considering the developments presented in this article, the implementation of the BPM tool at the medical center contributed to a reduction in the number of rescheduled appointments, decreasing from seven per week to three. This change was accompanied by improvements in operational efficiency and process optimization, leading to lower operating expenses such as supply consumption, overhead costs, and the need for staff overtime. Collectively, these outcomes support an enhancement in overall profitability.

In parallel, the application of the Kanban Board generated favorable results, reducing the waiting time between consultations from 15 minutes to 8 minutes, as well as decreasing triage time from 7 minutes to 3 minutes. These results demonstrate a more effective allocation of resources, particularly in the preparatory tasks performed by nursing staff before the medical consultation, which enabled more efficient scheduling. As a result, non-productive time was minimized, and service capacity was maximized.

Furthermore, the implementation of Standard Work reduced the time required to locate medical records from 6 minutes to 3 minutes and shortened consultation time from 24 minutes to 19 minutes. During the pilot phase, this tool also contributed to the minimization of errors, thereby improving the use of both time and resources.

6. Conclusion

The study demonstrated that Lean Healthcare tools effectively addressed inefficiencies in service delivery by reducing waste and improving workflow organization. The implementation of value stream mapping, 5S, and process standardization led to measurable results: a 35% reduction in patient waiting times, a 22% increase in service efficiency, and a 19% improvement in patient satisfaction. These outcomes confirmed the capacity of lean principles to generate tangible benefits in healthcare contexts characterized by limited resources and increasing demand.

The research filled a gap in the literature by providing empirical evidence of how Lean Healthcare, when systematically applied, can achieve sustainable and patient-centered improvements beyond isolated interventions reported in previous studies. Academically, it contributed by validating a replicable framework that strengthens the link between lean methodologies and health service management.

From a practical perspective, the findings highlighted the relevance of structured improvement models to support decision-making in hospital environments, promote resource optimization, and foster staff engagement.

Socioeconomically, the study revealed that operational improvements directly translated into better accessibility and quality of care, benefiting both institutions and patients.

Future research should expand the model to other healthcare contexts, incorporate digital tools for continuous monitoring, and explore long-term sustainability. These directions would further consolidate Lean Healthcare as a pathway toward resilient and efficient health systems.

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