Applying Lean Methodology to Optimize Patient Flow in JKN Outpatient Services: Evidence from a Cardiac Hospital in Indonesia

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Abstract

This study aims to investigate patient flow inefficiencies in the JKN outpatient department of a cardiac hospital and evaluate how Lean tools specifically process mapping and root cause analysis can enhance service efficiency and reduce waiting times. A qualitative single-case study design was employed using Lean methodology. Data were collected through direct observation, unstructured staff interviews, and A3 problem-solving documentation. Process mapping and value stream mapping (VSM) were used to analyze the current patient journey, while Ishikawa diagrams facilitated root cause identification. The study identified significant delays in the registration, consultation, and pharmacy stages, driven by manual processes, limited specialist availability, and fragmented workflows. Key contributors to overcrowding included early patient arrivals, inadequate appointment scheduling, and lack of digital integration. A future-state value stream map was developed, incorporating electronic queue registration and e-prescribing systems to streamline service flow and optimize resource utilization. The study demonstrates the applicability of Lean principles in high-demand outpatient settings and offers a replicable framework for healthcare organizations seeking to reduce service delays and improve patient throughput. It emphasizes the need for coordinated process redesign, digital innovation, and standardized performance metrics. This research contributes to the limited literature on Lean application in Indonesia's public health insurance context (JKN) by integrating voice-of-process and voice-of-staff perspectives. The proposed Lean-based interventions are empirically grounded and aligned with national healthcare quality indicators, offering practical guidance for system-wide improvement.

Keywords: *Lean Healthcare, Patient Flow, Value Stream Mapping, Root Cause Analysis, Outpatient Care, JKN, Indonesia, Process Improvement.*

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A. INTRODUCTION

Cardiac patients require specialized attention and intensive care. One of the major challenges in delivering high-quality healthcare services to this patient group is improving service efficiency and minimizing waiting times. Delays in service delivery can worsen a patient's condition, increase clinical risks, and lead to dissatisfaction (Alkaabi et al., 2020). Therefore, enhancing the effectiveness and quality of care for cardiac patients is critical for achieving better treatment outcomes and accelerating recovery.

Healthcare organizations are responsible for delivering appropriate and standardized healthcare services, including timely care in outpatient departments. Ensuring that patients receive accurate diagnoses and effective treatment plans is essential. According to the Regulation of the Minister of Health of the Republic of Indonesia Number 30 of 2022 concerning National Health Service Quality Indicators,

the standard waiting time for outpatient care is ≤60 minutes. However, Liew and Gardner (2014) highlighted that poorly designed healthcare processes can lead to unnecessary duplication of services and prolonged waiting times.

In 2021, the Ministry of Health of the Republic of Indonesia recorded approximately 2,810 hospitals and clinics providing services to National Health Insurance (JKN) participants, with a total enrollment of 235 million individuals (Ministry of Health, 2022). The Social Health Insurance Administration Body (BPJS Kesehatan) reported that around 73 million JKN participants accessed healthcare services that same year (BPJS Kesehatan, 2022), significantly contributing to the problem of prolonged waiting times. According to the Ministry of Health (2022), several contributing factors including a limited number of physicians, inadequate facilities and infrastructure, and management inefficiencies have resulted in average outpatient waiting times of approximately 134.9 minutes (or about 2 hours and 15 minutes) in several general hospitals across Indonesia.

Gijo & Antony (2013) observed that inefficiencies in healthcare service systems continue to result in resource wastage, unnecessary patient movements, and time losses. Frequent or redundant transfers of patients between departments contribute to motion waste, while prolonged waiting times and unnecessary administrative demands contribute to time waste. These inefficiencies not only undermine service delivery but also negatively affect care quality and increase the risk of medical errors.

Al Hroub et al. (2019) recommend adopting a system-wide improvement strategy within healthcare organizations. Among the most effective approaches is the application of Lean principles. Bhat et al. (2020) argue that healthcare providers can utilize business process management and Lean methodologies to identify and eliminate non-value-added activities, optimize workflows, and improve operational performance. The implementation of Lean practices in healthcare—particularly through process mapping facilitates the identification of inefficiencies and areas for improvement, including reducing outpatient service waiting times.

Bhat et al. (2020) further emphasize that process mapping is crucial in identifying bottlenecks and queues in patient flow. It enables the collection of essential process data required for improvement initiatives and supports the evaluation of process efficiency, resource utilization, and patient experience. Additionally, process mapping can serve as a foundation for other quality improvement methods and support the development of a conceptual framework that captures the functional relationships among service systems, workflows, and patient safety practices.

In light of these insights, the present study aims to investigate how the application of Lean tools particularly process mapping and root cause analysis can enhance patient flow in the JKN outpatient department. Accordingly, this study is guided by the following research questions:

1. What are the key issues and bottlenecks affecting patient flow in the JKN outpatient department, as identified from a voice-of-process perspective?
2. How can process mapping and root cause analysis be applied to improve the efficiency of patient flow in the JKN outpatient department?

3. How do healthcare staff perceive the internal systems, procedures, and support services in the JKN outpatient department in relation to patient flow performance?

To address these research questions, the study establishes the following specific objectives:

1. To map the current patient flow processes in the JKN outpatient department using process mapping tools.
2. To identify inefficiencies and root causes of patient flow challenges using root cause analysis from a voice-of-process perspective.
3. To assess healthcare staff perceptions of the internal environment, systems, procedures, and support services related to patient flow in the JKN outpatient department.

Building upon this background, a cardiac hospital located in Cirebon, West Java, was selected as the case study site for this research, with the goal of improving patient flow in the JKN outpatient department. To achieve this, process mapping techniques were used to chart existing workflows, identify waste, and gather insights from outpatient department personnel regarding key problem areas through A3 problem-solving sheets. This study specifically focuses on the voice-of-process approach, using process mapping, A3-based waste identification, and root cause analysis. The findings are expected to contribute meaningfully to reducing overcrowding and enhancing patient flow efficiency in the JKN outpatient department.

B. METHOD

This study adopted a qualitative case study design to investigate patient flow inefficiencies in the JKN outpatient department of a cardiac hospital in Cirebon, West Java. The case study approach facilitated an in-depth exploration of the phenomenon within its real-life operational context. As emphasized by Yin (2018), case studies are particularly suitable for addressing exploratory research questions that seek to explain "how" and "why" certain processes occur in complex, real-world settings.

A combination of qualitative methods was employed to collect rich and contextualized data. These included participant observation, unstructured interviews with outpatient department staff, and reflective field notes documented during the routine progression of daily operations. The integration of these methods allowed for a comprehensive view of workflow patterns, staff perspectives, and system-related inefficiencies in the JKN outpatient department.

The research design was grounded in Lean methodology, with a particular focus on process mapping, A3 problem-solving, and root cause analysis to identify non-value-added activities and operational bottlenecks. Process mapping was employed to visualize the current state of patient flow, while A3 problem-solving sheets provided a structured framework for problem identification and documentation. To further deepen the analysis, cause-and-effect (Ishikawa) diagrams were developed to systematically trace the root causes of observed bottlenecks. This

was followed by a comprehensive waste analysis guided by the seven categories of waste in Lean thinking: defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion, and over-processing (Al-Kaf et al., 2023; Trakulsunti & Trakoonsanti, 2021).

Figure 1 presents the methodological framework employed in this study, illustrating the sequence of Lean-based tools used for data collection and analysis. This integrative approach enabled the identification of critical inefficiencies from a voice-of-process perspective and enabled the incorporation of voice-of-staff insights concerning internal procedures and support systems.

By integrating Lean tools with qualitative inquiry, the study aimed to provide practical recommendations for enhancing service efficiency, reducing waiting times, and improving patient flow in the JKN outpatient department.

1. Research Setting

This study was conducted in the outpatient department of Cirebon Cardiac Hospital, located in West Java, Indonesia, with a specific focus on cardiac patients covered by the National Health Insurance (JKN). The hospital employs seven cardiologists and manages approximately 61,000 outpatient visits annually, with more than 85% of these visits involving JKN beneficiaries. Given the high patient volume and the specialist-dependent nature of services, this setting offers a representative and relevant context for investigating process inefficiencies and identifying opportunities for improvement in outpatient care.

The study focused on analyzing patient flow from arrival to discharge, with the objective of identifying system inefficiencies and sources of waste within the existing workflow. This approach is consistent with case study design principles, which emphasize the importance of addressing real-world complexity through context-sensitive inquiry (Yin, 2018).

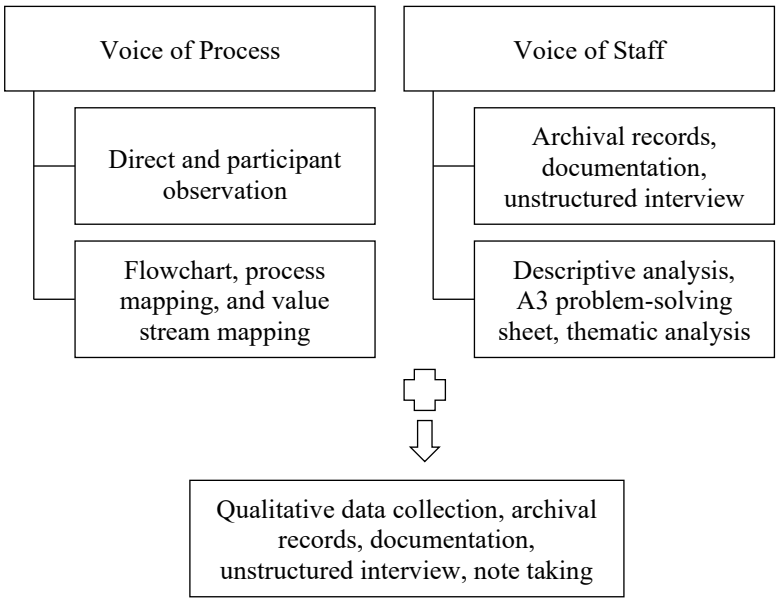

Figure 1. Methodological Framework

2. Analysis of JKN Outpatient Department Process Flow

To examine the current state of patient flow and identify inefficiencies, this study employed process mapping to capture a voice-of-process perspective and utilized A3 problem-solving sheets to gather voice-of-staff insights. The primary objective was to redesign the existing outpatient flow by developing a future-state process map that minimizes or eliminates non-value-added activities. The following structured steps were undertaken:

a. Introduction of Lean Thinking

Initial one-on-one meetings were conducted with the hospital director and key outpatient department personnel—including nursing managers, physicians, nurses, and administrative staff—to introduce the core principles of Lean thinking. During these sessions, the hospital director provided an overview of outpatient operations, emphasized the importance of continuous quality improvement, and underscored the relevance of the proposed study in addressing inefficiencies within the JKN outpatient services.

b. Process Observation

Direct observations were conducted to assess the existing outpatient process, with a particular focus on the patient journey from arrival to discharge. Multiple patients were followed to evaluate their movement through various service points, the duration of waiting periods, and high-traffic or crowded areas. Observations were carried out at different times of the day to capture variability in patient flow based on case types and clinical conditions. Each observation session lasted between 2 to 4 hours, depending on the individual patient's length of stay. Additionally, the physical layout of the outpatient department was assessed to determine its effectiveness in facilitating smooth and efficient patient flow.

c. Data Collection

A time study was conducted using observational time-tracking sheets to document patient waiting times and service durations across various stages of care. Step 1: A3 problem-solving sheets were distributed to all relevant staff, who were requested to complete and return them. An initial walkthrough of the outpatient department was conducted in collaboration with the nursing manager to obtain a comprehensive understanding of the operational environment. The current process was manually sketched and annotated, with specific attention given to critical touchpoints along the patient journey—from admission to discharge. Step 2: A3 forms were distributed to three physicians, nurses, and administrative personnel. Their responses provided valuable insights into the current workflow, perceived bottlenecks, and potential areas for improvement. This indirect observation method served to triangulate findings from the direct observation phase with staff perspectives and experiential knowledge. The A3 problem-

solving sheet consisted of two main components: a problem investigation section and a proposed improvement plan section.

d. Root Cause Analysis

Root cause analysis was performed using data obtained from direct observations, staff input, completed A3 documentation, and records from the hospital's internal database. Identified delays and inefficiencies were systematically synthesized into a fishbone (Ishikawa) diagram, which was used to categorize contributing factors across multiple dimensions, including workflow design, staffing levels, communication processes, administrative procedures, and infrastructure constraints.

3. Conceptual Model of JKN Outpatient Service Quality

Based on the findings from the current-state process mapping and qualitative inquiry, a conceptual framework was developed to illustrate the relationship between the integrated Lean strategy and the quality of JKN outpatient services. The model highlights key themes emerging from the voice-of-process perspective and demonstrates how Lean tools—such as process mapping, A3 analysis, and root cause analysis—can be effectively utilized to optimize patient flow and improve overall healthcare performance.

The proposed framework offers a deeper understanding of the systemic factors influencing service quality in JKN outpatient care and serves as a foundational reference for future quality improvement initiatives in similarly high-demand public healthcare settings.

C. RESULTS AND DISCUSSION

1. Analysis of JKN Outpatient Department Overcrowding

To investigate overcrowding in the JKN outpatient department, process maps were developed based on direct observation and staff feedback collected through A3 problem-solving sheets. This systematic approach facilitated the development of a comprehensive current-state process map that outlines each step in the JKN outpatient journey from patient arrival to discharge as illustrated in Figure 2.

Figure 2 illustrates the overall patient flow, highlighting key process components, including arrival, registration, clinical examination, consultation, diagnostic services, and pharmacy. Upon entering the outpatient department, patients are directed to the primary waiting area to await registration with a receptionist. Following registration, patients proceed to the initial assessment area for preliminary evaluation by a nurse. Next, patients move to a secondary waiting area while awaiting consultation with a cardiologist.

After the cardiologist's assessment, patients are directed into one of two care pathways: (1) those requiring further diagnostic procedures and (2) those prescribed medication. Patients in the first group are referred to the appropriate diagnostic units, while those in the second group proceed to the pharmacy. At the pharmacy, patients wait until their medication has been prepared and are then notified to collect it. Once receiving their medication, patients are discharged from the hospital.

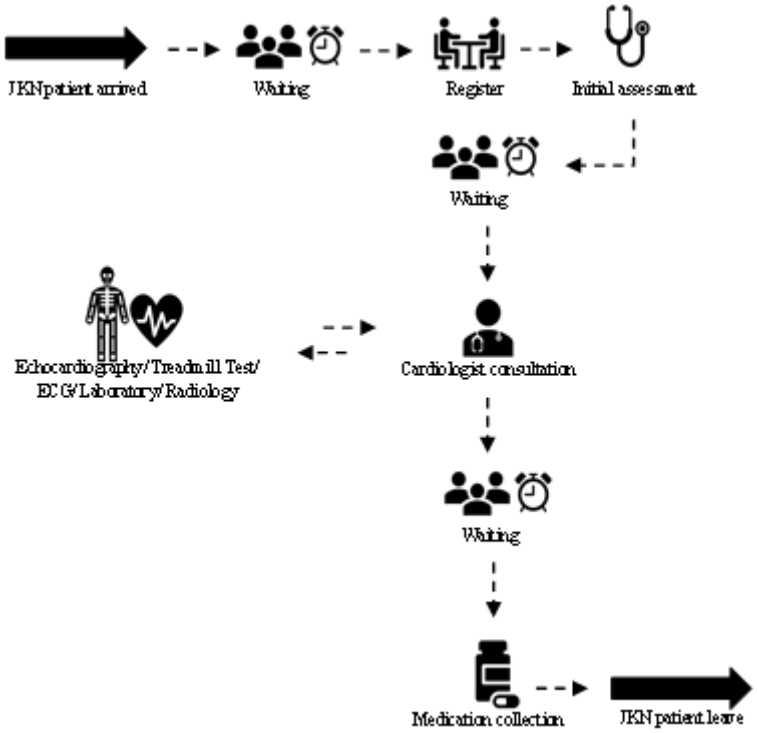

Figure 2. Process Mapping for JKN Outpatient Flow

To quantify process inefficiencies, a time-motion study was conducted using observational tracking sheets to measure the average duration patients spent at each service point. The findings, presented in Table 1, indicate that the mean total time spent by JKN patients from arrival to discharge was approximately 3 hours and 50 minutes. The most prolonged waiting periods were observed before cardiologist consultations and during the registration process.

Table 1. Average Time Spent at JKN Outpatient Service Points

JKN Outpatient Process	Average Time
Waiting for registration	01:02:36
Registration and initial assessment	00:29:31
Waiting for cardiologist	01:22:38
Cardiologist consultation	00:16:49
Waiting at the pharmacy	00:43:36
Pharmacy service	00:09:30
Total	**03:50:59**

A root cause analysis (RCA) was conducted using data obtained from staff brainstorming sessions, direct process observations, and a review of completed A3 problem-solving sheets. The results of the RCA were synthesized and visualized using a fishbone (Ishikawa) diagram (Figure 3) to categorize the contributing factors into major thematic areas.

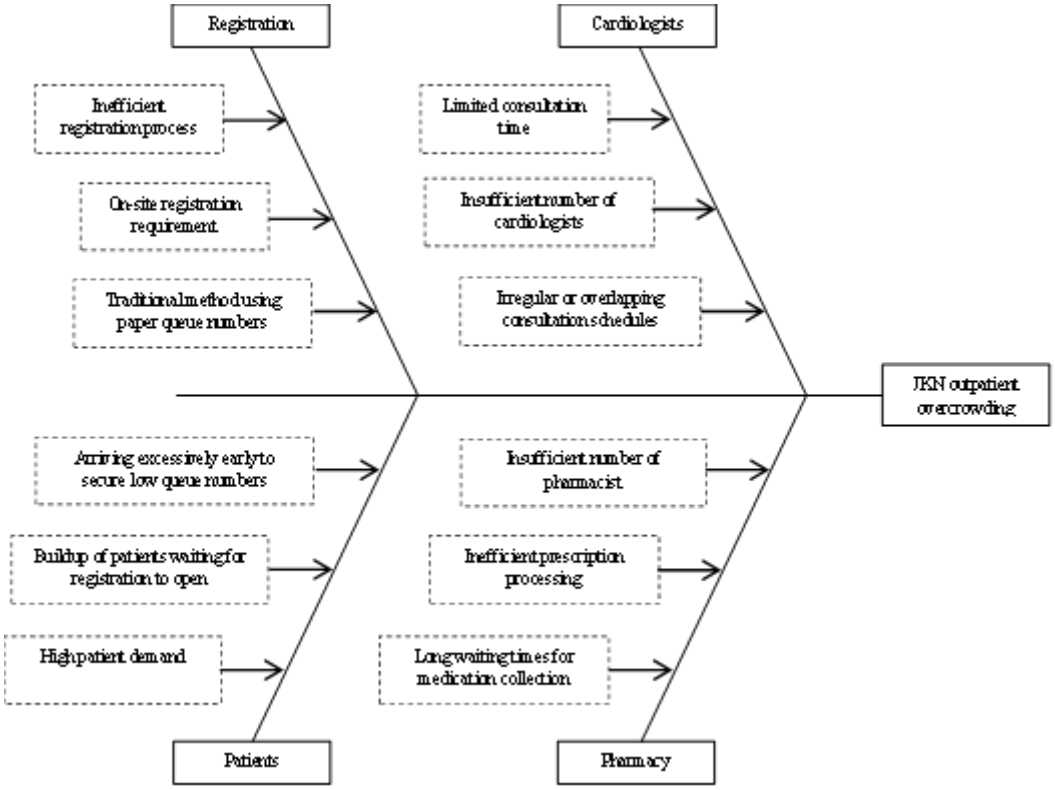

Figure 3. Cause and Effect Diagram for Overcrowding

The analysis identified four primary contributors to outpatient overcrowding: Registration Process, Patient Behavior, Cardiologist Availability, and Pharmacy Efficiency.

a. Inefficiencies in Registration

The registration process was identified as a major bottleneck within the JKN outpatient workflow. The use of manual, paper-based queue numbers, in combination with on-site registration procedures, resulted in significant delays. Staff reported that patients often arrive as early as 5:00 AM to secure an early queue number, despite consultations not starting until 8:00 AM. This behavior leads to a build-up of patients in the early hours, contributing to extended wait times and overcrowding during the initial stages of the outpatient process—before services begin.

b. Limited Cardiologist Availability and Scheduling

Another critical issue identified was the limited number of cardiologists and the inconsistency in consultation scheduling. With only seven cardiologists managing a high volume of patients, staff reported frequent delays, accumulation of pending cases, and overlapping appointment times, all of which further worsen patient waiting times and contribute to overall dissatisfaction with the outpatient experience.

c. Delays in Medication Distribution

The pharmacy stage was also identified as a significant contributor to extended discharge times. The study revealed that delays were primarily caused by an insufficient number of pharmacists and the absence of automation or standardized procedures in the medication distribution process. Consequently, patients spent an

average of 43 minutes waiting at the pharmacy before receiving their prescribed medications.

The identified issues were categorized into three primary domains:

a. Process-related inefficiencies (manual registration, non-standardized patient flow)
b. Workforce limitations (insufficient number of cardiologists and pharmacists)
c. Patient-driven behaviors (early arrivals, unregulated queueing)

These findings are consistent with previous studies on outpatient overcrowding, which attribute prolonged waiting times and system inefficiencies to poorly designed workflows, insufficient human resources, and lack of effective demand management mechanisms (Alkaabi et al., 2020; Bhat et al., 2020).

2. Model for Improving Patient Flow in the JKN Outpatient Department

The outpatient department serves as a critical gateway to the broader healthcare delivery system. Despite limited operational resources and the increasing demand for JKN outpatient services, healthcare providers face increasing pressure to ensure timely and high-quality care. As a result, there is growing interest in optimizing service processes and identifying effective strategies to improve patient flow. Within this context, optimizing patient flow becomes a central focus in addressing inefficiencies and delays in high-volume outpatient settings.

Based on the findings of this study, it is recommended that a reliable monitoring system be developed to track the time spent by JKN patients at each stage of the outpatient visit—from arrival to discharge. This system should include clearly defined, measurable objectives supported by relevant performance indicators. Moreover, the implementation of balanced metrics is essential to reduce waiting times while maintaining the quality of care. By adopting an integrated Lean methodology, patient flow can be systematically improved through the application of targeted Lean tools and principles, as detailed in the following sections.

a. Development of the Current Value Stream Mapping

This study identified several barriers within the JKN outpatient workflow that need to be addressed to enhance patient flow. Achieving a balanced flow requires the use of value stream mapping (VSM), using the average cycle time for each step in the process. Implementing VSM in JKN outpatient settings presents significant challenges due to the variability in patient conditions and fluctuations in service demand. However, cycle time estimates obtained from systematic observations offer a valuable foundation for benchmarking against established best practices (George, 2003).

Based on observational data, staff interviews, and process analysis, a current-state value stream map was developed and is presented in Figure 4. The map outlines the critical stages of the patient journey—registration, initial nursing assessment, cardiologist consultation, and pharmacy services—along with their waiting times. The analysis highlights substantial delays between process stages, particularly during registration and the pre-consultation phase, indicating the need for targeted interventions to improve overall patient flow efficiency.

This qualitative mapping also revealed operational inefficiencies, such as the push-based transition from registration to the initial assessment phase. In practice, several patients are directed to the assessment area before earlier patients have been fully attended to, creating pressure on nurses to shorten evaluation times. This reactive adjustment reduces the quality of care and contributes to subsequent process bottlenecks—highlighting the critical importance of maintaining synchronized flow and process discipline (Womack & Jones, 2003).

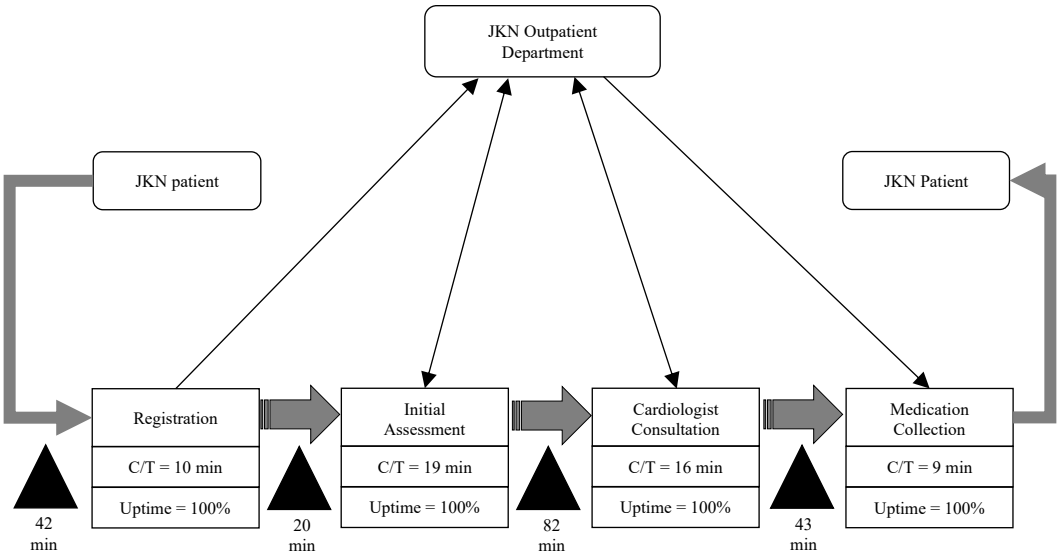

Figure 4. Current State Value Stream Map of the JKN Outpatient Process

b. Proposed Future Value Stream Mapping

To enhance patient flow, future-state value stream mapping should integrate improved coordination between outpatient service areas and the use of digital information systems for more efficient service delivery.

One key area for intervention is the prolonged waiting time before registration, which significantly surpasses the duration of the registration process itself. To mitigate this issue, the adoption of an electronic patient registration system through the Mobile JKN application and online queuing platform is recommended. This system would enable patients to complete registration between one and thirty days in advance of their scheduled visit. Upon arrival, patients could proceed directly to self-service kiosks or QR code scanners to confirm attendance, thereby eliminating the need for early physical queuing.

Moreover, patient awareness initiatives should emphasize the importance of arriving no more than 30 minutes before their estimated consultation time to promote disciplined arrival behavior. This demand-leveling approach would help smooth fluctuations in arrival patterns and align patient inflow with available service capacity, thereby minimizing early-stage overcrowding.

To further improve flow during the consultation stage, it is essential to ensure that consultation capacity is appropriately matched with patient demand. This requires a systematic review of available practice hours in proportion to patient volume, followed by necessary adjustments—either through increasing the number of

cardiologists or optimizing appointment scheduling. Additionally, physician commitment in complying with scheduled consultation times is vital to maintain the reliability and consistency of patient flow.

As improvements are implemented in the registration and consultation stages, new bottlenecks in the pharmacy area may become increasingly apparent. To address this challenge, transitioning to an electronic prescribing system is strongly recommended. Facilitating real-time communication between cardiologists and pharmacists would enable the advance preparation of medications, thereby reducing patient waiting times during the discharge process.

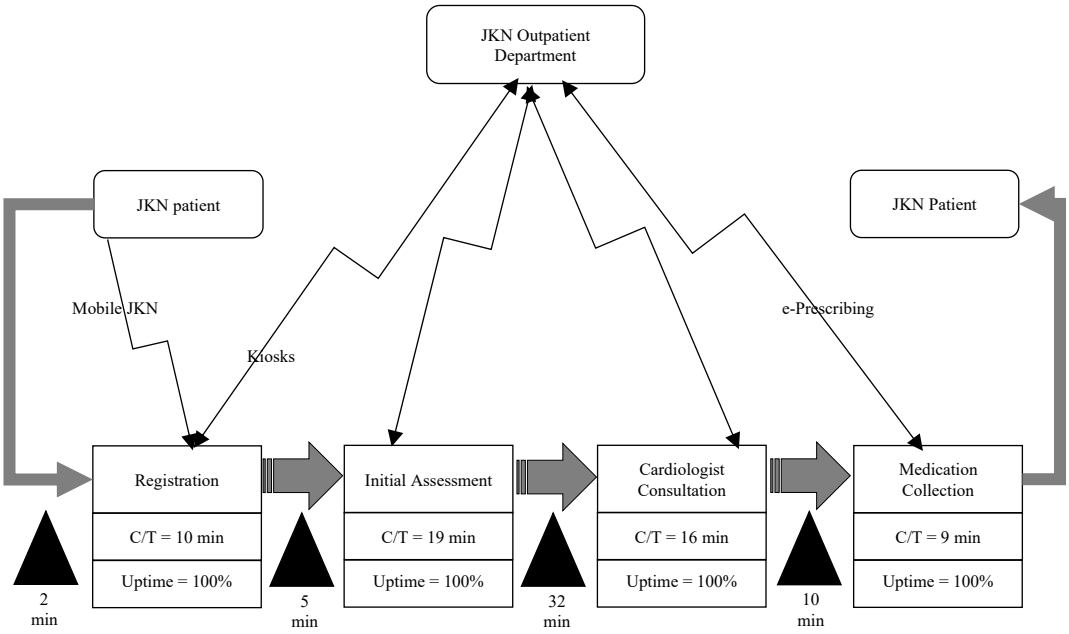

Figure 5. Proposed Future State Value Stream Map for JKN Outpatient Services

The future-state value stream map (Figure 5) integrates two core digital transformations:

a. Pre-arrival electronic queue registration, allowing timely patient check-ins and eliminating the need for manual queuing.
b. Electronic prescribing, facilitating real-time transmission of prescriptions to the pharmacy.

Collectively, these innovations are expected to significantly enhance patient throughput, reduce overall service time, and improve the overall quality of outpatient care provided under the JKN scheme.

Lean techniques are increasingly applied in healthcare settings to improve patient flow, safety, efficiency, and service quality by eliminating waste and optimizing operational processes (Bhat et al., 2020). This study identified overcrowding in the JKN outpatient department as a significant operational issue, with extended waiting times representing a major barrier to service quality and patient satisfaction.

An integrated Lean-based approach was adopted to address the root causes of inefficiency and enhance patient flow. Value stream mapping (VSM) was employed as

a diagnostic tool to visualize and analyze the current-state process (Figure 4) and to propose a future-state model (Figure 5) designed to eliminate non-value-added activities and optimize resource utilization. By addressing delays in registration, bottlenecks in cardiologist consultations, and extended pharmacy wait times, the proposed improvements are intended to improve service efficiency and expand outpatient capacity without diminishing the quality of care.

From a theoretical perspective, the findings contribute to a growing body of literature that supports the positive relationship between Lean implementation, healthcare process quality, and patient satisfaction. The combined application of the voice-of-process and voice-of-staff perspectives demonstrates how Lean tools—such as process mapping, A3 analysis, and root cause analysis—can reveal interdependencies among workflow design, workforce capacity, and patient behavior. The conceptual model developed in this study (Figure 5) integrates these insights and aligns with established theoretical frameworks that link Lean strategies to service quality and patient satisfaction (Arthur, 2016; George, 2003).

Root cause analysis (Figure 3), grounded in process observation and A3 documentation, identified registration inefficiencies, suboptimal scheduling, and inadequate staffing as primary contributors to interruptions in patient flow. These findings highlight the importance of coordinated efforts across three interdependent domains: process design, human resources, and patient arrival patterns. The study illustrates that service delays are not isolated events but are instead manifestations of structural challenges that necessitate integrated and system-level interventions.

From a managerial perspective, the findings highlight the importance of developing standardized time-tracking tools to monitor patient flow from entry to discharge in a non-clinical format. These tools should be integrated with balanced performance metrics that capture not only reductions in waiting time but also dimensions of service quality and patient experience. Establishing clear, measurable objectives—such as defined maximum wait times and real-time queue monitoring—is essential for promoting accountability, operational transparency, and continuous quality improvement.

The process mapping exercise revealed that transitioning from a manual, paper-based registration system to an electronic queue platform can substantially mitigate early-morning overcrowding and improve the synchronization of patient arrivals with scheduled consultation times. Furthermore, the adoption of electronic prescribing would enable real-time coordination between cardiologists and pharmacists, thereby accelerating medication preparation and reducing delays in the discharge process.

D. CONCLUSION

In response to the increasing demand for high-quality healthcare services, a range of strategic initiatives has been proposed, including the redesign of clinical workflows in outpatient care. These initiatives aim to address challenges such as overcrowding and extended waiting times—often driven by non-value-added

activities—and to eliminate structural barriers that restricts timely patient access and efficient service delivery.

This study demonstrates the utility of Lean principles and tools—particularly process mapping, value stream mapping (VSM), and root cause analysis—as effective mechanisms for identifying operational inefficiencies and eliminating waste in outpatient care. The implementation of these tools offered a systematic framework for analyzing patient flow, optimizing resource allocation, and improving service delivery within a high-volume JKN outpatient department.

A continuous improvement philosophy forms the foundation of the proposed approach, employing both current- and future-state value stream mapping (VSM) to minimize unnecessary delays and enhance workflow efficiency. Concurrently, elements of business process reengineering may be appropriate for addressing essential yet non-value-adding activities that still limit overall performance.

An important limitation of this study is its reliance on a single-site case study with a limited dataset. To improve the generalizability and strength of the proposed framework, future research should examine its implementation in multiple healthcare settings using more comprehensive data inputs—such as detailed time logs, patient acuity levels, service volumes, and capacity utilization metrics. Broadening the scope in this way would enable more accurate prioritization of interventions and promote continuous quality improvement across various healthcare contexts.

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