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Effectiveness of Lean Management to Reduce Waiting Time for Medicines at Hospital Outpatient Pharmacy

Edwin Tohaga[1*], Merita Arini[2], Dono Widiatmoko[3]
**Correspondence Author: etohaga76@gmail.com*
[1] Master of Hospital Management, Universitas Muhammadiyah Yogyakarta, Indonesia
[2] Department of Family Medicine and Public Health, Universitas Muhammadiyah Yogyakarta, Indonesia
[3] College of Health, Psychology and Social Care, University of Derby, United Kingdom

INDEXING

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ABSTRACT

Prolonged prescription waiting times continue to be a persistent challenge in many Indonesian hospitals, where studies on Lean management applications are still limited. The Indonesia Ministry of Health mandates a maximum 30-minute standard, yet compliance is often unmet, risking patient satisfaction and safety. This study employed a two-cycle action research approach using Value Stream Mapping (VSM) to analyze workflows and design targeted interventions in the outpatient pharmacy of a public hospital in Central Java. Across the two cycles—diagnosing, planning, action, and evaluation—both qualitative and quantitative assessments were conducted. The pharmacy processed an average of 150 prescriptions daily, with drug production identified as the main bottleneck, accounting for 61% of lead time. Lean interventions reduced non-value-added activities from eight to four, resulting in a 14.3% decrease in lead time (from 51.09 to 43.77 minutes) and an increase in the value-added ratio from 29.3% to 45.6%. Although the national target of ≤30 minutes was not achieved, the intervention demonstrated Lean's potential to improve efficiency and foster staff awareness of waste reduction. This study presents a practical Lean model for hospitals in resource-limited settings, emphasizing the importance of sustained leadership and digital integration to achieve long-term improvement.

Kata kunci:
Lean manajemen; Farmasi rawat jalan; Waktu tunggu

Waktu tunggu resep yang panjang masih menjadi tantangan di banyak rumah sakit di Indonesia, sementara penelitian terkait penerapan Lean management di bidang ini masih terbatas. Kementerian Kesehatan Republik Indonesia menetapkan standar maksimal 30 menit, namun kepatuhan terhadap standar ini seringkali belum tercapai sehingga berisiko menurunkan kepuasan dan keselamatan pasien. Penelitian ini menggunakan pendekatan action research dua siklus dengan Value Stream Mapping (VSM) untuk menganalisis alur kerja dan merancang intervensi pada apotek rawat jalan di sebuah rumah sakit umum di Jawa Tengah. Setiap siklus terdiri atas tahap diagnosis, perencanaan, tindakan, dan evaluasi dengan penilaian kualitatif maupun kuantitatif. Rata-rata 150 resep diproses setiap hari, dengan produksi obat teridentifikasi sebagai hambatan utama yang menyumbang 61% dari total waktu tunggu. Intervensi Lean berhasil menurunkan aktivitas non-value-added dari delapan menjadi empat, menghasilkan penurunan lead time sebesar 14,3% (dari 51,09 menit menjadi 43,77 menit) serta peningkatan value-added ratio (VAR) dari 29,3% menjadi 45,6%. Meskipun target nasional ≤30 menit belum tercapai, intervensi ini menunjukkan potensi Lean dalam meningkatkan efisiensi serta meningkatkan kesadaran staf terhadap pengurangan pemborosan. Studi ini memberikan model praktis Lean untuk rumah sakit dengan keterbatasan sumber daya dan menekankan pentingnya keterlibatan kepemimpinan serta integrasi digital untuk memastikan keberlanjutan perbaikan.

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INTRODUCTION

Pharmacy waiting times have emerged as a critical concern in healthcare systems worldwide, often cited as a key determinant of patient satisfaction and service quality (Susanto & Chalidyanto, 2020; Wardani & Guntari, 2024). Prolonged delays in medication dispensing not only diminish patient experience but may also affect the overall reputation and performance of hospitals. International evidence highlights the scope of this challenge: for

instance, a public hospital in the United Arab Emirates reported average waiting times of 21.5 minutes before implementing quality improvement measures (Alodan et al., 2020). Extended waiting periods may also jeopardize patient safety, particularly in time-sensitive clinical conditions (Ngaorungsi & Chutima, 2024). These concerns have driven increasing global attention toward system-level interventions such as lean management, which emphasizes reducing waste and optimizing value-added activities to enhance service delivery (Li et al., 2020).

In Indonesia, the Ministry of Health has set a national benchmark of 30 minutes as the maximum allowable pharmacy waiting time (Kementerian Kesehatan RI, 2008). However, many hospitals still fail to meet this standard (Sagia, 2024). Empirical evidence illustrates this gap: a study at Dr. OEN SOLO BARU Hospital reported average waiting times of 37 minutes for non-compounded and 73 minutes for compounded medications, both of which exceed national standards (Leemanza & Kristin, 2024). Rising patient volumes, reliance on manual workflows, and suboptimal allocation of pharmacy staff contribute to these persistent inefficiencies (Susanto & Chalidyanto, 2020; Ngaorungsi & Chutima, 2024). These challenges underscore the pressing need for structured approaches to streamline pharmacy services and enhance responsiveness. Lean management has been proposed as one such approach, offering a structured methodology to minimize waste and improve efficiency (Ismail et al., 2020; Moring & Meliala, 2022).

Globally, lean management has demonstrated significant promise in healthcare delivery, including pharmacy operations. Prior studies show that lean principles can reduce lead times, enhance patient flow, and increase satisfaction (de Barros et al., 2021; W.-J. Huang et al., 2024; Zdęba-Mozoła et al., 2023). Yet, most of this evidence comes from well-resourced health systems. Research in low- and middle-income countries (LMICs), particularly in Indonesia's public hospitals, remains scarce. Operational realities such as manual prescription handling, limited human resources, and high patient demand create unique challenges that may influence the success of lean interventions. This gap in the literature highlights the need for empirical studies that investigate both the applicability and effectiveness of lean management in resource-constrained hospital settings (Akmal et al., 2022).

Given this context, the present study aims to evaluate the effectiveness of lean management in reducing prescription waiting times at the outpatient pharmacy of RA Kartini Regional General Hospital in Jepara, This research was also driven by findings from recent patient satisfaction surveys, which indicated that a significant proportion of outpatients remained dissatisfied with prolonged prescription waiting times Jepara (2022). Specifically, the study seeks to identify existing inefficiencies, implement targeted lean interventions, and assess their impact on lead time, cycle time, and value-added ratio (VAR). By addressing this gap, the study contributes evidence on the potential of lean management as a practical model for improving pharmaceutical services in Indonesian public hospitals.

RESEARCH METHOD

Study Setting

This study was conducted at the outpatient pharmacy unit of RA Kartini Regional General Hospital, a Type B public and teaching hospital located in Jepara, Central Java,

Indonesia. The hospital is a fully accredited referral center with 340 inpatient beds and serves a large volume of outpatient visits, predominantly BPJS (national insurance) patients.

Participants and Sample

The study focused on pharmacy operations involving pharmacists, pharmacy technicians, and supporting staff directly engaged in outpatient dispensing activities. Additionally, prescribing doctors were included as indirect stakeholders due to their role in verifying prescriptions. To capture process variability, observations were conducted on both peak and off-peak working days.

A sample size was calculated using Cochran's formula, based on the daily prescription volume of 200–300 prescriptions, with a 95% confidence level and 5% margin of error. The required sample size consisted of 152 prescriptions, which were observed and recorded over multiple days.

Study Design

This research employed an action research design, conducted over two improvement cycles between April and June 2024. Each cycle followed four phases: diagnosis, planning, action, and reflection.

Cycle 1: Focused on identifying inefficiencies and root causes through direct observation, Value Stream Mapping (VSM), and staff discussions. Findings were disseminated to pharmacy personnel to raise awareness of workflow inefficiencies and time waste.

Cycle 2: Interventions were implemented based on the evaluation of Cycle 1. These included:

1. Appointing a dedicated supervisor to monitor real-time performance, coordinate staff, ensure compliance, and resolve delays.
2. Introducing pre-packaged drugs for high-demand items to reduce compounding and preparation time.
3. Enhancing communication with prescribing doctors to streamline verification and reduce prescription-related delays.

Indicators of Success: Effectiveness of the interventions was measured using both process and outcome indicators, including:

1. Reduction in average lead time (minutes) from prescription receipt to drug handover.
2. Decrease in Non-Value-Added Activities (NVA) and improvement in Value-Added Ratio (VAR).
3. Reduction in the percentage of prescriptions exceeding the 30-minute national standard.
4. Increased staff compliance with adjusted workflows and reduced production bottlenecks.

Data Collection Tools: To ensure rigor, a combination of quantitative and qualitative instruments was used:

1. Structured observation sheets to record timestamps across dispensing stages.
2. Checklist forms to document workflow inconsistencies and wastes (waiting, rework, over-processing, etc.).
3. Field notes and photo documentation of pharmacy operations and physical layout.
4. Focus Group Discussion (FGD) guides and interview protocols are used to gather insights from pharmacists, technicians, and prescribing doctors.
5. A3 Problem-Solving template to track root causes and action plans.

Data Analysis

Quantitative data (lead time, cycle time, VA, NVA, NNVA, VAR) were analyzed using descriptive statistics. Normality of distribution was assessed using the Kolmogorov–Smirnov test, and differences between pre- and post-intervention data were evaluated using the Mann–Whitney test.

Qualitative data, including focus group discussions (FGDs), interviews, and field notes, were analyzed using thematic analysis, a process that involved coding, categorization, and theme development. Triangulation across observation, interviews, and checklist data enhanced validity. Member checking with staff ensured the accuracy of interpretations.

Validity and Reliability

To strengthen rigor:

1. Triangulation of data sources (observation, checklist, FGD).
2. Inter-observer reliability is achieved by involving more than one trained observer in the data collection process.
3. Member-checking of qualitative findings with participants.

Ethical Considerations

The study received ethical approval from the Research Ethics Commission, Muhammadiyah University of Yogyakarta (Approval No. 079/EC-EXEM-KEPK FKIK UMY/VIII/2024). All procedures complied with ethical standards, ensuring confidentiality and no disruption to patient services.

RESULTS AND DISCUSSION

During the observation process, it was noted that the average waiting time continued to exceed 30 minutes, with 25 activities categorized into 6 sub-sections related to the medication dispensing process in outpatient services. The first cycle of research conducted at the outpatient pharmacy of RA Kartini Hospital in Jepara identified several key issues contributing to wait times exceeding the national standard of 30 minutes. These issues include: (1) delays in transitioning prescriptions from initial verification to production, (2) inefficiencies in the production phase where medications need to be located, packaged, and labeled, (3) prescriptions processed after the 10^{th} in line experience significantly longer wait times, (4) completed prescriptions often sit in boxes waiting to be handed to patients, causing further delays, and (5) discrepancies in dosage or medication instructions require additional confirmation with doctors, who are not always immediately available, causing further delays. Lastly, during the medication handover process, if a patient is not present, the next patient is served first, adding more time to the process for the initial patient. These findings underscore the need for comprehensive workflow enhancements to meet service time standards and enhance patient satisfaction.

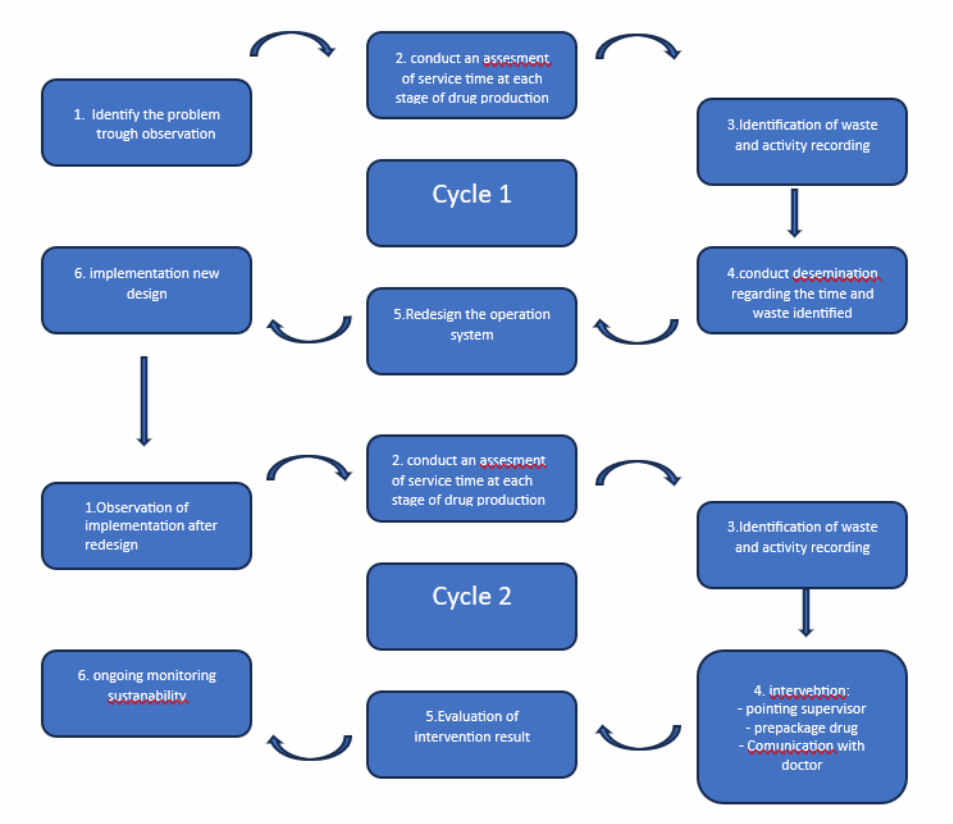

Figure 1. Action Research Cycle of the Study

In the first cycle, after identifying the issues, we shared the findings with all staff, highlighting the observed problems and waste. This dissemination aimed to help the staff understand the existing challenges, enabling them to take appropriate actions to address the issues effectively. During the second cycle, several measures were implemented, including the appointment of a supervisor to monitor prescriptions and ensure that any disruptions between cycles were promptly addressed, thereby preventing workflow delays. Additionally, prepackaged medications were introduced to streamline the production process by eliminating the need to search for and package drugs. This approach was feasible due to the predominance of chronic patients requiring consistent treatments. Furthermore, drug labeling was made during the drug verification process, further enhancing efficiency and reducing manual intervention. The next issue requires prompt communication between pharmacists and doctors to confirm prescriptions and dosages, utilizing all available communication channels, including telephone and social media platforms.

After the intervention, lead time in pharmacy operations improved by 7.32 minutes (14.3%). Additionally, wait times decreased by 36%, and cycle times improved by 5.7% (Table 1). There was also an increase in value-added time and a decrease in non-value-added activities before and after the intervention. The mean difference test results reveal a significant difference between the pre- and post-intervention phases, with a $p < 0.05$, as illustrated in Table 1.

Table 1. Average Time Distribution of Value Stream Mapping in the Outpatient Pharmacy Process (in minutes)

Time in VSM	Pre (n=152)	Post (n=152)	Difference (minutes/%)	P-value
Lead Time	51.09	43.77	(-) 7.32/14.3%	0.04
Waiting time	11	6	(-) 4/36%	0.00
Cycle Time	40.09	37.77	(-) 2.32/7.4%	0.00
Value Added	15	20	(+) 5/14.2%	0.00
Non-Value Added	24	15	(-) 9/23%	0.00
VAR	29.3%	45.6%	(-) 16.3%	0.00

The mean difference test results reveal a significant difference between the pre- and post-intervention phases, with a $p < 0.05$, as illustrated in Table 1.

The development of Value Stream Mapping (VSM) (Figure 2) provided a clear overview of the medication preparation process flow. In Figure 2, by measuring the cycle time of the sub-activities, it was found that the majority of time was consumed during the medication production process, which accounted for 61% of the total pharmacy service time. The second-largest portion of time was spent delivering medications to patients, while the least time was devoted to the prescription intake and verification process. This pattern was consistent both before and after the intervention.

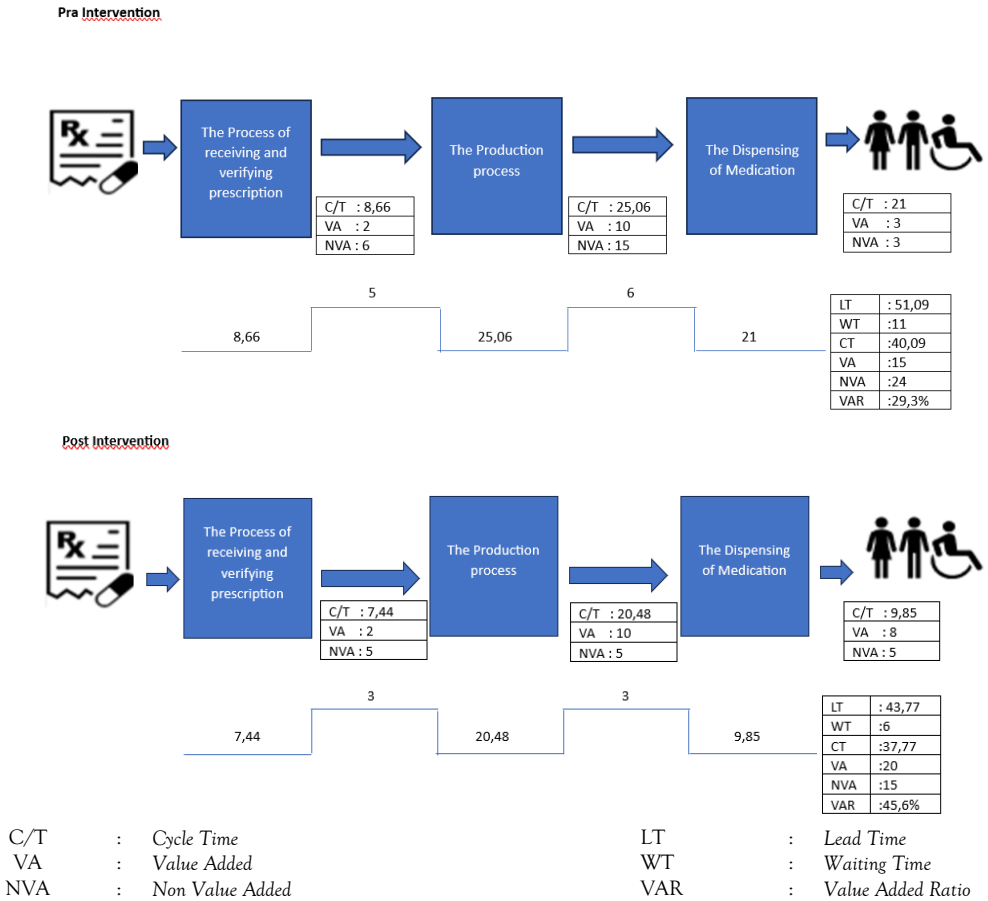

Figure 2. Value Stream Mapping Diagram

The mean difference test results (Table 2) show a significant difference in processes at Stage 2 and Stage 3, while no significant difference was observed in Stage 1, which involves prescription intake and verification. These statistical findings suggest that the processes with the highest levels of waste, specifically Stage 2 and Stage 3, still offer opportunities for intervention to eliminate waste and optimize execution time. The numbers between stages represent the waiting time and have no value-added contribution.

Table 2. Details of the Percentage of Cycle Time Consumption Relative to Total Waiting Time Duration in the Outpatient Pharmacy >30 Minutes

Activity Details	Pre	Post	*P* value
Duration of Prescription Intake and Verification	14.72%	20.10%	0.161
Duration of Prescription Production, Labeling, and Packaging	68.66%	53.35%	0.20
Duration of Medication Completion and Delivery to the Patient	16.62%	26.56%	0.000

The mean difference test results (Table 2) show a significant difference in processes at Stage 2 and Stage 3, while no significant difference was observed in Stage 1, which involves prescription intake and verification. These statistical findings suggest that the processes with the highest levels of waste, specifically Stage 2 and Stage 3, still offer opportunities for intervention to eliminate waste and optimize execution time.

In Table 3, the VSM observations indicated an improvement in time consumption of 2.32 minutes before and after the intervention. However, the labeling and packaging time increased by 3 minutes following the implementation of the intervention.

Table 3. Average Time Distribution of Subprocesses (in minutes)

Sub Proses	Pre (n=152)	Post (n=152)	Difference	*P* Value
Prescription Intake and Prescription Verification	8.66	7.44	1	0.161
Medication Production	25.06	20.48	5	0.020
Labeling and Packaging (Production Completed)	6.37	9.85	-3	0.000
Total time	40.09	37.77	-2.32	0.043

The VSM observations indicated an improvement in time consumption of 2.32 minutes before and after the intervention. However, labeling and packaging time increased by 3 minutes following the implementation of the intervention.

In Table 4, the assessment of the outpatient pharmacy service process identified six primary activities, totaling 25 activities overall. Recognizing these activities is essential for distinguishing between value-added (VA) and non-value-added activities (NVA). While some activities do not add value, they are necessary for carrying out service functions, which are classified as necessary non-value-added activities (NNVA). In outpatient pharmacy services, there are still non-value-added activities, such as waiting at various stages of prescription preparation. Following the intervention, one such activity was eliminated: the intervention for prescriptions that were not prepared according to established procedures.

Table 4. Activities of Outpatient Pharmacy Services

	Pre	Post	Persentage
Value-added activity (VA)	12	12	48%
Non Value-Added activity (NVA)	8	7	28%
Necessary non-value-added activity (NNVA)	6	6	245
Total	26	25	100%

In Table 4, the assessment of the outpatient pharmacy service process identified six primary activities, totaling 25 activities overall. Recognizing these activities is essential for distinguishing between value-added (VA) and non-value-added activities (NVA). While some activities do not add value, they are necessary for carrying out service functions, which are classified as necessary non-value-added activities (NNVA).

Discussion

This study demonstrated the effectiveness of lean management in addressing inefficiencies within the outpatient pharmacy workflow. Key results include a 14.3% reduction in lead time, a 36% decrease in waiting time, and a 23% decrease in non-value-added activities, aligning with the goal of lean management to eliminate waste and enhance efficiency. Although the achieved time of 43 minutes still does not meet the 30-minute standard, the intervention significantly improved workflow understanding and increased the Value-Added Ratio (VAR). However, several persistent structural and systemic challenges prevented full compliance with the Ministry of Health's target: The drug production phase significantly impacted the overall lead time due to essential manual preparations and safety procedures, which are vital and cannot be omitted. Staff shortages and facility limitations at the dispensing counter led to bottlenecks during the final phase. The daily workflow performance has been inconsistent because there are no standardized procedures in place across different shifts. The intervention did not yet utilize digital tools, such as e-prescriptions or automated queue management systems, which could have expedited processing. Delays in the early stage consistently increased due to ongoing coordination issues between clinics and the pharmacy system. These findings underscore the need for ongoing optimization through digital integration, effective staff resourcing, and standardized processes. Similar improvements in cycle times were observed by Marin-Garcia et al. (2021) and Pranata (2024) who emphasized lean principles' impact on patient satisfaction. However, Nina & Hakim (2020) highlighted the critical role of organizational commitment in the success of lean management.

Value Stream Mapping (VSM) played a crucial role in identifying inefficiencies and guiding staff toward effective solutions. The benefits of this process align with those of W. J. Huang et al. (2022) and Firman et al. (2019). The production stage emerged as the most time-consuming, followed by medication delivery, with minimal time spent on prescription verification. Similar to the previous study, pre-packaging medications, particularly for chronic patients, which Kassira (2021) and Hannigan (2020) noted could streamline production processes.

Another challenge was the increased waiting time for prescriptions later in the queue during peak hours, resulting in a cycle time of 20.48 minutes versus 25.06 minutes, respectively—an improvement from pre-intervention times. Assigning "sweeper" roles at each stage minimized idle time, aligning with Al Owad et al. (2022) and Gilchrist et al (2024) findings that system adjustments improve service outcomes . Overall, these strategies enhanced workflow efficiency, patient satisfaction, and staff awareness, offering a foundation for further lean applications.

Waste in Service Activities: During the implementation process, six sub-stages encompassing 25 activities were documented, with 28% of these activities identified as non-value-added (NVA). Following the intervention, NVAs decreased from 8 to 7, resulting in a 12.5% improvement in the Value-Added Ratio (VAR). However, eliminating NVAs remains challenging due to operational constraints. Marcetic emphasized that optimizing value-added (VA) activities and minimizing necessary but non-value-added (NNVA) activities are equally critical for effective process optimization (Marcetic, 2022).

Further improvements require updates to the IT infrastructure and modifications to the system, necessitating management approval. Limitations included insufficient IT infrastructure and staff shortages, emphasizing the need for integrated solutions in future interventions. Firman emphasized that the active involvement of decision-makers is crucial for the success of lean management (Firman et al., 2019; Cerchione et al., 2023). Wastes identified include overproduction, where prescriptions fail to enter the queue, necessitating re-verification and resulting in increased delays downstream. Waiting time, a common inefficiency at various stages, aligns with findings by Susanto & Chalidyanto (2020) and Meidawati (2024). Where the common wastes are waiting, overprocessing, and unnecessary motion (Meidawati & Arini, 2024). Unnecessary movements by pharmacy staff, often shifting between stages, were also highlighted. Marcelino noted that Lean tools could enhance workplace organization, reducing such movements and setup times. Dedicated staff to oversee operations were suggested to maintain workflow consistency (Marcelino et al., 2023). Discussions with pharmacy staff revealed that securing management support remains a significant barrier. During these discussions, staff proposed implementing IT solutions, such as queue management systems and monitors displaying real-time updates on prescription preparation status, to improve waiting times. However, these suggestions have not yet become a priority for management, limiting their potential implementation and impact on operational efficiency. Indah Naryanti suggests that digitization and system updates can minimize service delays and improve patient satisfaction (Indah Naryanti et al., 2022). These findings underscore the importance of integrating technology and collaborating on management to ensure sustained improvements in pharmacy operations. According to Trakulsunti & Trakoonsanti (2021) and Fernandes et al. (2020), the sustainability of lean improvements depends heavily on management support, cross-functional engagement, and the establishment of a culture of continuous improvement (kaizen).

CONCLUSION

Lean management has proven effective in reducing lead times in outpatient pharmacy services at the hospital studied. Although the Ministry of Health's target has not yet been achieved, the process has significantly improved staff understanding of the challenges within each stage of pharmacy services. This enhanced awareness lays a strong foundation for future improvements and fosters a shift in mindset toward continuous optimization. Addressing identified waste will remain a priority, requiring sustained efforts. Crucially, the involvement of key decision-makers, particularly the hospital director, will be indispensable to ensure the success of these ongoing enhancements.

To improve practices, it is recommended that systems be implemented to comprehensively track patient waiting times and utilize digital tools to enhance

communication between pharmacists and doctors. Policies should mandate complete wait time tracking and support IT infrastructure, such as e-prescription systems, alongside standardized workflow audits to ensure sustained efficiency. Future research should explore holistic patient experiences, evaluate the impact of automation and other lean strategies, and examine their effects on diverse patient groups. Long-term studies are crucial for evaluating the sustainability of lean interventions over time.

The study's limitations include measuring waiting times only from the point of prescription submission to medication handover, thereby excluding the time patients spent waiting after leaving the treatment rooms. This omission resulted in incomplete data on the overall patient experience. Additionally, external factors such as registration delays or insurance verification processes, which may significantly impact waiting times, were not analyzed in this study.

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