

OPTIMIZING OUTPATIENT PHARMACY WAITING TIME DURING PEAK HOURS: A JKN-BASED ANALYSIS OF QUEUE CATEGORIES AND POLYCLINIC BOTTLENECKS

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ABSTRACT

BACKGROUND:

Long prescription waiting times in outpatient pharmacies critically reduce patient satisfaction and hospital reputation, especially under Indonesia's National Health Insurance (JKN) dominance.

OBJECTIVE:

To compare prescription waiting times between morning (07.00-10.00) and afternoon (10.00-13.00) periods by queue category and originating polyclinic.

METHODS:

A cross-sectional observational study analyzed secondary data from 2,005 outpatient prescriptions (April 8-25, 2025) using descriptive statistics; unpaired t-tests compared mean waiting times across queues (ΣA : compounded, ΣB : JKN-chronic, ΣN : non-chronic, ΣF : fast track), and polyclinics. Results: Average waiting time surged from 45.46 minutes (morning) to 84.44 minutes (afternoon) ($p < 0.01$), with the steepest increases in the ΣA queue (110% rise) and Cardiology polyclinic (114% rise). Only 11.29% of compounded (ΣA) met the ≤ 60 -minute standard in the afternoon (vs. 89.09% in the morning, $p < 0.01$), while JKN-Chronic (ΣB) dropped to 2.82% compliance with the ≤ 30 -minute benchmark.

CONCLUSIONS:

Strategic Lean-ToC interventions are empirically recommended to resolve the critical peak-hour prescription bottleneck, strengthening Indonesia's JKN sustainability.

KEYWORDS

waiting time, outpatient pharmacy, peak hours, queue category, JKN (National Health Insurance)

INTRODUCTION

Outpatient pharmaceutical services, as the final hospital contact point [1], face critical waiting time issues impacting patient satisfaction and hospital reputation [1,2]. Long waiting times cause patient discomfort and frustration [3], affect patients' experiences [4], and potentially reduce trust [5], particularly in Indonesian government hospitals on Java, where JKN (National Health Insurance) patient queues are prevalent [6]. These facilities report lower satisfaction levels than private hospitals [7], high visit volumes causing congestion in and complaints [8].

Indonesia's JKN system creates unique challenges for government hospitals. High-volume prescription processing strains pharmacy workflows at Mohammad Noer General Hospital, East Java, Indonesia based on preliminary data in 2025. Preliminary observations indicate variability in outpatient prescription waiting times, particularly during peak hours [5]. One study at a government hospital found that the average waiting time was 80 minutes for compounded medications and 64 minutes for non-compounded medications [5]. This results in 40% longer waits than private hospitals [7]. Another study involving JKN patients revealed that only 18% of compounded and 20% of non-compounded medication met the standard waiting time requirements [9].

Previous studies have generally focused only on waiting times for two types of prescriptions: compounded and non-compounded medications [1,10]. Research analyzing the factors influencing waiting time has also been conducted, including studies that examine the number of drugs prescribed in a single prescription [11]. A recent study explored waiting time for compounded and non-compounded medications based on the time of prescription receipt [5]. Although factors such as prescription type (compounded/non-compounded) have been investigated [1,10], no prior study has concurrently analyzed four queue categories ($\Sigma A/\Sigma B/\Sigma N/\Sigma F$), originating polyclinics, and service time patterns (07.00–10.00 vs. 10.00–13.00) within an integrated framework. Identifying inefficiencies through these critical variables is vital for designing Theory of Constraints-based interventions, particularly under Indonesia's JKN system, which dominates healthcare delivery [12].

This study aims to analyze significant differences in the average waiting time for outpatient prescription services between two service periods (07.00–10.00 and 10.00–13.00), categorized by queue type, as well as variations in waiting time among different polyclinics. It offers new contributions to several aspects that have rarely been explored, namely: waiting time based on prescription service periods, four distinct queue categories, and the originating polyclinic of the prescription. The findings of this study are expected to serve as a basis for strategic recommendations for hospital management in optimizing service flow, resource allocation, and staff scheduling—particularly during peak hours. Furthermore, the results can contribute to the broader field of public health studies by demonstrating how time-related and system-related factors jointly influence the duration of outpatient prescription waiting time in the hospital.

METHODS

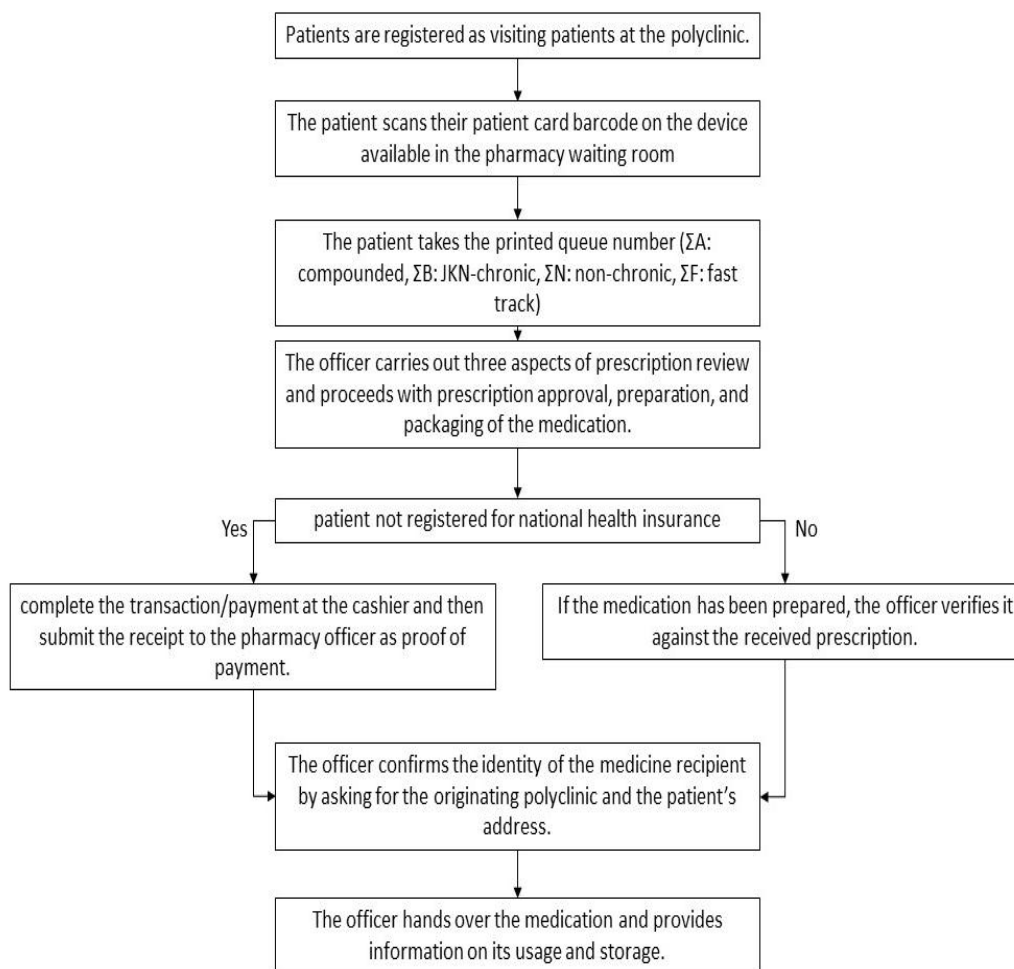
STUDY DESIGN

A comparative observational study with a cross-sectional design was conducted, selected for its efficiency in comparing group differences (morning vs afternoon periods) without intervention [13]. The prescription arrival times were grouped into two time periods: 07.00–10.00 (morning) dan 10.00–13.00 (afternoon). The selection of these time intervals was based on prescription intake patterns, which typically peak in the morning and continue into the afternoon [14].

STUDY SETTING

Secondary data were extracted from the hospital information system of Mohammad Noer General Hospital's outpatient pharmacy (April 8–25, 2025). Waiting time was operationally defined as the duration from patient barcode scanning (queue entry) to medication handover (service exit). The workflow of prescription services in the outpatient pharmacy department is illustrated in Figure 1.

FIGURE 1. THE WORKFLOW OF PRESCRIPTION SERVICES IN THE OUTPATIENT PHARMACY



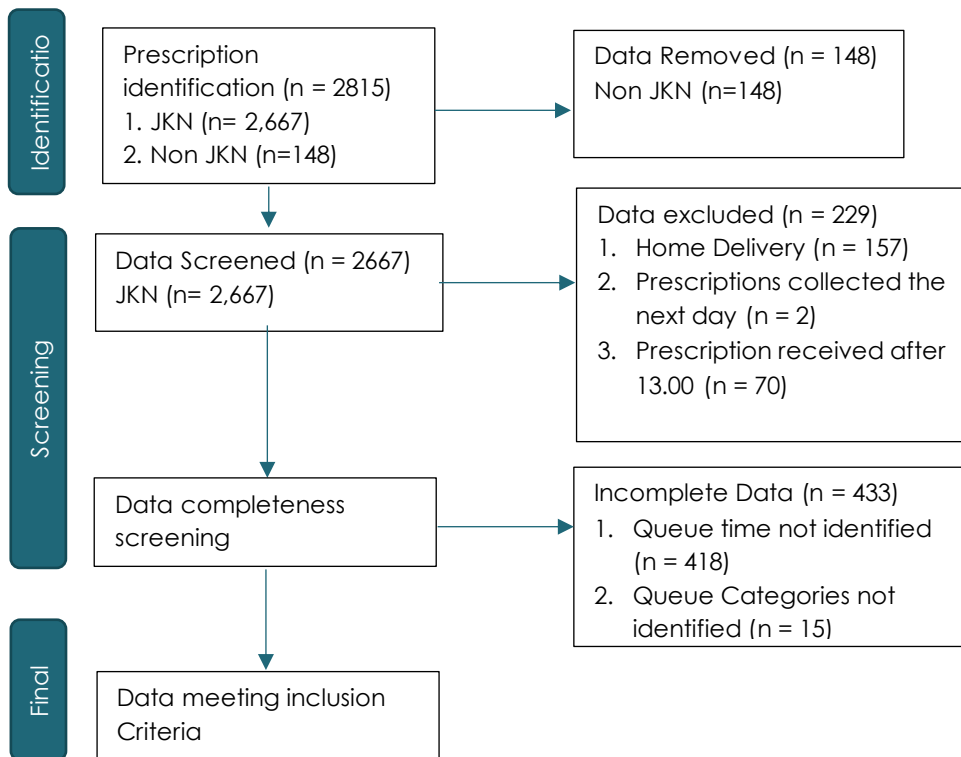
POPULATION AND SAMPLE

The study population consisted of all outpatient prescriptions issued during the study period (N = 2,815). Total sampling was applied, with inclusion criteria covering all JKN outpatient prescriptions. Exclusion criteria were:

1. Home-delivery prescriptions,
2. Prescriptions collected the next day,
3. Prescriptions arriving after 13.00,
4. Incomplete data (e.g., missing timestamps or queue categories).

The specifics for non-JKN prescriptions (n=148) that were excluded was because they followed a different workflow involving the payment process for medication at the cashier. Given that JKN prescriptions constitute 95% of the Indonesian healthcare system [12], optimizing the prescription workflow was the primary focus of this service improvement study. The final sample included 2,005 prescriptions (Figure 2). Incomplete data (n=433) were primarily due to unidentified queue timestamps (n=418) or missing queue categories (n=15). Missingness was random across periods and queues, suggesting no systematic bias. Sensitivity analysis confirmed a negligible impact on overall trends.

FIGURE 2. SAMPLE SELECTION CRITERIA



STATISTICAL ANALYSIS

All statistical analyses were conducted in Microsoft Excel. Quality control procedures included automated timestamp validation via the hospital's barcode system, double-checking data entry, and cross-checking selected results were conducted with two different researchers. For the t-test, assumptions were evaluated before analysis. Homogeneity of variances was tested using the F-test Two-Sample for Variances. The result ($p < 0.05$) indicated significant difference in variances of each of the groups in both of queue categories and polyclinics categories; therefore, an unpaired t-test assuming unequal variances (Welch's t-test) was applied. All tests used a significance level of $\alpha = 0.05$. Descriptive statistics (mean, SD, proportions) summarized waiting times. Unpaired t-tests compared mean waiting times between morning (07.00–10.00) and afternoon (10.00–13.00) periods across queue categories ($\Sigma A/\Sigma B/\Sigma N/\Sigma F$) and polyclinics. Analyses were conducted using Microsoft Office Excel 2019 statistical processing software.

ETHICAL APPROVAL

This study was conducted with the ethical approval and research permit from Mohammad Noer General Hospital, under approval number 000.9/2296/102.16/2025

RESULTS

A total of 2,005 prescriptions were analyzed, with 42.29% ($n=848$) arriving during the morning period (07.00 -10.00) and 57.71% ($n=1,157$) in the afternoon (10.00-13.00). Mean waiting time increased significantly from 45.46 minutes (morning) to 84.44 minutes (afternoon) ($\Delta = +85.7\%$, $p < 0.001$), indicating severe workflow inefficiency during peak hours.

VARIATIONS BY QUEUE CATEGORY

There are four queue categories: ΣA (prescription queue for compounded medications or compounded), ΣB (prescription queue for JKN patients receiving non-compounded medications for 30-day or chronic treatment or JKN-chronic), ΣN (prescription queue for non-chronic, non-compounded medications or non-chronic), and ΣF (prescription queue for fast-track category or fast track). Based on queue categories (Figure 2), the highest proportion of prescriptions was in category ΣB (50.57%)

As detailed in Table 1, all queue categories exhibited significant afternoon delays ($p < 0.001$). ΣA most impacted, with a 110.4% increase (45.44 to 95.61 minutes). Only 11.29% met the ≤ 60 -minute standard in the afternoon (vs. 89.09% morning). JKN-Chronic (ΣB): 85.5% longer waiting times (47.73 to 88.57 minutes), with ≤ 30 -minute compliance dropping to 2.82% (vs. 28.26% morning). Fast track (ΣF) & non-chronic (ΣN): Both exceeded 75-minute averages in the afternoon despite being "simpler" queues.

FIGURE 3. NUMBER OF PRESCRIPTIONS BY QUEUE CATEGORIES

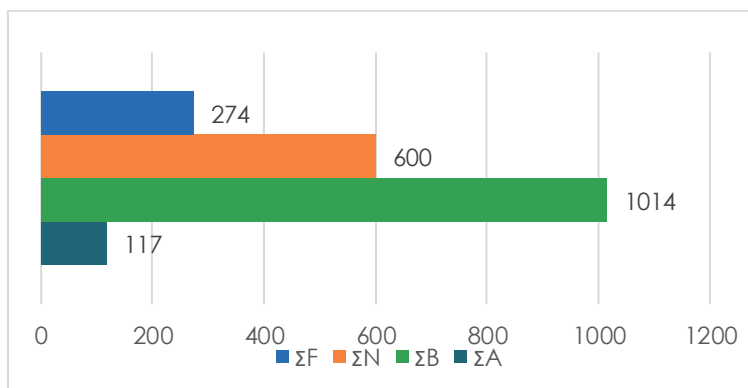


TABLE 1. WAITING TIME ANALYSIS BY QUEUE CATEGORY

Queue Category	Time Period	Number of Prescriptions (n)	Mean/Average Waiting Time (minutes)	Δ (%)	≤ 60 min (%)	≤ 30 min (%)	Sig.
ΣA	07.00-10.00	055	45.44 \pm 14.91		89.09		1.07×10^{-15}
	10.00-13.00	062	95.61 \pm 37.22	+110.4	11.29		
ΣB	07.00-10.00	375	47.73 \pm 27.94			28.26	1.81×10^{-71}
	10.00-13.00	639	88.57 \pm 38.71	+85.5		2.82	
ΣN	07.00-10.00	279	43.33 \pm 35.46			40.14	2.51×10^{-27}
	10.00-13.00	321	76.93 \pm 37.18	+77.5		8.41	
ΣF	07.00-10.00	139	43.58 \pm 26.11			38.85	1.27×10^{-15}
	10.00-13.00	135	77.57 \pm 38.82	+78.0		5.19	
Total	07.00-10.00	848	45.46 \pm 29.78				P < 0.001
	10.00-13.00	1,157	84.44 \pm 38.66	+85.7			

VARIATIONS BY ORIGINATING POLYCLINIC

Similar variations were observed based on the originating polyclinic of the prescription (Table 2). Cardiology ($\Delta=114\%$, $p<0.001$) and Pulmonology ($\Delta=151\%$, $p<0.001$) showed the most severe afternoon delays (Table 3). Internal Medicine consistently had high wait times (>69 minutes), indicating chronic workflow issues. Exceptions: ENT and TB-Dots showed no significant differences ($p>0.01$) due to small sample sizes ($n<15$).

FIGURE 4. NUMBER OF PRESCRIPTIONS BY ORIGINATING POLYCLINIC

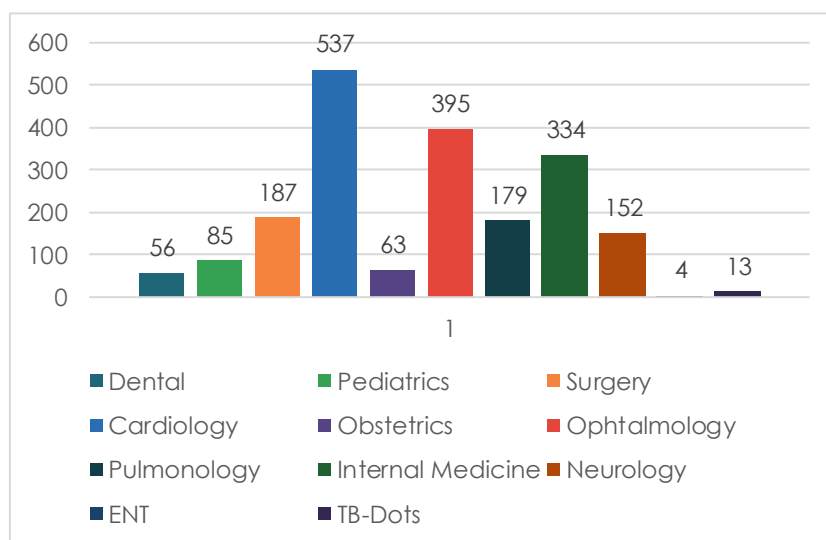


TABLE 2. WAITING TIME ANALYSIS BY ORIGINATING POLYCLINIC

Polyclinic	Time Period	Number of Prescriptions (n)	Average Waiting Time (minutes)	Δ (%)	Sig.
Dental	07.00-10.00	024	37.92 ± 16.18	+120%	2.40 × 10 ⁻⁷
	10.00-13.00	032	83.34 ± 39.38		
Pediatrics	07.00-10.00	050	49.16 ± 18.16	+85%	1.39 × 10 ⁻⁸
	10.00-13.00	035	90.83 ± 33.98		
Surgery	07.00-10.00	095	48.06 ± 44.49	+55%	1.04 × 10 ⁻⁵
	10.00-13.00	092	74.58 ± 38.33		
Cardiology	07.00-10.00	270	44.02 ± 26.00	+114%	3.33 × 10 ⁻⁴⁹
	10.00-13.00	267	94.07 ± 41.63		
Obstetrics	07.00-10.00	024	39.83 ± 22.96	+78%	3.51 × 10 ⁻⁵
	10.00-13.00	039	71.00 ± 34.98		
Ophthalmology	07.00-10.00	223	43.18 ± 30.71	+78%	3.30 × 10 ⁻¹⁹
	10.00-13.00	172	76.78 ± 37.99		
Pulmonology	07.00-10.00	062	36.82 ± 13.96	+151%	6.17 × 10 ⁻³³
	10.00-13.00	177	92.55 ± 35.45		
Internal Medicine	07.00-10.00	054	69.09 ± 36.47	+17%	1.76 × 10 ⁻²
	10.00-13.00	280	80.68 ± 35.71		
Neurology	07.00-10.00	043	46.37 ± 19.51	+88%	3.08 × 10 ⁻¹⁵
	10.00-13.00	109	87.24 ± 37.53		
TB-Dots	07.00-10.00	002	46.00 ± 36.77	+60%	2.31 × 10 ⁻¹
	10.00-13.00	011	73.73 ± 53.99		
ENT	07.00-10.00	001	40.00 ± 00.00	-	-
	10.00-13.00	003	52.33 ± 00.00	-	-

Overall, the greatest inefficiencies occur during the peak hours (10.00 – 13.00), particularly in prescription queues for ΣA and polyclinics with high patient volumes (such as Cardiology and pulmonology). On the other hand, TB-Dots and ENT polyclinic showed statistically insignificant results (p=0.231), primarily due to very small sample sizes (TB-Dots: n=2 in the morning, n=11 in the afternoon; ENT: n=1 in the morning, n=3 in the afternoon).

An imbalance in resource allocation and accumulation of prescription backlogs during peak hours are key factors that exacerbate waiting times, especially within the context of the JKN system, which dominates healthcare service delivery. These findings are consistent with the research objective, which is to identify critical inefficiency points based on service times and prescription queue categories. The results can serve as an empirical basis for hospital management in formulating strategies for staff allocation, workflow optimization, and priority scheduling during peak hours.

DISCUSSION

KEY BOTTLENECKS BASED ON THEORY OF CONSTRAINTS

This study demonstrates that outpatient prescription waiting times at Mohammad Noer General Hospital increase dramatically during afternoon peak hours (10.00–13.00), with the most severe inefficiencies observed in compounded (ΣA :110.4% increase) and Cardiology polyclinic services (114% increase). These patterns align with the Theory of Constraints (TOC), revealing two fundamental bottlenecks:

1. **Capacity-Throughput Mismatch:** Fixed pharmacy staffing levels clash with a 36% surge in prescription volume during peak hours (1,157 vs. 848 prescriptions), while ΣA processing requires 2.3× longer than non-compounded queues [5]
2. **Resource Constraints:** The limited number of compounding stations and mandatory JKN drug substitution protocols, which affect 30% of cardiovascular medications, create cascading delays during verification [15]. The collapse in service standards (only 11.29% of ΣA met ≤ 60 -minute targets) signals systemic failure under JKN-dominated workloads.

According to the Theory of Constraints (TOC), a bottleneck refers to the problem of resource capacity being less than or equal to the demand load [16]. Prolonged waits due to increasing patient volumes, complexity of patient management, and limited healthcare resources [17]. One of the key factors influencing waiting times is material constraints, particularly related to drug availability. If a medication for JKN patients is unavailable, patients must wait until it becomes available or until an alternative medication is approved. However, pharmacists are required to confirm substitutions beforehand, which ultimately extends the overall waiting time [15].

This suggests that the pharmacy service system is not adequately equipped to handle the complexity of prescriptions and the surge in demand during peak hours. During the medication preparation process, pharmacists are required to ensure the accuracy of the medication and dosage, particularly for pediatric patients. Additionally, drug interaction screening, especially for compounded medications, must be conducted as a critical step in evaluating the benefits and safety of treatment for each patient [5].

In addition, the queue for ΣB (JKN-chronic) also experienced a substantial increase of 86%, from 47.74 minutes in the morning to 88.57 minutes in the afternoon. Notably, only 2.82% of JKN-chronic (ΣB) met the ≤ 30 -minute benchmark (vs. 28.26% in morning), falling critically below Indonesia's Ministry of Health service standard [15]. This delay threatens medication adherence in chronic diseases like hypertension [18]. The pharmacy department is responsible for preparing a one-month (30-day) supply of medication for each patient in the ΣB queue. A greater number and variety of medications per prescription often indicate a tendency towards polypharmacy, which contributes to longer service waiting times [5].

High-volume polyclinics (e.g., Cardiology and Pulmonology) exhibited the highest increase in waiting times during the day (94.07 minutes and 92.55 minutes, respectively), indicating that prescription complexity and concentrated patient flow are critical contributing factors. The prolonged waiting time at the Cardiology polyclinic is largely because most medications prescribed to JKN patients are intended for 30-day use. The complexity of Cardiovascular therapy, which is often dominated by polypharmacy prescriptions, also carries a high risk of adverse drug events and therefore requires careful attention [18]. Similarly, long waiting times at the Pulmonology polyclinics may result from the frequent use of

compounded medications, particularly in cases such as stable Chronic Obstructive Pulmonary Disease (COPD), where combination therapy is more effective than monotherapy [19].

STRATEGIC RECOMMENDATIONS FOR LEAN INTERVENTION

The results of this study reveal the dynamics of outpatient prescription service waiting times, which are significantly influenced by prescription service hours. The sharp increase in the average waiting time from 45.46 minutes in the morning to 84.44 minutes in the afternoon reflects the workload accumulation that is not optimally managed. The accumulation is primarily due to multiple polyclinics operating simultaneously, leading to a surge in prescription submissions during peak hours (10.00-13.00) [5].

The practical implications of these findings highlight the necessity of implementing time-based and queue category-based management strategies, including staff allocation optimization by increasing personnel in the non-compounded medication preparation and packaging unit [21]. Furthermore, real-time hospital data integration for prescription prediction. This study also emphasizes the importance of tailored policies for JKN patients, considering their significant contribution to the pharmacy departments' workload. Implementing automated queuing systems, staff expansion for high patient volumes, redesigning the pharmacy layout to reduce congestion, providing a chair in the waiting area for patients, and implementing interdepartmental communication protocols [22].

The identified inefficiencies represent critical muda (waste) in seven lean domains, particularly waiting, overprocessing, and unnecessary motion [23]. Lean Six Sigma may be used to reduce waiting time and increase service capacity without additional resource input [17]. The implementation of Lean Healthcare can also contribute to reducing waiting times or Length of Stay (LOS) in outpatient services by focusing on identifying and eliminating non-value added activities (NVAs) [23]. To eliminate waste and restore service standards, we propose that pre-packaged compounding kits prepared during low-volume periods (07.00–09.00) could reduce preparation time by 40% through standardized formulations for the ΣA Queue [24].

The hospital where this study was conducted has implemented e-prescribing to streamline the prescription transcription process and enhance efficiency [5]. For High-Volume Polyclinics, Heijunka (load leveling) via staggered e-prescription, e.g., 30% of Cardiology requests pre-10.00 to flatten peak-hour demand. However, challenges such as technical issues highlight the need for improved technological infrastructure, including hardware, software, and network systems [25].

POLICY IMPLICATIONS FOR INDONESIA'S JKN SYSTEM

With JKN covering almost 95% of patients, prolonged waits directly threaten medication adherence for chronic conditions like heart failure and COPD [18,19]. This is important for JKN program from both of hospital and government to implement the policy, according to Decree of the Indonesian Ministry of Health Number HK.01.07/MENKES/1645/2024 concerning the Referral-Return System for Chronic Diseases to Primary Healthcare Facilities, patients with stable clinical conditions should be returning to the Primary Community Health Center, and patient with unstable clinical conditions are being classified to 'iter' prescription, which permits the advance preparation of medications. In line with this policy, hospital management requirements can be optimized to reduce patient volume and shorten waiting times for medication preparation. For certain chronic patients that takes routines medications, JKN reimbursement processing can be performed simultaneously with medication preparation, thereby eliminating the need for additional administrative input in the pharmacy. The integration of technology (Bridging JKN-Hospital Information System), wherein reimbursement checks are conducted simultaneously with medication preparation instead of sequentially, has the potential to reduce administrative delays by approximately 50%. [25].

LIMITATIONS AND RECOMMENDATIONS

This study has several limitations that must be acknowledged. The cross-sectional and retrospective nature of the design limits the capacity to ascertain causal relationships or to account for unmeasured confounding variables, such as variations in staffing levels or modifications in workflow. The short period of data collection timeframe at a single hospital may not adequately represent seasonal or contextual fluctuations, thereby diminishing the generalizability of the findings. However, to increase interpretability and potential validity, the authors used a total population sampling approach with

inclusion and exclusion criteria, where all data points that met eligibility criteria in the target population were included in the analysis. Future research should explore alternative validation methods, such as automated real-time tracking systems or randomized audits using available hardware, to enhance data reliability.

The others, polyclinics type likes TB-Dots and ENT polyclinic, showed statistically insignificant results due to very small sample sizes. The limitation affects the generalizability of the findings, as sample size determination is a critical component in quantitative research design [20]. Therefore, further studies with larger and more representative samples are recommended to better explore the dynamics of prescription waiting times in these polyclinics.

CONCLUSION.

This study confirms that outpatient prescription waiting times at Indonesian government hospitals under the JKN system escalate dramatically during afternoon peak hours (10.00–13.00), with the most severe inefficiencies observed in compounded (ΣA : 110.4% increase) and high-volume polyclinics like Cardiology (114% increase). These delays stem from systemic bottlenecks—identified through the Theory of Constraints—including workload-capacity imbalances and resource limitations, which reduce service standard compliance to critical lows (e.g., only 11.29% of ΣA prescriptions met ≤ 60 -minute targets). To address this, we propose a Lean-ToC hybrid framework integrating peak-hour staffing adjustments, pre-packaged compounding kits, and JKN-specific reforms like parallel e-claim validation. Future research should validate this model in multi-center trials and quantify its impact on medication adherence for chronic diseases. Ultimately, optimizing these bottlenecks is essential not only for patient satisfaction but also for strengthening the sustainability of Indonesia's national health insurance system.

ACKNOWLEDGEMENT

We would like to thank all individuals and institutions who contributed to the completion of this research. The Authors declares that there is no conflict of interest.

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