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Evaluating the Effect of Outpatient Registration Systems on Patient Recommendations Using Value Stream Mapping and Path Analysis

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Abstract

Digital transformation in healthcare requires hospitals to adopt efficient and integrated information systems. This research aims to analyze the influence of outpatient registration information system types—conventional, Hospital Management Information System (SIM-RS), and Mobile JKN—on recommendations to others using Value Stream Mapping (VSM) and path analysis with SmartPLS. The study was conducted at Citra Husada Hospital Jember with 98 respondents selected through convenience sampling. This research employed a quantitative approach that was conducted in two phases. The first phase was descriptive-observational, aiming to evaluate the efficiency of the outpatient service process using queueing theory and Value Stream Mapping (VSM). The second phase was analytical with a cross-sectional design to analyze the influence of information system types on patient satisfaction. The VSM results indicate that Mobile JKN has the shortest total service time (1 hour 32 minutes) and the highest efficiency value (8.6%). Statistical analysis shows that interaction with medical personnel, ease of access, ease of use, and data security significantly influence patient satisfaction. Medical information satisfaction and overall service quality are identified as the main factors driving patient recommendations. Consequently, Mobile JKN is the most efficient registration system alternative and has the potential to improve hospital service quality. Optimization of system integration and user education is recommended to support digital-based healthcare service transformation.

Keywords: Information System; Mobile JKN; Outpatient; Patient Satisfaction; VSM; Digital-based healthcare.

Introduction

The digital transformation in the healthcare service sector is a consequence of the increasing public demand for fast, accurate, and integrated services. In Indonesia, the Ministry of Health encourages hospitals to adopt information systems that support the smart hospital concept, such as the Hospital Management Information System (SIM-RS) and the Mobile JKN application, to enhance the efficiency of administrative processes and medical services (Kemenkes RI, 2021). However, the implementation of these information systems still faces various challenges, including limitations in human resources, regulatory issues, and data security (Bappenas, 2020).

Globally, the digitalization of healthcare services has become a primary focus in improving service quality and patient safety. The World Health Organization (WHO), in its global strategy, states that digital health is a crucial pillar in supporting responsive and sustainable health systems (World Health Organization, 2020). One concrete form of digitalization in Indonesia is the Mobile JKN application developed by BPJS Kesehatan (the Healthcare Security Agency). This application allows patients to register for outpatient care online without having to queue physically at the hospital. Nevertheless, previous studies indicate that the integration between Mobile JKN and SIM-RS has not been fully optimized, particularly regarding data synchronization and system interoperability (Trisna et al., 2020).

On the other hand, the results of a preliminary study at Citra Husada Hospital Jember showed that the majority of patients (73.91%) still prefer the conventional registration system. This is attributed to the perception that direct registration is easier, provides certainty of obtaining a queue number, and does not

require specific digital skills. Other research also reveals that aspects of efficiency, user control, and learnability are still weaknesses of the Mobile JKN application (Annisa et al., 2020). Demographic factors such as advanced age, low digital literacy, and limited internet networks also contribute to hindering the optimization of the online registration system (Kusumawardhani et al., 2022).

Improving service efficiency is a critical component in supporting patient satisfaction, which in turn impacts public loyalty and trust in healthcare facilities (Susaldi et al., 2018). One method considered effective in identifying non-value-added activities (waste) in service workflows is Value Stream Mapping (VSM). VSM is a process visualization tool capable of systematically identifying cycle times, flow bottlenecks, and inefficiencies. Recent international studies demonstrate that the application of VSM in healthcare services has proven capable of accelerating service flow, reducing patient waiting times, and increasing operational efficiency (Marin-Garcia et al., 2021; Batwara et al., 2023). Its application has also been proven relevant in the context of hospitals in Indonesia (Muna et al., 2023).

Based on this background, this research aims to analyze the influence of different types of outpatient registration information systems—conventional, SIM-RS, and Mobile JKN—on service quality and patient satisfaction. The Value Stream Mapping approach is used to evaluate service time efficiency and identify process improvements from the user's perspective. The findings of this research are expected to contribute to the development of more adaptive, integrated, and patient-needs-based hospital information systems.

Methods

This research employed a quantitative approach conducted in two phases. The first phase was descriptive-observational, aiming to evaluate the efficiency of the outpatient service process using queueing theory and Value Stream Mapping (VSM). The second phase was analytical with a cross-sectional design to analyze the influence of information system types on patient satisfaction. The research was conducted at Citra Husada Hospital Jember in October 2023. Primary data were collected through direct observation of the patient registration process and the distribution of structured questionnaires. Since the patient population is not definitively known, the researcher uses an unknown population. After calculating the number of samples with the formula, the number of samples obtained was 97 people. To anticipate drop-outs, 1 person was added so that the total was 98 people. They were selected using convenience sampling. Convenience sampling is used because there is limited access to the population. Additionally, secondary data were obtained from the hospital's institutional documents related to the service system and the number of patient visits.

The independent variables in this study are Ease of Use, Information Availability, Ease of Access, Satisfaction with the Registration Process, Data Security, Medical Information Satisfaction, Health services, Complaint Response, and Interaction with Medical Staff. The mediating variables in this study are Medical Information Satisfaction and Overall Service Quality. The dependent variable is Recommendation to Others, while the service process efficiency acts as an intervening variable. Intervening variable is a variable that explains the relationship between an independent and a dependent variable (can be seen clearly in Table 1). The questionnaire used for data collection underwent validity testing using Pearson correlation and reliability testing using Cronbach's Alpha. The results indicated that all indicators showed valid and reliable values. The indicators used in measuring patient satisfaction include ease of access to the system, ease of use, data security, and satisfaction with the administrative service process and interaction with medical staff.

Table 1. Operational Definition

No	Variables	Definition	Measurement Criteria	
1	Ease of Use	The ease with which users can access and operate digital or manual healthcare service systems	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
2	Information Availability	How satisfied are patients with the availability of health information provided by the outpatient service's information system types	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
3	Ease of Access	Patient perceived ease of access to healthcare services and information via outpatient information systems	Scored based on the assessment criteria for each statement, which are:	
			Very easy	5
			Easy	4
			Enough	3
			Difficult	2
			Very difficult	1
4	Satisfaction with the Registration Process	Patient satisfaction with outpatient registration via various information systems	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5

No	Variables	Definition	Measurement Criteria	
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
5	Data Security	How confident are patients about the security of their personal data stored in outpatient information systems	Scored based on the assessment criteria for each statement, which are:	
			Very confident	5
			Confident	4
			Enough	3
			Not confident	2
			Very unsure	1
6	Medical Information Satisfaction	How satisfied are patients with the medical information provided by the outpatient service's information system	Scored based on the assessment criteria for each statement, which are:	
			Very easy	5
			Easy	4
			Enough	3
			Difficult	2
			Very difficult	1
7	Health services	Patients' perceptions of the quality of medical services provided, including the competence of medical staff and the facilities available	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
8	Complaint Response	How satisfied are patients with the information system's response to their complaints or feedback	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
9	Interaction with Medical Staff	If any, how satisfied are patients with their interaction with medical staff via the information system	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
10	Overall Service Quality	How do patients perceive the overall service quality provided by the outpatient information system types	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1
11	Recommendation to Others	How do patients perceive the overall service quality provided by the outpatient information system types	Scored based on the assessment criteria for each statement, which are:	
			Very satisfied	5
			Satisfied	4
			Sufficient	3
			Less satisfied	2
			Very less satisfied	1

The collected data were analyzed in stages. VSM analysis was used to map the patient registration process flow and identify value-added and non-value-added activities to evaluate process efficiency from the patient's perspective. Furthermore, queueing theory analysis was applied to determine the characteristics of the service system based on waiting time, the number of patients in the system, and service rate. The quantitative data were then analyzed descriptively to describe the respondents' profiles and general perceptions of the systems used. Subsequently, the relationship between variables was tested using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method with the assistance of SmartPLS 4.0 software. This research obtained ethical approval from the Health Research Ethics Committee of Citra Husada Hospital Jember, and all participants signed informed consent as a form of voluntary agreement to participate in the study. Data confidentiality was fully maintained to ensure the rights and privacy of the respondents. The ethical test was carried out at The Ethical Committee of Medical Research Faculty of Dentistry University of Jember No. 2554/UN25.8/KEPK/DL/2024 on April 22nd, 2024.

Results

Stage 1

Comparing the effectiveness of patient registration service methods is achieved by calculating the average time taken by each method. The results of this average time calculation are presented in Table 2.

Table 2. Average Time for Each Service Stage

Stages Service	Type of Service		
	Mobile JKN	**Online WA**	**Conven-tional**
Counter Queue Processing Time	0:01:17	0:01:22	0:01:32
Registration Waiting Time	0:08:42	0:08:46	0:09:16
Registration Process Time	0:01:31	0:01:31	0:01:58
Nursing Assessment Waiting Time	0:10:30	0:14:41	0:17:13
Nurse Assessment Process Time	0:03:23	0:02:30	0:01:37
Medical Assessment Waiting Time	0:37:59	0:38:09	0:56:35
Medical Assessment Process Time	0:04:13	0:03:43	0:03:30
Medication Preparation Waiting Time	0:23:50	0:27:59	0:31:49
Drug Collection Process Time	0:01:23	0:01:34	0:01:26
Total Service Time	**1:32:48**	**1:40:14**	**2:04:56**

Source: Primary Data, 2025

The results of the Value Stream Mapping analysis indicate that the registration method using Mobile JKN has the shortest total service time, which is 1 hour, 32 minutes, and 48 seconds. This is attributed to the minimal waiting time during the medical assessment and medication preparation stages. Conversely, the conventional method demonstrates the longest service time at 2 hours, 4 minutes, and 56 seconds, primarily due to significant waiting times at nearly every stage of the service process. The online WhatsApp method falls in the middle, with a total service time of 1 hour, 40 minutes, and 14 seconds. The VSM analysis revealed the time required for each service stage across the three methods, as presented in Table 3.

Table 3. The results of the VSM analysis on service time

Process Stages	Mobile JKN	Online WA	Conventional On the Spot
Lead Time (LT) (Total service time)	1 hour 33 minutes	1 hour 48 minutes	2 hours 5 minutes
Process Time (PT) (Total service uptime)	8 minutes	7 minutes	8 minutes
Waiting Time (WT) (Total waiting time)	1 hour 25 minutes	1 hour 41 minutes	1 hour 57 minutes
***Value Added Ratio* (PT/LT)**	8.6%	6.5%	6.4%

Source: Primary Data, 2025

Based on the Value-Added Ratio, Mobile JKN recorded the highest efficiency at 8.6%, followed by online WhatsApp at 6.5%, and the conventional method at 6.4%. This demonstrates that the utilization of digital technology is capable of reducing waiting times and increasing the speed of service compared to manual methods.

Stage 2

The bivariate analysis conducted using SmartPLS (Figure 1) revealed a significant influence of the type of service information system on patients' perceived satisfaction.

The indicators (presented in Table 4) that significantly impact service quality and medical information satisfaction are interaction with medical personnel (O = 0.319; p = 0.001), ease of use of the system (O = 0.279; p = 0.002), ease of access to information (O = 0.258; p = 0.001), service health in a way general (O = 0.281; p = 0.001). Satisfaction with medical information has a positive influence on patients' tendency to recommend the service (O = 0.282; p = 0.001), which is further strengthened by the overall quality of service (O = 0.406; p = 0.001).

However, other variables such as data security (p = 0.055), information availability (p = 0.064), and satisfaction with the registration process (p = 0.065), while influential on satisfaction with medical information, do not contribute significantly to patients' tendency to recommend the service to others. Multivariate path analysis revealed a mediating effect between information system variables and patient recommendations. Specifically, interaction with medical staff, healthcare service, ease of access, and ease of use were proven to significantly enhance the tendency for recommendations by improving either service quality or medical information satisfaction. These factors represent crucial points that hospitals need to improve upon in their efforts to enhance service quality based on information technology.

Discussion

The research results indicate that the utilization of Mobile JKN as an outpatient registration method demonstrates the highest superiority in terms of effectiveness and service time efficiency compared to other methods, namely online registration via WhatsApp (HIS - Hospital Information System) and conventional on-site registration. The use of Mobile JKN enables patients to significantly reduce waiting times across almost all stages, from registration to medication retrieval. This

aligns with the findings of Suhena et al. (2024) and Hakim et al. (2024), which state that the digitalization of healthcare information systems enhances overall accessibility and service time efficiency.

Furthermore, the service efficiency of Mobile JKN is reinforced by the speed of the assessment process and the ease of obtaining queue numbers, as well as the certainty of appointment times, as explained by Kharismatus Ikhyana et al. (2023) and Ardiansyah et al. (2021). The automation of processes and the flexibility of access within the digital system are considered highly beneficial for patients in planning their daily activities and reducing queue congestion at healthcare facilities.

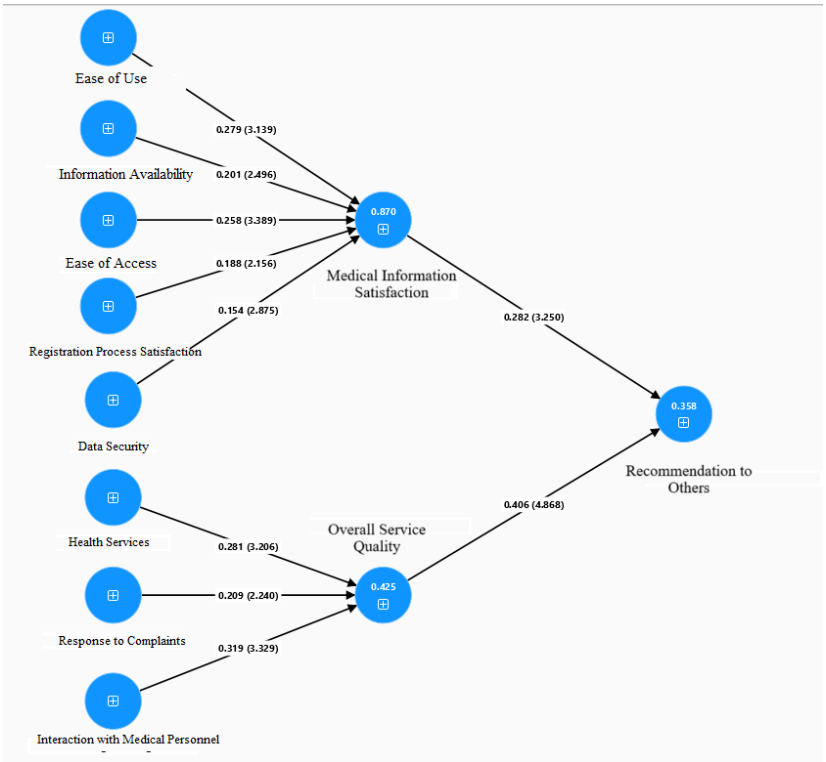

Figure 1. SmartPLS Analysis Diagram (Source: Primary Data, 2025)

In the context of patient satisfaction, bivariate and multivariate analyses using SmartPLS reveal that several factors within the information system have a significant influence on patients' perception of service quality. Interaction with medical personnel emerges as the most dominant factor in shaping perceptions of overall service quality. This is consistent with the SERVQUAL theory, which emphasizes the importance of empathy and assurance dimensions in creating a positive service experience (Mariyam et al., 2025).

Other factors that also contribute to satisfaction include data security, ease of access, and system usability. When patients feel that their data is secure, medical information is easily accessible, and the system is user-friendly, they tend to exhibit higher levels of satisfaction. This is supported by the Technology Acceptance Model (TAM) and Cognitive Load Theory, which highlight the significance of perceived comfort and ease of use in digital information systems. Increasing the accessibility and superiority of mobile banking applications can increase customer happiness, thereby encouraging customer loyalty (Setyani et al., 2024).

Table 4. Bivariate Analysis Results using SmartPLS

No	Variable Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
1	Interaction with Medical Personnel -> Overall Service Quality	0.319	0.318	0.096	3,329	0.001
2	Data Security -> Medical Information Satisfaction	0.154	0.151	0.053	2,875	0.004
3	Ease of Access -> Medical Information Satisfaction	0.258	0.253	0.076	3,389	0.001
4	Ease of Use -> Medical Information Satisfaction	0.279	0.281	0.089	3,139	0.002
5	Medical Information Satisfaction -> Recommendation to Others	0.282	0.281	0.087	3.25	0.001
6	Registration Process Satisfaction -> Medical Information Satisfaction	0.188	0.185	0.087	2,156	0.031

Table 4. Bivariate Analysis Results using SmartPLS

No	Variable Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
7	Information Availability -> Medical Information Satisfaction	0.201	0.206	0.081	2,496	0.013
8	Overall Service Quality -> Recommendation to Others	0.406	0.405	0.083	4,868	0.001
9	Health Services -> Overall Service Quality	0.281	0.278	0.088	3,206	0.001
10	Response to Complaints -> Overall Service Quality	0.209	0.213	0.094	2.24	0.025

Satisfaction with medical information also contributes to patients' inclination to provide recommendations to others, as explained by the Word of Mouth (WOM) theory. However, not all factors have a direct influence on recommendation behavior. For instance, variables such as data security, responsiveness to complaints, and information availability, while significant for satisfaction, do not directly motivate patients to recommend the service. User trust in the security and privacy of e-commerce applications, including health applications, significantly influences satisfaction and the intention to continue using the application (Wantias & Yuliaty, 2025).

One significant finding from the multivariate analysis is that overall service quality is the primary determinant in shaping patients' decisions to recommend the service. This factor reflects the cumulative experience of the patient throughout the service process, from registration and interaction with medical personnel to complaint handling. This finding aligns with the Customer Satisfaction Model and Service Quality Theory, which emphasize that positive recommendations only arise when the service experience is genuinely satisfying overall.

Overall, this discussion underscores that the selection and design of healthcare service information systems must consider time efficiency, ease of use, security, and the quality of interaction with patients. Technology-based innovations like Mobile JKN hold great potential in improving service quality and patient satisfaction, but they must be supported by non-technical service aspects such as the empathy of medical personnel and responsive complaint management.

Conclusion

Mobile JKN is the most efficient information system for outpatient services, offering shorter waiting times and faster processes compared to other methods. Factors such as interaction with medical personnel, ease of access and use, and data security significantly influence patient satisfaction with medical information, which subsequently encourages them to recommend the service. To enhance service quality, it is recommended that hospitals optimize user education for Mobile JKN, integrate the system with other services, and conduct regular evaluations to ensure the effectiveness of digital services.

Conflict of Interest

The authors declare no conflict of interest.

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Author contribution

Author 1 was responsible for the study design, data collection, and data analysis. Authors 2 and 3 contributed by providing input on the study, reviewing, and revising the manuscript. All authors have read and approved the final version of the manuscript.

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