International Journal of Management and Sustainability
2026 Vol. 15, No. 3, pp. 466-483
ISSN(e): 2306-0662
ISSN(p): 2306-9856
DOI: 10.18488/11.v15i3.5109

Primary healthcare centers in Surabaya, Indonesia: Improving the efficiency of outpatient services by increasing e-health capability and service quality

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Article History
Received: 24 November 2025
Revised: 12 May 2026
Accepted: 10 July 2026
Published: 20 August 2026

Keywords
E-health capability
Health centers
Outpatient service quality
Public health
Service performance
Waiting time.

ABSTRACT

Primary health services are experiencing a rise in the use of digital transformation tools, such as e-health, to enhance their efficiency and effectiveness. However, existing studies offer limited explanations of how e-health capabilities translate into sustained service performance in public primary healthcare settings. This study examines the influence of e-health capability on outpatient service performance by considering outpatient service quality as a mediating mechanism and waiting time as an operational factor. Two hundred and three outpatients from Surabaya, Indonesia's health centers, participated in this quantitative explanatory study. We used PLS-SEM, or Partial Least Squares, to evaluate the data. The research demonstrates that the efficiency and effectiveness of outpatient services are significantly improved through the use of e-health capabilities. Structural analysis reveals that improvements in e-health capability enhance service performance both directly and indirectly via outpatient service quality, with the latter exerting the strongest influence on performance outcomes. Additionally, no moderating effects were found, although wait times have a substantial detrimental impact on service performance. These findings indicate that primary healthcare digital transformation can only reach its full potential by integrating technology capabilities with improved service quality and operational efficiency. This research offers valuable policy recommendations for enhancing the long-term performance of primary healthcare systems and for strengthening the Capability-Quality-Performance model.

Contribution/Originality: This study contributes to the existing literature by extending the Capability–Quality–Performance framework in primary healthcare. The paper's primary contribution is finding that outpatient service quality mediates the relationship between e-health capability and service performance in Indonesian public health centers.

1. INTRODUCTION

One of the main goals of medical system reform in many countries is the widespread adoption of electronic health (e-health) technologies, particularly in primary and ambulatory care settings, where patients have frequent and extensive encounters with healthcare providers. Digital health systems are anticipated to improve access and continuity of care, system efficiency (by automating many of the inefficiencies caused by processing paper), quality of care (by improving accuracy), and patient-centeredness in health service delivery: by providing patients with options

that optimize the data capture journey through better enabling communication between patients and their health professionals. Such empirical investigation, however, shows that e-health adoption might contribute to a decrease in procedural duplication, access, and care coordination support at a distance, especially in the post-pandemic healthcare system. Nevertheless, there is a lack of a systematic relationship between the amount of these investments and the performance of health service delivery.

In primary and ambulatory care medicine, where patients often have follow-up appointments, the integration of e-health tools has emerged as a key concern in the global reform of health care systems. Digital health systems provide better patient-centered services, more continuity of care, and less paperwork by enhancing doctor-patient connections through better communication. Liu, Wang, Kong, Wang, and Liu (2019) cite anecdotal evidence that e-health implementation could eventually lead to the elimination of procedural waste, improved access to distant care, and continuity of care in the post-COVID-19 period. However, it remains unclear if these technological investments actually lead to noticeable enhancements in the quality of treatment provided; this is likely due to the fact that there is a great deal of variance among healthcare settings (Lewis, Harding, Snowdon, & Taylor, 2018).

For about half of Indonesia's population, public health centers (Puskesmas) serve as their initial point of contact with the healthcare system. According to Hung, Mujal, Jin, and Liang (2021), these units are meant to provide primary clinical care as well as integrated services for prevention, treatment, rehabilitation, and promotion of health.

And as Puskesmas are locally managed, in the public sector under local government supervision, they demonstrate a strong focus on Accessibility, Affordability, and Equity. Since digital health interventions are becoming more important in determining operational efficiency, quality of service processes, patient experience, and clinical outcomes should not be the only components of effectiveness assessments in this context (Al-Harajin, Al-Subaie, & Elzubair, 2019).

Over the past few years, many primary care providers have turned to e-health solutions. Yet, the outcomes have not been uniformly positive (Morikawa, Ando, Tezen, & Okada, 2025). In practice, some healthcare providers report that digital systems help simplify operational processes and contribute to more satisfying patient experiences. In certain contexts, digital initiatives may even risk deepening existing inequalities in access to care.

Such discrepancies suggest that technology uptake alone in healthcare organizations is not sufficient; organizational and service capabilities, such as system reliability, quality of information, and patient-provider relationships, critically influence the extent to which e-health can translate into significant performance improvements (Mesfin & Gintamo, 2019). This perspective is consistent with the Resource-Based View (RBV), where digital capability is a strategic asset and its value can only be realized in practice, inside organizational processes (AlShammari, AlSaif, Karim, & Alsaad, 2025).

From a service management point of view, Outpatient Service Quality (OSQ) stands out as an important channel through which digital capabilities influence service performance (Marshall, Miller, & Moritz, 2023). OSQ includes respondents' assessments of attributes such as responsiveness, empathy, reliability, and whether service processes are effective (Chang & Chang, 2018), which all directly influence satisfaction, loyalty, and perceived performance. However, the current service quality literature rarely treats OSQ as a mediating construct helping to understand why e-health capabilities produce better performance outcomes, and continues to emphasize system adoption, technical success, or user satisfaction levels with online platforms. Therefore, the route of service delivery processes in primary care services is still largely unknown (Aeenparast, Maftoon, Farzadi, & Yahyazadeh, 2021).

Long waiting time is also an important operational issue in outpatient clinics, as there are significant negative patient perceptions and lower satisfaction with long waiting times (Bahammam, 2023). However, existing research mostly treats waiting time as an output or control variable and does not explore its role within a broader capacity-quality-performance framework. Evidence for its buffering effect is scarce and mixed, especially in primary health care, where structural constraints such as manpower shortages, fragmented services, and standardized procedures inhibit deviations in waiting times between sites (Sarwat, 2021). Empirical inquiry is, therefore, needed to confirm

whether waiting time moderates the relationship between digital capability and service quality, performance, or serves as a main direct predictor of performance (Sharpe & Eastham, 2024).

Recent empirical studies in digital health services suggest that existing research has not fully clarified how e-health capability, beyond mere adoption, contributes to service performance in primary healthcare contexts. In particular, prior findings offer only limited empirical explanation of how outpatient service quality functions as an intermediary mechanism and how waiting time shapes performance evaluations within an integrated capability–quality–performance perspective (Rosen, Beilstein-Wedel, Shwartz, Davila, & Gurewich, 2024). This unresolved issue is addressed by positioning the Capability–Quality–Performance (CQP) framework as an analytical lens to explore the interconnection between organizational capabilities, service delivery processes, and performance outcomes in primary healthcare services (Mohammed, Mohsin, & Mohammed, 2021).

This research investigates the interrelationships among e-health capability (EHC), outpatient service quality (OSQ), and service performance (SP) within Indonesian primary healthcare centers. The empirical analysis focuses on how digital capability shapes service quality processes and overall performance outcomes, while also examining whether outpatient service quality operates as an intervening mechanism and whether waiting time directly influences performance evaluations. The study is grounded in empirical data collected from Surabaya, allowing the Capability–Quality–Performance (CQP) framework to be examined within the institutional realities of a developing country healthcare system. Rather than positioning technology as an isolated driver of performance, the analysis highlights the conditions under which digital initiatives translate into sustained service improvements (Yousef et al., 2024).

The remainder of the paper proceeds as follows. The next section outlines the theoretical foundation and hypothesis development. The methodology and empirical findings are then presented, followed by a discussion of managerial and policy implications for sustainable primary healthcare management.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS

2.1. Research Theoretical Framework

This study adopts the Capability–Quality–Performance (CQP) framework as an integrative lens for examining service performance in primary healthcare settings. Rather than treating digital technology as an isolated input, the framework conceptualizes performance outcomes as the result of how organizational capabilities, service quality processes, and operational resources are aligned and managed. Drawing on the Resource-Based View, information system success perspective, and service quality theory, sustainable service performance is understood as emerging from the effective transformation of digital resources into service processes that are perceived positively by users (Mohammed et al., 2021).

Resources and competencies with strategic value, low replicability, and contextual integration with organizational processes are the sources of performance excellence according to RBV (AlShammari et al., 2025). When it comes to healthcare, e-health capabilities are more than just technical infrastructure. Digital system trustworthiness, health record accuracy and usability, and the efficacy of provider-patient interactions made possible by technology are all part of these attributes. Its value depends on how effectively technology is embedded within the service flow and on the competence of the human resources responsible for its operation, reinforcing the socio-technical nature of this capability.

According to the information system success concept (Liu et al., 2019), digital system performance is commonly evaluated through user perceptions of system quality, information quality, and service quality. In outpatient service settings, e-health systems demonstrate their practical value by simplifying administrative processes, strengthening clinical decision support, and enabling more responsive and coordinated interactions between patients and healthcare providers. According to service quality theory, which was put forth by Chang & Chang (2018), the effectiveness of communication, responsiveness, empathy, and reliability are all aspects of the service process that patients perceive as contributing to the quality of outpatient treatments. Trust, loyalty, and patient pleasure are outcomes of service

performance, and this perspective on process quality connects the company's internal resources to these outcomes (Marshall et al., 2023). The CQP model positions e-health competence as a strategic capability, outpatient service quality as a service process mechanism, and service performance as its resulting outcome. Waiting time, in contrast, functions as an operational condition that shapes patients' evaluations of service performance.

2.2. E-Health Capabilities and Quality of Outpatient Services

Healthcare organizations' proficiency in establishing and maintaining dependable digital infrastructure, producing accurate medical records, and enabling productive patient-provider dialogues is reflected in electronic health (e-health). With this feature, outpatient service providers can improve coordination among various service functions, reduce the possibility of misrepresentation, and simplify administrative responsibilities (Mesfin & Gintamo, 2019).

Multiple empirical results show that when healthcare personnel have access to high-quality system information, they are better able to consistently meet patients' needs. Additionally, patients' sense of security and trust in the service process is strengthened by high-quality digital engagement (Aeenparast et al., 2021). Thus, patients often consider well-managed e-health services as providing outpatient care that is more organized, responsive, and dependable. The following hypothesis is derived from this argument.

H_1: The ability of e-health is positively related to the quality of outpatient services.

2.3. Quality of Outpatient Services and Service Performance

In addition to operational efficiency, perceptual metrics that represent medium- and long-term success, like patient happiness, loyalty, and trust, are used to gauge service performance in primary healthcare. As per Chang and Chang (2018), the service quality theory posits that a favorable appraisal of the service process will influence the patient's overall rating of service performance.

Services in the outpatient setting that are marked by attendant responsiveness, empathy, and dependability of the service process are regularly linked to higher patient satisfaction and trust, which in turn strengthens the perception of service performance (Marshall et al., 2023). To sum up, the quality of outpatient services is a major component in explaining the variation in service performance according to users. This reasoning leads to the following hypothesis.

H_2: The quality of outpatient services is positively related to service performance.

2.4. E-Health Capabilities and Service Performance

Competence in electronic health care has the potential to improve service efficiency in addition to its quality. Digitalizing service processes allows for better accessibility, faster service flows, and improved inter-unit coordination, all of which contribute to a positive perception of service performance (Lewis et al., 2018). In a healthcare setting, cutting-edge e-health capabilities empower patients to take charge of their own health information, streamline administrative tasks, and increase service transparency. This aspect can enhance the patient's evaluation of the institution's performance even before the quality of service exchanges is completely evaluated (Hung et al., 2021). Based on this reasoning, we can deduce the following hypothesis.

H_3: The ability of e-health is positively related to service performance.

2.5. The Role of Outpatient Service Quality Mediation

Service quality is an important mechanism that connects organizational capabilities to performance outcomes, as stated by the CQP paradigm. Improved patient interactions and processes are the primary means by which technology improves service performance in the e-health setting, which provides digital infrastructure and support (Mohammed et al., 2021).

Service quality has long been viewed as a link between organizational capability and performance (Rosen et al., 2024). Yet its role in primary healthcare has not been examined in depth. This study, therefore, considers whether outpatient service quality serves as the pathway through which e-health capability improves service performance.

H_4: Outpatient service quality mediates the effect of e-health capability on service performance.

2.6. Waiting Time and Service Performance

Regardless of the clinical quality offered, wait time is a very sensitive operational measure in outpatient services and is consistently linked to patient weariness and worse satisfaction (Bahammam, 2023). Patients' first assessments of the overall effectiveness of the service are often influenced by their perceptions of wait times.

Due to regular operating procedures and capacity constraints, waiting time variation in basic health services is typically quite small, making its function as a moderating variable less noticeable. On the other hand, patients' assessments of service delivery are more accurately positioned as a direct factor of wait time (Sarwat, 2021; Sharpe & Eastham, 2024). The following hypothesis results from these factors.

H_5: Waiting time is negatively related to service performance.

2.7. Research Conceptual Model

The conceptual model illustrates how e-health capability, outpatient service quality, waiting time, and service performance are connected within the Capability–Quality–Performance framework. The model emphasizes that service performance in primary healthcare settings emerges from the alignment of digital capabilities with service process quality, while operational characteristics such as waiting time influence patients' evaluations of performance outcomes.

3. METHODOLOGY

3.1. Research Design

We used a quantitative explanatory structural relationships method to examine how E-health capability (EHC), outpatient service quality (OSQ), service performance (SP), and waiting time (WT) were related. We rigorously evaluated hypotheses derived from the Capability-Quality-Performance (CQP) framework. Research in service management has focused on employing PLS-SEM as an analytical tool for data evaluation. This method is known for its robustness and ability to handle theoretical development, complex mediation, and predictive modeling (Chen, Hsiao, Chang, & Lai, 2024).

3.2. Population and Sample Characteristics

People who visited Puskesmas, public health centers in Surabaya, Indonesia, for outpatient e-health services, were the subjects of the study. Researchers used a purposive sampling strategy to recruit people who already had some familiarity with the target e-health platform. To be eligible, one must have utilized outpatient services within the past three months and be at least 18 years old. In the end, we received 203 valid replies, which is far more than the minimum required by PLS-SEM. This indicates that our results are statistically robust (Rahimi & Solymani, 2022).

3.3. Instrument Development

A structured questionnaire was used to gather the data, and it measured four latent variables: EHC, OSQ, WT, and SP. Measurement items were modified from existing measures in health and service quality literature, with some item modifications to fit the outpatient setting. Responses were recorded on a five-point Likert-type scale anchored at 1 (strongly disagree) and 5 (strongly agree) (Menap, Harmaen, & Sastrawan, 2021). Table 1 presents the

measurement constructs, dimensions, sample measurement items, number of items, and supporting references used in this study.

Table 1. Measurement constructs, indicators, and sources.

Construct	Dimension	Sample measurement items	Number of items	Source
E-Health Capability (EHC)	System Quality	Easy-to-use e-health system; The system is reliable and rarely experiences errors; The system responds quickly during service use.	4	Alrasheedi, Al-Mohaithef, Edrees, and Chandramohan (2019) and DeLone and McLean (2003)
	Information Quality	The e-health system delivers information that can be trusted for its accuracy; information is timely and easy to understand.	3	Alenoghena et al. (2022) and DeLone and McLean (2003)
	Interaction Quality	The e-health system facilitates effective communication with healthcare staff; digital interaction improves service convenience.	3	Bitner, Zeithaml, and Gremler (2010) and Ighomereho, Ojo, Omoyele, and Olabode (2022)
Outpatient service quality (OSQ)	Responsiveness	Staff provide prompt service; Staff respond quickly to patient needs	3	Donabedian (1988) and Zeithaml, Berry, and Parasuraman (1996)
	Empathy	Healthcare staff show personal attention; Staff understand patient concerns	2	Yang et al. (2025) and Zeithaml et al. (1996)
	Reliability	Services are delivered as promised; Procedures are performed consistently and accurately	4	Donabedian (1988) and Song and Jang (2020)
Waiting time (WT)	Registration time	The registration process is completed within a reasonable time	1	Mohammed and Lockey (2023) and Thompson, Yarnold, Williams, and Adams (1996)
	Examination time	Waiting time before examination is acceptable	2	Grot et al. (2023) and Jalloh, Nwosu, and Baysan (2023)
	Total waiting time	Overall, waiting duration meets patient expectations	1	Thompson et al. (1996)
Service performance (SP)	Satisfaction	Overall, I am satisfied with the outpatient service; The service meets my expectations	2	Bitner et al. (2010) and Mahajan, Anand, Hossain, and Vishwakarma (2025)
	Trust / Perceived Outcome	The service improves my health condition; I trust the service outcomes	2	Chen et al. (2024) and Salam, Waspodo, Ningsih, Kartika, and Yanti (2024)
	Loyalty	I am willing to revisit this health center; I would recommend this service to others	2	Bentum-Micah, Ma, Wang, Atuahene, and Bondzie-Micah (2020) and Budiman and Achmadi (2023)

EHC was modeled as a multi-dimensional construct reflecting patient perceptions of system quality, information quality, and digital interaction quality, each indicating focus on reliability, usefulness, and usability of e-health services. OSQ included patients' experiences with service mechanisms, including standard of care and empathy, based on the SERVQUAL model. WT assessed outpatient perception of service duration during each procedural stage, while SP evaluated outcomes of the services delivered, such as satisfaction, trust, and loyalty (Altuntas & Kansu, 2020).

All measurement items were content validity and clarity tested for comprehensiveness and relevance to the constructs in the study before data collection (Mendes & Da Silva, 2016).

3.4. Data Collection Procedures

The data were collected in August 2023 by distributing the survey on-site at specific Puskesmas in Surabaya. Ethical clearance and research permissions were secured from the relevant health authorities prior to fieldwork. The research followed voluntary participation, with consent obtained from all participants, and their privacy was preserved since no personal data were collected (Issa, El Guindy, Ahmade, & Abozied, 2022).

3.5. Data Analysis Methodology

SmartPLS 4 was used to look at the data in two steps: first, it looked at the measurement model, and then it looked at the structural model. We used outer loadings and AVE to test convergent validity and the HTMT criterion to test discriminant validity. Composite Reliability and Cronbach's alpha were used to check for reliability. After that, path coefficients, R^2, Q^2, and effect size (f^2) statistics (Jonkisz, Karniej, & Krasowska, 2022). were used to figure out the structural relationships. To find indirect effects and their confidence intervals for mediation analysis, we used bootstrapping with 5,000 resamples. Waiting time was added as another factor that could affect service performance.

The mediating role of outpatient service quality (OSQ) was evaluated through a bootstrapping approach with 5,000 resamples to estimate indirect effects and corresponding confidence intervals. Waiting time (WT) was specified as an additional predictor of service performance (SP). No moderation analysis was performed, in line with the proposed theoretical model and the characteristics of the dataset (Tanto, Nursanti, & Laksmana, 2024).

1. Validity and Reliability Tests: Convergent Validity: We checked for convergent validity by looking at outer loadings and the Average Variance Extracted (AVE). The outer loadings for all the EHC, OSQ, SP, and WT constructs were higher than the suggested level of 0.70, and the AVE values were greater than 0.50. This suggests that the convergent validity was good. These results suggest that the methods utilized are good for measuring the construct being researched.

Reliability: Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR). The CR coefficients for EHC (0.944), OSQ (0.957), SP (0.962), and WT (0.954) all exceeded the recommended threshold of 0.70, indicating strong internal consistency across the constructs.

2. Discriminating Validity Test: To test the discriminant validity, the Heterotrait-Monotrait Ratio (HTMT) was used. The entire pair for the construct has an HTMT value < 0.90, suggesting that constructs do not have substantial overlap in our model. The findings suggest that the constructs are sufficiently distinct from one another, indicating that discriminant validity has been achieved.

3. Multicollinearity Test: The Variance Inflation Factor (VIF) was used to check for multicollinearity. The overall VIF of this construct is below the recommended threshold (3.3), indicating the absence of multicollinearity among constructs in this model. This is necessary to avoid high collinearity among independent variables that can affect the independence of the construct and the estimation of parameters in the PLS-SEM model.

4. Structural Model Evaluation: Structural model fit is assessed through the Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), and chi-square goodness-of-fit statistic. The fit of the model was excellent, as shown by the test results. SRMR = 0.061 (below the cutoff of 0.08), and NFI = 0.912 suggest a good model fit; this indicates that the model fits the data very well, with an acceptable fit to the hypothesized structure.

5. Mediation and Moderation Test: For mediation attenuation testing, we also performed bootstrapping (5,000 resamples) to find the indirect effect of EHC on SP through the OSQ. The mediating analysis showed a significant effect with $\beta = 0.460$ ($p < .05$), and the 95% confidence interval [0.322, 0.589] did not contain zero, confirming OSQ as a significant mediator between EHC and SP, indicating that e-Health capability can positively enhance service performance at Puskesmas.

While WT exhibited a significant direct effect on SP ($\beta = -0.211$, $p = 0.006$), the moderation test indicated that WT did not play a significant moderating role between EHC → OSQ and OSQ → SP. This may be because better timelines are less variable and do not act as strong moderators in this model. Other institutional factors influencing

the demand-supply dynamics of medical services, such as low availability of medical manpower and manual handling in administrative processes, may contribute more to wait times than the e-health system design itself.

3.6. Ethical Consideration

This research also follows ethical standards rigorously to safeguard privacy and respondent rights. The health-related information of all participants is encrypted and placed on a server that is only accessible to authorized members of the study group. This data will only be used for research purposes and will not be distributed to third parties without the permission of the respondent. Moreover, informed consents to participate were guaranteed as participants received no later than oral information on the objectives of the research and procedures involved in it. Moreover, they had the possibility of withdrawing at any time without negative consequences. Participation in the study was voluntary, and every respondent signed a declaration of informed consent where it was clearly stated that they could withdraw without repercussion.

4. RESULT

In this study, most subjects were female (55.2%). Respondents were primarily (67.1%) in the 26-45 years economically active age group. Furthermore, over 70% of respondents have achieved at least a high school education and possess sufficient literacy and numeracy to understand e-health apps. Legally employed individuals are the only ones with jobs in this study, forming 35%, which is the highest percentage. Meanwhile, civil servants and housewives form the third largest group. So far, only a small number of respondents in this study appear to use digital e-health services regularly, with 45.3% reporting they most often use digital e-health services (Table 2).

Demographic characteristics, including gender, age, education, occupation, and the frequency of visits, explain the gap between patients' perceptions and behavior in digital healthcare. Therefore, enhancing digital literacy and health, especially among women, is crucial. To be complete, well-functioning, and graded to different levels of access, primary healthcare systems require interventions, policies, and joint actions from governments, health professionals, and communities.

Table 2. Demographic characteristics of respondents.

Characteristic	Category	n	%
Gender	Male	91	44.8
	Female	112	55.2
Age (Years)	17–25	25	12.3
	26–35	78	38.4
	36–45	58	28.6
	46–55	31	15.3
	>55	11	5.4
Educational level	Primary school (SD)	15	7.4
	Junior high school (SMP)	29	14.3
	Senior high school (SMA)	81	39.9
	Bachelor's degree	63	31.0
	Postgraduate	15	7.4
Occupation	Civil servant/Army/Police	32	15.8
	Private employee	71	35.0
	Entrepreneur	24	11.8
	Student	17	8.4
	Retired	3	1.5
	Housewife	36	17.7
	Unemployed	20	9.9
Frequency of visits	1 time	92	45.3
	2 times	53	26.1
	3 times	37	18.2
	4 times	12	5.9
	5 times	6	3.0
	>6 times	3	1.5

The descriptive analysis in Table 3 reveals that all the individual means of the research variables were above 3.90, highlighting that respondents had a positive perception of the services received at the HC. The E-Health Capability (EHC) was rated good across all three dimensions: system quality, information quality, and interaction quality. Outpatient Service Quality (OSQ) also scored high in responsiveness, empathy, and reliability domains. Waiting Time (WT) falls into the good category, with minimal variation between dimensions. Additionally, Service Performance (SP) showed the highest score, with patient loyalty being most prominent. These results clearly indicate that respondents have a positive experience regarding the quality of e-health systems and service processes, as well as overall service performance at the health center.

Table 3. Distribution of the research variable.

Variables	Indicator	Mean	Scale Category
E-health Capability (EHC)	Quality of Information	4.10	Good
	System Quality	4.07	Good
	Quality of Interaction	4.07	Good
Outpatient Service Quality (OSQ)	Responsiveness	4.06	Good
	Empathy	4.10	Good
	Registration	4.09	Good
Waiting Time (WT)	Registration	3.97	Good
	Inspection	4.02	Good
	Total Time & Convenience	4.01	Good
Service Performance (SP)	Clinical Outcomes / Trust	4.06	Good
	Patient Satisfaction	4.10	Good
	Patient Loyalty	4.26	Good

Figure 1 illustrates the conceptual research model explaining the relationships among e-health capability, outpatient service quality, waiting time, and service performance.

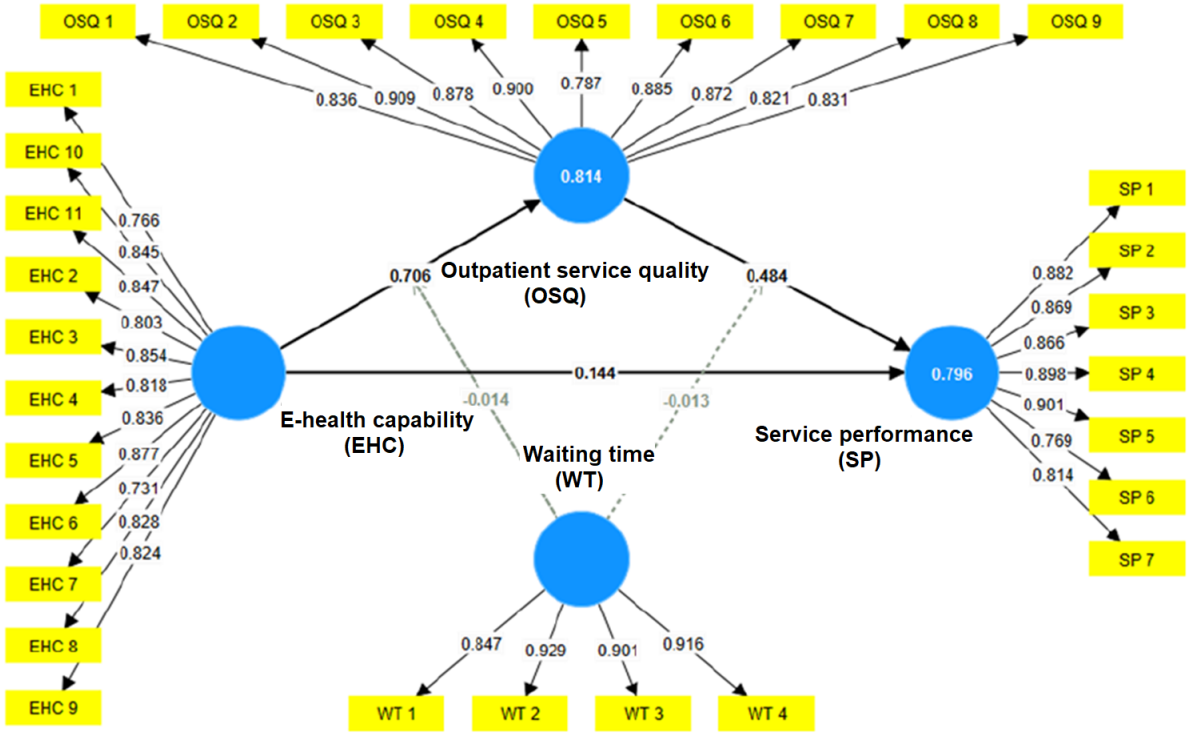

Figure 1. Research model structure.

The proposed model was evaluated using PLS-SEM to examine relationships among research variables. The goodness-of-fit indices for the measurement model showed that all indicators for the EHC, OSQ, SP, and WT

constructs had outer loadings above 0.70, meeting convergent validity requirements. The AVE for each construct exceeds 0.50, indicating that each explains most of the variance of its items. The constructs are reliable, with Composite Reliability (CR) and Cronbach's Alpha values between 0.920 and 0.962, surpassing the minimum standard of 0.70, as shown in Table 4. Additionally, the Heterotrait-Monotrait Ratio (HTMT) demonstrated that all construct pairs were less than 0.90, satisfying discriminant validity. The overall VIF was less than 3.3, indicating no multicollinearity within the model indicators.

The fit between the structural model and the data is found to be acceptable. SRMR (standardized root mean square residual) is 0.061, below the threshold of 0.08, indicating an acceptable fit to the model. The Normed Fit Index (NFI) of 0.912 also shows that the empirical and theoretical models fit well together. The results from the Chi-square saturated model also show that there isn't much difference between the estimated and expected models. In general, these fit indices are indicative of a good fit and encourage our structured comparison.

Table 4. Convergent validity and reliability.

Latent Variables	Items	Loadings	AVE	Composite Reliability (CR)	Cronbach's Alpha
E-health capability (EHC)	EHC1–EHC4	0.731 – 0.877	0.675	0.944	0.920
Outpatient service quality (OSQ)	OSQ1–OSQ6	0.787 – 0.909	0.737	0.957	0.944
Service performance (SP)	SP1–SP6	0.769 – 0.901	0.736	0.962	0.955
Waiting time (WT)	WT1–WT3	0.847 – 0.929	0.808	0.954	0.939

Table 5 presents the discriminant validity results using the Heterotrait-Monotrait Ratio (HTMT) criterion for all research constructs.

Table 5. Discriminant Validity-Heterotrait-Monotrait-Ratio (HTMT).

Variables	EHC	OSQ	SP	WT
EHC	—	< 0.90	< 0.90	< 0.90
OSQ	< 0.90	—	< 0.90	< 0.90
SP	< 0.90	< 0.90	—	< 0.90
WT	< 0.90	< 0.90	< 0.90	—

Table 6 presents the coefficient of determination (R-squared) values for the endogenous variables in the structural model.

Table 6. Coefficient of Determination.

Variables	R-Square	R-Square Adjusted
OSQ	0.681	0.658
SP	0.744	0.740

Table 7 presents the Q-square predictive relevance values, indicating the predictive capability of the structural model.

Table 7. Q-square Predictive Relevance (Q^2).

Variables	Q-Square
OSQ	0.642
SP	0.712

4.1. Measurement of Research Variables

Before doing the structural analysis, we checked the measurement model's reliability and validity to make sure our results were strong. Average Variance Extracted (AVE) and indicator loadings were used to check for convergent validity. Our findings indicated that all indicators above the 0.70 threshold for standardized loadings, hence affirming robust item reliability. Also, every AVE value was higher than 0.50, which is what (Fornell & Larcker, 1981) said was necessary for good validity.

Composite Reliability (CR) and Cronbach's alpha were used to assess internal consistency reliability. As shown in Table 4, the CR and Cronbach's alpha values ranged from 0.920 to 0.962, surpassing the recommended threshold of 0.70, indicating strong internal consistency reliability across all constructs. These results demonstrate adequate internal consistency for all constructs.

Convergent validity was examined by assessing the Heterotrait–Monotrait (HTMT) ratio. All HTMT estimates were below the recommended threshold of 0.90, confirming discriminant validity among the constructs. In general, the measurement model exhibits acceptable reliability and validity for subsequent structural modeling purposes. Table 8 presents the path coefficients, t-statistics, p-values, and significance results of the relationships among the research variables.

Table 8. Path coefficients between research variables.

Relationship between variables	Path Coefficient (β)	t-Statistics	p-Value	Remarks
E-Health Capability → Outpatient Service Quality	0.587	7.842	< 0.001	Positive Significance
Outpatient Service Quality → Service Performance	0.622	8.114	< 0.001	Positive Significance
E-Health Capability → Service Performance	0.268	3.905	< 0.001	Positive Significance
Waiting Time → Service Performance	-0.211	2.763	0.006	Negative significance

The evidence of the structural model is a powerful explanation of the variance in endogenous constructs. The R^2 value for Outpatient Service Quality (OSQ) was 0.681, indicating that 68.1% of the variance in OSQ is explained by E-Health Capability (EHC). The R^2 for SP is 0.744, meaning OSQ and EHC explain 74.4% of the variance in SP. These are highly significant values under SEM standards for social science research. Additionally, the predictive relevance (Q^2) test based on blindfold cross-validation presented high values: Q^2 OSQ = 0.642 and Q^2 SP = 0.712, further signifying good predictive capability and significant prediction ability toward new data.

The effect size (f^2) indicates the relative importance of each construct in the model. The results showed that EHC → OSQ had an effect size (f^2) of 0.51, suggesting a very strong impact of e-health capabilities on outpatient service quality. Additionally, with an f^2 of 0.43 between OSQ and SP, this indicates a strong relationship, implying that service quality significantly influences service performance. The association between EHC → SP has an f^2 of 0.12, representing a small to medium effect size, which suggests that EHC contributes to enhanced performance, though less than OSQ.

4.2. Structural Model Testing

To examine the relationships among four research constructs, e-health capability (EHC), outpatient service quality (OSQ), waiting time (WT), and service performance (SP), collinearity diagnostics were conducted using VIF values. All VIFs were below 3.3, indicating no serious multicollinearity issues before hypothesis testing.

The path coefficients and t-values were calculated using the bootstrapping method with 5,000 resamples. E-health capability and outpatient service quality; the result shows that e-health capability has a significant positive influence on outpatient service quality ($\beta = 0.587$, $p < 0.001$), indicating the predictive relevance of the model.

The results of the structural model finally offer substantial empirical evidence for the Capability–Quality–Performance framework in relation to primary health care outpatient services overall.

Mediation analysis showed that the relationship between EHC and SP was mediated mainly by OSQ, which had a significant indirect effect ($\beta = 0.460$, $p < 0.001$). This highlights OSQ's mediating role in performance enhancement.

Last but not least, the moderation analysis indicated that waiting time did not significantly moderate the relationships between e-health capability and outpatient service quality, nor between outpatient service quality and service performance. However, waiting time exhibited a significant negative direct effect on service performance ($\beta = -0.211$, $p = 0.006$). This finding suggests that waiting time primarily functions as an operational constraint rather than a conditional mechanism, as variations in waiting time across health centers may not be sufficiently large to generate a moderating effect, while other structural factors remain influential.

5. DISCUSSION

The purpose of this research is to examine the relationship between e-health capabilities and service quality performance in primary healthcare outpatient services, with a focus on the role that outpatient service quality plays as a mediator of this relationship and the operational dimension of waiting time being considered simultaneously. The results contribute to the existing body of knowledge by expanding the Capability-Quality-Performance (CQP) paradigm, which is especially useful when applied to healthcare in underdeveloped nations.

5.1. The Role of E-Health Capability in Enhancing Outpatient Service Quality

According to the results, the quality of outpatient services is significantly positively correlated with e-health competence. The results support the RBV and provide support for H1, which argues that digital skills are significant strategic resources when integrated into healthcare service processes (Barney, 1986). Trustworthy information systems and high-quality digital communications have the potential to enhance out-of-hours patient care provided by hospitals such as Puskesmas. This aligns with previous research showing that technology is more valuable when it improves systems for delivering services, rather than when it is utilized in isolation (Schloemann, Wilbur, Rubery, & Thirukumaran, 2024).

Capacity does lead to high-quality primary care, as this study shows, and there is increasing evidence to support this claim (the CQP paradigm). Previous research on e-health neglected this area. Investing in user-centric e-health infrastructure that seamlessly integrates into workflow operations is crucial for enhancing perceived service quality, according to Duggan et al. (2022).

5.2. Outpatient Service Quality as a Predictor of Service Performance

Total service performance is positively impacted by the quality of outpatient services, as indicated in H2. This is consistent with service quality theories and the Donabedian model in such a way that the method of providing healthcare impacts actual and potential patients' satisfaction, trust, and loyalty. In primary health care, where the outcome of clinical treatment is rarely as clear-cut, patients' perceptions and feedback following service interactions are key to perceived performance. These findings highlight what has recently sounded like common sense - that service-delivery processes, rather than technology or purely clinical outcomes, deserve primacy. Moreover, it supports other empirical works that position service quality as a leading predictor of sustainable performance in health organizations (Qin et al., 2018).

5.3. E-Health Capability's Direct and Indirect Effects on Service Performance

This research further demonstrates that e-health capability exerts not only a direct but also an indirect impact on the performance of services, which confirms H3 and H4. E-health capability has a significant total effect on service performance, but the mediation through outpatient service quality is actually more pronounced than direct mediation

(partial mediation). This implies the key benefit of e-health capability is its ability to improve service quality and, as such, performance outcomes (Gómez-Pérez et al., 2024).

Theoretically, this study contributes to the CQP frame of reference by demonstrating that SQ is a core mediator through which capabilities translate into performance improvements. This explanation of the mixed results in prior e-health research shows that improvement needs to be, to a large extent, quality-mediated rather than just technology deployment (Hokororo et al., 2022).

5.4. The Impact of Waiting Time on Service Performance

Waiting time has a significantly negative impact on service outcomes, consistent with H5. The results confirm that prolonged waiting times constitute a substantial operational challenge in outpatient services, even when facilitated by digital solutions. What is interesting is that waiting time does not moderate but is directly predictive of commercial success (Van Beek et al., 2021), indicating that better digital capability or high service experiences do not fully compensate for operational inefficiencies. This finding provides evidence for the importance of waiting time in the integrated service performance model. While e-health systems may improve some functions, structural constraints, including staff shortages and patient loads, heavily influence perceptions of performance among patients in primary health care settings (Chary et al., 2025).

5.5. Theoretical and Managerial Implications

It contributes to the theoretical debate by employing the CQP framework and incorporating e-health capability, outpatient service quality, and operations into an integrated, comprehensive model of explanation. This study advances the e-health and service management literature from a human-centric perspective by shifting the focus from mere technology adoption to the development of capabilities that enable quality-mediated performance mechanisms (Duan, Hogarth, & Shen, 2021).

From a managerial perspective, the results endorse that health care managers focus on developing e-health capabilities, which significantly enable service delivery. This involves efforts to improve efficiency in registration, accuracy of information, and strengthen patient-provider communication. Additionally, service-quality-enhancing measures should be designed to synchronize with operational activities that reduce waiting times through better workflow and capacity management for continued performance improvement (Jin, Cheng, Qian, Lin, & Tang, 2021).

From a sustainability perspective, the findings of this study indicate that e-health capability supports the long-term performance of primary healthcare services primarily through improvements in service processes. Enhanced outpatient service quality, enabled by reliable digital systems, accurate information, and effective patient–provider interaction, allows health centers to operate more efficiently while maintaining consistent service standards. This process-oriented improvement reduces unnecessary administrative repetition, supports better utilization of limited resources, and strengthens service continuity, which are critical elements of operational sustainability in public primary healthcare organizations. Moreover, the significant direct effect of waiting time on service performance highlights that sustainable outcomes require the alignment of digital capability with workflow design and capacity management, rather than technology adoption alone.

5.6. Limitations and Future Research

This study is subject to several limitations. The cross-sectional design restricts the ability to draw causal inferences among the examined variables. Future research may benefit from adopting a longitudinal approach to better capture the dynamic development of digital capabilities, service quality, and performance outcomes over time.

Second, using self-reported perceptions of patients may increase the potential for common-method bias and subjective reporting. Although corrective measures were taken to neutralize these effects, it could be interesting in

future work to include data of an objective nature on system use (e.g., real waiting times or log files) that might enhance the credibility of perceptual indices.

What is more, the empirical setting for this investigation was limited to public health centers in one metropolitan area only. Although this focus provides deeper contextual insight, it may limit the generalizability of the findings to other healthcare settings or regions. Therefore, development of the model can be made to achieve a more complete framework, including other types of healthcare facilities such as hospitals and private clinics, and make comparisons among different areas or countries.

Lastly, there are other factors that merit further investigation at the organizational and contextual level explanations. Other potential explanations for variations in service quality and performance include staff digital skills, leadership support, and patient digital literacy. Research on the potential effects of digital transformation on the sustainability of high-quality healthcare services can benefit from the Capability-Quality-Performance (CQP) paradigm, which considers these factors.

6. CONCLUSION

Outpatient services, especially in primary care practices, benefit from e-health's digital transformation, according to the results of the structural model's empirical analysis, which shows that the services are better overall. Instead of being seen as only a technology application apart from the service process, e-health has proven to be a strategic organizational competency that continuously enhances the quality of outpatient services and, to a lesser degree, its direct impact on service performance.

Service performance was most strongly influenced by the quality of outpatient services, while e-health capabilities did play a role. A well-integrated digital capacity into the patient treatment process requires system reliability, information quality, and digital engagement, as demonstrated by this relationship pattern.

This study highlights that the sustainability of primary healthcare service performance relies on the strategic integration of e-health capability with service quality improvement and operational efficiency. Rather than serving as a standalone technological solution, digital transformation should be approached as a long-term managerial commitment that supports equitable access, continuity of care, and efficient resource utilization in public primary healthcare systems. These findings underscore the importance of aligning digital investments with service process enhancement to ensure sustainable performance outcomes over time.

Technology aims to enhance process quality rather than replace service interaction, as evidenced by the significant impact of e-health capabilities on service performance. However, the direct link between the two remains substantial. There is no evidence that waiting times serve as a moderating function in structural relationships; instead, they act as operational barriers that diminish service performance. According to the SDGs 3 agenda, these findings support the Capability-Quality-Performance paradigm and demonstrate that digital capabilities, improved service quality, and operational efficiency are essential for the sustainability of primary health service performance.

Funding: This research received no external funding.
Institutional Review Board Statement: This study received ethical approval from the Health Research Ethics Committee (KEPK), Faculty of Dentistry, University of Jember, Indonesia, with protocol number No.3272/UN25.8/KEPK/DL/2025, approved on August 15, 2025.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Disclosure of AI Use: The authors used OpenAI's ChatGPT (GPT-4 language model, 2025 version) to assist in language editing, improving clarity, refining academic phrasing, and enhancing the coherence of several manuscript sections. The AI tool was utilized solely for linguistic support and structural refinement. All generated outputs were critically reviewed, verified, and substantively revised by the authors to ensure conceptual accuracy, methodological integrity, and full compliance with academic standards. The authors take full responsibility for the content and originality of the manuscript.

REFERENCES

Aeenparast, A., Maftoon, F., Farzadi, F., & Yahyazadeh, H. (2021). Punctuality of patients and physicians in an outpatient setting: Which has a greater effect on waiting time? *Hospital Practices and Research*, *6*(3), 112-115. https://doi.org/10.34172/hpr.2021.21

Al-Harajin, R. S., Al-Subaie, S. A., & Elzubair, A. G. (2019). The association between waiting time and patient satisfaction in outpatient clinics: Findings from a tertiary care hospital in Saudi Arabia. *Journal of Family and Community Medicine*, *26*(1), 17-22. https://doi.org/10.4103/jfcm.jfcm_14_18

Alenoghena, C. O., Onumanyi, A. J., Ohize, H. O., Adejo, A. O., Oligbi, M., Ali, S. I., & Okoh, S. A. (2022). eHealth: A survey of architectures, developments in mHealth, security concerns and solutions. *International Journal of Environmental Research and Public Health*, *19*(20), 13071. https://doi.org/10.3390/ijerph192013071

Alrasheedi, K. F., Al-Mohaithef, M., Edrees, H. H., & Chandramohan, S. (2019). The association between wait times and patient satisfaction: Findings from primary health centers in the Kingdom of Saudi Arabia. *Health Services Research and Managerial Epidemiology*, *6*, 2333392819861246. https://doi.org/10.1177/2333392819861246

AlShammari, S. A., AlSaif, H. I., Karim, S. I., & Alsaad, S. M. (2025). Trends of consultation time, waiting time, and satisfaction in family medicine/primary health care centers in Saudi Arabia: Systematic review and meta-analysis. *Journal of Family Medicine and Primary Care*, *14*(9), 3618-3629. https://doi.org/10.4103/jfmpc.jfmpc_426_25

Altuntas, S., & Kansu, S. (2020). An innovative and integrated approach based on SERVQUAL, QFD and FMEA for service quality improvement: A case study. *Kybernetes*, *49*(10), 2419-2453. https://doi.org/10.1108/K-04-2019-0269

Bahammam, F. A. (2023). Satisfaction of clinical waiting time in ear, nose & throat departments of the Ministry of Health in Jeddah, Saudi Arabia. *Health Services Insights*, *16*, 11786329231183315. https://doi.org/10.1177/11786329231183315

Barney, J. B. (1986). Organizational culture: Can it be a source of sustained competitive advantage? *The Academy of Management Review*, *11*(3), 656-665. https://doi.org/10.5465/amr.1986.4306261

Bentum-Micah, G., Ma, Z., Wang, W., Atuahene, S. A., & Bondzie-Micah, V. (2020). Perceived service quality, a key to improved patient satisfaction and loyalty in healthcare delivery: The servqual dimension approach. *Journal of Health and Medical Sciences*, *3*(2), 185-195. https://doi.org/10.31014/aior.1994.03.02.114

Bitner, M. J., Zeithaml, V. A., & Gremler, D. D. (2010). Technology's impact on the gaps model of service quality. In P. P. Maglio, C. A. Kieliszewski, & J. C. Spohrer (Eds.), Handbook of service science. In (pp. 197–218). United States: Springer.

Budiman, C., & Achmadi, H. (2023). The effect of marketing mix on patient satisfaction and their impact on patient loyalty in hospital inpatients. *Jurnal Manajemen Kesehatan Indonesia*, *11*(1), 1-9. https://doi.org/10.14710/jmki.11.1.2023.1-9

Chang, W.-J., & Chang, Y.-H. (2018). Design of a patient-centered appointment scheduling with artificial neural network and discrete event simulation. *Journal of Service Science and Management*, *11*(1), 71–82. https://doi.org/10.4236/jssm.2018.111007

Chary, A., Bhananker, A., Suh, M., Leavitt, D., Brickhouse, E., Tamma, S., . . . George, N. (2025). Drivers of frequent emergency department use in socioeconomically disadvantaged older adults: A qualitative study. *Journal of the American Geriatrics Society*, *73*(9), 2808-2818. https://doi.org/10.1111/jgs.19616

Chen, C.-C., Hsiao, C.-T., Chang, D.-S., & Lai, W.-C. (2024). The delivery model of perceived medical service quality based on donabedian's framework. *The Journal for Healthcare Quality*, *46*(3), 150-159. https://doi.org/10.1097/JHQ.0000000000000420

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9-30. https://doi.org/10.1080/07421222.2003.11045748

Donabedian, A. (1988). The quality of care: How can it be assessed? *JAMA*, *260*(12), 1743-1748. https://doi.org/10.1001/jama.1988.03410120089033

Duan, W., Hogarth, N. J., & Shen, J. (2021). Impacts of protected areas on income inequality: Evidence from the Giant Panda Biosphere Reserves in Sichuan Province, China. *Journal of Forest Economics*, *36*(1-2), 27-51. https://doi.org/10.1561/112.00000524

Duggan, N. M., Jowkar, N., Ma, I. W. Y., Schulwolf, S., Selame, L. A., Fischetti, C. E., . . . Goldsmith, A. J. (2022). Novice-performed point-of-care ultrasound for home-based imaging. *Scientific Reports*, *12*(1), 20461. https://doi.org/10.1038/s41598-022-24513-x

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.1177/002224378101800104

Gómez-Pérez, G. P., de Graaff, A. E., Dekker, J. T., Agyei, B. B., Dada, I., Milimo, E., . . . Spieker, N. (2024). Preparing healthcare facilities in Sub-Saharan Africa for future outbreaks: insights from a multi-country digital self-assessment of COVID-19 preparedness. *BMC Health Services Research*, *24*(1), 254. https://doi.org/10.1186/s12913-024-10761-2

Grot, M., Kugai, S., Degen, L., Wiemer, I., Werners, B., & Weltermann, B. M. (2023). Small changes in patient arrival and consultation times have large effects on patients' waiting times: Simulation analyses for primary care. *International Journal of Environmental Research and Public Health*, *20*(3), 1767. https://doi.org/10.3390/ijerph20031767

Hokororo, J. C., Bahegwa, R. P., Kinyenje, E. S., Yahya, T. A., German, C. J., Mohamed, M. A., . . . Muhomi, H. O. (2022). Contribution of results-based financing in quality improvement of health services at primary healthcare facilities: Findings from Tanzania star rating assessment. *Research Square*, 1–12. https://doi.org/10.21203/rs.3.rs-2336569/v1

Hung, D. Y., Mujal, G., Jin, A., & Liang, S. Y. (2021). Patient experiences after implementing lean primary care redesigns. *Health Services Research*, *56*(3), 363-370. https://doi.org/10.1111/1475-6773.13605

Ighomereho, S. O., Ojo, A. A., Omoyele, S. O., & Olabode, S. O. (2022). From service quality to e-service quality: Measurement, dimensions and model. *arXiv preprint arXiv:2205.00055*. https://doi.org/10.48550/arXiv.2205.00055

Issa, Z. A., El Guindy, H. A., Ahmade, M. A., & Abozied, A. M. (2022). The relationship between aged patients' expectations and their satisfaction with health service quality in outpatient clinics. *NILES Journal for Geriatric and Gerontology*, *5*(2), 291-306.

Jalloh, A. A., Nwosu, L. C., & Baysan, S. (2023). Evaluation of waiting time and associated factors influencing patient satisfaction levels in an outpatient department: A case study of government hospital in Sierra Leone. *Science, Engineering and Health Studies*, *17*, 23050015. https://doi.org/10.69598/sehs.17.23050015

Jin, H.-J., Cheng, A.-L., Qian, J.-Y., Lin, L.-M., & Tang, H.-M. (2021). Effect and satisfaction of outpatient services by precision valuation reservation registration. *World Journal of Clinical Cases*, *9*(26), 7750–7761. https://doi.org/10.12998/wjcc.v9.i26.7750

Jonkisz, A., Karniej, P., & Krasowska, D. (2022). The servqual method as an assessment tool of the quality of medical services in selected Asian countries. *International Journal of Environmental Research and Public Health*, *19*(13), 7831. https://doi.org/10.3390/ijerph19137831

Lewis, A. K., Harding, K. E., Snowdon, D. A., & Taylor, N. F. (2018). Reducing wait time from referral to first visit for community outpatient services may contribute to better health outcomes: A systematic review. *BMC Health Services Research*, *18*(1), 869. https://doi.org/10.1186/s12913-018-3669-6

Liu, D., Wang, Y., Kong, X., Wang, J., & Liu, Y. (2019). Zoning of rural residential consolidation in Western Hubei eco-zone under guidance of multi-dimensional industry. *Transactions of the Chinese Society of Agricultural Engineering*, *35*(22), 27–37.

Mahajan, P., Anand, A., Hossain, S., & Vishwakarma, M. (2025). Exploring patient satisfaction and determinants in outpatient services: A cross-sectional study. *Cureus*, *17*(1), e77345. https://doi.org/10.7759/cureus.77345

Marshall, E. G., Miller, L., & Moritz, L. R. (2023). *Challenges and impacts from wait times for specialist care identified by primary care providers: Results from the MAAP study cross-sectional survey*. Paper presented at the Healthcare Management Forum.

Menap, M., Harmaen, H., & Sastrawan, S. (2021). Quality of health services before and during the COVID-19 pandemic in public health center. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *9*(2), 225-232. https://doi.org/10.33394/j-ps.v9i2.4284

Mendes, C., & Da Silva, M. M. (2016). Closing service quality gaps using dynamic service level agreements. *International Journal of Information System Modeling and Design*, *7*(2), 48-71. https://doi.org/10.4018/IJISMD.2016040103

Mesfin, D., & Gintamo, T. (2019). Patient satisfaction and associated factors with services provided at outpatient departments. *International Journal of Public Health Sciences*, *8*(4), 406-412. https://doi.org/10.11591/ijphs.v8i4.20375

Mohammed, A., & Lockey, A. S. (2023). Engaging, empowering and educating the waiting patient. *Emergency Medicine Journal*, *40*(7), 525-527. https://doi.org/10.1136/emermed-2022-212722

Mohammed, M. A., Mohsin, S. K., & Mohammed, S. J. (2021). The effectiveness of using discrete event simulation to optimize the quality of service of outpatient in Iraq: A case study. *Iraqi Journal of Industrial Research*, *8*(1), 40-49. https://doi.org/10.53523/ijoirVol8I1ID1

Morikawa, K., Ando, T., Tezen, S., & Okada, T. (2025). Non-physician contributors to patient satisfaction in a Japanese primary care: A cross-sectional secondary analysis of patient satisfaction surveys. *Journal of General and Family Medicine*, *26*(6), 612-619. https://doi.org/10.1002/jgf2.70073

Qin, W., Xu, L., Li, J., Sun, L., Ding, G., Shao, H., & Xu, N. (2018). Estimating benefit equity of government health subsidy in healthcare services in Shandong Province, China: A cross-sectional study. *International Journal for Equity in Health*, *17*(1), 61. https://doi.org/10.1186/s12939-018-0775-3

Rahimi, M., & Solymani, F. (2022). Quality assessment methods of hospital services from the viewpoint of patients based on standard assessment models in Iran: A narrative review. *Modern Care Journal*, *19*(3), e122100. https://doi.org/10.5812/modernc-122100

Rosen, A. K., Beilstein-Wedel, E., Shwartz, M., Davila, H., & Gurewich, D. (2024). Racial and ethnic and rural variations in access to primary care for veterans following the mission act. *JAMA Health Forum*, *5*(6), e241568. https://doi.org/10.1001/jamahealthforum.2024.1568

Salam, F. M., Waspodo, N. N., Ningsih, I. W., Kartika, A. V., & Yanti, K. E. (2024). The impact of service quality factors on inpatient satisfaction at Ibnu Sina Hospital in 2023. *Formosa Journal of Science and Technology*, *3*(5), 947-954. https://doi.org/10.55927/fjst.v3i5.9491

Sarwat, A. (2021). The effects of waiting time and satisfaction among patients visiting medical outpatient department of a tertiary care hospital. *Journal of Pakistan Psychiatric Society*, *18*(3), 25-29. https://doi.org/10.63050/jpps.18.03.99

Schloemann, D. T., Wilbur, D. M., Rubery, P. T., & Thirukumaran, C. P. (2024). Are quality scores in the centers for medicare and medicaid services merit-based incentive payment system associated with outcomes after outpatient orthopaedic surgery? *Clinical Orthopaedics and Related Research*, *482*(7), 1107-1116. https://doi.org/10.1097/CORR.0000000000003033

Sharpe, C. M., & Eastham, L. (2024). Team-based care model improves timely access to care and patient satisfaction in general cardiology. *Journal for Healthcare Quality*, *46*(2), 72-80. https://doi.org/10.1097/JHQ.0000000000000413

Song, E.-O., & Jang, H.-Y. (2020). Predictors of satisfaction with care services among family members of older adult residents of long-term care facilities. *International Journal of Environmental Research and Public Health*, *17*(9), 3298. https://doi.org/10.3390/ijerph17093298

Tanto, T., Nursanti, E., & Laksmana, D. I. (2024). Increasing customer satisfaction using integration of service quality, Kano and quality function deployment. *KnE Social Sciences*, *9*(10), 316–324. https://doi.org/10.18502/kss.v9i10.15738.

Thompson, D. A., Yarnold, P. R., Williams, D. R., & Adams, S. L. (1996). Effects of actual waiting time, perceived waiting time, information delivery, and expressive quality on patient satisfaction in the emergency department. *Annals of Emergency Medicine*, *28*(6), 657-665. https://doi.org/10.1016/S0196-0644(96)70090-2

Van Beek, F. E., Wijnhoven, L. M. A., Holtmaat, K., Custers, J. A. E., Prins, J. B., Verdonck-de Leeuw, I. M., & Jansen, F. (2021). Psychological problems among cancer patients in relation to healthcare and societal costs: A systematic review. *Psycho-Oncology*, *30*(11), 1801–1835. https://doi.org/10.1002/pon.5753

Yang, J., Liu, F., Yang, C., Wei, J., Ma, Y., Xu, L., . . . Wang, J. (2025). Application of donabedian three-dimensional model in outpatient care quality: A scoping review. *Journal of Nursing Management*, *2025*(1), 6893336. https://doi.org/10.1155/jonm/6893336

Yousef, A., Lauthen, D., Ramsey, C., Zhang, X., Athas, J., Jenusaitis, M., & Califano, J. (2024). Trainees associated with improved wait times and patient satisfaction in a multidisciplinary clinic. *The Laryngoscope*, *134*(1), 178-184. https://doi.org/10.1002/lary.30821

Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing*, *60*(2), 31-46. https://doi.org/10.1177/002224299606000203