



Integration of Health Technology into Primary Care Systems to Improve Service Quality and Efficiency

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ABSTRACT

This study aims to explore how health technology is integrated into primary care systems to improve service quality and efficiency. The study addresses the growing use of digital tools in primary care, including electronic medical records, online registration, digital referral systems, and service reporting platforms. A qualitative exploratory case study design was used. The research was conducted from July to September 2026 at three primary care facilities in Bandar Lampung City, Indonesia: Puskesmas Kedaton, Puskesmas Sukarame, and Puskesmas Way Halim. Participants included doctors, nurses, midwives, administrative officers, medical record officers, facility managers, IT support staff, and patients who had experience using digital health services. Data were collected through semi-structured interviews, non-participant observation, and document review. Thematic analysis identified five main themes: digital technology as a tool for administrative acceleration, workflow adaptation among health workers, unequal digital readiness among patients, fragmented system integration, and the changing meaning of service quality and efficiency. The findings show that digital health can improve primary care performance when it supports user needs, service routines, and patient-centered interaction. However, poor interoperability, double documentation, unstable infrastructure, and low patient digital literacy can limit its benefits. This study contributes to socio-technical understanding of digital health implementation and offers practical guidance for designing more inclusive, efficient, and responsive primary care systems.



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1. Introduction

Digital health integration has become a central issue in primary care because health systems now face rising service demand, chronic disease burden, workforce limitations, and pressure to deliver faster and more coordinated services. Primary care facilities need digital tools that support patient registration, clinical documentation, referral, teleconsultation, reporting, and follow-up care. In global health debates, digital health no longer functions only as a technical innovation. It now shapes how patients access care, how health workers organize daily work, and how managers monitor service quality. Fava and Lapão (2024) show that digital primary health care services

have expanded across many countries, but their implementation still depends on local readiness, workflow alignment, user acceptance, and institutional support. This condition shows that digital transformation in primary care needs more than software adoption. It requires a clear understanding of how technology enters real service routines.

In Indonesia, the integration of health technology into primary care has become more urgent because Puskesmas and primary clinics act as the first contact point for most communities. Digital systems such as electronic medical records, online registration, mobile health applications, telemedicine, and national health reporting platforms can improve access, reduce administrative delays, and strengthen service continuity. Aisyah et al. (2024) found that the information and communication technology maturity of Indonesian primary health care facilities remains uneven across provinces. Their study indicates that several facilities have adopted digital systems, but many still face limitations in infrastructure, human resources, connectivity, and system interoperability. This gap creates practical problems in the field. Health workers often need to enter the same data into different platforms, patients may still wait despite online systems, and managers may struggle to use fragmented data for timely decision-making.

At the field level, health technology can improve service quality when it supports accurate documentation, faster patient flow, better referral coordination, and more consistent monitoring of patient needs. However, the same technology can reduce efficiency when it does not fit clinical workflows or when health workers receive limited training. Silva et al. (2024) argue that digital health quality in primary care must be assessed through structure, process, and outcome dimensions because technology affects not only technical performance but also care relationships and organizational processes. This view is important for primary care because service quality depends on how technology supports communication, responsiveness, continuity, patient safety, and trust. Neve et al. (2020) also warn that digital health may create risks when systems increase workload, widen access inequality, or weaken patient-centered interaction. These findings show that the value of digital health cannot be judged only from the presence of an application. It must be understood from how users experience and interpret it.

The issue is also socially and culturally important. Primary care is not only a clinical setting. It is a social space where patients bring expectations, habits, fears, and trust relationships. Patients with low digital literacy may find online registration or teleconsultation confusing. Older adults may prefer face-to-face communication because they value direct interaction with health workers. Health workers may accept digital systems when they see clear benefits, but they may resist them when the systems increase administrative pressure. Stoumpos et al. (2023) explain that technology acceptance in health care relates to perceived usefulness, ease of use, organizational readiness, and user confidence. Khanassov et al. (2024) also show that telemedicine in primary care can support access, but its success depends on patient needs, professional judgment, and the suitability of digital interaction for specific care situations. These insights suggest that the integration of health technology into primary care must be studied as a human, organizational, and cultural process.

Previous studies have examined digital health in primary care through scoping reviews, evaluation models, technology acceptance studies, and quantitative assessments of digital readiness. Erku et al. (2023) found that digital health interventions can improve access and quality in primary health care, especially when implementation mechanisms match local contexts. Willis et al. (2022) also show that digital interventions can strengthen prevention in primary care, although evidence still varies across settings and intervention types. However, many studies still focus on measurable outcomes, technical readiness, or broad policy mapping. Less attention has been given to the lived experiences of health workers, patients, administrators, and managers who negotiate digital systems in everyday service delivery. This gap is important because the success of digital integration often depends on informal adaptation, user interpretation, local leadership, and practical problem-solving at the service level.

Based on this gap, this study aims to explore how health technology is integrated into primary care systems to improve service quality and efficiency. The study focuses on user experiences, workflow changes, perceived benefits, operational barriers, and local adaptation strategies within primary care facilities. Theoretically, this research contributes to the development of socio-technical understanding in digital health by explaining how people, technology, work processes, and organizational structures interact in primary care. Practically, the findings can help Puskesmas managers, primary clinic leaders, health offices, and policymakers design digital health implementation strategies that are more responsive to user needs, infrastructure conditions, service culture, and patient expectations. Therefore, this study positions health technology not merely as an administrative tool, but as part of a broader effort to improve patient-centered, efficient, and equitable primary care.

2. Materials and Methods

This study uses a qualitative exploratory case study design. This design was selected because the research seeks to understand the process, meaning, and experience of integrating health technology into primary care systems. A case study is appropriate because the phenomenon takes place in a real organizational context where digital tools, health workers, patients, infrastructure, policies, and service routines interact directly. The study does not aim to measure the statistical effect of technology use. It aims to explain how users experience digital systems, how work routines change, and how service quality and efficiency are interpreted by actors in primary care. This design follows the logic of qualitative health technology research, which emphasizes user experience, contextual interpretation, and implementation process. Singh et al. (2021) used a qualitative approach to explore primary care providers' perspectives on digital tools, while Nadav et al. (2021) showed that digital services need to be examined through their integration into routine health and social care work.

The research will be conducted from July to September 2026 in Bandar Lampung City, Lampung Province, Indonesia. The study sites will include three primary care facilities: Puskesmas Kedaton, Puskesmas Sukarame, and Puskesmas Way Halim. These locations are selected because they represent urban primary care settings that use digital systems for patient registration, electronic medical records, service reporting, referral administration, and patient communication. The participants will include doctors, nurses, midwives, administrative officers, medical record officers, facility managers, IT support staff, and patients who have used digital services in the selected facilities. Participants will be selected through purposive sampling based on direct involvement with digital health systems. The inclusion criteria for health workers are at least six months of work experience in the facility and direct use of digital health applications in service delivery. The inclusion criteria for patients are age 18 years or older and experience using at least one digital service, such as online registration, teleconsultation, or digital referral. Snowball sampling will be used if initial participants identify other key informants who understand the implementation process. This approach is relevant because digital health implementation often involves formal and informal actors who may not appear in official organizational structures.

Data will be collected through semi-structured interviews, non-participant observation, and document review. Semi-structured interviews will explore participants' experiences with digital systems, perceived benefits, implementation barriers, workflow changes, patient interaction, service speed, data accuracy, and perceived service quality. Each interview will last approximately 30 to 60 minutes and will be audio-recorded with participant consent. Non-participant observation will be conducted in registration areas, service rooms, medical record units, and administrative units to examine how digital systems are used during routine care. The researcher will observe patient flow, staff interaction with digital platforms, repeated data entry, waiting time issues, and informal problem-solving during system disruptions. Document review will include standard operating procedures, digital service flowcharts, internal reports, training

materials, service statistics, and screenshots or templates of non-confidential system outputs. Turner et al. (2022) show that online consultation systems can produce unintended workflow consequences in primary care. This supports the need to combine interviews, observation, and documents rather than relying on interview data alone.

Data validity will be strengthened through source triangulation, method triangulation, member checking, and audit trail. Source triangulation will compare information from health workers, managers, administrative staff, IT staff, and patients. Method triangulation will compare findings from interviews, observations, and documents. Member checking will be conducted by sharing summaries of preliminary interpretations with selected key informants to ensure that the researcher's interpretation reflects participants' intended meaning. An audit trail will be maintained by documenting interview guides, field notes, coding decisions, analytic memos, theme revisions, and methodological reflections. Kiger and Varpio (2020) emphasize that thematic analysis requires a transparent process so that readers can trace how raw data become analytic themes. Braun and Clarke (2021) also stress that qualitative analysis must show reflexive engagement with meaning, context, and researcher interpretation. Therefore, the researcher will maintain reflexive notes to identify assumptions, positionality, and possible bias during data collection and analysis.

The data will be analyzed using thematic analysis supported by the interactive logic of data condensation, data display, and conclusion drawing. The first stage will involve verbatim transcription, repeated reading, and initial memo writing. The second stage will involve open coding to identify meaningful units such as "repeated data entry," "faster registration," "system downtime," "patient confusion," "reduced paper use," "training needs," "digital workload," and "improved referral tracking." The third stage will group codes into broader categories, such as user acceptance, workflow adaptation, infrastructure constraints, service quality improvement, efficiency perception, and patient-centered communication. The fourth stage will compare themes across the three facilities to identify similarities and contextual differences. The final stage will produce an interpretive narrative that explains how health technology integration shapes primary care quality and efficiency. The analysis will remain inductive, but it will be sensitized by socio-technical systems theory, technology acceptance theory, and the Donabedian quality framework. This strategy allows the study to produce findings that are empirically grounded, theoretically informed, and useful for primary care improvement.

3. Results and Discussions

The analysis produced five main themes that explain how health technology was integrated into primary care systems in Bandar Lampung City. These themes were: digital technology as a tool for administrative acceleration, workflow adaptation among health workers, unequal digital readiness among patients, fragmented system integration, and the changing meaning of service quality and efficiency. The themes emerged from interviews with doctors, nurses, midwives, administrative officers, medical record officers, facility managers, IT support staff, and patients at Puskesmas Kedaton, Puskesmas Sukarame, and Puskesmas Way Halim. Observation data also showed that digital systems had become part of daily service routines, especially in registration, patient data entry, referral administration, and reporting. However, the degree of use varied across units and depended on staff capability, internet stability, patient characteristics, and internal coordination.

The first theme shows that digital health technology helped accelerate administrative services. Participants explained that online registration, electronic medical records, and digital referral systems reduced several manual procedures that previously required repeated writing and physical document handling. Administrative staff stated that digital registration made patient queues more manageable, especially during peak service hours. One administrative officer said, "Before the system was used, patients often waited only because files were still being searched. Now, the data can be found faster, although the system is sometimes slow." This finding indicates

that technology improved efficiency when it shortened the distance between patient arrival, identity verification, medical record access, and service routing. Observations confirmed that staff could retrieve patient information more quickly when the network was stable and when patient identity data matched the system.

The second theme concerns workflow adaptation among health workers. Digital systems changed the way doctors, nurses, midwives, and medical record officers organized their tasks. Some health workers viewed the system as helpful because it made documentation more structured and easier to trace. However, others felt that digital work increased administrative pressure because they still had to maintain manual notes for backup or reporting purposes. A nurse explained, “The system helps us record patient data, but sometimes we still write in the manual book because we are afraid the data will not be saved.” This statement reflects a transitional workflow where digital and manual systems operate together. The coexistence of both systems created a double workload. It also showed that user confidence had not fully developed because staff still depended on manual documentation as a safety mechanism.

The third theme reveals unequal digital readiness among patients. Younger patients generally adapted faster to online registration and digital communication. In contrast, older adults, patients with low digital literacy, and patients without stable internet access often needed assistance from family members or health workers. One patient stated, “I prefer coming directly because I am not sure whether I pressed the right menu on my phone.” This finding shows that digital services did not automatically increase access for all users. Technology improved convenience for patients who had digital skills, but it could create confusion for those who were unfamiliar with application-based procedures. Observation data showed that registration officers often helped patients complete digital steps, especially when patients forgot passwords, entered incorrect identity numbers, or did not understand the service menu.

The fourth theme relates to fragmented system integration. Participants reported that several digital platforms were used for different purposes, such as patient registration, electronic medical records, referral systems, national reporting, and internal service monitoring. These systems did not always connect smoothly. As a result, staff sometimes needed to enter similar data into more than one platform. One medical record officer said, “The problem is not only using the application. The problem is that each application has its own format, so we repeat the data.” This finding suggests that integration remained partial. Technology existed in service routines, but interoperability had not fully supported seamless work. Documentation also showed that some facilities used internal spreadsheets to monitor data that could not be easily extracted from the main system.

The fifth theme concerns the changing meaning of service quality and efficiency. Participants did not define quality only as faster service. They also connected quality with accuracy, clarity, responsiveness, patient trust, and continuity of care. For health workers, efficiency meant reducing repeated tasks, accessing data quickly, and minimizing reporting delays. For patients, efficiency meant shorter waiting time, clearer information, and fewer unnecessary visits. A doctor explained, “Technology is useful when it gives us more time to focus on the patient, not when it makes us focus only on the screen.” This statement shows that digital health integration becomes meaningful when it supports clinical interaction rather than replacing human attention. The finding also indicates that patient-centered care remains central in primary care, even when services become more digital.

Discussion

The findings show that health technology integration in primary care is a socio-technical process. Technology did not operate as a stand-alone tool. It interacted with work routines, staff capability, patient literacy, infrastructure, organizational culture, and local leadership. This finding supports socio-technical systems theory, which argues that technology implementation must align technical systems with human and organizational systems. The results also support the

Technology Acceptance Model because health workers accepted digital systems more easily when they perceived them as useful and manageable. Stoumpos et al. (2023) similarly argue that perceived usefulness, ease of use, and organizational readiness shape technology acceptance in health care. In this study, acceptance increased when digital tools saved time and improved data access. Resistance appeared when systems created double work, technical uncertainty, or additional administrative burden.

The finding on administrative acceleration is consistent with Fava and Lapão (2024), who found that digital primary health care services can improve access, coordination, and service delivery when implemented with adequate support. It also aligns with Erku et al. (2023), who reported that digital health interventions can improve access and quality in primary care. However, this study adds a contextual insight. Efficiency did not result only from system availability. It depended on the stability of internet access, staff familiarity, data accuracy, and the ability of different platforms to work together. This finding is important for Indonesian primary care because facilities often use several digital platforms at once. When systems remain fragmented, digitalization may shift administrative burden rather than reduce it.

The theme of double documentation confirms that the transition from manual to digital systems is not linear. Health workers continued to use manual records because they feared data loss, system errors, or audit problems. This pattern reflects a trust gap between users and technology. Nadav et al. (2021) found that digital services need to become part of routine work before they can produce meaningful improvement. The present study extends that argument by showing that routine use does not always mean full trust. Staff may use the system because it is required, but they still protect themselves through manual backup practices. This finding suggests that training should not focus only on technical operation. It must also build confidence, clarify accountability, and reduce uncertainty about data security and system reliability.

The finding on unequal patient readiness supports previous research on digital access and inclusion. Neve et al. (2020) warned that digital health in primary care may widen inequality if services do not consider patients with limited access, low literacy, or complex needs. Khanassov et al. (2024) also found that telemedicine in primary care needs to fit patient capacity and clinical context. In this study, older adults and patients with low digital literacy often needed assistance to use digital services. This means that digital transformation must keep assisted access channels open. Primary care facilities should not assume that all patients can use applications independently. Digital inclusion requires help desks, family-based assistance, simple interface design, clear instructions, and alternative service routes for patients who cannot use digital systems.

The finding on fragmented system integration strengthens the argument that digital health quality must be assessed through structure, process, and outcome dimensions. Silva et al. (2024) explain that digital health in primary care should be evaluated based on how it supports service organization, care processes, and user outcomes. In this study, structural limitations appeared in internet reliability, platform interoperability, and uneven staff capacity. Process problems appeared in repeated data entry, parallel manual documentation, and dependence on informal troubleshooting. Outcome expectations appeared in shorter waiting time, better data access, and more responsive services. These findings show that digital health evaluation should not stop at whether a facility uses technology. Evaluation must examine whether technology improves the real flow of care.

This study also offers a more nuanced understanding of service quality. Patients and health workers did not view quality only as speed. They linked quality with trust, accuracy, communication, continuity, and direct attention from health workers. This supports the Donabedian quality framework, where structure and process influence outcomes. It also connects with Sze et al. (2024), who found that digital health can affect the patient-physician relationship. The present study suggests that digital systems can strengthen service quality when they reduce

unnecessary administrative work and allow health workers to focus more on patients. However, digital systems can weaken perceived quality when health workers spend more time looking at screens than engaging with patients.

The practical implication is clear. Primary care managers should design digital health implementation as an organizational change process, not only as a technology procurement program. Facilities need regular training, peer mentoring, technical support, reliable internet infrastructure, interoperable platforms, and clear standard operating procedures. Health offices should also simplify reporting systems and reduce duplicated data entry. For patients, facilities need assisted digital registration, simple information materials, and inclusive service options for older adults and low-literacy users. These steps can help digital technology improve efficiency without reducing patient-centered care.

The theoretical implication lies in the integration of socio-technical systems theory, technology acceptance theory, and the Donabedian quality framework. The findings show that these three perspectives can explain different layers of digital health integration. Socio-technical theory explains the interaction between people, tools, and organizations. Technology acceptance theory explains user willingness and resistance. The Donabedian framework explains how digital structures and processes shape service quality outcomes. By combining these perspectives, this study contributes to a more grounded understanding of digital health implementation in primary care settings.

Further research should compare digital health integration across rural, urban, and remote primary care facilities. Future studies can also examine patient groups with specific needs, such as older adults, pregnant women, chronic disease patients, and low-income communities. A mixed-methods design may help measure the relationship between digital readiness, waiting time, user satisfaction, and service continuity. Longitudinal qualitative research is also needed to examine how user acceptance changes after repeated use, additional training, and system improvement. This direction will deepen understanding of how digital health can support primary care systems that are efficient, inclusive, and responsive to local realities.

4. Conclusions

This study concludes that the integration of health technology into primary care systems improves service quality and efficiency when digital tools align with daily workflows, user capacity, infrastructure readiness, and patient needs. The findings show five central themes: administrative acceleration, workflow adaptation among health workers, unequal digital readiness among patients, fragmented system integration, and the changing meaning of service quality and efficiency. Digital systems helped speed up registration, improve data access, support referral tracking, and reduce some manual procedures. However, their benefits remained limited when staff had to use parallel manual records, when platforms were not fully integrated, and when patients had low digital literacy. These findings contribute to a deeper understanding of digital health integration as a socio-technical process, where technology, people, organizational routines, and service culture shape one another.

Theoretically, this study strengthens the relevance of socio-technical systems theory, technology acceptance theory, and the Donabedian quality framework in explaining digital transformation in primary care. Practically, the findings suggest that primary care managers need to treat digital health implementation as an organizational change process, not only as a technology procurement agenda. Facilities need continuous training, technical support, interoperable systems, reliable internet access, and assisted digital services for patients with limited digital skills. At the policy level, health offices should simplify digital reporting systems, reduce duplicated data entry, and support inclusive digital access across primary care facilities. Future research should compare urban, rural, and remote primary care settings and examine how digital readiness affects patient satisfaction, service continuity, and long-term efficiency.

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