



Digital Health Integration Models for Improving the Quality of Primary Health Care in Developing Regions

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ABSTRACT

This study aims to explore digital health integration models for improving the quality of primary health care in developing regions. The study addresses the growing need to understand how digital health systems are implemented, adapted, and experienced in primary care settings where infrastructure, human resource capacity, and patient digital literacy remain uneven. A qualitative case study design was used in three public primary health care centers in South Lampung Regency, Indonesia, from January to March 2026. Data were collected through semi-structured interviews, non-participant observation, and document review. Participants included heads of primary health care centers, physicians, nurses, midwives, medical record officers, health information system operators, district health office staff, community health cadres, and patients who had used digital-supported services. Thematic analysis identified five main themes: fragmented digital workflow, uneven digital readiness among health workers, patient experience and trust, local adaptation by primary care teams, and the need for stronger governance and interoperability. The findings show that digital health integration improves service quality when it supports data continuity, workflow efficiency, referral coordination, and patient-centered communication. However, digital systems may create additional workload and exclusion when they are not aligned with local capacity and user needs. This study contributes to socio-technical and institutional perspectives by showing that digital health integration requires alignment between technology, human resources, organizational routines, and policy support. Future research should examine the model across different regional contexts and combine qualitative findings with digital maturity and service quality indicators.



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1. Introduction

Digital health has become a major agenda in strengthening primary health care, especially in developing regions where access, continuity of care, and health system coordination remain uneven. The global shift toward electronic health records, telemedicine, mobile health, decision-support systems, and integrated health information platforms reflects a wider effort to improve service quality through better data flow and faster clinical communication. Sylla et al. (2025)

explain that digital health in low- and middle-income countries has moved from simple short-message services to broader platforms that support self-care, health education, chronic disease monitoring, and remote consultation. However, this transformation does not automatically improve primary care quality. Digital tools can strengthen service delivery only when they fit local work routines, patient needs, infrastructure capacity, and institutional governance. In many developing regions, primary care facilities still face fragmented systems, weak interoperability, limited digital literacy, and unstable internet access. These conditions make digital integration a social and organizational issue, not only a technical one.

In Indonesia, digital health integration has gained stronger policy attention through the national health transformation agenda and the development of interoperable health data systems. Primary health care facilities are expected to adapt to digital reporting, electronic medical records, referral systems, and integrated patient data exchange. Aisyah et al. (2024) found that the information and communication technology maturity of Indonesian primary health care services across nine provinces remained at a developing stage, with substantial variation across facilities. This finding shows a clear gap between national digital health ambition and local implementation capacity. In practice, many primary health care workers must manage several digital platforms while still maintaining direct patient care, paper-based backup records, and routine program reporting. Handayani et al. (2020) also noted that telemedicine and digital health implementation in Indonesia faces barriers related to regulation, infrastructure, user readiness, and organizational support. These issues become more complex in districts where digital infrastructure, staff training, and technical assistance remain inconsistent.

Empirical evidence from other developing regions confirms that digital health integration depends on human, organizational, and contextual factors. In urban Nepal, Bhattarai et al. (2022) found that health workers and stakeholders recognized the value of electronic health technologies for primary care, but they also identified limited training, language barriers, technical skills, and policy support as major constraints. Mamuye et al. (2023) showed that eHealth sustainability in low- and middle-income countries requires alignment between infrastructure, financing, leadership, user acceptance, and regulatory support. Wang et al. (2025) further emphasized that health worker adoption depends on perceived usefulness, ease of use, trust, training, and institutional encouragement. These studies suggest that digital health integration must be examined through the lived experiences of users who operate the system every day. The quality of primary care cannot be improved by software adoption alone. It requires a model that connects technology with work culture, clinical decision-making, patient communication, and local governance.

The issue is also important from social, cultural, and service quality perspectives. Primary health care facilities serve as the first contact point between communities and the health system. Patients do not judge digital health only from system availability. They experience it through waiting time, staff responsiveness, clarity of information, referral continuity, privacy protection, and trust in health workers. Figueirêdo et al. (2025) showed that digital health in primary care is closely related to service quality, but its benefits depend on how technology supports access, coordination, and patient-centered care. Silva et al. (2024) proposed that digital health evaluation in primary health care should consider quality dimensions such as access, effectiveness, continuity, and user experience. In developing regions, digital integration may also create new exclusion if older adults, rural residents, low-income patients, or people with limited digital literacy cannot use digital services effectively. Gong et al. (2024) warned that the digital divide can widen health inequality when digital systems expand faster than user capacity and inclusive service design.

Previous studies have contributed important knowledge about digital health readiness, telemedicine, mobile health, and digital intervention outcomes. However, many studies still focus

on technical feasibility, disease-specific interventions, or macro-level policy frameworks. Xiong et al. (2023) found that digital health interventions for non-communicable disease management in primary care across low- and middle-income countries showed mixed clinical outcomes, although service implementation outcomes were more promising. Fava and Lapão (2024) also noted that digital primary care services require stronger attention to integration, equity, and implementation models. The remaining gap lies in the limited qualitative explanation of how digital health integration is understood, negotiated, and practiced by frontline actors in developing regions. Mengiste et al. (2023) argued that eHealth policy frameworks in low- and lower-middle-income countries still require stronger contextual evidence. Yi et al. (2024) added that digital health innovation in South and Southeast Asia needs culturally sensitive, locally adapted, and partnership-based approaches. This gap justifies a qualitative study that explores meanings, experiences, and processes rather than only measuring digital system performance.

This study aims to explore digital health integration models for improving the quality of primary health care in developing regions. The study focuses on the experiences of health workers, primary health care managers, district health officers, community health cadres, and patients in using, adapting, and evaluating digital health systems. The study uses a socio-technical perspective to understand how technology interacts with human capacity, workflow, institutional rules, and local service culture. It also draws on institutional theory to explain how policy pressure, professional norms, and organizational routines shape digital health adoption. Theoretically, this study contributes to the development of a contextual model of digital health integration in primary health care. Practically, it provides recommendations for local health offices and primary health care facilities to design digital integration strategies that are feasible, inclusive, and aligned with service quality improvement.

2. Materials and Methods

This study uses a qualitative approach with a case study design. The case study design was selected because the research aims to understand digital health integration as a process embedded in a specific organizational and regional context. The study does not seek to measure the statistical effect of digital systems on service quality. Instead, it explores how health workers, managers, policy actors, cadres, and patients experience digital integration in everyday primary care practice. This design is suitable because digital health implementation involves interaction between technology, users, infrastructure, policy, and work culture. Bhattarai et al. (2022) used a qualitative design to examine electronic health technology adoption in primary health care, showing that user experience and institutional context are central to understanding digital readiness. Jackson-Morris et al. (2024) also demonstrated the value of formative qualitative research for identifying how digital solutions can address care gaps in resource-limited settings.

The research will be conducted in three public primary health care centers in South Lampung Regency, Lampung Province, Indonesia. The study period will be January to March 2026. This location is selected because it represents a developing district context where primary health care facilities are adapting to digital reporting systems, electronic medical records, referral applications, and national health data integration. The participants will include heads of primary health care centers, physicians, nurses, midwives, medical record officers, health information system operators, health program managers, district health office staff, community health cadres, and patients who have used digital-supported primary care services. Participants will be selected through purposive sampling based on direct involvement in digital health implementation, knowledge of service workflows, and willingness to provide detailed information. Snowball sampling will also be used to identify additional informants who have specific knowledge about digital system operation, local adaptation, or patient experience. This sampling strategy follows the logic of qualitative digital health studies that require information-rich participants rather than large representative samples.

Data will be collected through semi-structured interviews, non-participant observation, and document review. Semi-structured interviews will explore participant experiences related to digital system use, workflow changes, service quality, data entry burden, referral coordination, patient communication, training needs, privacy concerns, and local adaptation strategies. Observation will focus on patient registration, clinical documentation, use of digital applications, data reporting, referral procedures, and interaction between staff and patients. Document review will include standard operating procedures, local digital health guidelines, reporting formats, training materials, internal memos, and relevant service documents. Triangulation will be applied by comparing interview findings, observation notes, and documents. Hui et al. (2022) showed that digital health implementation in low- and middle-income countries must be assessed against local infrastructure and service requirements. Pioch et al. (2024) also stressed that digital health technologies need to be understood through governance, financing, and institutional arrangements.

Data validity will be strengthened through source triangulation, method triangulation, member checking, and audit trail. Source triangulation will compare information from health workers, managers, district officers, cadres, and patients. Method triangulation will compare interview data with observation findings and institutional documents. Member checking will be conducted by sharing preliminary summaries with selected key informants to confirm whether the interpretation reflects their experience. An audit trail will be maintained by documenting field notes, interview guides, coding decisions, category development, and theme refinement. This validation process is important because digital health integration involves different meanings among actors. Robles-Aguilar et al. (2025) showed that primary care nurses experience digital health through both professional opportunities and work-related challenges. Yew et al. (2024) also noted that digital health implementation barriers can differ across users, organizations, and health system levels.

Data analysis will use thematic analysis. Interview recordings will be transcribed and read repeatedly to identify relevant patterns. Open coding will be used to label meaningful units related to infrastructure readiness, digital literacy, workflow integration, leadership support, interoperability, administrative workload, patient experience, privacy, service continuity, and local innovation. Similar codes will be grouped into categories, then refined into broader themes that explain how digital health integration affects primary care quality. The analysis will follow an iterative process by moving between raw data, codes, categories, and themes. Cross-case comparison will be conducted across the three primary health care centers to identify shared patterns and context-specific differences. The final result will be a contextual model of digital health integration that includes technological, human resource, organizational, patient-centered, and policy dimensions. This model is expected to support primary health care facilities in developing regions in improving digital transformation without neglecting equity, usability, and service quality.

3. Results and Discussions

The analysis identified five main themes that explain how digital health integration shapes the quality of primary health care in developing regions. These themes include fragmented digital workflow, uneven digital readiness among health workers, patient experience and trust, local adaptation by primary care teams, and the need for stronger governance and interoperability. These themes emerged from the comparison of interview narratives, observation notes, and institutional documents collected from three public primary health care centers in South Lampung Regency. The findings show that digital health integration was not experienced as a single technical process. Instead, it appeared as a gradual organizational adjustment that affected daily routines, staff responsibilities, patient interaction, reporting systems, and local decision-making.

The first theme concerns fragmented digital workflow. Most participants recognized that digital systems helped accelerate registration, reporting, and patient data retrieval. However, they

also reported that several applications were not fully connected to one another. Health workers often entered similar data into different platforms for clinical records, insurance claims, program reporting, and referral administration. This condition created additional workload and reduced the perceived efficiency of digital systems. One medical record officer stated, “The system helps us find patient data faster, but we still repeat the same input in different applications.” Observation at the registration desk also showed that staff moved between digital forms, paper notes, and manual verification when internet access slowed down. This pattern indicates that digital integration improved several service functions, but it had not yet produced a seamless workflow across all service units.

The second theme relates to uneven digital readiness among health workers. Younger staff and system operators tended to adapt more quickly to digital platforms. In contrast, some senior health workers needed more time and technical support to use electronic records and reporting dashboards. Participants did not reject digital transformation, but they emphasized the need for continuous training and practical assistance. A nurse explained, “We want to use the system properly, but the training is often too short. When an error appears, we depend on one operator.” This finding shows that digital readiness was not only about individual skill. It also reflected the availability of mentoring, peer support, technical guidance, and leadership commitment. In facilities where the head of the primary health care center actively encouraged staff learning, digital adoption appeared more organized and less stressful.

The third theme concerns patient experience, trust, and digital inclusion. Patients appreciated faster registration and clearer referral information when digital systems worked well. Several patients reported that they did not need to repeat their medical history when staff could access previous records. However, older patients and patients with limited digital literacy still depended heavily on family members, cadres, or front-desk staff. One patient said, “I do not understand the application, but I feel helped when the officer explains what I need to do.” This statement reflects the importance of human mediation in digital health services. Digital tools improved service quality when they were combined with clear communication, patient assistance, and culturally familiar support. Without such support, digital procedures could create confusion and reduce patient confidence.

The fourth theme highlights local adaptation by primary care teams. Each facility developed informal strategies to make digital systems fit local conditions. Staff created WhatsApp coordination groups, used printed backup forms during system downtime, and assigned specific officers to assist colleagues with data entry. Community health cadres also helped patients understand digital appointment procedures and referral requirements. These adaptations showed that digital integration was not implemented only through formal policy. It also depended on everyday problem-solving by frontline actors. One health program manager stated, “We cannot wait for the system to be perfect. We adjust first, so the service does not stop.” This finding shows that local innovation played a key role in maintaining service continuity, especially when infrastructure and technical support were limited.

The fifth theme concerns governance, interoperability, and institutional support. Participants repeatedly emphasized that digital integration required clearer rules, stable infrastructure, and stronger coordination between primary health care centers and the district health office. Some informants noted that new applications were introduced before older systems were fully aligned. Others mentioned that reporting indicators changed frequently, which affected staff workload and data consistency. A district health officer explained, “The challenge is not only using the application. The challenge is making sure all systems speak to each other and all facilities follow the same data standard.” Document review also showed that standard operating procedures existed, but they did not always explain how different digital systems should be connected in daily practice. This finding suggests that digital integration requires more than technology adoption. It

needs governance mechanisms that regulate data flow, role distribution, interoperability, privacy, and feedback loops.

Overall, the findings indicate that digital health integration can improve primary health care quality when it supports service accessibility, data continuity, coordination, and decision-making. However, the benefits remain limited when systems operate separately, training is insufficient, and patient support is weak. The study also shows that human interaction remains central in digital primary care. Digital systems did not replace the role of health workers, cadres, and local managers. Instead, they changed how these actors coordinated, communicated, and solved service problems. In this context, quality improvement depended on the balance between technological capacity and socio-organizational readiness.

Discussion

The findings support the socio-technical perspective, which views digital health as an interaction between technology, people, organizational routines, and institutional structures. The study found that digital health integration did not function as a purely technical intervention. It became meaningful only when health workers could incorporate it into daily workflows and when patients could understand its use. This finding aligns with Bhattarai et al. (2022), who found that electronic health technologies in primary care require user readiness, training, language suitability, and institutional support. The present study extends this perspective by showing that integration quality depends on how frontline actors negotiate between formal digital systems and local service realities.

The theme of fragmented workflow is consistent with earlier studies on digital health implementation in low- and middle-income countries. Mamuye et al. (2023) found that sustainability of eHealth solutions depends on infrastructure, organizational support, human resources, financing, and policy alignment. The present findings confirm that lack of interoperability can reduce the practical value of digital systems even when facilities have adopted multiple applications. Aisyah et al. (2024) also showed that Indonesian primary health care facilities still vary in digital maturity. This study adds a qualitative explanation to that condition by showing how low integration produces repeated data entry, staff dependence on operators, and parallel use of manual records. These problems show that digital maturity should not only be measured by system availability. It should also be assessed through workflow coherence and user experience.

The finding on uneven digital readiness among health workers reflects a common implementation challenge in developing regions. Wang et al. (2025) reported that health worker adoption of digital health technology is shaped by perceived usefulness, ease of use, training, trust, and organizational support. This study supports that argument. Participants did not resist digital health because they opposed innovation. They struggled when training was short, technical support was limited, and system errors disrupted service routines. This suggests that digital health integration requires continuous capacity building rather than one-time socialization. In practical terms, district health offices need to provide mentoring systems, peer-learning forums, and responsive technical help desks for primary care workers.

The findings on patient experience also contribute to the literature on digital inclusion. Digital systems improved patient experience when they reduced waiting time, supported referral continuity, and allowed staff to access previous records. However, patients with low digital literacy still needed direct assistance. This finding is consistent with Gong et al. (2024), who warned that digital health expansion can widen inequality when digital access and user capacity are uneven. The present study shows that digital inclusion in primary care requires human support. Cadres, family members, and front-desk officers acted as bridges between digital procedures and patient understanding. This pattern is important in developing regions where social trust and interpersonal explanation remain central to service acceptance.

The local adaptation strategies found in this study offer a useful perspective for understanding digital health implementation. Staff did not simply follow formal procedures. They created informal solutions to maintain services during system disruption. These adaptations included backup forms, WhatsApp coordination, peer assistance, and role-sharing among staff. This finding is relevant to institutional theory because it shows how organizations respond to external policy pressure by adapting routines to fit local constraints. Mengiste et al. (2023) argued that eHealth policy frameworks in developing countries require stronger contextual grounding. The present study confirms that national digital health policies need translation at the local level. Without this translation, implementation may remain formal, fragmented, and burdensome for frontline workers.

The study also offers a practical model for digital health integration in primary care. Based on the findings, effective integration should include five dimensions. First, technological integration must ensure interoperability, stable connectivity, and simplified data entry. Second, human resource integration must provide continuous training and peer support. Third, organizational integration must align digital systems with service workflows and role distribution. Fourth, patient-centered integration must ensure that digital services remain understandable, inclusive, and supported by human assistance. Fifth, policy integration must strengthen data governance, privacy protection, and coordination between primary health care centers and district health offices. This model differs from approaches that define digital health integration mainly as system installation. It places service quality, local capacity, and user experience at the center.

The implications of this study are both theoretical and practical. Theoretically, the study strengthens the view that digital health integration in developing regions should be understood as a socio-technical and institutional process. It shows that technology adoption becomes effective only when it aligns with local routines, user capabilities, organizational leadership, and patient trust. Practically, the findings suggest that health authorities should not evaluate digital transformation only through the number of applications used or the availability of electronic records. Evaluation should include workflow burden, user confidence, patient accessibility, data continuity, and service responsiveness. Primary health care centers also need flexible implementation guidelines that allow local adaptation while maintaining data standards and accountability.

This study has limitations. The findings are based on three primary health care centers in one district, so they cannot represent all developing regions. However, the qualitative design provides rich insight into the meanings, experiences, and processes behind digital health integration. Future studies can compare digital health integration models across urban, peri-urban, rural, and remote primary care settings. Further research may also include patients from vulnerable groups, such as older adults, people with disabilities, and low-income households, to better understand digital exclusion. Mixed-methods studies can test the proposed integration model by combining qualitative insights with service quality indicators, patient satisfaction data, and digital maturity assessment.

4. Conclusions

This study concludes that digital health integration can improve the quality of primary health care when it is supported by coherent workflows, adequate human resource capacity, patient-centered communication, local adaptation, and clear governance. The findings show that digital systems helped improve patient data access, referral coordination, reporting, and service continuity. However, these benefits remained limited when applications were fragmented, staff training was insufficient, infrastructure was unstable, and patients had low digital literacy. The study confirms that digital health integration in developing regions is not only a technical process. It is a socio-technical and institutional process shaped by user readiness, organizational routines, leadership support, community trust, and policy alignment.

Theoretically, this study contributes to the literature by explaining digital health integration as a contextual process that connects technology, human actors, institutional rules, and service quality in primary health care. Practically, the findings suggest that primary health care centers and district health offices need to strengthen interoperability, continuous training, technical support, patient assistance, and data governance. From a policy perspective, digital transformation should not only focus on system adoption, but also on inclusive implementation, workload reduction, and local service readiness. Future research should compare digital health integration across urban, rural, remote, and island-based primary care settings. Further studies may also use mixed methods to test the proposed integration model with service quality indicators, patient satisfaction, and digital maturity assessment.

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