



Digital Transformation in Primary Health Care: Analysis of Barriers and Effective Implementation Strategies

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ABSTRACT

This study aims to analyze the barriers and effective implementation strategies of digital transformation in primary health care. The study focuses on how health workers, facility managers, administrative staff, information technology staff, and patients experience the use of digital systems in daily service delivery. A qualitative approach with a descriptive case study design was used. The research was conducted in five primary health care facilities in Bandar Lampung City, Indonesia, from July to September 2026. Data were collected through semi-structured interviews, non-participant observation, and document review involving 30 participants selected through purposive sampling and limited snowball sampling. The data were analyzed using reflexive thematic analysis supported by data condensation, data display, and conclusion drawing. The findings reveal six main themes: infrastructure readiness, workflow disruption, digital literacy gaps, interoperability problems, data security and user trust, and local adaptation strategies. The study shows that digital transformation in primary health care is not merely a matter of technology adoption, but a socio-technical process that depends on organizational readiness, user capacity, service culture, and policy support. The findings contribute to a deeper understanding of digital health implementation by highlighting the role of local adaptation in maintaining service continuity. This study implies that effective digital transformation requires continuous training, integrated platforms, clear data governance, patient assistance, and phased implementation based on facility readiness.



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1. Introduction

Digital transformation in primary health care has become a central issue in health system strengthening because first-level facilities now carry a broader role in prevention, early detection, chronic disease management, referral coordination, and health education. The use of electronic medical records, teleconsultation, mobile health applications, digital queue systems, remote monitoring, and data-based reporting can improve service speed, continuity of care, and access to health information. Pagliari (2021) explains that the pandemic accelerated the use of digital health in primary care, but this acceleration also exposed gaps in readiness, governance, infrastructure,

and user capacity. This issue is important because primary health care is the first point of contact for most patients, especially in developing countries where access to specialist services remains uneven.

Globally, digital health has shown strong potential to improve access and quality in primary care. Erku et al. (2023) found that digital health interventions can support universal health coverage by improving communication, monitoring, health education, and service coordination. However, digital transformation does not always produce equal benefits across health systems. Fava and Lapão (2024) argue that the provision of digital primary health care depends on service design, organizational readiness, digital infrastructure, and the ability of health workers to integrate technology into daily clinical routines. This means that digital transformation must be understood as a socio-technical process, not only as the adoption of hardware, software, or health applications.

In Indonesia, digital transformation in primary health care has developed through electronic medical records, online referral systems, telemedicine services, digital reporting, and health information platforms. Aisyah et al. (2024) found that the maturity of information and communication technology in Indonesian primary health care still varies across provinces, which indicates uneven readiness among facilities. This condition creates practical challenges for puskesmas and private primary clinics, especially in areas where internet stability, staff training, interoperability, and technical support remain limited. Harahap et al. (2022) also reported that personal health record adoption in Indonesian health facilities faces barriers related to data security, infrastructure, interoperability, regulation, user attitude, and e-health literacy.

Field problems in primary health care often appear in daily service routines. Health workers may need to input the same data into several platforms, manage unstable systems during service hours, and help patients who have low digital literacy. Borges do Nascimento et al. (2023) show that health professionals often face workload pressure, psychological resistance, usability problems, limited training, and infrastructure barriers when using digital health technologies. Similar challenges appear in electronic health record implementation, where resistance to change, weak technical support, system complexity, and limited interoperability can reduce the expected value of digital systems. Alzghaibi and Hutchings (2025) highlight that electronic health record implementation in primary health care requires more than technical deployment because it changes workflow, professional roles, and communication patterns.

The issue is also socially important because digital transformation affects the relationship between patients, health workers, and health institutions. Willis et al. (2022) found that digital interventions can support preventive care in primary care settings, but their success depends on patient engagement and the ability of providers to use digital tools meaningfully. Rabet et al. (2024) show that vulnerable groups may face barriers related to language, trust, device access, digital skills, and service inclusiveness. In the Indonesian context, these findings matter because differences in education, age, income, geography, and digital literacy can shape how patients experience digital services. Without a context-sensitive strategy, digital transformation may widen service gaps rather than reduce them.

Previous studies have explained the benefits, barriers, and outcomes of digital health in primary care, but many still emphasize technical adoption, intervention types, or clinical effectiveness. Peyroteo et al. (2021) focused on remote monitoring systems for chronic disease patients in primary health care, while El Asmar et al. (2021) examined clinical decision support systems in chronic disease management. Jonnagaddala et al. (2021) discussed the shift from telehealth to virtual primary care, but the lived experiences of health workers, managers, administrative staff, and patients in local primary care settings still need deeper qualitative exploration. Therefore, this study aims to analyze barriers and effective implementation strategies for digital transformation in primary health care. The study focuses on how local actors experience, interpret, negotiate, and adapt digital systems in daily service delivery. Theoretically,

this study contributes to socio-technical understanding of digital health implementation. Practically, it provides evidence for puskesmas, private clinics, local health offices, system developers, and policymakers in designing more realistic, inclusive, and sustainable digital transformation strategies.

2. Materials and Methods

This study uses a qualitative approach with a descriptive case study design. This design was selected because the study aims to understand barriers and implementation strategies of digital transformation in primary health care within real service settings. A case study approach is suitable for examining a complex health service phenomenon that involves technology, organization, human behavior, policy, and patient interaction. Sibbald et al. (2021) argue that case study methodology is relevant in health services research because it allows researchers to examine context, process, actors, and implementation dynamics. In this study, digital transformation is treated as a contextual process that involves health workers, managers, patients, digital systems, service routines, and institutional rules.

The study will be conducted in Bandar Lampung City, Lampung Province, Indonesia, from July to September 2026. The research sites will include Puskesmas Sukaramé, Puskesmas Way Halim, Puskesmas Kedaton, one private primary clinic in Sukaramé District, and one private primary clinic in Kedaton District. These sites are selected because they represent public and private primary health care facilities that have used digital service components, such as electronic medical records, online registration, digital queue systems, digital referral, health reporting applications, or teleconsultation support. Frennert et al. (2024) show that the same digital platform can be used differently across primary care units because leadership, training, workflow, and staff involvement vary between facilities. For this reason, the use of several sites allows the study to compare implementation experiences across different organizational contexts.

The participants will be selected through purposive sampling because the study requires informants who have direct experience with digital transformation in primary health care. Campbell et al. (2020) state that purposive sampling helps qualitative researchers select information-rich participants who can explain the phenomenon in depth. The participants will include five facility leaders, five doctors, five nurses or midwives, five medical record or administrative officers, three information technology support staff, and seven patients who have used digital services. The total number of participants is planned to be 30 people. If the initial participants identify other key actors who have relevant experience, limited snowball sampling will be used. Guest et al. (2020) explain that saturation can be assessed when additional interviews no longer produce substantially new themes.

The inclusion criteria for health worker participants are direct involvement in digital service use for at least six months, active work in one of the selected facilities, and willingness to participate in interviews. The inclusion criteria for patient participants are age above 18 years, experience using digital registration, teleconsultation, digital referral, or electronic medical record-related services, and willingness to share service experiences. Participants who do not have direct experience with digital health services will not be included. Hennink and Kaiser (2022) emphasize that sample adequacy in qualitative research depends not only on participant numbers, but also on information power, topic specificity, data quality, and analytic depth. Therefore, the final number of participants may be adjusted if data saturation is achieved before or after 30 interviews.

Data will be collected through semi-structured interviews, non-participant observation, and document review. Semi-structured interviews will explore participants' experiences related to infrastructure readiness, digital literacy, staff training, workflow changes, workload, patient response, system usability, data security, interoperability, and local strategies for solving implementation problems. Doyle et al. (2020) explain that qualitative descriptive research is

useful when researchers need clear and practice-oriented descriptions of health service experiences. Non-participant observation will be conducted in registration areas, service rooms, medical record units, referral desks, and administrative reporting units. Document review will include standard operating procedures, internal guidelines, training materials, service flow documents, digital reporting forms, and technical problem records.

Data validity will be strengthened through triangulation of sources, triangulation of methods, member checking, and audit trail. Source triangulation will compare information from facility leaders, doctors, nurses, midwives, administrative staff, information technology staff, and patients. Method triangulation will compare interview data, observation notes, and documents. Member checking will be conducted by asking selected participants to confirm interview summaries and preliminary interpretations. Ahmed (2024) explains that credibility, transferability, dependability, and confirmability are key pillars of trustworthiness in qualitative research. An audit trail will be maintained by documenting interview guides, field notes, coding decisions, analytic memos, theme development, and revisions during analysis.

Data will be analyzed using reflexive thematic analysis supported by the interactive logic of data condensation, data display, and conclusion drawing. The analysis will begin with repeated reading of interview transcripts and observation notes. Initial codes will then be developed to identify statements related to barriers, adaptation processes, user experiences, organizational support, patient access, and implementation strategies. Braun and Clarke (2021) emphasize that reflexive thematic analysis requires active interpretation by the researcher and continuous reflection on how meaning is constructed from data. The codes will be grouped into categories, reviewed as potential themes, refined, named, and written as analytic findings. Byrne (2022) explains that thematic analysis can help researchers move from raw qualitative data to coherent themes when each phase is conducted systematically. Ahmed et al. (2025) add that thematic analysis is flexible but must remain transparent in coding, theme development, and interpretation. The final themes are expected to explain how digital transformation is experienced in primary health care, what barriers shape implementation, and what strategies are considered effective by local actors.

3. Results and Discussions

The findings show that digital transformation in primary health care was experienced as a necessary change, but not as a fully settled practice. Participants viewed digital systems as useful for registration, medical records, referral, reporting, and service documentation. However, they also described digital transformation as a process that added new demands to already busy service routines. Facility leaders generally supported digital adoption because it aligned with health system modernization and administrative accountability. Health workers, however, experienced the transformation more directly through daily service pressures. One doctor stated, “The system helps us find patient data faster, but when the network is slow, the consultation becomes longer and patients start asking why they have to wait.” This finding indicates that the value of digital technology depends on its fit with the rhythm of primary care work, not only on its availability.

The first major theme was infrastructure readiness as the foundation of digital service continuity. Interviews and observations showed that unstable internet connections, limited computers, shared devices, and system downtime affected service flow. In public facilities, digital tools were used for registration, reporting, and referral, but several units still kept manual notes as backup. Administrative staff explained that manual records were not abandoned because digital systems could fail during peak hours. One medical record officer said, “We still write some data manually because if the application has an error, we cannot stop the service.” This pattern shows that digital transformation in primary care often creates a hybrid system where paper and digital records operate together. Aisyah et al. (2024) reported that information and communication technology maturity in Indonesian primary health care varies across regions, which supports the finding that digital readiness remains uneven across facilities.

The second theme was workflow disruption and additional administrative workload. Health workers reported that digital systems improved documentation, but they also increased time spent on data entry. Nurses and midwives described situations where clinical tasks, patient education, and digital reporting had to be completed by the same staff. Observation in registration areas showed that staff often helped patients use digital registration while also handling walk-in patients and manual verification. One nurse stated, “The problem is not only the application. The problem is that we must serve patients, explain the process, and enter data at the same time.” This finding suggests that digital transformation changes task distribution inside primary care facilities. It does not automatically reduce workload when staffing, training, and workflow redesign are not adjusted.

The third theme was digital literacy gaps among health workers and patients. Younger staff were generally more confident in using digital platforms, while some senior staff needed repeated assistance. Patients also showed different levels of readiness. Some patients preferred online registration because it reduced waiting time, while others still depended on family members or registration staff. A patient explained, “I can use WhatsApp, but I am confused when I have to register through a link. I am afraid I will press the wrong button.” This finding reveals that digital health access depends not only on the existence of digital platforms, but also on user confidence, language clarity, and guidance during service use. Rabet et al. (2024) found that vulnerable users may face digital primary care barriers related to trust, language, device access, and digital skills, which is relevant to the patient experience found in this study.

The fourth theme was interoperability and fragmented digital platforms. Participants reported that several applications were used for different purposes, such as patient registration, medical records, referral, disease reporting, and insurance-related processes. These platforms did not always connect smoothly with each other. As a result, staff sometimes entered similar data into more than one system. One administrative officer stated, “The patient data are already in one application, but we still need to input them again into another system because the systems are not connected.” This fragmentation reduced the perceived efficiency of digital transformation. It also created frustration among staff because digital tools were expected to simplify work, but in practice they sometimes multiplied documentation tasks. Harahap et al. (2022) also found that interoperability, infrastructure, regulation, and e-health literacy shape the adoption of digital health records in Indonesian health facilities.

The fifth theme was data security, privacy, and user trust. Facility leaders and information technology staff recognized the importance of protecting patient data, but frontline workers did not always receive detailed training on data privacy. Some staff shared devices across units, used simple passwords, or relied on informal technical support when systems failed. Patients rarely asked about data protection, but several expressed concern when their personal information had to be entered into online systems. One patient said, “I do not really understand where my data goes. I just follow what the staff asks.” This finding shows that trust in digital health systems often depends on institutional confidence rather than informed user understanding. Borges do Nascimento et al. (2023) identify privacy, security, technical issues, workload, and psychological barriers as key concerns for health professionals using digital health technologies.

The sixth theme was local adaptation as an effective implementation strategy. Facilities did not wait for ideal conditions before using digital systems. Instead, they developed practical strategies such as assigning informal digital champions, creating WhatsApp groups for technical coordination, preparing manual backup forms, giving peer-to-peer training, and helping patients directly at the registration desk. One facility leader explained, “We cannot just tell staff to use the system. We need one or two people in each unit who can guide others when problems happen.” This finding shows that effective implementation relies on local problem-solving and shared learning. Frennert et al. (2024) found that digital platforms can be used differently across primary care settings because leadership, staff involvement, and workflow integration shape implementation outcomes.

Discussion

The findings indicate that digital transformation in primary health care is best understood as a socio-technical process. Technology alone did not determine success. Implementation depended on infrastructure, human capacity, workflow design, leadership support, patient readiness, and local adaptation. This confirms the argument that digital primary care requires integration between technological systems and service organization. Fava and Lapão (2024) show that digital primary health care services vary in effectiveness because implementation depends on organizational context, service design, and user involvement. In this study, facilities with stronger internal coordination were better able to manage system errors, guide staff, and support patients, even when technical limitations remained.

The finding on infrastructure readiness supports previous studies that identify technical barriers as a major challenge in digital health implementation. Unstable internet, limited hardware, and downtime forced facilities to maintain manual systems. This hybrid practice shows that digital transformation does not always replace older systems immediately. Instead, digital and manual procedures often coexist during the transition period. Alzghaibi and Hutchings (2025) found that large-scale electronic health record implementation in primary care can face barriers related to system complexity, technical readiness, training, and organizational support. The present study adds a local perspective by showing how frontline staff manage these barriers through informal backups and flexible service routines.

The finding on workload disruption also expands previous literature. Digital systems were expected to improve efficiency, but participants reported that they often increased administrative tasks when systems were fragmented. This supports the review by Borges do Nascimento et al. (2023), which found that workload-related concerns remain a key barrier for health professionals using digital technologies. In the context of Bandar Lampung primary care facilities, workload was not only caused by digital data entry, but also by the need to assist patients with low digital literacy. This means that digital transformation shifts part of the digital burden to frontline workers, especially administrative staff, nurses, and midwives.

The finding on digital literacy gaps confirms that patient participation is central to digital primary care. Digital registration, teleconsultation, and online referral systems require patients to understand instructions, own suitable devices, and trust digital processes. Willis et al. (2022) argue that digital interventions in primary care can support prevention and service engagement, but their success depends on user participation. This study shows that participation cannot be assumed. Older patients, patients with limited education, and patients unfamiliar with online forms may require assisted digital access. This finding offers a practical insight for primary care managers: digital inclusion must be built into service design, not treated as an individual patient responsibility.

The finding on interoperability reveals a structural barrier in digital transformation. Participants did not reject digital systems, but they questioned fragmented platforms that required repeated data entry. This finding aligns with Harahap et al. (2022), who identified interoperability as an important barrier to personal health record adoption in Indonesia. It also supports Xiong et al. (2023), who found that digital health interventions in primary care settings in low- and middle-income countries require integration with existing health systems. Without interoperability, digital transformation risks becoming procedural digitalization, where paper forms are replaced by multiple screens but service efficiency does not improve.

The finding on privacy and trust highlights a critical but less visible dimension of implementation. Patients often complied with digital procedures without fully understanding data flows, while staff did not always receive sufficient privacy training. This condition may create long-term risks for trust in digital health services. Pagliari (2021) argues that digital health in primary care needs strong governance because rapid digital adoption can create ethical, organizational, and equity-related challenges. In this study, trust was built mainly through face-

to-face relationships with health workers. This suggests that primary health care facilities should use their close relationship with communities to explain data use, privacy protection, and patient rights in simple language.

The most important contribution of this study lies in its explanation of local adaptation strategies. Facilities used digital champions, informal peer support, manual backups, and patient assistance to keep services running. These strategies show that implementation success depends on micro-level practices, not only formal policy. This finding is consistent with Sibbald et al. (2021), who emphasize the value of case study research in revealing contextual processes in health services. The study also offers a practical contribution by showing that digital transformation in primary care should be implemented gradually, with workflow mapping, user training, technical support, and patient assistance as core components.

Theoretically, this study strengthens the socio-technical perspective in digital health implementation. Digital transformation should not be reduced to technology adoption because its success depends on interaction between users, organizations, infrastructure, rules, and service culture. Practically, the findings suggest that health offices and facility managers should assess digital readiness before expanding new applications, reduce duplicate data entry, provide continuous training, assign digital support roles, and design inclusive patient assistance mechanisms. Future studies should compare digital transformation across rural and urban primary care settings, examine patient groups with different levels of digital literacy, and assess how interoperability reforms affect workload and service quality over time.

4. Conclusions

This study concludes that digital transformation in primary health care is not only a technical shift, but also a socio-organizational process shaped by infrastructure readiness, workflow adaptation, staff capacity, patient digital literacy, interoperability, and trust in data governance. The findings show that primary care facilities in Bandar Lampung used digital systems for registration, medical records, referral, reporting, and patient communication, but implementation remained uneven because digital tools often operated alongside manual procedures. The main barriers included unstable internet access, limited devices, fragmented platforms, repeated data entry, insufficient training, workload pressure, and limited patient readiness. The study contributes to the literature by showing that the success of digital transformation depends on how local actors interpret, negotiate, and adapt technology within daily service routines.

The findings have theoretical, practical, and policy implications. Theoretically, this study strengthens the socio-technical perspective by showing that digital health implementation requires alignment between technology, users, workflow, organizational culture, and institutional support. Practically, primary health care managers need to provide continuous training, assign digital support roles, simplify service flows, reduce duplicate data entry, and provide assisted digital access for patients with low digital literacy. At the policy level, local health offices should strengthen infrastructure, improve interoperability between platforms, develop clear data protection guidelines, and support phased implementation based on facility readiness. Future research should compare digital transformation in urban and rural primary care settings, examine patient groups with different digital literacy levels, and assess the long-term impact of interoperability improvement on workload, service quality, and patient access.

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