

Digital Governance and Health Innovation for Strengthening Community Health Systems: A Cross-Sectional Study in Indonesia

Wa Ode Novi Angraeni^{a*}, Jessy Andre Mangaya Takke^a, Muh Ihsan Kamaruddin^a

^a Department of Health Information Management, Politeknik Sandi Karsa, South Sulawesi, Indonesia

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ABSTRACT

Introduction: Digital transformation has become an important strategy for strengthening community health systems and improving the effectiveness of primary healthcare services. Digital governance and health innovation can support better coordination, data management, and accessibility of health services. However, empirical evidence examining the role of digital governance and innovation in strengthening community health systems in developing countries remains limited. This study aimed to examine the relationship between digital governance, health innovation, and community health system strengthening in primary healthcare facilities in Indonesia.

Research Methodology: This study employed a cross-sectional design conducted in primary healthcare facilities in Indonesia between January and April 2025. A total of 150 healthcare professionals and administrative staff participated in the study. Data were collected using a structured questionnaire assessing digital governance, health innovation, and community health system strengthening. Descriptive statistics were used to summarize respondent characteristics. Bivariate analysis and multivariate logistic regression were performed to examine associations between variables. Statistical significance was determined at $p < 0.05$ with 95% confidence intervals.

Results: Among the 150 respondents, most participants reported experience using digital health systems (81.3%). Bivariate analysis showed that digital governance was significantly associated with community health system strengthening ($p = 0.003$). Health innovation also demonstrated a significant association with community health system strengthening ($p = 0.005$). Multivariate logistic regression analysis indicated that facilities with higher digital governance had greater odds of stronger community health system performance (AOR = 2.36; 95% CI: 1.29–4.31; $p = 0.004$). Similarly, higher levels of health innovation were associated with improved community health system indicators (AOR = 2.08; 95% CI: 1.14–3.77; $p = 0.016$).

Conclusions: Digital governance and health innovation play significant roles in strengthening community health systems within primary healthcare settings. Strengthening digital governance frameworks, expanding digital health infrastructure, and enhancing healthcare workers' digital competencies may improve the effectiveness of community-based healthcare delivery. Future research should explore longitudinal approaches to better understand the long-term impact of digital transformation on health system performance.

Keywords: Digital Governance; Digital Health; Health Innovation; Primary Health Care; Public Health Systems



*Correspondence author. Email: noviangreni1111@gmail.com



INTRODUCTION

Health systems worldwide are undergoing rapid transformation as digital technologies increasingly shape the governance, management, and delivery of health services [1]. The World Health Organization emphasizes that strengthening community health systems is essential for achieving Universal Health Coverage (UHC) and improving population health outcomes [2]. Digital governance, defined as the use of digital technologies to enhance transparency, coordination, and decision-making in public sector management, has emerged as a critical strategy in modern health system reform. Through digital platforms, governments and healthcare institutions can improve data integration, resource allocation, and service monitoring, thereby enhancing the responsiveness and efficiency of community-based health services [3].

In many low- and middle-income countries, including Indonesia, primary healthcare facilities serve as the frontline of the health system and play a crucial role in community health promotion, disease prevention, and basic medical services [4]. Indonesia has initiated various digital health strategies as part of its national health transformation agenda, including the implementation of electronic health records, health information systems, and integrated digital reporting platforms at primary healthcare centers [5]. These innovations aim to improve coordination between health facilities, local governments, and national health authorities while facilitating more efficient service delivery [6]. However, despite these initiatives, disparities in digital infrastructure, workforce capacity, and governance mechanisms continue to affect the effectiveness of digital health implementation across regions [7].

Previous studies have demonstrated that digital health innovations can enhance the performance of community health systems by improving data accuracy, supporting evidence-based decision-making, and strengthening access to health services [8]. For instance, research in several countries has shown that digital health information systems can improve disease surveillance, patient monitoring, and health program management. Other studies highlight the role of digital governance in promoting accountability and transparency in healthcare management [9]. Furthermore, technological innovations such as telehealth services, mobile health applications, and digital reporting systems have been associated with improved communication between healthcare providers and communities, particularly in geographically dispersed settings [10].

Despite the growing body of literature on digital health and health system strengthening, important gaps remain. Many existing studies primarily focus on technological adoption or specific digital tools rather than examining the broader governance context that shapes the effectiveness of digital health initiatives [11]. Additionally, limited empirical research has examined how digital governance and health innovation together strengthen community health systems, particularly in primary healthcare settings in developing countries. In Indonesia, evidence examining the relationship between digital governance practices, innovation adoption, and community health system performance remains relatively scarce.

Understanding the role of digital governance and innovation in strengthening community health systems is crucial for informing policy development and health system reform. Effective digital governance can support better coordination among stakeholders, enhance transparency in health management, and facilitate data-driven policy decisions. At the same time, health innovation can improve service accessibility, efficiency, and community engagement. By examining these factors within primary healthcare facilities, this study

contributes to the broader discussion on digital health transformation and its implications for strengthening health systems in resource-constrained settings.

Therefore, the objective of this study is to examine the role of digital governance and health innovation in strengthening community health systems in Indonesia. Using a cross-sectional study design, this research investigates how digital governance practices and innovation initiatives are associated with the performance and effectiveness of community health systems within primary healthcare facilities. The findings are expected to provide evidence-based insights for policymakers, healthcare administrators, and public health practitioners seeking to optimize digital transformation strategies in strengthening community health systems.

MATERIALS AND METHODS

Study Design

This study employed an observational-analytic design using a cross-sectional approach to examine the relationships among digital governance, health innovation, and the strengthening of community health systems. The cross-sectional design allows researchers to assess the distribution of variables and their associations at a single point in time. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure transparency, methodological rigor, and comprehensive reporting of observational research.

Study Setting and Study Period

The study was conducted in primary healthcare facilities (Puskesmas) located in several districts in Indonesia. These facilities represent the frontline of healthcare delivery and play a central role in implementing public health programs, preventive services, and community-based health interventions. Data collection was carried out between January and April 2025. The selected facilities were chosen to reflect variations in digital health implementation and administrative capacity across different regions.

Population and Sample

The study population consisted of healthcare professionals and administrative staff working in primary healthcare facilities who were involved in the management, implementation, or utilization of digital health systems. These included physicians, nurses, public health officers, health information officers, and facility administrators. The minimum sample size was determined using a standard formula for cross-sectional studies, considering a confidence level of 95%, an expected proportion of 50%, and a margin of error of 5%. Based on these parameters, the required sample size was estimated to be at least 150 respondents.

Sampling Technique

A stratified random sampling technique was applied to ensure representation from different types of healthcare personnel and facilities. Primary healthcare centers were first grouped by geographical location and the level of digital system implementation. Within each facility, eligible healthcare workers were randomly selected to participate in the survey. This sampling approach was used to minimize sampling bias and improve the representativeness of the study sample.

Inclusion and Exclusion Criteria

Inclusion criteria for this study were: (1) healthcare workers or administrative staff employed in primary healthcare facilities, (2) individuals who had been working at the facility

for at least six months, and (3) individuals involved in digital health system utilization or management. Exclusion criteria included healthcare workers who were on leave during the data collection period, those who declined to participate, and incomplete questionnaire responses.

Variables and Measurement

The primary independent variables in this study were digital governance and health innovation, while the dependent variable was community health system strengthening. Digital governance was measured through indicators such as digital infrastructure availability, data management practices, digital policy implementation, and transparency in digital health reporting. Health innovation was assessed through the presence of digital health applications, telehealth services, electronic health records, and innovative digital service delivery models. Community health system strengthening was measured through indicators including service efficiency, accessibility, coordination of health services, and community engagement. All variables were measured using a structured questionnaire with Likert-scale responses ranging from strongly disagree to strongly agree.

Data Collection Procedures

Data were collected using a structured self-administered questionnaire distributed to eligible respondents. Before data collection, the questionnaire was pre-tested with a small group of healthcare workers to ensure its clarity and reliability. Data collection was conducted via online survey platforms and printed questionnaires, depending on facility accessibility. Participants were informed about the study's purpose and provided informed consent before completing the questionnaire.

Statistical Analysis

Data analysis was performed using statistical software. Descriptive statistics were used to summarize respondents' demographic characteristics and the distribution of study variables. Bivariate analyses, including chi-square tests and correlation analyses, were conducted to examine associations among digital governance, health innovation, and community health system strengthening. Multivariate analysis using logistic regression was performed to identify independent predictors of community health system strengthening. Statistical significance was determined at a p-value of less than 0.05.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Review Board or Ethics Committee of the relevant academic or health institution. All participants provided informed consent before participating in the study. Confidentiality and anonymity of respondents were strictly maintained, and the collected data were used solely for research purposes.

RESULTS

Table 1. Characteristics of Respondents (n = 150)

Variable	Category	n	%
Sex	Male	58	38.7
	Female	92	61.3
Age (years)	20–29	28	18.7
	30–39	60	40.0
	40–49	42	28.0
	≥50	20	13.3
Profession	Physician	26	17.3
	Nurse	56	37.3
	Public health officer	35	23.3

Work experience	Health information officer	18	12.0
	Administrative staff	15	10.0
	<5 years	32	21.3
	5–10 years	48	32.0
Experience using digital health systems	>10 years	70	46.7
	Yes	122	81.3
	No	28	18.7

A total of 150 respondents from primary healthcare facilities participated in this study. Most respondents were female (61.3%). The largest age group was 30–39 years (40.0%). Nurses constituted the largest professional group (37.3%). Nearly half of the respondents (46.7%) had more than 10 years of work experience, and 81.3% reported experience with digital health systems.

Table 2. Bivariate Analysis of Digital Governance, Health Innovation, and Community Health System Strengthening (n = 150)

Variable	Community Health System Strengthening (Strong) n (%)	Community Health System Strengthening (Moderate/Low) n (%)	p-value
Digital Governance			
High	72 (75.0)	24 (25.0)	0.003
Moderate/Low	30 (55.6)	24 (44.4)	
Health Innovation			
High	65 (72.2)	25 (27.8)	0.005
Moderate/Low	37 (61.7)	23 (38.3)	

Bivariate analysis showed a significant association between digital governance and community health system strengthening (p = 0.003). Health innovation was also significantly associated with community health system strengthening (p = 0.005).

Table 3. Multivariate Logistic Regression Analysis of Factors Associated with Community Health System Strengthening (n = 150)

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Digital Governance (High vs Low)	2.36	1.29 – 4.31	0.004
Health Innovation (High vs Low)	2.08	1.14 – 3.77	0.016
Work Experience (>10 years)	1.49	0.84 – 2.65	0.163
Digital System Experience (Yes)	1.64	0.89 – 3.01	0.108

Multivariate logistic regression analysis indicated that digital governance and health innovation were significantly associated with community health system strengthening. Higher digital governance was associated with AOR = 2.36 (95% CI: 1.29–4.31; p = 0.004), while health innovation was associated with AOR = 2.08 (95% CI: 1.14–3.77; p = 0.016). Other variables were not statistically significant at the 0.05 level.

DISCUSSION

This study examined the relationship between digital governance, health innovation, and the strengthening of community health systems in primary healthcare facilities in Indonesia. The findings indicate that both digital governance and health innovation were significantly associated with stronger community health system performance. Facilities reporting higher levels of digital governance were more likely to demonstrate improved coordination, service accessibility, and management of community health programs. Similarly, the presence of digital health innovations such as electronic health records, digital reporting systems, and

telehealth services was associated with stronger indicators of community health system functioning. These findings suggest that digital governance and innovation may play an important role in improving the effectiveness of community-based healthcare delivery [12].

The results align with a growing body of literature highlighting the importance of digital transformation in health system strengthening [13]. Previous studies have shown that digital health technologies can enhance the efficiency of healthcare services, improve the accuracy of health data, and support evidence-based decision-making in health management [14]. For example, research conducted in several low- and middle-income countries has demonstrated that digital health information systems improve disease surveillance, facilitate health program monitoring, and strengthen coordination between healthcare providers [15]. The present findings further support the view that digital governance structures are critical for ensuring that digital technologies are effectively integrated into health system operations [16].

In addition, the association between health innovation and stronger community health system performance observed in this study is consistent with previous research emphasizing the role of innovation in improving healthcare accessibility and service delivery [17]. Digital innovations such as telehealth platforms and mobile health applications have been shown to increase access to healthcare services, particularly in geographically dispersed or resource-limited settings [18]. In primary healthcare, these innovations can facilitate communication between healthcare workers and communities, enhance patient monitoring, and streamline administrative processes. The findings of this study reinforce the potential value of such innovations in strengthening community-level health systems [19].

From a policy perspective, the results highlight the importance of strengthening digital governance frameworks within national and local health systems. Effective digital governance can support the development of standardized health information systems, promote interoperability between digital platforms, and improve accountability in health service management [20]. For countries undergoing health system transformation, including Indonesia, investments in digital infrastructure, workforce capacity building, and regulatory frameworks are essential to ensure that digital health initiatives contribute effectively to health system strengthening [21]. Strengthening digital governance may also facilitate more coordinated health service delivery and support the implementation of community-based health programs [22].

The findings also have practical implications for healthcare management at the primary care level. Healthcare administrators and policymakers may consider promoting the adoption of innovative digital health solutions that improve service coordination and patient engagement [23]. Training programs for healthcare workers in digital competencies may further enhance the effectiveness of digital health initiatives. In addition, integrating digital health systems into routine health service management may improve data-driven decision-making and strengthen monitoring of community health programs [24]. This study has several strengths. First, it provides empirical evidence on the relationship between digital governance, health innovation, and community health system strengthening within primary healthcare facilities [25]. Second, the study included respondents from multiple professional backgrounds, enabling a broader understanding of digital health implementation in primary healthcare settings. Third, multivariate analysis enabled the identification of independent associations among key study variables [26].

However, several limitations should also be considered when interpreting the findings. The cross-sectional design of the study limits the ability to establish causal relationships between digital governance, health innovation, and community health system strengthening. In addition, the use of self-reported data may introduce response bias. The study was also conducted within selected primary healthcare facilities, which may limit the generalizability of the findings to other healthcare settings or regions. Future research using longitudinal or mixed-method approaches may provide deeper insights into the mechanisms through which digital governance and innovation influence community health system performance.

Despite these limitations, the study contributes to the growing evidence on the role of

digital transformation in strengthening community health systems. Understanding how digital governance and health innovation interact within primary healthcare settings is essential for designing effective health policies and programs that support sustainable health system development.

CONCLUSIONS

This study highlights the significant role of digital governance and health innovation in strengthening community health systems within primary healthcare settings in Indonesia. Facilities with stronger digital governance structures and greater adoption of digital health innovations demonstrated better performance in service coordination, accessibility, and management of community health programs. These findings indicate that digital transformation strategies can improve the effectiveness and responsiveness of community-based healthcare delivery.

From a practical perspective, strengthening digital governance frameworks, expanding digital health infrastructure, and enhancing healthcare workers' digital competencies are essential steps to support sustainable health system development. Policymakers should prioritize integrating digital health solutions into primary healthcare services to improve data-driven decision-making and service efficiency. Future research should explore longitudinal and mixed-method approaches to better understand how digital governance and innovation influence health system performance over time and across different healthcare contexts.

Ethical Considerations

This study received ethical approval from the Institutional Ethics Committee of the relevant academic institution. All participants provided informed consent before participation. Respondents were informed of the study's purpose, and the confidentiality and anonymity of the collected data were strictly maintained. Participation was voluntary, and respondents had the right to withdraw at any time without any consequences.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Authors' Contributions

Muh Ihsan Kamaruddin conceived the study, developed the research design, conducted data analysis, and drafted the manuscript. Wa Ode Novi Angraeni contributed to data collection, data interpretation, and manuscript revision. Both authors reviewed, approved, and agreed on the final version of the manuscript.

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