



Community Health Workers' Digital Competencies in Using Digital Technologies and Artificial Intelligence

Sabrina Intan Zoraya¹, Abdillah Adipatria Budi Azhar^{1*}, Winda Kurnia Sari²,
 Iman Saladin Budi Azhar², Rizma Adlia Syakurah³

1. Faculty of Medicine, Universitas Islam Al-Azhar, Mataram, Nusa Tenggara Barat, Indonesia
2. Faculty of Computer Science, Universitas Sriwijaya, Ogan Ilir, Sumatera Selatan, Indonesia
3. Faculty of Public Health, Universitas Sriwijaya, Ogan Ilir, Sumatera Selatan, Indonesia

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Abstract

Background: Strengthening community health workers' (CHWs) digital competencies is critical to ensuring that digital health transformation translates into improved community-level services. **Aims:** This systematic review aimed to synthesize evidence on the effectiveness of training, empowerment, or capacity-building interventions in enhancing CHWs' competencies in using digital technologies and artificial intelligence (AI). **Methods:** Following PRISMA guidelines, articles published between 2016 and 2026 were identified from four databases. Quantitative studies and community-based implementation reports assessing improvements in digital knowledge and/or skills were included. **Results:** Of 885 records screened, 30 met eligibility criteria. Interventions encompassed mobile health applications, web-based information systems, digital data management tools, and AI-assisted screening platforms. Most studies reported significant gains in knowledge scores, digital data entry and reporting skills, electronic form management, digital surveillance, and AI-assisted interpretation. Improvements in data completeness, timeliness, and perceived reporting accuracy were also documented. However, sustainability challenges emerged, including limited internet infrastructure, unequal access to devices, heterogeneous baseline digital literacy, reliance on external mentoring, short-term evaluations, and incomplete integration with routine health information systems. **Conclusion:** Overall, structured digital training interventions consistently enhance CHWs' competencies and support the strengthening of primary health care. Sustainable impact, however, requires institutional embedding, standardized tiered training, infrastructure investment, and governance mechanisms to prevent digital initiatives from remaining fragmented pilot projects.

Keywords

Community health workers, Digital competencies, Digital health, Artificial Intelligence, Capacity building

Correspondence

Abdillah Adipatria Budi Azhar

Faculty of Medicine, Universitas Islam Al-Azhar,

Jl. Unizar No. 20, Turida, Sandubaya, Mataram, Nusa Tenggara Barat 83237, Indonesia

Email: abdillahadipatria@unizar.ac.id

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I. BACKGROUND

Digital transformation in the health system is an inevitable reality, including at

the community-based health services level.

Community health workers, often referred to as “kader kesehatan” in Indonesia, play a

strategic role as the frontline in monitoring maternal and child health, conducting nutrition surveillance, preventing non-communicable diseases, and providing family health education (Jeet et al., 2017; Pusat Pelatihan SDM Kesehatan, Badan PPSDM Kesehatan, 2018). Persistent public health challenges, such as stunting, chronic diseases, and inequities in access to health services at the national level, have made strengthening the capacity of CHWs increasingly urgent.

The urgency of this issue has intensified as the global and national digital health transformation accelerates. The World Health Organization (WHO), through the Global Strategy on Digital Health 2020–2025, emphasizes that digital technologies, including AI, play a critical role in improving service quality, system efficiency, and data-driven decision-making (World Health Organization, 2021b). Digital transformation risks widening the digital divide without adequate human resources preparedness at the community level, particularly in areas with limited digital literacy capacity (Hollimon et al., 2025). Limited digital skills among CHWs may directly affect the quality of recording and reporting, the validity of health data, and the accuracy of community-based interventions.

Digital transformation in the health system is a complex process that involves integrating digital technologies to enhance healthcare delivery, improve patient outcomes, and optimize operational processes. This transformation is not merely about adopting new technologies but also about fundamentally changing healthcare systems, practices, and interactions. It encompasses a wide range of technologies and approaches, including electronic health records (EHR), telemedicine, data analytics, the Internet of Things (IoT), and AI. These technologies facilitate remote patient monitoring, personalized treatment plans, predictive analytics, and efficient communication among healthcare providers, ultimately improving the quality, accessibility, and cost-effectiveness of healthcare services. While digital transformation holds immense potential to revolutionize healthcare, it is essential to address the challenges it poses, such as data privacy concerns and the need to upgrade the workforce (Abdulai, 2024; Berzins, 2024).

In this context, digital competencies for CHWs refer to the knowledge and skills required to use digital technologies effectively in healthcare settings. These competencies are important for adapting to changes in the digital health landscape. The

emphasis is on developing technical and methodological skills to improve patient care and health outcomes. In addition to knowledge and skills, digital competencies also involve attitudes and motivation, such as willingness to engage with digital culture and adapt to technological change (Duplaga et al., 2025; Mainz et al., 2024).

Several studies have demonstrated improvements in CHWs' competencies following training interventions on the use of health applications, posyandu (integrated health post) information systems, and AI-based platforms. Nevertheless, the available evidence remains dispersed across various study designs, including quantitative research and community-based implementation reports, with diverse outcome measures. This study aimed to synthesize scientific evidence on CHWs' digital competencies in using digital technologies and AI, particularly in the context of training, empowerment, or capacity building, to provide an evidence-based foundation for strengthening digital health transformation policies and practices in Indonesia.

2. METHODS

This systematic review used the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA). The population (P) was CHWs; the intervention (I) was training, empowerment, or capacity building; and the outcome (O) was improved digital competencies (knowledge, skills, or both) in the use of digital technologies and AI. The inclusion criteria were Indonesian or English, free full-text, open-access, research papers or community-based implementation reports with descriptive or analytical quantitative data for CHWs' digital competencies. The articles should be published between 2016 and 2026. The exclusion criteria included review articles, books, articles on digital application design/development, and non-health-related topics. The articles were retrieved from PubMed, ScienceDirect, Semantic Scholar, and Google Scholar databases using a combination of terms. For PubMed and ScienceDirect, an advanced search used terms *posyandu* AND ("artificial intelligence" OR "digital technology" OR application); *posyandu* AND ("artificial intelligence" OR "digital technology" OR application OR "information system") AND training. For Semantic Scholar and Google Scholar, the search was conducted with Publish or Perish (PoP). Search for Semantic Scholar database used terms such as "kader posyandu" AND ("teknologi digital" OR "aplikasi kesehatan"); "kader

kesehatan" AND ("aplikasi" OR "sistem informasi") ("kader posyandu" OR "kader kesehatan") AND kecerdasan buatan, "kader posyandu" AND ("teknologi digital" OR "aplikasi kesehatan" OR "kecerdasan buatan" OR "artificial intelligence OR "sistem informasi") AND pelatihan. Meanwhile, the Google Scholar database

search with 100 maximum results on PoP used terms "kader posyandu" and "teknologi digital", or "aplikasi kesehatan", "kecerdasan buatan", "kader kesehatan", and "aplikasi digital"; "sistem informasi kesehatan" and kader, "pelatihan kader" and aplikasi.

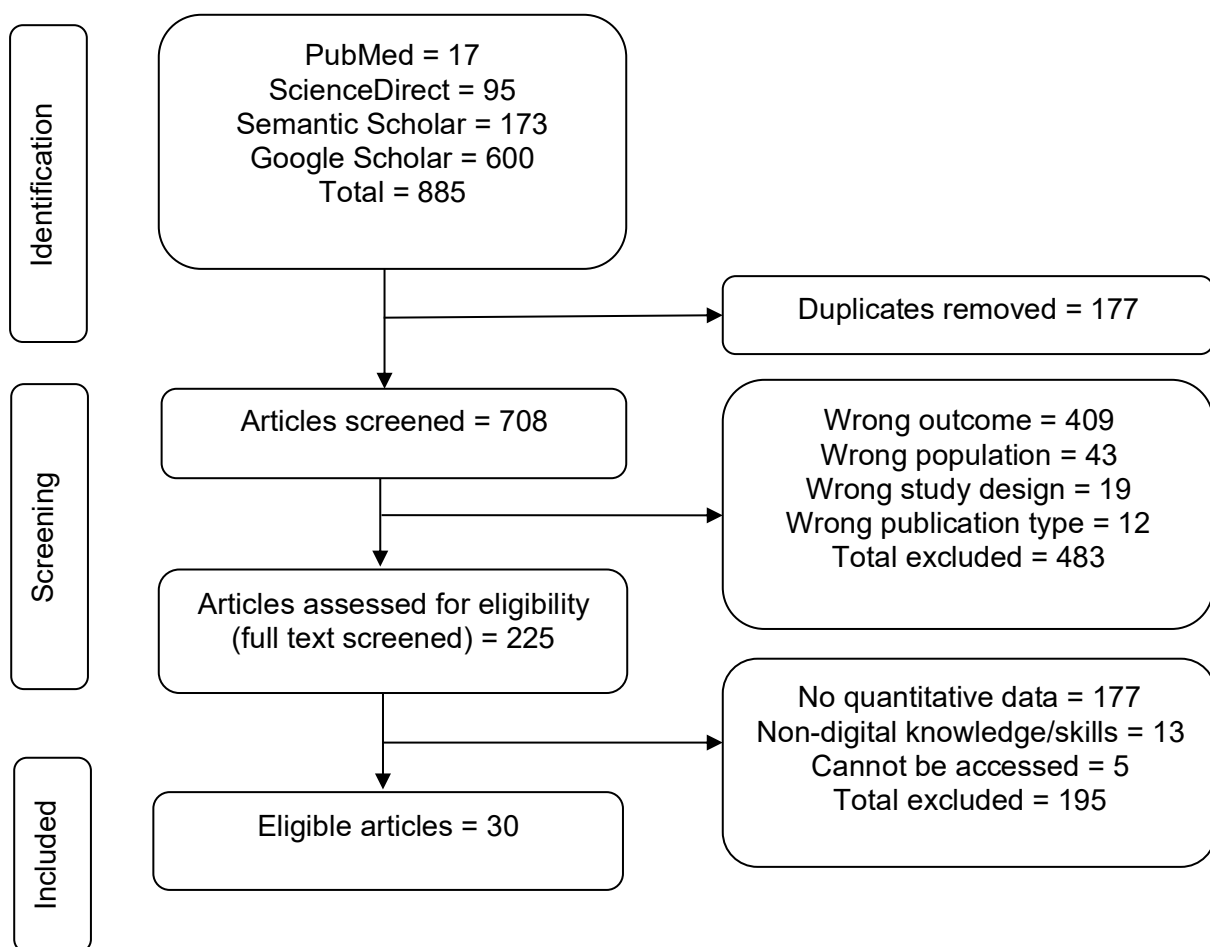


Figure 1. PRISMA Flow Diagram

Figure 1 shows the PRISMA flow diagram. A total of 885 articles were obtained from the databases. After the duplicate removal, the articles were

screened and assessed for eligibility. Data from the eligible articles were synthesized narratively using a qualitative content analysis approach. Data were coded into

predefined outcome categories (improved knowledge, improved skills, or both), followed by categorization of the types of digital competencies reported across studies. The coding and classification

process was conducted by two independent reviewers, with discrepancies resolved through discussion and consensus.

3. RESULTS

Table 1. Summary of Included Articles on Digital Technology and Outcome among CHWs

| No. | Author | Technology | Platform | Outcome |
|-----|---------------------------|----------------------------------|-----------|---------|
| 1 | Aisyah et al. (2025) | WhatsApp | Messaging | S |
| 2 | Anjani et al. (2025) | Google Forms and Microsoft Excel | Forms | K |
| 3 | Anugrahanti et al. (2023) | Posyandu Website | Web | B |
| 4 | Budiarti et al. (2025) | Pronalin-Cek Application | Mobile | K |
| 5 | Geasela et al. (2025) | AI-Based Digital System | AI | S |
| 6 | Hasrul et al. (2024) | Balitaku Sehat Application | Mobile | K |
| 7 | Hidayah et al. (2025) | TEMASEFT Application | Mobile | S |
| 8 | Iskandar et al. (2025) | BagahTP Website | Web | K |
| 9 | Karima et al. (2021) | Primaku Application | Mobile | S |
| 10 | Sari and Mustamu (2022) | Google Sites | Web | B |
| 11 | Kasim et al. (2024) | Posyandu Application | Mobile | B |
| 12 | Kriswibowo et al. (2025) | Google Forms and Google Sheets | Forms | S |
| 13 | Kunsah et al. (2025) | POSDEM Application | Mobile | S |
| 14 | Ma'rifah (2025) | Pregnancy Class Application | Mobile | B |
| 15 | Masfi et al. (2025) | AFIKROS Application | Mobile | B |
| 16 | Prastyawati et al. (2025) | Canva | Design | S |
| 17 | Pratama et al. (2025) | AI-KustaCare Application | AI | S |
| 18 | Putri et al. (2025) | Sehatlink Application | Mobile | S |
| 19 | Setiawati (2025) | Stroke Prevention Application | Mobile | B |
| 20 | Setyowati (2023) | SPK-TB Application | Mobile | S |
| 21 | Soejoto et al. (2025) | Digital Posyandu Application | Mobile | B |
| 22 | Subaedah et al. (2025) | Smart Posyandu Application | Mobile | S |
| 23 | Sukiman et al. (2025) | Google Forms and Google Drive | Forms | S |
| 24 | Suwanti et al. (2021) | ABA Application | Mobile | S |
| 25 | Trisnadoli et al. (2025) | BiBu Application | Mobile | S |
| 26 | Utami (2025) | Digital KIA Book | Record | S |
| 27 | Vidayanti et al. (2022) | SiKIA Application | Mobile | K |
| 28 | Widarti et al. (2018) | iPosyandu Application | Mobile | K |
| 29 | Wijayanti et al. (2025) | ERLINA Application | Mobile | K |
| 30 | Zainuddin et al. (2024) | SIREKAP-DM Application | Mobile | K |

Note: K = improved knowledge, S = improved skills, B = improved both.

Table 2. Categories of Digital Technology and Competencies among CHWs (Continue to page 16)

| Category | Technology | Competencies |
|--|---|---|
| 1. Digital Data Management & Reporting | Posyandu apps (iPOSYANDU, Smart Posyandu, Sehatlink, SiKIA, BiBu, Balitaku Sehat), Google Forms/Sheets/Excel, Web-based systems | Digital data entry; electronic form management; cloud storage; reporting; data accuracy improvement; faster documentation |

| Category | Technology | Competencies |
|---|---|--|
| 2. Digital Surveillance & Screening | WhatsApp, Primaku, Stroke Detection App, POSDEM, ABA, SPK-TB, AI-KustaCare, AI-based digital system | Growth monitoring; non-communicable disease screening (diabetes mellitus, stroke); Tuberculosis suspect identification; AI-assisted early detection; digital classification of health status |
| 3. Digital Health Education & Promotion | Google Sites, Canva, Kelas Ibu Hamil, Pronalin-cek, AFIKROS, TEMASEFT | Delivering digital education; developing online materials; digital counseling support; health promotion media design |
| 4. AI-Assisted Decision Support | AI-KustaCare, AI-based digital system | Interpretation of AI outputs; image-based screening; data-driven decision-making at community level |
| 5. Digital Literacy & System Navigation | All mobile apps and web platforms | Account creation and management; system navigation; feature operation; peer training capability |

4. DISCUSSION

The synthesis of articles meeting the inclusion criteria indicates that training, empowerment, or capacity-building interventions for CHWs have consistently led to measurable improvements in digital competencies (Table 1). The interventions spanned a wide range of technologies, including posyandu recording applications, web-based information systems, mobile health platforms, chatbot-based counseling tools, and AI-supported early-detection systems. Across studies, increases in competencies were substantial, and a higher proportion of CHWs reached a good knowledge category after training (Anjani et al., 2025; Anugrahanti et al., 2023; Budiarti et al., 2025; Hasrul et al., 2024; Iskandar et al., 2025; Kasim et al., 2024; Ma'rifah, 2025;

Masfi et al., 2025; Sari & Mustamu, 2022; Setiawati, 2025; Soejoto et al., 2025; Vidayanti et al., 2022; Widarti et al., 2018; Wijayanti et al., 2025; Zainuddin et al., 2024). Competencies such as digital data entry, electronic form management, screening, media design, and community-level decision-making also improved (Table 2). These patterns suggest that even short-term, structured digital training programs can generate meaningful gains in competencies among volunteer-based health cadres.

These findings are consistent with the framework articulated by the WHO in the Global Strategy on Digital Health 2020 to 2025, which emphasizes that strengthening the capacity of the health workforce is a foundational pillar of digital health transformation (World Health

Organization, 2021b). The WHO strategy underlines that digital technologies alone do not improve health outcomes unless accompanied by adequate training, governance, and sustainable system integration. In the Indonesian context, where CHWs function as frontline actors in promotive and preventive services, the alignment between empirical findings and global strategic guidance highlights the strategic relevance of investing in digital competencies and readiness among CHWs.

The improvement in CHWs' digital competencies has important implications for data quality and health system performance. Many included studies reported enhanced completeness, timeliness, and perceived accuracy of recording and reporting after the introduction of digital applications (Aisyah et al., 2025; Geasela et al., 2025; Kriswibowo et al., 2025; Soejoto et al., 2025; Subaedah et al., 2025; Sukiman et al., 2025; Utami, 2025). Improved digital recording reduces manual transcription errors, facilitates real-time data aggregation, and strengthens the feedback loop between Posyandu activities and primary health care facilities. This aligns with the broader health system transformation agenda promoted by Kementerian Kesehatan Republik

Indonesia (Ministry of Health of the Republic of Indonesia), which prioritizes integration of health information systems and data-driven decision-making at all service levels. Reliable community-level data are critical for monitoring priority programs, such as stunting reduction, maternal health surveillance, tuberculosis control, and non-communicable disease prevention.

The strengthened role of CHWs in digital reporting reflects the mandate for community empowerment embedded in Undang-Undang Nomor 17 Tahun 2023 tentang Kesehatan (Act Number 17 of 2023 concerning Health) and further operationalized in Peraturan Menteri Kesehatan Nomor 8 Tahun 2019 tentang Pemberdayaan Masyarakat Bidang Kesehatan (Regulation of the Minister of Health of the Republic of Indonesia Number 8 of 2019 concerning Community Empowerment in the Health Sector). These regulatory instruments underline that community participation is not peripheral but integral to the national health system (Republik Indonesia, 2019; Kementerian Kesehatan, 2023). Therefore, digital capacity building for CHWs should not be regarded as a supplementary innovation but as a structural investment to reinforce primary health care. When CHWs are equipped with digital and AI

competencies, they are better positioned to support surveillance, promote evidence-informed health education, and contribute to early detection of health risks.

Despite these positive outcomes, several persistent challenges were identified. Limited internet connectivity and inconsistent access to digital devices were recurrent barriers, particularly in rural or geographically dispersed areas (Aisyah et al., 2025; Geasela et al., 2025; Kriswibowo et al., 2025). This infrastructural limitation constrains the scalability of digital health interventions and may widen disparities if not addressed systematically. The WHO digital health strategy warns against digital transformation that exacerbates inequities, emphasizing the need for inclusive design and infrastructure support. In addition, baseline digital knowledge varied substantially among CHWs. Older CHWs sometimes required more intensive mentoring and repeated practice sessions (Wijayanti et al., 2025). This variation underscores the importance of tailoring training modules to initial competency levels and of adopting adult learning principles.

Dependence on external mentoring emerged as another concern. Several programs relied heavily on academic institutions or short-term project teams to

deliver training and troubleshooting. This phenomenon reflects a broader implementation challenge frequently observed in digital health projects, where sustainability is jeopardized by limited institutional embedding. Without integration into routine supervisory structures and budgetary planning, digital initiatives risk remaining isolated pilot projects (Nathan et al., 2025).

The sustainability of capacity-building programs depends on regulatory support, system integration, tiered training approaches, and continuous monitoring. Evidence from a systematic review of digital health interventions in low- and middle-income countries indicates that long-term sustainability is closely linked to strong governance structures, institutional commitment, integration into routine health systems, and continuous monitoring and evaluation mechanisms (Kaboré et al., 2022). Tiered training allows new CHWs to acquire basic competencies while more experienced CHWs advance toward higher-level skills, including introductory AI literacy. Integration with national health information platforms ensures that data entered by CHWs contribute directly to official reporting streams, reinforcing motivation and accountability. Regular monitoring by primary health care facilities can promote correct usage, provide

feedback, and identify refresher training needs.

The growing inclusion of AI-based platforms in CHWs training represents both an opportunity and a responsibility. AI-supported applications for early detection of stunting, skin lesions, tuberculosis risk, or chronic disease screening may enhance efficiency and standardization. However, CHWs' understanding of AI must encompass not only operational use but also limitations, data privacy considerations, and the importance of human oversight. The WHO's ethics and governance of AI for health highlights the need for ethical principles, transparency, and data protection (World Health Organization, 2021a). Therefore, future training curricula should integrate modules on digital ethics, informed consent, and responsible data management to ensure that technological empowerment does not compromise community trust.

This systematic review has several methodological limitations. Most included articles have heterogeneity of measurement instruments and definitions of digital competencies. The predominance of short-term evaluations limits conclusions about long-term sustainability and the impact on population health indicators. Restricting inclusion to open-access articles may have

introduced publication bias. Nevertheless, the review offers notable strengths. It addresses a timely policy-relevant issue within the digital health transformation agenda and centers on CHWs who are often underrepresented in global digital health discourse. The comprehensive mapping of interventions from simple digital recording tools to AI-based platforms provides a progressive understanding of capacity development trajectories. By synthesizing evidence from both research and community-based practice, this review captures real-world implementation experiences and offers practical insights for policymakers, program managers, and educators.

In summary, the collective evidence indicates that strengthening digital competencies among CHWs is feasible, beneficial, and aligned with national and global health transformation strategies. However, long-term institutional commitment, infrastructure investment, standardized curricula, and strong governance mechanisms are essential to ensure that digital empowerment translates into sustained improvements in health system performance and community health outcomes.

5. CONCLUSION

This systematic review demonstrates that CHWs' training, empowerment, or capacity-building in the use of digital technologies and AI consistently improves their digital competencies in recording, reporting, and using health data at the community level. These findings indicate that strengthening CHWs' digital capacity is a strategic component in supporting health system transformation and the implementation of digital health strategies. Although methodological limitations and sustainability challenges remain, this synthesis provides strong scientific evidence that sustained investment in enhancing CHWs' digital competencies is essential to strengthening community-based health services in the era of digital health transformation.

AUTHOR CONTRIBUTIONS

SIZ and AABA was responsible for conceptualization, data collection, data analysis, and manuscript preparation. WKS, ISBA, and RAS contributed to the methodological design. SIZ critically revised the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research.

DATA AVAILABILITY STATEMENT

The data can be accessed from the corresponding author upon reasonable request.

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