



Digital Health Information Systems and Patient-Centered NCD Promotion: A Systematic Review

Jumriyanti Nasaru^{1,2✉}, Mahalul Azam¹, Oktia Woro Kasmini Handayani¹, Ari Yuniastuti³

¹Faculty of Medicine, Public Health Study Program, State University of Semarang

²Faculty of Health Sciences, Muhammadiyah University of Gorontalo

³Faculty of Mathematics and Natural Sciences, State University of Semarang

Article Info

Article History:

Submitted October 2025

Accepted March 2026

Published July 2026

Keywords:

Digital Health Information Systems; Noncommunicable Diseases; Patient-Centered Care; Health Promotion

DOI

<https://doi.org/10.15294/kemas.v21i4.41782>

Abstract

The Non-communicable diseases (NCDs) account for 71% of global deaths and require digital transformation in management at the primary healthcare level. Analyze the impact of digital health information systems on the effectiveness of patient-centered health promotion strategies for NCDs in public health clinics. The Systematic Literature Review uses the PRISMA 2020 methodology with searches on 7 electronic databases (Scopus, ScienceDirect, Frontiers, SpringerLink, Heliyon, Taylor & Francis, PubMed) for the period 2020-2025. Of the 309 articles identified, 40 studies met the inclusion criteria. Digital platforms integrated with robust eHealth infrastructure indicate significant effectiveness in improving patient health outcomes, with hypertension control reaching 59% and mental health improvement up to 86%. Patient-centered communication and eHealth are key moderators in increasing patient engagement. The implementation of digital health information systems has a positive impact on patient-centered health promotion for NCDs. A systemic approach that integrates technology, human resources, and comprehensive policies is needed to optimize digital health transformation at the community level.

Introduction

The era of digital transformation in the health sector has brought a significant paradigm shift in the provision of health services, especially in the handling of non-communicable diseases (*Non-communicable diseases*/PTM) at the primary health service level. Non-communicable diseases are the leading cause of global deaths, with an increasing prevalence of 71% of all deaths in the world. The World Health Organization notes that an additional investment of US\$0.24 per patient per year in digital health interventions could save more than 2 million lives from non-communicable diseases in the next decade (Lu *et al.*, 2025). Empirical findings suggest that the implementation of digital health information systems can significantly improve the quality of care and patient health

outcomes, but meaningful adoption in chronic disease management is still low, especially in developing countries. Public health clinics, as the frontline in the management of non-communicable diseases, face the complex challenge of integrating digital technology with patient-centered health promotion strategies (*Patient-centered care*). Recent research reveals that patient-centered approaches to care that take into account cultural sensitivities have a significant impact on health behavior modification, especially in low- and middle-income countries such as Indonesia. Research has shown that different cultural factors influence the effectiveness of digital health interventions in local contexts. However, there is still a huge gap in understanding how digital health information systems can be optimized to support truly patient-centered health

✉ Correspondence Address:

Faculty of Medicine, Public Health Study Program, State University of Semarang
Email: jumriyantn@gmail.com

promotion strategies at the community level (Aisyah *et al.*, 2024; Yi *et al.*, 2024).

Digital health innovations have emerged as a transformative force to address health system challenges, especially in resource-constrained settings. The COVID-19 pandemic accelerated the development of national digital health capacity and increased the number of daily health app users, who now exceed 15 million people. Through the launch of the *Blueprint of Digital Health Transformation Strategy 2024*, the Indonesian government has shown a serious commitment to the digitalization of the health system. Perspectives on digital health innovation in South and Southeast Asia, including Indonesia, reveal the dynamic interplay between challenges and opportunities in a complex and culturally diverse healthcare landscape. Previous research has shown that motivational strategies in digital interventions to improve chronic disease self-care adherence have been developed, but still require a comprehensive analysis of their impact on patient-centered health promotion. A systematic review analyzing the application of digital health in the management of chronic diseases indicated that the implementation frameworks, methods, and strategies used are still diverse without clear standardization. It creates a significant gap in research in understanding the effectiveness of digital health information systems on patient-centered health promotion strategies, particularly for the management of non-communicable diseases in public health clinics (Silva *et al.*, 2024).

Novelty: This research is a comprehensive approach that integrates an impact analysis of digital health information systems with patient-centered health promotion strategies specifically for non-communicable diseases in the community health clinic setting. This study will fill a gap in the literature by providing a synthesis of the latest evidence on how health information technology can be leveraged to improve the effectiveness of health promotion oriented to the individual needs and preferences. This approach is particularly relevant to Indonesia's health system, which is undergoing digital transformation and requires scientific evidence to guide the implementation of optimal digital health policies. Based on the

background analysis presented, the problem formulation in this study is focused on the main research question: "What is the impact of the implementation of digital health information systems on the effectiveness of patient-centered health promotion strategies in the management of non-communicable diseases in public health clinics?" The formulation of this problem is then elaborated into several specific research questions which include: first, how the characteristics and components of digital health information systems have been applied in supporting the promotion of non-communicable disease health in public health clinics; second, how patient-centered health promotion mechanisms and strategies are facilitated by digital health information systems in the context of non-communicable disease management; third, the extent of the effectiveness of digital health information systems in improving patient health outcomes and patient involvement in health promotion programs for non-communicable diseases; and fourth, what are the factors that affect the success of the implementation of digital health information systems in supporting patient-centered health promotion strategies in public health clinics (Cipta *et al.*, 2024).

The general objective of this study is to analyze and synthesize the current scientific evidence about the impact of digital health information systems on patient-centered health promotion strategies for non-communicable diseases in public health clinics by a systematic review approach. In particular, this study aims to identify and characterize the different types of digital health information systems implemented in supporting the promotion of non-communicable diseases in the community health clinic environment. The study also aims to analyze patient-centered health promotion mechanisms and strategies facilitated by digital health information technology and evaluate the effectiveness in improving health outcomes and patient engagement. In addition, this study aims to identify the factors that affect the successful implementation of digital health information systems in the context of patient-centered health promotion, as well as provide evidence-based recommendations to optimize the use of health information technology in the

management of non-communicable diseases in public health clinics (Pong *et al.*, 2024).

The theoretical benefit of this research is its contribution to the development of the *Body of Knowledge* in the field of health informatics and health promotion, particularly in understanding the integration of digital technology with patient-centered approaches to care for non-communicable diseases. This research will provide a comprehensive conceptual framework on the relationship between digital health information systems and patient-centered health promotion strategies, which can serve as a foundation for future research. From a practical perspective, the results of this study can provide evidence-based guidance for health practitioners, clinic administrators, and policymakers in designing, implementing, and optimizing digital health information systems to support effective health promotion programs in public health clinics. The benefits of the policy that can be obtained include providing strategic recommendations for the development of regulations and standards for the implementation of digital health information systems that support patient-centered care. The results of this study can also contribute to the development of *Best practices* and *Clinical Guidelines* for the integration of health information technology in handling non-communicable diseases at the primary health service level, so as to improve the quality and accessibility of public health services in a sustainable manner (Liang *et al.*,

2024; Manyazewal *et al.*, 2023).

Method

This study uses the *Systematic Literature Review* (SLR) by adopting the PRISMA methodology (*Optional Reporting Items for Systematic Review and Meta-Analysis*) 2020 as the main guide in the process of identification, selection, assessment, and synthesis of studies. PRISMA 2020 was chosen for its ability to provide transparency and accuracy in systematic review, enable research replicability, and help establish appropriate inclusion and exclusion criteria in responding to research questions (Canfell *et al.*, 2022). The inclusion criteria include scientific articles published in the 2020–2025 time frames to ensure the relevance of the findings, in accessible English *Full text*, discussing the application of digital health information systems in health promotion or non-communicable disease management, conducted in public health clinics or primary health services, as well as integrate patient-centered approaches to care. Exclusion criteria include articles’ *Reviews*, narrative, editorial, *Conference Abstract*, studies that are not relevant to the main topic, research on infectious diseases or acute conditions, articles that are not in English or are not accessible in *Full text*, and duplication of publications that do not go through the process of *Peer review* (SF Khan & Jhaveri, 2025).

The search strategy was carried out through seven international electronic

Table 1. Inclusion and Exclusion Criteria

Aspects	Inclusion Criteria	Exclusion Criteria
Publication Period	Articles published in 2020-2025	Articles published before 2020
Language	Speak English	Speak a language other than English
Accessibility	Full text available	Abstract or inaccessible, only available
Main Topics	Digital health information systems, health promotion, non-communicable diseases	Not discussing digital health technologies or infectious diseases
Research Setup	Public health clinics, primary health services	Referral hospitals, non-community settings
Approach	Patient-centered care	Conventional approach without patient focus
Publication Type	Original research article	Narrative review, editorial, letter, conference abstract
Peer Review Status	Has gone through a peer-review process	Not through peer-review, duplication

databases: Scopus as the primary source of digital health multidisciplinary, Elsevier ScienceDirect for high-quality medical informatics and health journals, Frontiers as an open access publication on public health and medical technology, SpringerLink for a leading health information systems journal, Heliyon as access open multidisciplinary innovative health research journals, Taylor & Francis Online for specialist journals of health promotion and medical technology, and PubMed as the largest biomedical database with comprehensive coverage of the health literature. The SLR process is carried out through four systematic stages of the PRISMA 2020. The identification stage begins with the development of a search strategy using a combination of keywords

“digital health information system”, “patient-centered care”, “health promotion”, “non-communicable diseases”, “public health clinic”, with Boolean operators in the 2020-2025 publication period. The screening stage involves unification and filtering by title and abstract according to the established criteria. The feasibility stage includes a *detailed full-text* assessment to ensure suitability with research questions and methodological quality assessments using *critical assessment tools*. The findings synthesis stage involves systematic data extraction, thematic analysis to identify key patterns, along with narrative synthesis to integrate findings from studies that meet the inclusion criteria, with documentation following the PRISMA flowchart.

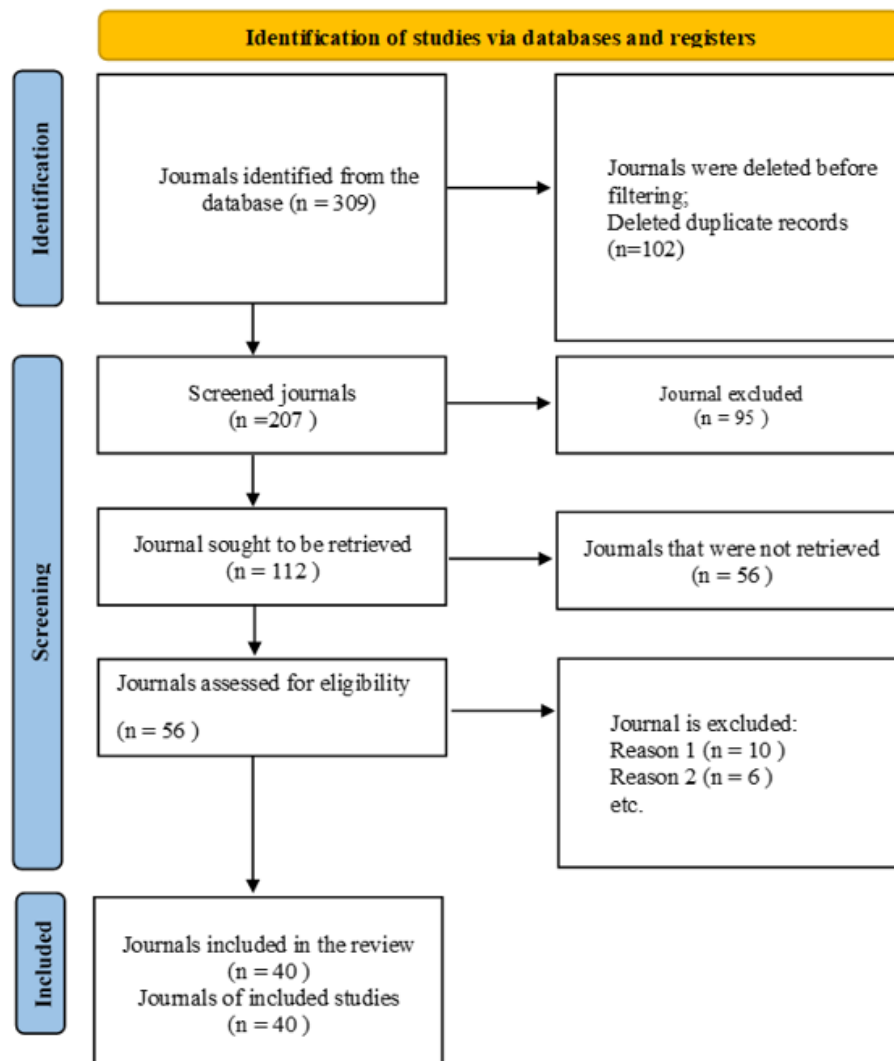


Figure. 1. PRISMA Flowchart

Result and Discussion

Based on Figure 1, the study selection process in this systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. It consists of three main stages: identification, screening, and inclusion. At the identification stage, a literature search in various databases and registration resulted in 309 journals relevant to the topic of the impact of digital health information systems on patient-centered health promotion strategies for non-communicable diseases in public health clinics. Before entering the screening stage, the data was cleaned by deleting 102 duplicate journals. So there were 207 journals that would be further filtered. The screening stage involves a systematic evaluation of 207 journals based

on the inclusion and exclusion criteria. From this process, 95 journals were excluded since they did not meet the relevant criteria, leaving 112 journals that were then searched for full text. However, of the 112 journals, 56 were not obtained due to various access constraints, so only those 56 journals could be assessed as feasible as a whole. At the feasibility assessment stage, 56 journals were evaluated in depth based on methodological criteria and content relevance. This process resulted in the exclusion of an additional 16 journals for a variety of specific reasons, including 10 for the first reason and 6 for the second reason. Finally, 40 high-quality journals successfully met all the criteria and were included in this systematic review for further analysis and synthesis of the impact of digital health information systems regarding

Table 2. Journal Synthesis Related to Digital Health Information Systems to Patient-Centered Health Promotion Strategies for Non-Communicable Diseases in Public Health Clinics

Yes	Journal Title	Author & Year	Research Focus	Digital Health Information System	Patient-Centered Health Promotion Strategies	Public Health Clinics	Non-Communicable Diseases (NCDs)	Key Findings	Implication
1	Simplification, decentralization, proximity – Critical analysis of Portugal's digital health framework through expert interviews	(Estrela et al., 2025)	Evaluation of the digital health policy framework and the challenges of its implementation	Integrated digital platforms, eHealth infrastructure, national health information systems	Decentralized approach to improving service accessibility	No specifics mentioned	No specifics mentioned	The need for improved governance, transparency, and connectivity of digital infrastructure to build a strong digital health ecosystem	The importance of a clear strategic vision and data availability to optimize digital healthcare
2	Socio-legal critique of the commercialization of digital health in Sub-Saharan Africa	(Sekala et al., 2025)	Analysis of the impact of commercialization of digital health technology on health systems	Government information management systems, digital diagnostics, and pharmaceutical platforms	Innovative diagnostic and pharmaceutical services with a focus on improving access	Public health facilities in Kenya, Uganda, and South Africa	NCDs that require ongoing diagnostics and care	The involvement of unregulated commercial actors distorts fragile health systems and occurs in a governance vacuum	The need for more targeted regulations for commercial actors and increased the role of the state in supervision
3	Stakeholder perspectives on enhancing the role of community pharmacists for non-communicable disease control in the UAE	(Ahmad et al., 2024)	Strategies to increase the role of community pharmacists in NCD control	Digital pharmaceutical information system for NCD monitoring, digital health education platform	Special education programs for NCDs, interprofessional collaboration frameworks, engagement in public health platforms	Community pharmacy	Non-communicable diseases (NCDs) - public health pandemic	A coherent multidisciplinary effort from policymakers, educational institutions, and health professionals is needed	The importance of building a specific accredited program for NCDs and increasing collaboration between professionals
4	Adapting to Global Health: Health Data Infrastructure, Epidemiological Accountability, and a Digital Workforce in Ghana	(Thiel & Christensen, 2025)	Health data infrastructure innovation and global epidemiological accountability practices	DHIS2 digital health information system, health data infrastructure	Adaptation of public health practices to global priorities, translation of standard case definitions with a community-centered approach	Ghana's community-level public health facilities	NCDs that require ongoing epidemiological monitoring	Public health professionals are adjusting to global health priorities and data practices at different levels	The importance of adapting local contexts in the implementation of global health information systems
5	Barriers and supporting factors to improve integrated primary health services for NCDs and mental health conditions in Ethiopia	(Bekele et al., 2024)	Identify barriers to implementation of clinical guidelines for NCDs and mental health conditions	Digital clinical information system for EPHCG documentation, technology-based training platform	Ethiopian Primary Health Care Clinical Guidelines (EPHCG), a facility-based, patient-centered guideline-based care	Primary health facilities (18 facilities)	NCDs and mental health conditions	Key barriers include lack of resource availability, maintenance structures, and lack of familiarity with PTM-MHC	The need to pay attention to social determinants of health and increase public awareness

6	Behavioural change techniques to improve the eHealth competence of healthcare professionals: A systematic review of interventions	(Virtanen et al., 2021)	Evaluation of behavior change techniques in eHealth competency interventions	Diverse eHealth systems and devices	Action planning, participatory approaches, social-emotional support, user-centered interventions	Healthcare facilities that implement eHealth systems	NCDs that require sustainable digital management	Interventions are more likely to improve ability to use eHealth than motivation to use	The importance of empathy, support, and user-centered work environment change
7	Melanoma burden in China and its provinces from 1990 to 2021: analysis for the Global Disease Burden Study 2021	(Yu et al., 2024)	Analysis of the burden of melanoma disease at the national and subnational levels	Digital cancer surveillance system, technology-based national epidemiology database	Targeted prevention strategies for high-risk populations with a personalized approach	Public health facilities and community dermatology clinics	Melanoma as a NCD	The incidence rate of age-adjusted melanoma increased by 89.2% from 1990, with patterns differing by age and sex	The need for more targeted strategies for older adult populations, especially women
8	Community clinics in Bangladesh: A unique example of public-private partnerships	(Riaz et al., 2020)	Evaluation of the pattern of public-private partnerships in health services through community clinics	Digital basic health information system for service recording and referrals	Participatory health services with community involvement in management, community-based health education	Community clinics (more than 13,000 clinics)	NCDs that require ongoing care and referral	96.9% of clinics are located in easily accessible areas with good infrastructure, land donated by the community	Public-private partnerships can play an important role in sustainable public health development
9	Community medical service development: identifying factors influencing medical options for patients with chronic non-communicable diseases in Southwest China	(Zhang et al., 2024)	Analysis of factors influencing the medical choices of NCD patients in community medical institutions	No specifics mentioned	Service attitudes, tariff standards, privacy protection, nursing services	Community medical institutions	Chronic non-communicable diseases	Service attitudes, tariff standards, and privacy protections have the most significant marginal increase effects	Optimizing the service content of community institutions can encourage NCD patients to seek treatment at basic hospitals
10	The current status of digital health interventions in the health system in Burkina Faso	(Sylla et al., 2024)	Comprehensive assessment of digital health interventions for strategy development	Digital platforms, open-source applications, electronic patient records	Harmonization of digital health interventions to improve patient care coordination	Public health facilities and national health systems	NCDs that require digital care coordination	35 digital health interventions identified with 89% funding from technical partners and the private sector	Frameworks are needed to effectively guide future digital health initiatives
11	Evaluation of the digital health technology landscape in sub-Saharan Africa and its implications for cardiovascular health	(Segun-Omoshin et al., 2025)	Exploration of digital technologies and their potential applications in cardiovascular medicine	Digital health technology (DHT), an artificial intelligence tool	Transforming healthcare with a personalized approach to cardiovascular management	Sub-Saharan African public health facilities	Cardio-vascular disease as the biggest burden of NCDs	Digital technology can accelerate health transformation and improve health services	The great potential of digital technologies for health transformation in the context of cardiovascular NCDs
12	Gender, education, and digital generation as determinants of attitudes towards health information for health workers in West Java, Indonesia	(Dida et al., 2021)	Analysis of health workers' attitudes towards health information based on demographic characteristics	WhatsApp platform for digital health information exchange	Dissemination of credible health information with a tailored approach based on digital generation	Public health facilities in West Java	NCDs that require continuing education	Attitudes toward health information are determined by educational attainment and generational differences	The importance of considering demographic factors in the strategy of disseminating digital health information
13	Global occurrence, prevalence, years of life with disability (YLD), disability-adjusted years of life (DALY), and healthy life expectancy (HALE) for 371 diseases and injuries	(Ferrari et al., 2024)	Comprehensive analysis of the global burden of disease including the impact of the COVID-19 pandemic	Digital data-driven global health surveillance system, epidemiological analysis platform	Evidence-based interventions for the prevention of NCDs with a population-based approach	The global health system includes community facilities	NCDs contributed 1.73 billion DALY in 2021	NCDs remain a major contributor to the global burden of disease with significant increases in anxiety disorders and depression	The importance of policy priorities for the prevention and treatment of NCDs and strengthening the health system
14	Guy's Cancer Cohort: Guy Cancer Center's Real-World Evidence Program 5 years later	(Moss et al., 2025)	Evaluation of real-world evidence programs for cancer research	Real-world evidence database, pseudo-anonymous data system	Enhanced data internalization to support patient-centered clinical decision-making	Cancer centers and community oncology facilities	Cancer (about 8000 cancer diagnoses per year)	Databases provide critical infrastructure for clinical research and supportive care	Optimize data collection and linkage to improve patient care and outcomes

15	Health beliefs mediate the relationship between the number of non-communicable diseases and preventive behaviors in middle-aged and elderly adults in southern China	(Huang et al., 2025)	Exploration of the triadic relationship between NCD count, preventive behavior, and health trust	Digital questionnaire system for the collection of health and trust behavioural data	Preventive behavior, self-efficacy, perception of barriers with an individualized approach	Communities in southern China	Non-communicable diseases (NCDs)	Health beliefs and self-efficacy mediate a partial relationship between the number of NCDs and preventive behaviors	Interventions that target health beliefs can help promote positive behavioural change
16	Health information technology and hospital performance: the role of health information quality in educational hospitals	(Alolayyan et al., 2020)	Investigation of the impact of health information technology on hospital performance	Health Information Technology (HIT)	Quality of health information as a mediator for improved patient experience	Teaching hospitals and public health facilities	NCDs that require ongoing documentation and monitoring	HIT has a direct positive impact on hospital performance and the quality of health information	Investments in HIT and health information quality result in increased productivity and reduced errors
17	Healthcare workers' experience in the integration of digital medical devices for HPV vaccination and cervical cancer services in Rwanda	(Sibomana et al., 2025)	User experience assessment in digital health intervention integration	E-tracker for HPV vaccination, mUzima app for cervical cancer screening and treatment	Accessibility and effectiveness of preventive interventions	Rwanda health facilities	Cervical cancer as a NCD	The user experience is mostly positive despite the challenges of transitioning from paper-based systems	Commitment to leadership, technical support, and critical oversight for successful implementation
18	Healthcare Workers' Acceptance and Satisfaction with the Usability of Digital Health Goods in Kono District, Sierra Leone	(Pognon et al., 2025)	Evaluation of end-user acceptance and satisfaction of digital health systems	Digital health systems, digital health goods	Improved accessibility and quality of healthcare with an easy-to-use approach	Community-based health facilities	NCDs that require continuous digital documentation	72.2% of respondents have good acceptance of the digital health system with a high level of satisfaction	Long-term acceptance of the system can be achieved by addressing end-user preferences and potential barriers
19	HIV-related knowledge, attitudes, practices, and stigma among healthcare providers treating HIV in Jordan	(Saad et al., 2024)	Assessment of the competence of healthcare providers in HIV care	Health information system for HIV treatment documentation and patient monitoring	Counseling focused on anxiety reduction, risk modification, and medication adherence with an empathetic approach	HIV Service Center (the only one in Jordan)	HIV as a chronic condition	Better knowledge, practice, and stigma with greater participatory exposure	The need for comprehensive training and stigma reduction to improve the quality of care
20	The impact of the Mediterranean diet on chronic diseases is not contagious and longevity	(Domínguez et al., 2021)	Analysis of the benefits of Mediterranean diet patterns for the prevention of NCDs	Digital nutrition information platform, nutrition education application	Traditional diet and lifestyle for NCD prevention/management with a holistic approach	Mediterranean community and community health centers	Cardio-vascular and metabolic diseases, neurodegenerative diseases, cancer, depression	The Mediterranean diet is linked to beneficial effects in the prevention/management of age-related NCDs	The Mediterranean diet is a way of eating and living healthily while respecting the environment
21	Improving patient-centered mental health promotion in primary care in vulnerable communities through mindfulness training in Rio de Janeiro, Brazil	(Teixeira et al., 2024)	Awareness-based interventions for mental health promotion in primary health services	Digital-based documentation and evaluation system for pre-intervention monitoring	Mindfulness Based Health Promotion (MBHP)-based group interventions tailored to the local context	Primary healthcare units in Rio de Janeiro in the SUS system	Anxiety (42%) and depression (35%)	Significant improvements in levels of anxiety, depression, and quality of life; 86% of female participants are low-income	Mindfulness interventions have been shown to be effective as complementary psychosocial support for vulnerable populations in primary health care
22	Investigating the perceived threat role of Cybersecurity in the adoption of health information systems	(Zhan et al., 2024)	The impact of cybersecurity threats on the adoption of health information systems	Health information systems with a focus on cybersecurity aspects	Technology adoption strategy that considers the trust and security of patient data	Healthcare facilities in Pakistani industry	NCDs that require long-term data management (diabetes, hypertension, heart disease)	External attacks and technological factors are the main obstacles to the adoption of health information systems; The employee factor has no significant effect	The importance of strengthening cybersecurity in the implementation of health information systems to increase trust and adoption
23	Non-Communicable Disease (NCD) Management and Prevention Strategy and Its Risk Factors	(Budreviciute et al., 2020)	NCD management and prevention strategies and their risk factors	Data-driven monitoring and evaluation system for NCD prevention strategies	Integrated prevention strategies include individual lifestyle management and community awareness	Global public and societal health services	NCDs in general with a focus on nutrition and modifiable risk factors	The best prevention strategies include individual, social, national, and global elements with a focus on lifestyle changes	An integrated, multi-sectoral approach is needed for effective NCD prevention at all levels of service

24	Managing population health through the prevention and early detection of cancer and other non-communicable diseases: a call to action	(Ibrahim et al., 2025)	Population health management through prevention and early detection of cancer and other NCDs	Cancer registration and information systems for screening program planning	Alternative models for public health promotion and integrated care	Structured primary health care system	Cancer, cardiovascular disease, chronic respiratory disease, and diabetes mellitus	NCDs account for 74% of global deaths; A policy framework that includes cancer registration and early detection programs is needed	Low- and middle-income countries need strong policy frameworks and primary health care systems
25	Opportunities and challenges for the integration of non-communicable disease management in HIV care and treatment services in Tanzania	(Rugakigira et al., 2024)	Opportunities and challenges of integrating NCD management in HIV care services	Reliable information and communication system	Policy-based service integration with donor support	HIV treatment services in Tanzania	NCDs that are integrated with HIV services	Integration opportunities are available such as policies, guidelines, donor support, and human resources; The challenges include cost and reluctance of service providers	The integration of HIV-PTM services requires policy support, funds, infrastructure, human resources, and the will of stakeholders
26	Patient-centered care: Transforming the healthcare system in Vietnam with the support of digital health technology	(Dang et al., 2021)	Vietnam's healthcare system is transforming into a patient-centric service with the support of digital health technology	Electronic Medical Record (EMR) and integrated digital healthcare system (Bespoke Health Care System)	Personalized and integrated healthcare model to empower patients	Healthcare providers and clinical practices in Vietnam	Dementia, cancer, and diabetes	Vietnam has a supportive environment to switch to the BHS model, but it is still in the early stages of health digitalization	A comprehensive systems approach with a shared design is required in the development of digital health initiatives
27	Patient-Centered Communication and the Mental Health of Sexual Minority Adults: A Moderated Mediation Model	(Liu & Yeo, 2025)	Patient-centered communication and sexual minority mental health with a moderated mediation model	eHealth as a moderator in communication-mental health relations	Patient-Centered Communication for Sexual Minority Populations	Health care in the United States that serves sexual minorities	Mental health (as part of a chronic condition)	The efficacy of personal health mediates the relationship between patient-centered communication and mental health; eHealth moderates the effects of mediation	Patient-centered communication and eHealth are important to reduce health disparities in sexual minorities
28	Physical inactivity, non-communicable diseases and China's national fitness plan for physical activity	(Menhas et al., 2021)	Physical inactivity, PTM, and China's national fitness plan for physical activity	Digital platforms and applications for physical activity monitoring in NFP programs	National Fitness Plan for the promotion of physical activity	Built-up environment and green garden under China's national fitness program	NCDs in general with a focus on prevention through physical activity	32% of participants stated that NFP helps promote the sports and health environment; 28% report NFP encourages cycling and walking environments	NFP with built-in environment facilities and green parks plays an important role in NCD mitigation
29	Prognostic score model for resistance obtained to anti-programmed cell death protein therapy 1/ programmed death ligand 1 in metastatic non-small cell lung cancer	(Murray et al., 2025)	Prognostic score model for resistance to anti-PD-(L)1 therapy in metastatic small cell lung cancer	Electronic health records and ConcertAI Patient360 database	Personalized and predictive approach to patient risk identification	Oncology centers and hospitals that treat metastatic lung cancer	Metastatic small cell lung cancer	The prognostic model successfully identifies patients at high risk of immunotherapy resistance with a shorter duration of response	Electronic data-driven prognostic models can facilitate the identification of high-risk patients for therapy personalization
30	Putting non-communicable disease data to work in Vietnam: an investigation of public health surveillance capacity	(Nguyen et al., 2023)	Investigation of public health surveillance capacity for NCD data in Vietnam	PTM monitoring system with a focus on data quality and completeness	A community-based surveillance approach with the involvement of different levels of the health system	Institute of Preventive Medicine, Centers for Disease Control, and commune health stations	NCDs in general with a focus on mortality and morbidity surveillance	Vietnam has a well-functioning PTM surveillance system but there are data quality issues; limitations of PEDU, human resource capacity, and funding	It is necessary to strengthen the capacity of the health system through the development of integrated policies, guidelines, and training programs
31	Smart product service systems in the healthcare industry: Intelligent connected products and stakeholder communication are driving the adoption of digital healthcare	(Negash & Calahorra Sarmiento, 2023)	Intelligent product service system in the healthcare industry with a focus on digital healthcare adoption	Intelligent connected products and intelligent product service system	Stakeholder communication as a key attribute of digital healthcare adoption	Healthcare industry practitioners who care for patients with chronic conditions	Chronic disease management	Intelligent connected products and stakeholder communication are causal attributes and focus to increase digital healthcare adoption	Adoption driving criteria include data management, multifunctionality, data reliability, interoperability, and patient communication

32	Social integration and utilization of national basic public health services among Chinese internal migrants with chronic diseases: Structural equation modeling approach	(L. Wang et al., 2024)	Social integration and utilization of national basic health services among Chinese internal migrants with chronic diseases	Not explicitly mentioned	National Basic Public Health Services	Basic health services for internal migrants	Hypertension and type 2 diabetes	26.80% of migrants with chronic diseases do not use NBPBS services; social integration is positively correlated with the utilization of NBPBS	Government measures and supporting policies are needed to encourage migrant participation in social organizations and community activities
33	Sociodemographics and Digital Health Literacy in Using Wearables for Health Promotion and Disease Prevention: A Cross-Sectional National Survey in Germany	(Pan et al., 2025)	Socio-demographics and digital health literacy in the use of wearables for health promotion and disease prevention	Wearable technology for health promotion and disease prevention	Technology-based personal health promotion strategy taking into account sociodemographic factors	National survey of adult internet users in Germany	Health promotion and disease prevention in general	24% of participants used wearables for health; the most popular mobile health app (44.4%); There is a digital divide based on age and socio-demographic factors	Public health initiatives that use health technology must consider social and digital determinants of health
34	The relationship between physical activity combined with eating habits and cardiovascular risk factors	(W. Wang et al., 2024)	The relationship between physical activity combined with eating habits and cardiovascular risk factors	Community-based survey data collection and analysis system	Prevention strategies that target physical inactivity and unhealthy diets	Public and community health facilities in Nanjing, China	Cardio-vascular risk factors (hypertension, type 2 diabetes, dyslipidemia, obesity)	Unhealthy diet and physical inactivity together produce additive effects on T2 diabetes, hypertension, HLDL-c, and dyslipidemia.	Prevention strategies that target physical inactivity and unhealthy diets are needed to reduce cardiometabolic risk
35	A model of proactive community health management based on grounded theory: The case of Beijing, China	(Dia & Wang, 2023)	A theoretical model of proactive public health management based in Beijing, China	The application of information technology as one of the dimensions of public health management	Community-based proactive health management model with six dimensions	Beijing's four distinctive communities	Health, medical care, and elderly care needs in the post-pandemic era	The conceptual model of community-based proactive health management consists of six dimensions: perceptions and willpowers, primary populations, health behavioral paradigms, management mechanisms, information technology applications, and service facilities	This model contributes to community-based health management and provides strategies to improve public health management
36	The Importance of Patient-Centered Research in Postpartum Mental Health Promotion	(Albanese et al., 2021)	The importance of patient-centered research in postpartum mental health promotion	Patient-centered research and documentation system	Patient-centered clinical services and research for the postpartum period	Maternal health services and postpartum clinics	Postpartum mental health	There is a gap between the service provider's recommendations and the mother's wishes; The importance of involving mothers from different backgrounds	Patient voices should be centered on clinical research efforts to address the psychosocial needs of mothers during the postpartum transition
37	The Role of Integrated District Hospital-Based Non-Communicable Disease Clinics in Cardiovascular Disease Control: Preliminary Data from Rwanda	(Kabakambira et al., 2022)	The role of district hospital-based integrated NCD clinics in the control of cardiovascular disease in Rwanda	Electronic health records for patient monitoring	Nurse-led integrated PTM clinic	Integrated PTM clinics in 45 district hospitals in Rwanda	Diabetes (31%), hypertension (38%), and a combination of both (31%)	59% of hypertension patients were controlled in district hospitals compared to 38% in referral hospitals; 20% diabetes control in referral hospitals	Consistent blood pressure control in district hospitals; Diabetes control is not optimal despite the resources and logistics available
38	Understanding dental caries as a non-communicable disease	(Pitts et al., 2021)	Understanding dental caries as a non-communicable disease	Information and supervision systems for caries monitoring and prevention	Caries prevention and control strategies that are integrated with other NCDs	Dental and oral health services at the community level	Dental caries as a PTM	Dental caries is classified as a NCD that shares risk factors with other chronic diseases; Prevention of caries is no longer about eradicating certain microorganisms	Caries prevention and control should be integrated at the upstream, middle, and downstream levels to help control other NCDs.

39	User-centric requirements engineering to manage the run-end front-end of open innovation in e-health: A study of support systems for the physical activity of the elderly	(Ehn et al., 2021)	User-centric needs engineering to manage the early phases of open innovation in e-health	A software system to support the physical activity of the elderly with four complementary sub-systems	User-centric methods in the early phases of e-health innovation	Various organizations and sectors in the development of e-health systems for the elderly	Physical activity of the elderly (related to the prevention of NCDs)	User-centered requirements engineering methods are successfully used to define high-level systems and requirements descriptions; Operation Concept Documents facilitate communication in the innovation process	The application of software engineering methods and user group engagement in the early phases of open innovation can contribute to the development of concepts that meet complex real-world needs
40	Digital health technology utilization, challenges, and training needs: Perspectives from healthcare professionals	(R. Khan et al., 2025)	The utilization, challenges, and training needs of digital health technology from the perspective of health professionals	Electronic Health Record (EHR) systems, mobile health apps, and remote monitoring systems	Not discussing directly	500 medical experts	NCDs implicitly (diabetes is mentioned as a condition that requires long-term treatment)	The most popular mobile health app (44.4%); benefits include reduced administrative burden (50%) and improved diagnostic accuracy (46.2%); 63% of respondents received limited training	There is a gap between the rapid adoption of DHT and the necessary infrastructure; Comprehensive technical support and staff training required

patient-centered health promotion.

Based on a comprehensive analysis of the evaluated literature, the characteristics of digital health information systems that support the health promotion of non-communicable diseases indicate significant diversity of implementations (Estrela *et al.*, 2025). Identifying that digital platforms are integrated with Health Strong’s infrastructure is a key foundation in the development of an effective digital health ecosystem. The implementation of the national health information system requires improved governance, transparency, and connectivity of digital infrastructure to achieve service optimization. In line with these findings (Dang *et al.*, 2021) emphasizes that Electronic Medical Records (EMRs) and integrated digital healthcare systems, such as Bespoke Healthcare Systems, contribute substantially to the transformation of healthcare models towards personalized and integrated approaches to empowering patients. The components of health information technology identified in various studies show a broad spectrum, ranging from government information management systems to diagnostic and digital pharmaceutical platforms (Sekalala *et al.*, 2025). It revealed that government information management systems integrated with digital pharmaceutical and diagnostic platforms can improve the accessibility of services, although it

requires more targeted regulation to avoid the health system distortion (Thiel & Christensen, 2025). Reinforcing this perspective by showing that the DHIS2 health information system, as a health data infrastructure, makes a significant contribution to global epidemiological accountability practices, especially in adapting the local context to the implementation of global health information systems.

Security and trust aspects in digital health information systems are crucial in the implementation. Zhan *et al.* (2024) identifies that cybersecurity threats, especially external attacks and technological factors, are the major barriers to the adoption of health information systems for the long-term management of NCDs such as diabetes, hypertension, and heart disease. These findings demonstrate the need for comprehensive cybersecurity strengthening to increase trust and adoption of health information systems. Moreover, Alolayyan *et al.* (2020) shows that health information technology has a direct positive impact on hospital performance through improving the quality of health information as a mediator in the patient experience.

Patient-centered health promotion mechanisms facilitated by digital health information systems show a significant evolution in the contemporary healthcare paradigm. Liu & Yeo (2025) identify that

Table 3. Classification of Digital Health Information System Components by Function and Implementation

Component Categories	System Type	Main functions	Implementation Examples	Reference
Integrated Platform	EMR & EHR systems	Clinical documentation and monitoring	Vietnam Healthcare System	Dang <i>et al.</i> , 2021
Data Infrastructure	DHIS2	Epidemiological accountability	Ghana Health Information System	Thiel & Christensen, 2025
Diagnostic Platform	Digital Diagnostic Tools	Early screening and detection	Kenya, Uganda, South Africa	Sekalala <i>et al.</i> , 2025
Mobile App	mHealth app	Patient monitoring and education	mUzima Rwanda Cancer Screening	Sibomana <i>et al.</i> , 2025
Wearable Technology	Health Monitoring Devices	Continuous health monitoring	German National Survey	Pan <i>et al.</i> , 2025
	Digital Pharmacy Platform	Drug management	UAE Community Pharmacy	Ahmad <i>et al.</i> , 2024

patient-centered communication (*Patient-Centered Communication*), which is integrated with ne HealthAs moderators, makes a substantial contribution to improving mental health, especially in the sexual minority population. The study shows that the efficacy of personal health mediates the relationship between patient-centered communication and mental health outcomes, demonstrating the importance of personalization in digital health promotion strategies. Decentralization strategies in health promotion have shown significant effectiveness regarding NCD management. Estrela *et al.* (2025) emphasizing that a decentralized approach to improving service accessibility requires optimal coordination between different levels of the health system. The implementation of this strategy is facilitated by digital platforms that enable data integration and communication between service levels. In line with this perspective (Sylla *et al.*, 2024) identified that the harmonization of digital health interventions to improve patient care coordination requires a comprehensive framework, with the 35 digital health interventions identified showing the dominance of funding from technical partners and the private sector at 89%.

Participatory approaches in patient-centered health promotion strategies show high effectiveness in a variety of implementation contexts. Virtanen *et al.* (2021) reveals that

action planning, participatory approaches, social-emotional support, and user-centered interventions regarding health tend to enhance the ability to use digital health technologies rather than motivations. These findings demonstrate the importance of empathy, support, and a user-centered work environment change in the implementation of digital health information systems. Riaz *et al.* (2020) reinforced this perspective by showing that participatory health services with community involvement in community-based health management and education in Bangladesh achieve optimal accessibility, with 96.9% of clinics located in easily accessible areas with adequate infrastructure.

Evaluating the effectiveness of digital health information systems in improving patient outcomes. Patient health shows consistent and multidimensional evidence. Kabakambira *et al.* (2022) showed that nurse-led NCD clinics were integrated with support Electronic Health Records for patient monitoring, and hypertension control was achieved by 59% in district hospitals compared to 38% in referral hospitals. These findings suggest that decentralization of services with the support of digital information systems can significantly improve the effectiveness of NCD management. Nonetheless, diabetes control showed suboptimal outcomes with a 20% control rate in referral hospitals, suggesting

the need for more specific strategies for diabetes management. Patient engagement in health promotion programs shows substantial improvement through the proper application of digital health technologies. Teixeira *et al.* (2024) revealed that the intervention was based on Mindfulness-Based Health Promotion (MBHP), documented through a digital evaluation system that resulted in significant improvements in levels of anxiety, depression, and quality of life, with 86% of participants being low-income women. This study shows that mindfulness interventions have proven effective as complementary psychosocial support for vulnerable populations in primary health care. In line with these findings (Huang *et al.*, 2025) identified that health beliefs and self-efficacy mediated the relationship between NCD rates and preventive behaviors, suggesting that interventions targeting health beliefs could help in promoting positive behavioral change.

TechnologyWearable apps and mobile healthcare show significant potential in improving patient engagement and self-management of NCDs. Pan *et al.*, (2025) reported that 24% of participants used wearable devices for health, with a health mobile app being the most popular (44.4%). However, there is a digital divide based on age and sociodemographic factors that requires special attention in the implementation of technology-based public health initiatives. R. Khan *et al.* (2025) reinforcing this perspective by identifying that the mobile health app provides benefits in reducing administrative burden (50%) and improving diagnostic accuracy (46,2%), although 63% of respondents received limited training, indicating a gap between the adopting of the technology and the necessary supporting infrastructure.

The identification of the factors influencing the successful implementation of digital health information systems shows a multidimensional complexity that requires a holistic approach. Bekele *et al.* (2024) identified key barriers in the implementation of clinical guidelines for NCDs and mental health conditions, including unavailability of resources, inadequate care structures, and lack of familiarity with NCD-MHC management. These findings show the need to pay attention to

the social determinants of health and increase public awareness as a prerequisite for successful implementation. In line with this perspective, Nguyen *et al.* (2023) revealed that Vietnam has a well-functioning NCD surveillance system, but there are data quality issues, limited guidelines, human resource capacity, and funding that require strengthening the capacity of the health system through the development of integrated policies, guidelines, and training programs. Organizational leadership and supporting factors show an important role in determining the success of digital health technology implementation. Sibomana *et al.* (2025) emphasized that leadership commitment, technical support, and oversight are critical to the successful implementation of the integration of digital medical tools for HPV vaccination and cervical cancer services. While the user experience is largely positive, the challenges of transitioning from paper-based systems require comprehensive change management. Rugakingira *et al.* (2024) reinforced this perspective by identifying that the integration of HIV-NCD services requires synergistic policy support, funding, infrastructure, human resources, and stakeholder willingness to achieve optimal effectiveness.

Sociodemographic and digital literacy are significant determinants in the adoption and utilization of digital health information systems. Dida *et al.* (2021) identified that attitudes towards health information are determined by educational attainment and differences in the digital generation, demonstrating the importance of considering demographic factors in the strategy of disseminating digital health information. Wang *et al.* (2024) added the social dimension by showing that social integration is positively correlated with the utilization of national basic health services, with 26.80% of migrants with chronic diseases not utilizing NBPHS services, demonstrating the need for government measures and supporting policies to encourage participation in social organizations and community activities.

Based on a comprehensive analysis of the available evidence, the implications of the development of digital health information systems in the health promotion of NCDs show the need for a systemic and integrated

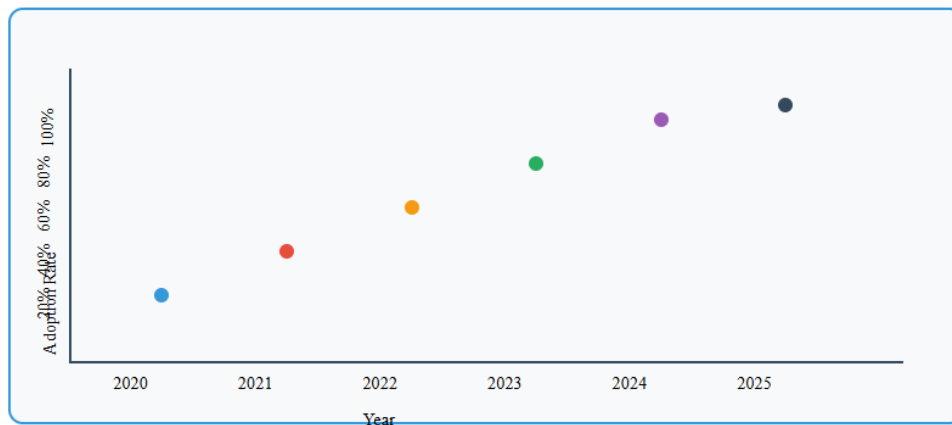


Figure 2. Digital Health Technology Adoption Trend Chart (2020-2025)

Source: Trend analysis from various longitudinal studies 2020-2025

approach. Negash & Calahorrano Sarmiento (2023) identifies that intelligently connected products (*Smart Connected Products*) and communicationSquirrel attributes causal and focus on increasing digital healthcare adoption, with adoption driving criteria including data management, multifunctionality, data reliability, interoperability, and patient communication. These findings show the importance of developing a holistic, user-centric technology ecosystem in the implementation of digital health information systems. Strategic recommendations for the development of digital health information systems should take into account the local context and the specific needs of the community. Dia & Wang (2023) proposed a community-based proactive health management model consisting of six dimensions: perception and willpower, primary population, health behavior paradigm, management mechanisms, information technology applications, and service facilities. This model contributes to community-based health management and provides strategies to improve public health management in a sustainable manner. In line with this perspective, Budreviciute *et al.* (2020) emphasized that the best prevention strategies include individual, social, national, and global elements with a focus on lifestyle change, which requires an integrated, multi-sectoral approach to effective NCD prevention at all levels of service. Human resource capacity development and technological infrastructure are

fundamental prerequisites for the sustainable implementation of digital health information systems. Ehn *et al.* (2021) demonstrated that user-centered requirements engineering methods are successfully used to define high-level systems and requirements descriptions, with a Operation Concept facilitating communication in the innovation process. The application of software engineering methods and user group engagement in the early phases of open innovation can contribute to the development of concepts that meet complex real-world needs (Ibraheem *et al.*, 2025).

Reinforcing these recommendations by emphasizing that low- and middle-income countries need strong policy frameworks and primary health care systems, with NCDs accounting for 74% of global deaths and requiring a policy framework that includes cancer registration and early detection programs integrated with robust and sustainable digital health information systems. A holistic perspective in the development of digital health information systems must also consider environmental and social sustainability. Dominguez *et al.* (2021) identified that the Mediterranean diet as a health promotion model based on digital nutrition information technology is linked to beneficial effects in the prevention and management of age-related NCDs, while respecting the environment. These findings suggest that integrating health promotion with digital technologies should concern the ecological sustainability dimension.

Segun-Omosehin *et al.* (2025) reinforcing this transformative perspective by demonstrating that digital health technologies have great potential to accelerate health transformation and improve healthcare in the context of cardiovascular NCDs in sub-Saharan Africa. A comprehensive evaluation of the application of digital health information systems in the promotion of NCD health shows that the success of implementation depends on the optimal convergence between technology, society, and organizational systems. Pitts *et al.* (2021) identified that dental caries is an NCD that shares risk factors with other chronic diseases, requiring integrated prevention and control upstream, midstream and downstream *to help control other NCDs. This integration perspective shows the need for an ecosystem approach in the development of digital health information systems that are able to accommodate the complexity of multimorbidity and social determinants of health.* Moss *et al.* (2025) reinforcing this paradigm by demonstrating that optimizing data collection and linkage through real-world evidence can significantly improve patient care and outcomes, providing critical infrastructure for ongoing clinical research and supportive care.

Conclusion

Based on a systematic analysis of 40 evaluated studies, the implementation of digital health information systems showed a significant positive impact on the effectiveness of patient-centered health promotion strategies in the management of non-communicable diseases in public health clinics. The characteristics of an effective digital health information system include an integrated platform with a *robust eHealth* infrastructure, comprehensive cybersecurity components, and optimal data interoperability. Patient-centered health promotion mechanisms facilitated by digital technology show an evolution towards a more personalized, participatory, and decentralized approach, with patient-centered communication and *eHealth* as the main moderators in improving *health outcomes*. The effectiveness of digital health information systems in improving patient health outcomes and patient engagement showed significant

variation by type of NCDs, with hypertension control reaching 59% and mental health showing an increase of up to 86%. Factors that affect the success of implementation include organizational leadership, technical support, digital literacy, social determinants of health, and social integration. The strategic implications indicate the need for a systemic approach that integrates technological, human, and organizational elements in a comprehensive and sustainable policy framework to achieve optimal digital health transformation in the management of NCDs at the community level.

References

- Aisyah, D.N., Setiawan, A.H., Lokopessy, A.F., Faradiba, N., Setiaji, S., Manikam, L., & Kozlakidis, Z., 2024. The Information and Communication Technology Maturity Assessment at Primary Health Care Services Across 9 Provinces in Indonesia: Evaluation Study. *JMIR Medical Informatics*, 12.
- Ahmad, M., Naja, F., Alzubaidi, H., Alzoubi, K.H., Hamid, Q., & Alameddine, M., 2024. Stakeholder Perspectives on Increasing the Role of Community Pharmacists in Controlling Non-Communicable Diseases in the United Arab Emirates. *Journal of Pharmaceutical Policy and Practice*, 17(1), pp.1–29.
- Aisyah, D.N., Setiawan, A.H., Lokopessy, A.F., Faradiba, N., Setiaji, S., Manikam, L., & Kozlakidis, Z., 2024. Assessment of Information and Communication Technology Maturity in Primary Health Care Services in 9 Provinces in Indonesia: An Evaluation Study. *JMIR Medical Informatics*, 12.
- Albanese, A.M., Geller, P.A., Sikes, C.A., & Barkin, J.L., 2021. The Importance of Patient-Centered Research in Promoting Postpartum Mental Health. *Frontiers in Psychiatry*, 12 (September), pp.12–15.
- Alolayyan, M.M., Alyahya, M.S., Alalawin, A.H., Shoukat, A., & Nusairat, F.T., 2020. Health Information Technology and Hospital Performance the Role of Health Information Quality in Teaching Hospitals. *Heliyon*, 6(10), pp.e05040.
- Bekele, A., Alem, A., Seward, N., Eshetu, T., Gebremariam, T., Getachew, Y., Mengiste, W., Medhin, G., Fairall, L., Sevdalis, N., Prince, M., Fekadu, A., & Hanlon, C., 2024. Barriers and Drivers to Improve Integrated Primary

- Health Care for Non-Communicable Diseases and Mental Health Conditions in Ethiopia: A Mixed-Methods Study. *BMC Primary Care*, 25(1), pp.1–16.
- Budreviciute, A., Damiati, S., Sabir, D.K., Onder, K., Schuller-Goetzburg, P., Plakys, G., Katileviciute, A., Khoja, S., & Kodzius, R., 2020. Non-Communicable Disease Management and Prevention Strategy (NCD) and its Risk Factors. *Frontiers in Public Health*, 8 (November), pp.1–11.
- Canfell, O.J., Davidson, K., Woods, L., Sullivan, C., Cocoros, N.M., Klompas, M., Zambarano, B., Eakin, E., Littlewood, R., & Burton-Jones, A., 2022. Precision Public Health for Noncommunicable Diseases: An Emerging Strategic Roadmap and Multinational Use Cases. *Frontiers in Public Health*, 10 (April), pp.1–10.
- Cipta, D.A., Andoko, D., Theja, A., Utama, A.V.E., Hendrik, H., William, D.G., Reina, N., Handoko, M.T., & Lumbuun, N., 2024. Culturally Sensitive Patient-Centered Healthcare: A Focus on Health Behavior Modification in Low- and Middle-Income Countries—Insights from Indonesia. *Frontiers in Medicine*, 11 (April), pp.1–7.
- Dang, T.H., Nguyen, T.A., Van, M.H., Santin, O., Tran, O.M.T., & Schofield, P., 2021. Patient-Centered Care: Transforming the Healthcare System in Vietnam with the Support of Digital Health Technology. *Journal of Medical Internet Research*, 23(6).
- Dida, S., Hafiar, H., Kadiyono, A.L., & Lukman, S., 2021. Gender, Education, and Digital Generation as Determinants of Attitudes Towards Health Information for Health Workers in West Java, Indonesia. *Heliyon*, 7(1).
- Dominguez, L.J., Di Bella, G., Veronese, N., & Barbagallo, M., 2021. The Impact of the Mediterranean Diet on Chronic Non-Communicable Diseases and Longevity. *Nutrition*, 13(6), pp.1–31.
- Ehn, M., Derneborg, M., Revenäs, Å., & Cicchetti, A., 2021. User-Centric Requirements Engineering to Manage the Runaway front-end of Open Innovation in e-Health: A Study of Support Systems for the Physical Activity of Seniors. *International Journal of Medical Informatics*, 154 (April).
- Estrela, M., Ferreira, P.L., Roque, F., & Herdeiro, M.T., 2025. “Simplification, Decentralization, Proximity” – Critical Analysis of the Digital Health Framework in Portugal Through Expert Interviews. *International Journal of Medical Informatics*, 201 (June 2024).
- Ferrari, A.J., Santomauro, D.F., Aali, A., Abate, Y.H., Abbafati, C., Abbastabar, H., ElHafeez, S.A., Abdelmasseh, M., Abd-Elsalam, S., Abdollahi, A., Abdullahi, A., Abegaz, K.H., Zuñiga, R.A.A., Aboagye, R.G., Abolhassani, H., Abreu, L.G., Abualruz, H., Abu-Gharbieh, E., Abu-Rmeileh, N.M.E., & Murray, C.J.L.L., 2024. Global Incidence, Prevalence, Years of Life with Disability (YLD), Disability-Adjusted Years of Life (DALY), and Healthy Life Expectancy (HALE) for 371 Diseases and Injuries in 204 Countries and Territories and 811 Subnational Locations, 1990–2021: A Systematic Analysis for the 2021 Global Disease Burden Study. *The Lancet*, 403(10440), pp.2133–2161.
- Dia, J., & Wang, T., 2023. A Model of Proactive Community Health Management Based on the Theory it is Based on: The Case of Beijing, China. *Heliyon*, 9(4), pp.e14992.
- Huang, Y., Wang, T., Wang, H., Zeng, Y., & Xie, L., 2025. Health Beliefs Mediate the Link Between the Number of Non-Communicable Diseases and Preventive Behaviors in Middle-Aged and Older Adults in Southern China. *Clinical and Experimental Research on Aging*, 37(1), pp.10–12. <https://doi.org/10.1007/s40520-025-02939-3>
- Ibraheem, A.S., Nwosu, C.B., Omowumi, R.K., & Ayodapo, O., 2025. Managing Population Health Through Prevention and Early Detection of Cancer and Other Non-Communicable Diseases: A Call to Action. *Find Public Health*, 22(1).
- Kabakambira, J.D., Shumbusho, P., Mujawamariya, G., Rutagengwa, W., & Twagirumukiza, M., 2022. The Role of Integrated District Hospital-Based Noncommunicable Disease Clinics in Cardiovascular Disease Control: Preliminary Data from Rwanda. *Diabetes, Metabolic Syndrome and Obesity*, 15, pp.2107–2115.
- Khan, R., Khan, S., Almohaimeed, H.M., Almars, A.I., & Pari, B., 2025. Digital Health Technology Utilization, Challenges, and Training Needs: Perspectives from Healthcare Professionals. *International Journal of Medical Informatics*, 197 (February), pp.105833.
- Khan, S.F., & Jhaveri, A., 2025. Fighting Non-Communicable Diseases in a Digital World: Youth are Shaping the Future Through Digital Citizenship for Health. *PLOS Digital Health*, 4(4), pp.4–6.
- Liang, F., Yang, X., Peng, W., Zhen, S., Cao, W., Li, Q., Xiao, Z., Gong, M., Wang, Y., & Gu, D., 2024.

- Application of Digital Health Approaches to the Prevention and Management of Cardiometabolic Diseases in the Western Pacific Region. *Regional Health The Lancet – Western Pacific*, 43, pp.100817.
- Liu, P.L., & Yeo, P.L., 2025. *Patient-Centered Communication and the Mental Health of Sexual Minority Adults: A Mediated Model of Health Communication*, pp. 1–12.
- Lu, T., Lin, Q., Yu, B., & Hu, J., 2025. A Systematic Review of Strategies in Digital Technology to Motivate Adherence to Chronic Disease Self-Care. *NPJ Health System*, 2(1).
- Manyazewal, T., Ali, M.K., Kebede, T., Magee, M.J., Getinet, T., Patel, S.A., Hailemariam, D., Escoffery, C., Woldeamanuel, Y., Makonnen, N., Solomon, S., Amogne, W., Marconi, C.V., & Fekadu, A., 2023. Mapping the Digital Health Ecosystem in Africa in the Context of Endemic Infectious and Non-Communicable Diseases. *NPJ Digital Medicine*, 6(1).
- Menhas, R., Dai, J., Ashraf, M.A., Noman, S.M., Khurshid, S., Mahmood, S., Weng, Y., Laar, R.A., Sang, X., Kamran, M., Shahzad, B., & Iqbal, W., 2021. Physical Inactivity, Non-Communicable Diseases and China's National Fitness Plan for Physical Activity. *Health Care Risk Management and Policy*, 14, pp.2319–2331.
- Moss, C.L., Russell, B., George, G., Handford, J., Josephides, E., Green, S., Merrill, A., Haire, K., Igra, A., Gladman, M., Hachlili, S., Davies, A., Smith, D., Dolly, S., Ross, P., Lei, M., Sawyer, E., Harrison, C., Kazmi, M., & Brady, J., 2025. Guy's Cancer Cohort: Guy Cancer Center's Real-World Evidence Program 5 years later. *ESMO Real World Data and Digital Oncology*, 8(C), pp.100145.
- Murray, J.C., Huang, Q., Chen, Y.-C., Hu, C., DiSantostefano, R.L., Wong, C., Glatz, L., Curran, E., Villaruz, L.C., Hasan, A.N., & Schoenfeld, A.J., 2025. A Prognostic Score Model for Resistance Obtained to Anti-Programmed Cell Death Protein Therapy 1/ Ligand of Programmed Death 1 in Metastatic Non-Small Cell Lung Cancer. *ESMO Real-World Data and Digital Oncology*, 8(C), pp.100148.
- Negash, Y.T., & Calahorrano Sarmiento, L.S., 2023. Smart Product Service Systems in the Healthcare Industry: Intelligent Connected Products and Stakeholder Communication are Driving the Adoption of Digital Healthcare. *Heliyon*, 9(2), pp.e13137.
- Nguyen, T.T., Nguyen, T.T., Tran, B.Q., Pham, C.T., Perry, K.E., Haregu, T., Oldenburg, B., & Kowal, P., 2023. Putting Non-Communicable Disease Data to Work in Vietnam: An Investigation of Public Health Surveillance Capacity. *BMC Public Health*, 23(1), pp.1–13.
- Pan, C.C., De Santis, K.K., Muellmann, S., Hoffmann, S., Spallek, J., Barnils, N.P., Ahrens, W., Zeeb, H., & Schüz, B., 2025. Sociodemographics and Digital Health Literacy in Using Wearables for Health Promotion and Disease Prevention: A Cross-Sectional National Survey in Germany. *Journal of Prevention*, 46(3), pp.371–391.
- Pitts, N.B., Twetman, S., Fisher, J., & Marsh, P.D., 2021. Understanding Dental Caries as a Non-Communicable Disease. *British Journal of Dentistry*, 231(12), pp.749–753.
- Pognon, P.R., Boima, F., & Mekonnen, S.A., 2025. Acceptance and Satisfaction of Health Workers with the Usability of Digital Health Goods, in Kono District, Sierra Leone. *Journal of Multidisciplinary Health Care*, 18, pp.1067–1079.
- Pong, C., Tseng, R.W., Tham, Y.C., & Lum, E., 2024. Current Implementation of Digital Health in Chronic Disease Management: A Scope Review. *Journal of Medical Internet Research*, 26.
- Riaz, B.K., Ali, L., Ahmad, S.A., Islam, M.Z., Ahmed, K.R., & Hossain, S., 2020. Community Clinics in Bangladesh: A Unique Example of Public-Private Partnerships. *Heliyon*, 6(5), pp.e03950.
- Rugakingira, A.A., Yondu, E., Thobias, J.M., Dionis, I., Kamata, C.C., Kilonzi, M., Metta, E., & Sirili, N., 2024. Opportunities and Challenges for the Integration of Non-Communicable Disease Management in HIV Care and Treatment Services in Tanzania. *HIV Research and Clinical Practice*, 25(1).
- Saad, R.K., Khader, Y., Aqel, A.J., Satyanarayana, S., Wilson, N., & Abaza, H., 2024. HIV-Related Knowledge, Attitudes, Practices, and Stigma Among Healthcare Providers Treating HIV in Jordan: Identify Some Organizational Challenges. *Heliyon*, 10(2), pp.e24423.
- Segun-Omosehin, O.A., Omiye, J.A., Elalfy, A., Moideen-Sheriff, S., Kuti, F., Omole, O., Ogunyankin, K.O., Idemili-Aronu, N., Olawepo, J.O., Ezeanolue, E.E., & Adedinsewo, D., 2025. Evaluating the Digital Health Technology Landscape in Sub-Saharan Africa and Its Implications for Cardiovascular Health. *NPJ Cardiovascular Health*, 2(1), pp.1–11.
- Sekalala, S., Rawson, B., & Andanda, P., 2025. Socio-Legal Critique of the Commercialization of

- Digital Health in Sub-Saharan Africa. *Policy Studies*, 2872, pp.1–21.
- Sibomana, H., Ukwishaka, J., Mtenga, H., Luoga, O., Acosta, D., Fisher-Borne, M., Soma, G.J., Bahizi, M., Uwinkindi, F., Hagenimana, M., Mukanyandwi, I., Mbele, I., & Hildebrand, M.R., 2025. Healthcare Workers' Experience on the Integration of Digital Medical Devices for HPV Vaccination and Cervical Cancer Services in Rwanda. *BMC Digital Health*, 3(1).
- Silva, Í. de S., Silva, C.R.D.V., Martiniano, C.S., Araújo, A.J.d., Figueirêdo, R.C.d., Lapão, L.V., Moili, R.C., Brito, E.W.G., & Uchôa, S.A.d.C., 2024. Digital Health and Quality of Care in Primary Healthcare: An Evaluation Model. *Frontiers in Public Health*, 12 (October), pp.1–13.
- Sylla, B., Ouedraogo, B., Traore, S., Ouedraogo, O., Savadogo, L.G.B., & Diallo, G., 2024. The Current Status of Digital Health Interventions in the Health System in Burkina Faso. *Medical Informatics and BMC Decision-Making*, 24(1), pp.1–13.
- Teixeira, D.S., Fortes, S., Kestenberg, C., Alves, K., Campos, M.R., Neto, A.O., Ortega, F., García-Campayo, J., & Demarzo, M., 2024. Improving Patient-Centered Mental Health Promotion in Primary Care in Vulnerable Communities Through Mindfulness Training in Rio de Janeiro, Brazil. *Frontiers in Medicine*, 11 (June), pp.1–15.
- Thiel, A., & Christensen, L.R., 2025. Aligning with Global Health: Health Data Infrastructure, Epidemiological Accountability, and the Digital Workforce in Ghana. *Medical Anthropology: Cross-Cultural Studies in Health and Disease*, *Medical Anthropology*, 44(6), pp.547–559.
- Virtanen, L., Kaihlanen, A.M., Laukka, E., Gluschkoff, K., & Heponiemi, T., 2021. Behavior Change Techniques to Promote eHealth Competence of Health Professionals: A Systematic Review of Interventions. *International Journal of Medical Informatics*, 149 (September), pp.104432.
- Wang, L., Chao, J., Wu, Y., Zhang, N., & Bao, M., 2024. Social Integration and Utilization of National Basic Public Health Services Among Chinese Internal Migrants with Chronic Diseases: A Structural Equation Modeling Approach. *Heliyon*, 10(3), pp.e25797.
- Wang, W., Zhou, H., Qi, S., Yang, H., & Hong, X., 2024. The Relationship Between Physical Activity Combined with Eating Habits and Cardiovascular Risk Factors. *Heliyon*, 10(7),