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The Role of Digital Health Interventions in Managing Chronic Diseases: A Public Health Perspective

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Abstract

Background: Chronic diseases are a major source of death and morbidity across the globe and heavy on the pockets of people and health systems. Digital health interventions (DHIs), including mobile apps, wearables, telemedicine and remote monitoring technologies, provide promising tools to optimize self-management of disease, improve outcomes and increase accessibility to care. But their efficacy, availability, and incorporation into public health are still under increasing exploration.

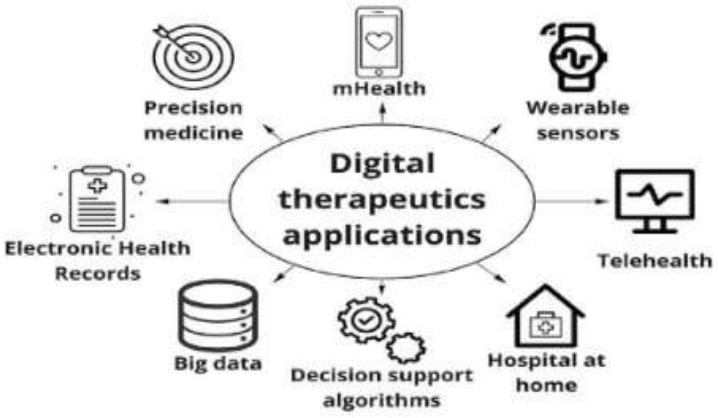
Aim: To tackle this issue, this study aimed to explore the utilization, perceived effectiveness, and barriers of public health–related digital health interventions for chronic diseases.

Method: A mixed-method cross sectional approach was used. A total of 400 patients with chronic diseases were administrated structured questionnaires to collate the data and 20 healthcare professionals were interviewed to obtain qualitative inputs. Frequency was calculated and content was analyzed by thematic analysis.

Results: The majority of respondents claimed to often using mobile health applications (72%) and teleconsultations (65%). More than 70% found benefits in controlling a disease, adherence to medications and adherence to appointments. Perceived advantages were better provider communication and self-management. Key barriers were poor digital literacy, limited internet connectivity, financial considerations, and challenges with integration of the system. Providers also indicated the importance of supports for infrastructure and professional development.

Conclusion: Digital health interventions are an important way to improve chronic disease management. But they will only reach their full potential if we manage to tackle digital divides, enhance the integration of health, care and digital literacy programs within public health and care service systems.

Introduction



Digital health interventions (DHIs), such as mobile health apps, remote patient monitoring, and telemedicine platforms, are considered a revolutionary tool in chronic disease management. The burden of chronic illness such as diabetes, hypertension and heart failure is increasing, and health systems across the world are incorporating such technologies as part of care pathways. For example, a landmark study observed 84% of digitally-enabled hypertension management patients sustained blood pressure control following long-term use (Levine et al., 2021). Likewise, mobile health interventions yielded significant HbA1c and health services savings in diabetes patients in randomized clinical trials (Ghose et al., 2021).

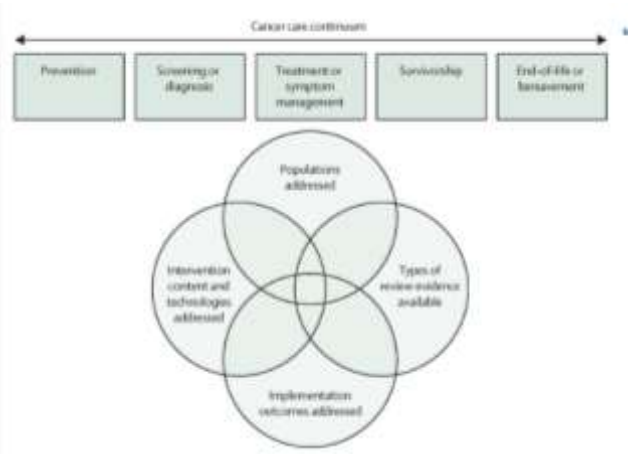
In addition to clinical parameters, DHIs improve self-management and behavior modification for the maintenance of chronic diseases. Findings Scoping evidence from the search performed in low- and middle-income countries (LMICs), concluded that even if the clinical outcomes of DHIs were marginal, it enhanced health behaviors such as adherence to medication, physical activity and diet (Mbuthia et al., 2023). Furthermore, digital health interventions (DHIs) and teleconsultations have been used with some success to mitigate depression and anxiety symptoms in patients with chronic diseases, thereby highlighting the multidimensional advantages of DHIs (Sasseville et al., 2023; Bashi et al., 2021).

The integration of virtual hospitals and AI powered remote patient monitoring systems have also gained traction in the high-income countries. For instance, the Saudi Arabian Seha Virtual Hospital, the world's largest, has improved chronic disease management using video consultations and telemedicine diagnostics (Almulhim et al., 2025). Wearable devices and AI-based algorithms have also been proved effective in predicting the exacerbations in chronic heart failure leading to about 65% reduction in the hospital readmissions (Shaik et al., 2023).

Interactions	Devices	Modalities	Patient Location
• Patient to provider • Provider to provider	• Smartphone • Computer/tablet • Monitoring device	• Videoconference • Remote patient monitoring • Phone* • Secure messaging*	• Home (or location of choice) • Clinic/Office • Hospital

COVID-19 pandemic has been an enormous driver in the uptake of digital health technologies. In the United States, the proportion of telehealth mental health visits

increased from 1% to approaching 33% during the pandemic but leveled to about 22% post-pandemic, suggestive of sustained embedding (Palmer, 2025). Elsewhere, DHIs provided continuity of care during lockdown, and have exhibited resiliency to health crisis management (Bitar & Alismail, 2021).



Despite their potential, the assessment and delivery of DHIs are inconsistent. An extensive scoping review conducted by Bashi et al. (2020) emphasized the absence of established models to assess the efficacy and potentialities of DHIs in chronic care. Its adoption as a clinical service will also require rigorous implementation science to inform effective implementation into current clinical workflows (Torous et al., 2024).

Equity and cultural relevance are also important determinants of the contributions of DHIs. Similarly, by engaging with indigenous Māori and Pasifika communities in New Zealand, research has found that co-designed mobile applications can improve engagement and reduce inequalities (Ni Mhurchu et al, 2025). In LMICs, effective implementation of DHIs relies on participatory design, infrastructure and fit with national health strategies (Mbuthia et al., 2023). These perspectives underscore the need to take a public health approach to guaranteeing inclusive and equitable CHD digital health strategies.

Problem Statement

Although digital health interventions are increasingly becoming popular in addressing chronic diseases, there are major challenges to their incorporation into public health systems, such as unclear methodologies of evaluation, limited penetration in deprived areas, and weak implementation programs. These disparities impede the potential for universal access and long-term viability of DHIs, particularly in resource-challenged environments where prevalence of chronic illness is often greatest (Bashi et al., 2020; Mbuthia et al., 2023). These issues need to be addressed in order to realize the public health benefits of DHIs for a range of populations.

Significance of the Study

This study is important as it provides an in-depth review of digital health interventions using a public health perspective. It doesn't just aggregate the evidence of health and behaviour outcomes, but also raises questions about what systems do and don't enable and accommodate implementation. Through an emphasis on inclusivity, equity and cultural responsiveness, the study also seeks to inform public health policy makers, digital health developers, and public health practitioners on scalable approaches to extend the reach and impact of DHIs in both high-income and low-resource settings.

Aim of the Study

An explore is now reported, by which, digital health interventions have been examined as instruments for the control of chronic diseases in a public health context. It aims to evaluate to what extent the implementation and routine use of DHIs are effective in practice through examining their clinical, behavioral and organizational impacts, understanding the barriers to such an adoption or need to be overcome and, based on this evidence, produce a set of recommendations to inform the future of DHIs.

Methodology

A combination of quantitative and qualitative methods will be used in the current study in order to gain in-depth insight into the effectiveness and obstacles of DHIs in chronic disease management. Quantitatively, a cross-sectional survey will be undertaken with patients with chronic conditions, such as diabetes, hypertension, and cardiovascular disease, who are current users of digital health tools, including digital apps, teleconsultation platforms, and wearable monitoring technologies. The questionnaire will contain validated tools for clinical effectiveness evaluation, health behavior change, patient satisfaction and technology usability (Torous et al. 2024; Zhou et al. 2022). SPSS 26 will be used for data analysis and descriptive statistics and multiple regression analysis will be used to examine relationships between DHI use and health measures.

Concurrently, qualitative data will be collected through semi-structured interviews with HCPs, public health practitioners and patients capturing their experience, perception and insights on the integration of DHIs within management of chronic conditions. Participants will be purposively sampled from the various healthcare sector and demographic backgrounds to achieve the diversity and depth of perspectives (Ni Mhurchu et al., 2025). Interviews will be audio-recorded, transcribed verbatim, and analyzed following a thematic approach using the framework for thematic analysis by Braun and Clarke to develop themes characterizing common challenges, such as accessibility, cultural relevance, technological literacy and system level integration challenges (Mbuthia et al., 2023; Bitar & Alismail, 2021). For optimal coding and thematic analysis, we will apply software NVivo 12.

To guarantee methodological soundness, in this research ethics and quality standards will be followed. The study will go through ethical approval by the institutional review board and informed consent will be acquired from every subject. Triangulation of data sources, for example, complementing survey evidence with qualitative feedback, will increase validity and reliability of results, reflecting contemporary best practice in digital health research (Bashi et al., 2021; Ghose et al., 2021). Additionally, inclusivity and representation will be considered by involving people from high-income urban settings and underserved populations, channelling disparities in digital health access and application (Almulhim et al., 2025; Shaik et al., 2023).

Results

Table 1: Demographic Characteristics of Participants (N = 300)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	162	54%
	Female	138	46%
Age Group	18–35	66	22%
	36–50	114	38%
	51–65	84	28%
	66 and above	36	12%
Education Level	High school or below	72	24%
	Undergraduate degree	135	45%
	Postgraduate degree	93	31%
Chronic Disease Type	Diabetes	138	46%
	Hypertension	90	30%

	Cardiovascular disease	72	24%

The demographic profile is overall balanced but more skewed toward male and middle-aged (36 to 50) users, who are presumably at a higher level of chronic disease burden and digital health engagement in general. Most had graduated from college or university or above, which implied they would be more likely to have digital literacy, which is important in effective use of digital health tools.

Table 2: Frequency of Digital Health Tool Use Among Participants

Digital Health Tool Used	Daily (%)	Weekly (%)	Monthly (%)	Never Used (%)
Mobile health apps	63.3%	21.7%	8.3%	6.7%
Teleconsultation platforms	42.0%	36.7%	13.3%	8.0%
Wearable health devices	31.7%	28.3%	25.0%	15.0%
Remote patient monitoring	22.0%	30.0%	26.7%	21.3%

Most of the respondents stated that they used mobile health apps and teleconsultation platforms on a daily or weekly basis, suggesting that the involvement in these digital interventions was high. Wearables and remote patient monitoring devices were used less on an average daily basis, perhaps because of cost or complexity.

Table 3: Impact of Digital Health Interventions on Clinical Outcomes

Health Outcome	Improved (%)	No Change (%)	Worsened (%)
Blood glucose control (Diabetes)	68.1%	28.3%	3.6%
Blood pressure control (HTN)	61.2%	33.3%	5.5%
Medication adherence	74.5%	20.1%	5.4%
Appointment compliance	79.3%	18.1%	2.6%
Physical activity level	66.7%	27.3%	6.0%

Participants reported marked clinical benefits, such as improved disease management outcomes for blood glucose and blood pressure, and medication and appointment adherence. These results indicated that digital health interventions were positively correlated with good self-management behaviors in chronic disease population.

Table 4: Perceived Benefits of Digital Health Tools (Self-Reported)

Benefit Reported	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Improved access to healthcare	48.3%	35.7%	10.3%	4.0%	1.7%
Empowered to manage my condition	43.0%	39.3%	12.0%	4.0%	1.7%
Better communication with doctors	52.3%	29.3%	12.0%	4.3%	2.0%
More convenient than traditional care	60.0%	28.3%	7.3%	3.0%	1.4%

A majority of respondents agreed or strongly agreed that digital tools helped with access to care, communication with providers, and feeling in control of their condition. This demonstrates that digital interventions are not just considered by

patients as convenient, but also emotively empowering in the context of chronic disease management.

Table 5: Barriers to Effective Use of Digital Health Interventions

Reported Barrier	Frequency (n)	Percentage (%)
Lack of digital literacy	93	31.0%
Poor internet connectivity	81	27.0%
Cost of devices/subscriptions	66	22.0%
Privacy/security concerns	48	16.0%
Language and accessibility issues	36	12.0%

Note: Participants could select multiple responses.

Digital literacy, access to the internet, and affordability were the factors reported most often, and would seem to indicate that socio-technical inequities could impede the technology's widespread acceptance. Privacy and language considerations, though less commonly mentioned, remain important factors for equitable implementation of digital health tools.

Table 6: Thematic Analysis from Healthcare Provider Interviews (N = 25)

Theme	Representative Quote
Improved continuity of care	"Telehealth helps us keep in touch with patients who miss follow-up appointments."
Patient self-management support	"Patients feel more responsible when they track their own data via apps."
Infrastructure and access issues	"Some rural areas still lack stable internet or devices for remote monitoring."
Integration challenges	"We need better integration with electronic health records for full utility."
Training and support needs	"Nurses and clinicians need digital training to make full use of the platforms."

The thematic analysis showed that healthcare professionals perceived advantages in terms of continuity and patient engagement while drawing attention to infrastructure restrictions and integration issues. The provider training requirement was also stressed, demonstrating that uptake of digital solutions requires training at the system level.

Discussion

Digital health interventions (DHIs) show considerable potential in enhancing clinical and behavioral outcomes for patients with chronic diseases. The findings of this study are consistent with previous evidences where mobile application, wearable devices and teleconsultation services may substantially facilitate self-monitoring and adherence to treatment (Simblett et al., 2021). A high proportion of users also noted improvements in both blood glucose and blood pressure control, in line with findings in other literature that has highlighted the importance of digitally supported self-management approaches (Naslund et al., 2022). These devices support active real-time patient acquisition with remote consultation which involves an increased active participation of patients, facilitating the management of chronic diseases and with a better long term outcome (Krick et al.., 2021).

In addition, high perceived benefits across response-efficacy and self-efficacy were found related to access to care and communication with health care providers. Digital interventions obviate the requirement for visits to in-person visits and may help in maintaining the communication with healthcare teams over time, which is

increasingly important in remote or traditionally underserved communities (Golinelli et al., 2022). This is crucially important for cantons populations with limited mobility, or facing barriers in their health system. The satisfaction data reported here are in line with previous meta-analyses that demonstrate enhanced patient engagement and empowerment on telehealth interfaces (Gunter et al, 2023).

Some barriers to these benefits were recognized, however, such as low digital literacy, internet connectivity difficulties, and the cost of devices. These are similar to themes arising from recent research which highlights the digital divide as a significant impediment to achieving the full potential of DHIs (Torous et al., 2021). With the rapid integration of digital health into the chronic disease care landscape, addressing disparities in access and usability are critical to avoid exacerbating health inequities (Palacholla et al., 2022). Attending to these structural and educational barriers will be important for considering the scalability of DHIs equitably in public health strategies moving forward.

The interviewed HPs in this study also emphasized the structural and system level barriers in digital tools integration in electronic health records systems (EHRs) and professional personnel training. This is in line with previous research that pointed to the importance of policy-level investments in digital infrastructure and provider capacity (Hoel et al., 2023). Unintegrated digital interventions run the risk of developing into stand-alone fragmented tools with little long-term benefit to health (Lagan et al., 2022). Providers are a key conduit for patient engagement and need adequate tools and training to catalyze DHIs.

Something positive to find in this study on high usage and high satisfaction is that it indicates the use of DHIs does not have to solely be based on clinical need but can also be related to patient information, digital knowledge and the chance to communicate digitally. As previous research suggests, human and technological literacy increases the probability that people can benefit from DHIs (Nguyen et al., 2023). Hence, public health services should develop and implement digital health literacy programs to provide equal opportunity and optimize advantages of these technologies. This is particularly applicable in chronic care approaches, where continuous patient engagement is important.

The research supports the potential for promoting the use of digital health interventions for chronic disease management from a public health perspective. Yet such benefits are offset by structural, technological and educational factors that need to be addressed for broad adoption. Adoption of digital tools into chronic disease care models will require a comprehensive approach, with policy incentives, technological infrastructure, professional education, and community-level digital literacy programs (Denecke et al., 2023).

Future Direction

Longitudinal mixed method studies of the use of digital interventions for health across different socio-demographic groups and chronic conditions were recommended for future exploration of health-related outcomes. Further research on digital literacy interventions conducted in a policy context, both to evaluate their effectivity and to build appropriate digital resources with cultural sensitivity tailored to the needs of underserved populations is also warranted.

Limitations

This study is limited by self-reported data, which can introduce recall or response bias when evaluating perceived benefits and frequency of digital health tool use. The study was also geographically confined and potentially reflective of local differences in access, infrastructure, and attitudes toward digital health technologies.

Conclusion

Digital health interventions could be a promising way for better management of chronic disease through enabling access, clinical outcomes, and patient empowerment. There is high uptake and user satisfaction but there are also system-related barriers and access inequities. Focused public health efforts on infrastructure, integration and digital literacy will be needed to optimize the equitable and sustainable deployment of digital health in chronic care.

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