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COMMUNITY PERCEPTION OF TECHNOLOGY IN DIGITAL HEALTH: A QUALITATIVE INQUIRY INTO DIGITAL HEALTH LITERACY

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Abstract

Introduction

Digital health is an emerging field that integrates digital technologies with healthcare, daily life, and social demands to enhance healthcare delivery by making it more personalized, precise, and easily available. It serves as a tool to improve healthcare delivery efficiency in the community. This study explores community perceptions of technology in digital health and examines digital health literacy (DHL) through a qualitative approach.

Materials and methods

A qualitative study design was employed to explore community perceptions of technology in digital health and digital health literacy. Participants were recruited using purposive sampling from an urban health centre in Thirumazhisai. Data was collected using focus group discussions. Data were analyzed using manual content and thematic analysis, a method for identifying, analyzing, and reporting patterns (themes) within data. NVivo software was used to manage and organize the data.

Results

The study found that participants had diverse understandings of digital health, influenced by personal experiences and exposure to technology. Access to digital health tools also varied, with socio-economic disparities playing a significant role. Participants with access to digital devices and internet connectivity found these tools valuable, while others faced barriers due to costs and lack of technological infrastructure. Trust, reliability, and privacy concerns further impacted participants' willingness to engage with digital health technologies, highlighting the need for more transparent and secure digital health solutions.

Conclusion

The study concludes the importance of enhancing digital health literacy, simplifying digital health tools, and improving access to technology across socio-economic groups to ensure equitable use of digital health resources. Addressing the digital divide and providing targeted education and support can help build trust and empower individuals to engage confidently with digital health technologies, ultimately improving healthcare experiences and outcomes.

Keywords: Digital health, Digital health literacy, Healthcare technology, Qualitative study, Technology perception

INTRODUCTION

Digital health involves integrating digital technologies into healthcare, encompassing tools such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth, and telemedicine. These technologies aim to improve healthcare delivery by offering more personalized, precise, and timely care, ultimately enhancing patient outcomes and healthcare efficiency [1]. Digital health literacy (DHL) refers to "the ability to seek, understand, and use health information from digital sources to address health-related issues". It is vital for patients and healthcare providers to effectively engage with digital health tools and technologies [2].

Globally, digital health literacy levels vary, with higher levels in developed countries and significant gaps in low and middle-income countries due to limited access to technology and education [3,4]. In Europe, digital health literacy is uneven, with a survey showing a digital divide between countries and socioeconomic groups [5]. In India, digital health literacy is emerging, but disparities persist, especially between urban and rural areas, and among different socioeconomic groups [6].

Digital health literacy is crucial for ensuring that people can efficiently access and use digital health technologies. Enhanced patient participation, improved decision-making regarding health, and the effective use of healthcare resources are all facilitated by higher digital health literacy [7]. Reduced health outcomes and growing health inequities could be the result of low digital health literacy [8]. To choose and suggest appropriate digital health tools in clinical settings, healthcare practitioners must be digitally literate [9].

Digital health technologies offer numerous advantages, including improved access to healthcare services, particularly for remote and underserved populations, enhanced patient engagement through tools that promote self-management and monitoring, and increased efficiency in healthcare delivery through remote consultations and timely information sharing [10]. These technologies are especially beneficial for managing chronic conditions, facilitating communication between patients and healthcare providers, and providing personalized healthcare experiences [11]. Despite its benefits, several challenges impact digital health literacy and the adoption of digital health technologies. Factors such as socioeconomic disparities, inadequate access to digital infrastructure, and low digital competence among older adults and marginalized groups further hinder digital health literacy [8,12].

Understanding these perceptions is essential for developing user-centered digital health interventions accessible to all. The variability in trust and acceptance of digital health technologies can be explained by the Technology Acceptance Model (TAM), which suggests that perceived ease of use and usefulness influence users' attitudes toward technology [12]. Additionally, the digital divide, characterized by differences in access and digital competence, can be understood through the lens of social determinants of health, which highlights how socioeconomic factors impact access to digital health resources [13]. There is a lack of region-specific data on digital health literacy in Tamil Nadu. While national-level studies provide some insights, the unique challenges faced by populations in Tamil Nadu remain underexplored. This gap limits the ability to design and implement effective digital health interventions tailored to the state's specific needs [14].

Given the limited data on digital health literacy in Tamil Nadu, this study explores community perceptions of digital health technologies and identifies factors influencing digital health literacy. This study aims to address the gap in knowledge regarding community perceptions of digital health and digital health literacy in Tamil Nadu. The objectives are to explore the perceptions of digital health literacy to understand the barriers and facilitators to digital health adoption and provide recommendations for enhancing digital health literacy through targeted interventions. This study aims to contribute to the design of inclusive digital health strategies that promote equitable access and utilization.

MATERIALS & METHODS

A qualitative study design was conducted to explore community perceptions of technology in digital health and digital health literacy. The qualitative approach allows an inquiry using focused group discussion, and understanding of participants' experiences, attitudes, and beliefs regarding digital health technologies. The study was conducted among patients who had visited the Urban Health Centre, Thirumazhisai, Saveetha Medical College and Hospital from March to May, 20024. Patients, who are 18 years and above having experience with at least one device with digital health technology (mobile phones, laptops, tablets, or any other devices) were included as study participants. Participants were recruited using the purposive sampling method after obtaining informed consent from them. Participants were selected based on their ability to speak and describe their perceptions during the focused group discussion. Data was collected till data saturation was attained, and 5 FGD were conducted with 6-8 participants per session which makes for a sample size (N = 32).

Data was collected using an interview guide and adequate probes were asked for the patient responses. The interview guide was developed based on a review of the literature and expert opinion. Focused group discussion

lasted approximately 20-30 minutes. All interviews and focus groups were audio-recorded with participants' consent and transcribed verbatim for analysis. At the end of the focused group discussion, the summary points were informed to the participant to validate the information summarized.

The interviews were transcribed into the language of record (Tamil) and then translated into English. Notes were taken while listening to the audio recording of the focused group discussions. Manual descriptive content analysis was used to analyze the transcripts. Codes, themes, and categories were generated based on the grounded theory approach. Inferences were drawn and meaning was derived based on the study's objectives. The conceptual framework was derived based on the codes, themes, and categories generated from the participant's statements.

Data were analyzed using manual content and thematic analysis, a method for identifying, analyzing, and reporting patterns (themes) within data. NVivo software was used to manage and organize the data. Ethical approval for the study was obtained from the relevant institutional review board (300/03/2024/PG/SRB/SMCH). Privacy and confidentiality were maintained throughout the data collection process.

RESULTS

Table 1 shows the distribution of socio-demographic variables among the study participants. The study population is characterized by a fairly balanced gender distribution, of females (53.1%) compared to males (46.9%). More than half of the study participants have a relatively high level of education, with 56.25% having completed graduation and above. The predominant occupation among participants is employment for wages (46.9%), and professionals (37.5%). More than half of the study participants belonged to the upper socio-economic class (59.3%), with the remaining 40.7% belonging to the middle class and below [15]. A significant majority of participants (87.5%) own digital devices, and 75% of the study participants express trust in digital health technologies.

Table 1. Socio-demographic variables among the study participants N = 32

Sl. No	Variable	Category	Frequency N (%) N = 32
1	Gender	Male	15 (46.9)
		Female	17 (53.1)
2	Education	Illiterate	4 (12.5)
		Up to high school	2 (6.25)
		High school and above	8 (25)
		Graduate and above	18 (56.25)
3	Occupation	Employed for wages	15 (46.9)
		Professional	12 (37.5)
		Unemployed	5 (15.6)
4	Socio economic status*	Upper class**	19 (59.3)
		Middle class and below***	13 (40.7)
5	Digital device ownership	Yes	28 (87.5)
		No	4 (12.5)
6	Trust in digital health technology	Yes	24 (75)
		No	8 (25)

*Socio-economic status according to the modified Brahm Govind (BG) Prasad scale, January 2024

**Upper class and upper middle were categorized as upper class.

***Middle class, lower middle class, and lower class were categorized as lower class.

Table 2 shows the thematic analysis of barriers and facilitators of digital health N = 32. Major themes were understanding of digital health, access and use of digital health tools, digital health literacy, trust, reliability and privacy concerns, impact on healthcare experience, and suggestions for improvement. Then the 6 major themes were further divided into respective codes mentioned in table 2.

Table 2. Thematic analysis of barriers and facilitators of digital health N = 32

Sl. No	Themes	Codes
1	Understanding of digital health	Lack of awareness about digital health concepts
		Limited knowledge of how digital health tools operate and their benefits
2	Access and use of digital health tools	Inadequate access to reliable internet or digital devices
		Complexity of digital health platforms and applications
3	Digital health literacy	Insufficient skills to navigate and utilize digital health tools effectively
		Misinterpretation of health information provided online
4	Trust, reliability, and privacy concerns	Concerns over data security and privacy of personal health information
		Lack of trust in the accuracy and credibility of online health resources
5	Impact on healthcare experience	Feeling of isolation or depersonalization due to increased reliance on technology in healthcare interactions
		Difficulty in integrating digital health tools with traditional healthcare practices
6	Suggestions for improvement	Need for user-friendly digital health interfaces
		Enhanced education and training programs to improve digital health literacy among community members
		Strict regulations and standards to ensure data privacy and security
		Integration of patient feedback and involvement in the development of digital health solutions

Figure 1 shows schematic diagram of barriers and facilitators of digital health literacy.

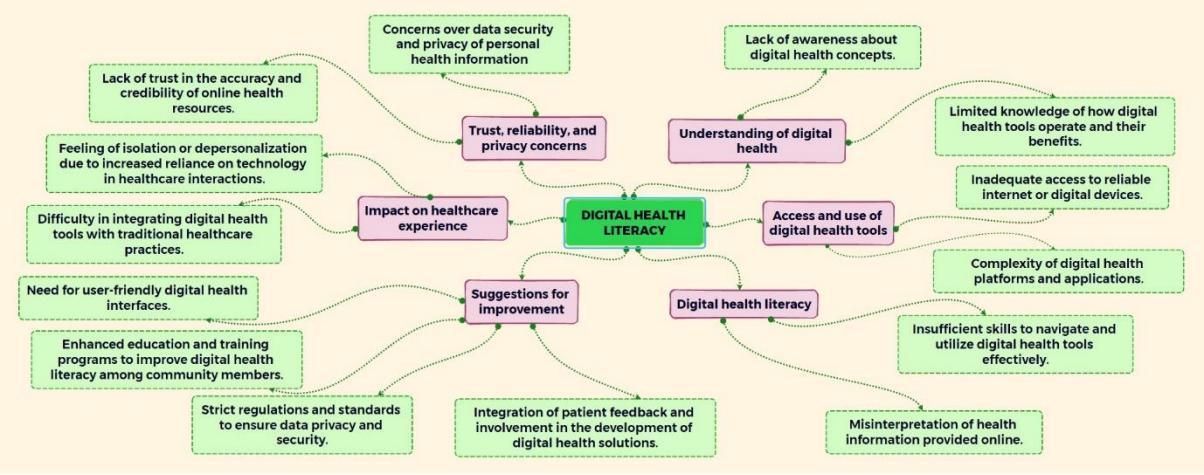

Figure 1: Schematic diagram of Barriers and facilitators of Digital Health Literacy (DHL)

Understanding of digital health

Participants had varied understandings of digital health, influenced by their personal experiences and exposure to technology. One participant (a 34-year-old school teacher) expressed a positive view, stating, "*Digital health? It's been a lifesaver for me, literally. I was able to solve small issues and get advice without leaving my home*". This statement likely reflects the convenience and accessibility digital health tools provide, particularly for managing minor health concerns from home. In contrast, another participant admitted, "*I'm not really aware of digital health technology. I only use apps to watch reels and videos on YouTube. I didn't know it could be used for monitoring health*." This highlights a gap in awareness about the broader applications of digital health tools beyond entertainment, suggesting a need for better education on how these technologies can be leveraged for health management.

In contrast, another participant (a 28-year-old college student) described digital health as "*a nightmare, honestly. I thought I could trust those online forums and health websites, but they led me down a rabbit hole of misinformation*". This negative perception could stem from encountering unreliable or misleading information online, which caused confusion and mistrust. The probable reason for this view is a lack of familiarity with trustworthy digital health resources or negative past experiences with unverified sources.

Access and use of digital health tools

Access to and use of digital health tools varied significantly among participants. One person (a 37-year-old male engineer) mentioned, "*Yeah, I used this app my friend told me about. It lets you see a doctor on your phone from YouTube. It was convenient*". This statement suggests that the participant found digital health tools easy to use and valuable for avoiding in-person visits, particularly when accessible through commonly used platforms like YouTube.

However, not all experiences were positive. A 45-year-old female homemaker shared, "*I have a slow internet connection, and the application has a very slow interface. It takes forever to load anything*". Another participant (a 29-year-old male graphic designer) complained, "*Digital health applications seem to crash very often, especially when I need them the most*". Additionally, a 33-year-old female retail worker noted, "*Sometimes the options in the applications require a subscription to access the complete features, which I can't always afford*". These responses highlight the technical and financial barriers some users face, underscoring the need for more reliable, accessible, and affordable digital health solutions.

Conversely, another participant (a 21-year-old female craft worker) expressed frustration with the complexity of using digital health tools, saying, "*Sometimes it's hard to understand how to use them, or I worry about my privacy*". This concern likely arises from a lack of user-friendly interfaces or clear instructions, making it difficult for some users to navigate digital health platforms confidently. Additionally, one participant (a 37-year-old housewife) highlighted the significant barrier of not having access at all: "*No, I can't spend money on gadgets so I can't afford the luxury of looking at things online. I can barely make ends meet. My daughter is in college and she has a smartphone. She tells me that it has useful health tips and advice, I can't afford a phone or internet, so I haven't used any of those things*". This reflects socio-economic disparities that limit access to digital health tools for some individuals.

Digital health literacy

Digital health literacy, or the ability to effectively use digital health tools, was a concern for many participants. One person (a 26-year-old male electrical engineer) admitted, "*It would be helpful if digital health tools were easier to understand and use. Sometimes it's helpful, but other times it just confuses me, especially for people like me who didn't have much education. I'm never quite sure if I'm doing it right*". This confusion indicates that the participant lacks the knowledge or skills to fully understand and utilize digital health tools, which may lead to improper use or frustration.

Another participant (a 35-year-old female shopkeeper) reflected on their overconfidence, saying, "*I thought I was pretty confident using it, but then I tried to diagnose myself online and ended up making myself sicker*". This statement suggests that a lack of digital health literacy can result in harmful outcomes when individuals attempt to self-diagnose or treat themselves based on online information. The probable reason for these views was insufficient training or guidance on how to use digital health tools properly and distinguish reliable information from misinformation.

Trust, reliability, and privacy concerns

Participants frequently mentioned concerns about trust, reliability, and privacy. One participant (a 29-year-old male college lecturer) shared, "*I do worry a bit about it, but I try not to let it bother me too much. I figure if I stick to using trusted apps and websites, my info should be safe*". This shows a cautious trust in digital health technologies, provided reputable sources or known entities recommend them. In contrast, a 42-year-old female accountant expressed a different experience, saying, "*I got scammed by clicking the links on websites while using digital health applications, and my phone got hacked*". Another participant (a 35-year-old male Information Technology professional) reported, "*My bank account was hacked and it led to financial loss. It happened while I was using digital health technology*". Additionally, a 27-year-old female student shared, "*My private information was leaked out while using digital health technology, especially when I clicked on those advertisement pop-ups*". These responses highlight significant privacy and security concerns, emphasizing the need for enhanced protective measures and user education on safe practices when engaging with digital health tools.

Another participant expressed "*I mainly looked for information that matched my symptoms and seemed to make sense. I didn't question whether it was accurate or not. I mainly relied on the YouTube video's comments. If it worked for them, it would work for me too*". Another participant (a 27-year-old female accountant) expressed more apprehension, saying, "*I'm a bit worried about it, to be honest. I'm not sure how secure these apps are, and that makes me nervous*". This concern likely arises from uncertainty about the security measures in place to protect personal health information on digital platforms. The probable reason for this distrust is a lack of transparency from digital health providers about their data security policies or past experiences with data breaches.

Impact on healthcare experience

The impact of digital health tools on healthcare experiences varied widely. One participant (a 36-year-old male chemical engineer) reported a positive impact, stating, "*Using digital health tools has made things a lot easier for me. I can track my symptoms, listen to doctors from Google, and search for more treatment*". This response suggests that digital tools have enhanced their ability to manage their health independently, making the healthcare experience more accessible and less reliant on in-person visits.

One participant (a 26-year-old carpenter) expressed "*I was pretty confident using it, but then I tried to diagnose myself online and ended up making myself sticker which made my diarrhea worse. I'm never going down that road again*". However, another participant (a 26-year-old male electrical engineer) had a mixed experience, noting, "*It's been a bit of a mixed bag, to be honest. On one hand, it's convenient to be able to access my medical records and history. But on the other hand, I miss the personal touch of seeing my doctor face-to-face*". This reflects a trade-off between the efficiency and accessibility of digital health tools and the loss of personal interaction with healthcare providers, which some patients may value highly.

Suggestions for improvement

Participants offered several suggestions for improving digital health tools. One participant (a 62-year-old watchman) suggested, "*I think it would be helpful if digital health tools were easier to understand and use. Sometimes they can be confusing, especially for people like me who didn't have much education*". This highlights the need for simpler, more intuitive designs that cater to users with varying levels of digital literacy.

Another suggestion was to make digital health tools more accessible, as one person (a 26-year-old auto driver) noted, "*It would be great if digital health tools were more accessible to everyone, even people who can't afford fancy smartphones or computers. Maybe they could make simpler versions that work on basic devices*". This reflects a desire for more inclusive technology that accommodates all socio-economic backgrounds. Additionally, some participants emphasized the need for personalized support, suggesting, "*They could provide more education and training on how to use these tools. Maybe children can teach elders who need extra help*". This shows a recognition that digital health literacy can be improved through targeted educational initiatives and community support.

Discussion

Understanding of digital health

The participants' understanding of digital health was shaped by their personal experiences and exposure to technology. While some viewed digital health tools positively, others expressed frustration due to misinformation encountered online. The mixed perceptions could stem from varying levels of digital literacy, access to reliable sources, and prior experiences with digital tools. Participants who reported positive experiences likely benefited from user-friendly digital health platforms and adequate guidance. Conversely, those who encountered negative experiences may have lacked knowledge about credible sources or faced challenges due to misleading information.

This finding aligns with previous research by Mensah et al. (2023), which highlighted that while digital health technologies are perceived positively for enhancing efficiency and access, the presence of misinformation can negatively impact users' trust and confidence [10]. Similarly, Jarva et al. (2022) found that healthcare professionals often experience a learning curve when adopting new digital tools, suggesting that a lack of adequate training and familiarity may contribute to negative perceptions [8].

Access and use of digital health tools

Access to and use of digital health tools varied significantly among participants, influenced by factors such as ease of use, availability of technology, and socio-economic status. Participants who found digital health tools convenient often had access to the necessary devices and internet connectivity, whereas others faced barriers due to cost and lack of technological infrastructure. This variation highlights the digital divide that persists across different communities.

These findings are consistent with Odendaal et al. (2015), who identified similar barriers among healthcare workers in low-resource settings, where limited access to technology and connectivity posed significant challenges [16]. Moreover, Konttila et al. (2019) noted that the adoption of digital tools is influenced by their perceived usability and the availability of user support, further emphasizing the importance of user-friendly design and access [11].

The digital divide was a prominent theme, with participants noting disparities in access to digital health technologies based on socioeconomic status, geographic location, and education level. These disparities were seen as barriers to equitable healthcare delivery and highlighted the need for targeted interventions to bridge the digital divide [17]. The findings of this study align with previous research that has identified trust, accessibility, and the digital divide as critical factors influencing the adoption of digital health technologies. However, this study provides a more in-depth qualitative perspective, highlighting the lived experiences and specific challenges faced by different population groups [13].

Digital health literacy

Digital health literacy, or the ability to effectively use digital health tools, was a notable concern among participants. Those who lacked digital literacy reported confusion and frustration when navigating digital platforms. This could be due to insufficient training, unfamiliarity with digital tools, or difficulty distinguishing between reliable and unreliable sources of information.

This concern is shown in previous studies by van Kessel et al. (2022) and Fitzpatrick (2023), which emphasize the need for improving digital health literacy to enable safe and effective use of digital health tools [5, 18]. A study by Busse et al. (2022) highlighted that digital literacy is a critical factor in determining how effectively patients and healthcare providers can engage with digital health technologies, suggesting that targeted educational interventions could bridge this gap [7].

Trust, reliability, and privacy concerns

Trust, reliability, and privacy were recurrent themes among participants, with varying levels of concern regarding data security and the accuracy of information available on digital platforms. Participants who expressed cautious trust often relied on trusted apps or websites, while those with greater apprehension were uncertain about the security measures in place.

This is consistent with the findings of Jarva et al. (2022), who reported that healthcare professionals also experience concerns regarding data privacy and the reliability of digital tools [8]. Similarly, Konttila et al. (2019) found that confidence in digital health technologies is influenced by users' perceptions of data security and data protection measures. These concerns suggest that increasing transparency about data security policies and, enhancing the credibility of digital tools could improve trust among users [11].

Impact on healthcare experience

The impact of digital health tools on healthcare experiences was mixed among participants. Some reported positive experiences, noting that digital tools made health management easier and more accessible, particularly for routine monitoring and communication with healthcare providers. However, others experienced a trade-off between convenience and the perceived quality of care, missing the personal interaction of face-to-face consultations.

These findings align with Mensah et al. (2023), who noted that digital health technologies could improve accessibility and efficiency but may reduce the quality of interpersonal interactions between patients and healthcare providers [10]. Similarly, Odendaal et al. (2015) observed that while mHealth technologies can enhance service delivery, they may also alter the nature of patient-provider communication, which could affect patient satisfaction [16].

Suggestions for improvement

Participants offered several suggestions for improving digital health tools, including simplifying the tools to make them more user-friendly, increasing accessibility to ensure they are available to all socio-economic groups, and providing education and training to improve digital health literacy. These suggestions reflect the need for more inclusive and accessible digital health technologies.

These recommendations are consistent with the findings of Konttila et al. (2019), who advocated for more user-centered designs and enhanced training for both healthcare providers and patients [11]. Fitzpatrick (2023) also emphasized the importance of improving digital health literacy through targeted education, suggesting that such interventions could help bridge the gap in digital competence and enhance the overall effectiveness of digital health tools [18].

Artificial intelligence (AI) and machine learning (ML) are increasingly being integrated into healthcare technologies, enhancing the accuracy and accessibility of digital health tools. Shiammala et al. (2023) highlight the potential of AI and ML to address complex challenges in drug design, indicating that these technologies could similarly improve the precision and usability of digital health tools across various healthcare applications [19]. AI-driven tools, as demonstrated in dental health by Negi et al. (2024), have proven effective in diagnostics, offering opportunities to reduce healthcare disparities by improving diagnostic accuracy and accessibility [20].

Additionally, Brahma and Vimal (2024) explore AI's role in neuroimaging, acknowledging the need for ethical considerations to ensure equitable access to these technologies. As AI continues to enhance digital health capabilities, it is essential to prioritize user-centered design and inclusivity in these tools [21]. Future research should focus on developing and evaluating interventions aimed at improving digital health literacy, particularly among underserved populations. Additionally, longitudinal studies are needed to assess the long-term impact of digital health technologies on health outcomes and to explore changes in community perceptions over time.

Strengths of the Study

The study's primary strength lies in its use of qualitative methods, which allowed for an in-depth exploration of participants' experiences, perceptions, and beliefs regarding digital health technologies. Conducting multiple focus group discussions (FGDs) with diverse participants provided a wide range of perspectives, enhancing the

study's comprehensive understanding of community views on digital health. The use of grounded theory and thematic analysis enabled the direct identification of patterns and themes, adding credibility and relevance to the findings. Furthermore, conducting interviews in the participant's native language (Tamil) and translating the data ensured cultural and linguistic relevance, which is essential for accurately capturing the nuances of participants' viewpoints. Qualitative studies are particularly strong in providing detailed insights into complex issues, allowing researchers to explore the "how" and "why" behind participants' behaviors and attitudes.

Limitations of the Study

The limitation of the study is the potential for social desirability bias, as participants might have altered their responses to align with what they perceived the researchers wanted to hear, especially in a group setting. Additionally, the study's focus on individuals from urban areas may limit the generalizability of the findings to other regions or rural populations who might have different levels of access to digital health tools.

Recommendations

There is a need for targeted educational interventions to improve digital health literacy, especially among older adults, individuals with lower educational backgrounds, and those with limited exposure to technology. This could include community-based workshops, digital health literacy campaigns, and the integration of digital health education into existing health services. To address usability challenges, digital health tools should be designed with a user-centered approach, focusing on intuitive interfaces and simplified navigation. Tools should be tested with end-users from diverse backgrounds to ensure accessibility and ease of use. Efforts should be made to reduce socio-economic barriers to accessing digital health tools, such as providing affordable or subsidized devices and internet services. Healthcare providers should communicate their data security and privacy policies to the users to build trust in digital health technologies. Future studies should explore the impact of specific interventions aimed at improving digital health literacy and accessibility. Longitudinal research is needed to evaluate the long-term effects of digital health tool adoption on healthcare outcomes and to track changes in community perceptions over time.

CONCLUSION

Digital health technologies can transform healthcare delivery and improve patient outcomes. This study underscores the importance of enhancing digital health literacy and developing user-centered digital health interventions to ensure equitable access and maximize the benefits of digital health for all communities. It highlights the need for targeted strategies to enhance trust and improve accessibility to maximize the benefits of digital health. However, successfully adopting these technologies is contingent upon addressing barriers related to trust, accessibility, and the digital divide. Further research is needed to continue exploring these themes and to develop effective strategies for integrating digital health technologies into everyday healthcare practice. Targeted strategies, including educational interventions and inclusive design, are necessary to address these challenges and improve the adoption and effectiveness of digital health tools.

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