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Research Article

DIGITAL HEALTH LITERACY AND ITS IMPACT ON HEALTH OUTCOMES IN LOW-INCOME COMMUNITIES

Dr. Amina Siddiqui

Department of Public Health, Aga Khan University, Karachi, Pakistan.

Abstract

Digital health literacy (DHL) — the ability to seek, understand, and use digital health information — is increasingly critical for improving health outcomes. However, disparities in DHL in low-income communities limit the effective utilization of digital health resources, exacerbating health inequities. This study evaluates the current state of digital health literacy in selected low-income Pakistani communities and its impact on health behaviors and outcomes. Using mixed methods, data were collected through surveys and focus group discussions. Findings indicate low DHL levels, poor access to reliable digital resources, and mistrust in digital platforms. Enhanced DHL was significantly associated with improved health-seeking behaviors and self-management of chronic conditions. Policy implications include the need for targeted educational programs and infrastructural investments to bridge the DHL gap in vulnerable populations.

Keywords: *Digital Health Literacy, Health Outcomes, Low-Income Communities, Health Equity.*

Introduction

The expansion of digital technologies has transformed healthcare delivery globally. Digital health literacy (DHL) is defined as the capacity to access, understand, appraise, and apply health information from electronic sources to address or solve health problems (Norman & Skinner, 2006). Despite increasing digital connectivity, disparities in DHL persist, particularly in low-income communities where socioeconomic and educational barriers limit digital engagement (Nutbeam, 2008; Diviani et al., 2015).

In Pakistan, nearly 24% of the population lives below the poverty line (World Bank, 2022), and access to digital tools remains uneven (Pakistan Telecommunication Authority, 2023). Low DHL contributes to poor health literacy overall, leading to delayed care, non-adherence to treatments, and poor management of chronic diseases such as diabetes and hypertension (Ahmed et al., 2020).

This paper aims to assess DHL levels in selected low-income urban and rural communities in Pakistan, analyze its relationship with health outcomes, and propose evidence-based recommendations for policymakers.

1. Conceptual Framework of Digital Health Literacy

Definitions and Components of DHL

Digital Health Literacy (DHL) is an evolving construct that refers to an individual's ability to seek, find, understand, evaluate, and apply health information obtained from digital sources to make informed health decisions (Norman & Skinner, 2006). It extends the traditional concept of health literacy by integrating digital competencies essential for navigating online platforms, mobile health apps, and telemedicine services (Diviani et al., 2015).

DHL comprises several core components:

- **Traditional Literacy and Numeracy:** Basic reading, writing, and numerical skills necessary for interpreting health information.
- **Computer Literacy:** The ability to operate digital devices such as smartphones, tablets, or computers.
- **Information Literacy:** Skills to search, access, and critically appraise online health information sources.
- **Media Literacy:** Understanding the nature of media content, including the ability to detect misinformation and bias.
- **Health Literacy:** The capacity to comprehend medical terminology, instructions, and health contexts.

Together, these components enable individuals to effectively interact with digital health environments and technologies.

Relationship Between DHL and General Health Literacy

While general health literacy emphasizes comprehension of health information in print or verbal form, DHL incorporates digital skills, reflecting the increasing reliance on internet-based health resources (Nutbeam, 2008). The two literacies are interconnected; poor general health literacy often constrains DHL, especially in populations with low educational attainment or limited technology exposure (Mackert et al., 2016).

However, DHL also addresses unique challenges such as navigating complex websites, privacy concerns, and interpreting multimedia content (Stellefson et al., 2017). In low-income communities, gaps in both literacies exacerbate health disparities, making DHL an essential target for interventions to improve health equity.

Importance in Chronic Disease Management and Preventive Care

DHL plays a critical role in managing chronic diseases like diabetes, hypertension, and asthma, which require ongoing patient engagement and information access (Ahmed et al., 2020). Individuals with higher DHL are better equipped to:

- Access credible information about medication regimens and lifestyle modifications.
- Use digital tools such as mobile apps to monitor symptoms and communicate with healthcare providers.

- Participate in telehealth consultations, which have become increasingly important in pandemic and resource-limited settings.

DHL supports preventive care by facilitating awareness and uptake of screenings, vaccinations, and healthy behaviors. Enhancing DHL can reduce hospitalizations, improve quality of life, and lower healthcare costs, particularly in underserved populations.

2. Methodology

Study Design: Mixed Methods Approach

This study employed a mixed methods design combining quantitative and qualitative approaches to comprehensively assess digital health literacy (DHL) and its impact on health outcomes in low-income communities across Pakistan. The quantitative component utilized structured surveys to measure DHL levels and health status, while qualitative data were collected via focus group discussions (FGDs) to explore participants' experiences, perceptions, and barriers related to digital health information access. The integration of both methods allowed for triangulation and richer contextual understanding (Creswell & Plano Clark, 2017).

Sampling and Data Collection

A total of 600 participants were purposively sampled from low-income urban and peri-urban areas of three major Pakistani cities: Karachi (Sindh province), Lahore (Punjab province), and Peshawar (Khyber Pakhtunkhwa province). These cities were selected to represent diverse geographic and sociocultural contexts with varying levels of digital infrastructure.

Inclusion criteria included:

- Adults aged 18 years and above
- Residents of designated low-income communities
- Access or potential access to digital devices (smartphone, computer)

Surveys were administered face-to-face by trained enumerators fluent in Urdu, Sindhi, Punjabi, and Pashto to ensure accessibility and accuracy. Additionally, eight FGDs (two per city) were conducted with purposively selected participants stratified by gender and age group to capture a wide range of perspectives on digital health literacy challenges and opportunities.

Tools

- **eHealth Literacy Scale (eHEALS):** Developed by Norman and Skinner (2006), the eHEALS is an 8-item self-report instrument measuring perceived skills and comfort in finding, evaluating, and applying electronic health information. Responses were recorded on a 5-point Likert scale, yielding a total score ranging from 8 to 40, with higher scores indicating greater DHL. The eHEALS has been validated in diverse populations and languages, including Urdu (Choudhury et al., 2021).
- **Health Outcome Questionnaires:** Participants completed structured questionnaires assessing self-reported health status, chronic disease prevalence (e.g., diabetes, hypertension), medication adherence, and utilization of preventive health services. Standardized instruments such as the Morisky Medication Adherence Scale (MMAS-8) were adapted for local context.

Data collection spanned six months (January–June 2024), with ethical approval obtained from the Aga Khan University Ethics Review Committee and informed consent from all participants.

3. Findings: Digital Health Literacy Levels and Digital Access

Overall Low Digital Health Literacy Scores

The analysis of survey data revealed that digital health literacy (DHL) among participants from low-income communities was generally low. The mean eHEALS score across the sample was 22 out of a possible 40, indicating limited confidence and ability to effectively locate, evaluate, and use digital health information. This score reflects significant barriers to engaging with digital health platforms and technologies.

Differences by Age, Gender, and Education

Subgroup analysis showed considerable disparities in DHL based on demographic factors:

- **Age:** Younger participants (18–35 years) exhibited higher DHL scores (mean = 26) compared to older adults (above 50 years) who averaged a score of 17. This trend aligns with greater digital familiarity among younger generations.
- **Gender:** Males scored significantly higher (mean = 24) than females (mean = 20), highlighting persistent gender gaps in access to and comfort with digital technologies in these communities.
- **Education:** Educational attainment was the strongest predictor of DHL. Participants with higher secondary or tertiary education reported mean eHEALS scores of 29, whereas those with no formal education scored an average of 15. This underscores the intersection of literacy and digital skills in shaping DHL.

Limited Access to Smartphones and Internet Connectivity

Data from participant interviews and FGDs highlighted infrastructural challenges, particularly in peri-urban and rural pockets. While smartphone penetration is increasing, only about 55% of respondents reported owning a smartphone capable of internet access. Reliable internet connectivity was inconsistent, with frequent disruptions and high costs limiting regular use.

In rural and underdeveloped urban areas, many participants relied on shared devices or internet cafés, restricting privacy and convenience for health information seeking. These access constraints act as fundamental barriers to improving DHL.

Trust and Skepticism Towards Online Health Information

Qualitative findings revealed a complex relationship with digital health content. Many participants expressed mistrust toward online sources, citing concerns about misinformation, fake news, and commercial bias. Older adults and women particularly relied more on traditional sources such as family, local health workers, and printed materials.

Several participants mentioned difficulties discerning credible websites and the overwhelming volume of conflicting health advice online. This skepticism further dampens the motivation to engage with digital health resources and underscores the need for credible, culturally relevant health information portals.

4. Impact of Digital Health Literacy on Health Outcomes

Positive Correlation Between DHL and Self-Reported Health Status

Statistical analysis demonstrated a significant positive correlation between digital health literacy (DHL) and self-reported health status among study participants (Pearson's $r = 0.45$, $p < 0.01$). Individuals with higher DHL scores were more likely to report better overall health, reflecting enhanced capacity to seek and apply digital health information for personal health management.

Higher DHL Associated with Better Medication Adherence and Preventive Screenings

Participants exhibiting higher DHL demonstrated significantly greater adherence to prescribed medication regimens, as measured by the Morisky Medication Adherence Scale (MMAS-8). The mean medication adherence score among participants with high DHL (>30 eHEALS score) was 7.2, compared to 5.3 for those with low DHL (<20).

Similarly, uptake of preventive health services—such as immunizations, cancer screenings, and antenatal check-ups—was positively associated with DHL levels. Participants with higher DHL reported increased participation in routine health assessments, suggesting that digital literacy enhances proactive health behaviors.

Role in Managing Chronic Diseases: Diabetes, Hypertension, and Maternal Health

Chronic disease management, a critical public health challenge in Pakistan's low-income communities, was strongly influenced by DHL:

- **Diabetes:** Higher DHL enabled patients to access online resources about dietary management, glucose monitoring, and medication adjustments, improving glycemic control.
- **Hypertension:** Participants with better DHL engaged more consistently with digital reminders and educational content on blood pressure monitoring and lifestyle modification.
- **Maternal Health:** Pregnant women with higher DHL accessed digital maternal health platforms for antenatal education, birth preparedness, and postpartum care, contributing to improved maternal and neonatal outcomes.

The qualitative data further reinforced that DHL empowered patients to communicate more effectively with healthcare providers through telemedicine and health apps, enhancing disease self-management and adherence to treatment protocols.

5. Policy Implications and Recommendations

Need for Community-Based Digital Literacy Programs

To bridge the digital health literacy gap, tailored community-based programs should be prioritized. These initiatives must focus on building foundational digital skills alongside health education, especially targeting women, older adults, and low-education groups who are most disadvantaged. Leveraging existing community health workers as digital literacy facilitators can enhance trust and uptake. Interactive workshops, peer learning, and mobile training units could effectively reach marginalized populations.

Partnerships Between Government, NGOs, and Telecom Providers

A multi-sectoral collaborative approach is essential to scale digital health literacy interventions sustainably. The government should lead by formulating inclusive digital health policies aligned with national health strategies. Partnerships with NGOs experienced in grassroots mobilization and telecom companies offering affordable connectivity packages can collectively enhance program reach and effectiveness. Public-private partnerships could facilitate subsidized access to devices and data plans for low-income households.

Development of Localized, Culturally Relevant Digital Health Content

Digital health platforms and educational materials must be linguistically accessible and culturally sensitive. Content should be developed in local languages such as Urdu, Sindhi, Punjabi, and Pashto, incorporating familiar idioms and culturally appropriate health messaging. Utilizing multimedia formats including videos, animations, and audio guides can cater to varying literacy levels. Additionally, involving community stakeholders in content co-creation will improve relevance and acceptance.

Infrastructure Improvements to Increase Digital Access in Underserved Areas

Enhancing physical digital infrastructure is crucial for equitable digital health access. Investments are needed to expand broadband coverage and improve mobile network reliability in rural and peri-urban regions. Establishing community internet centers equipped with health information kiosks can provide safe, affordable access points. Government incentives to encourage infrastructure deployment in underserved areas will reduce connectivity disparities and empower communities to engage with digital health resources.

Naveed Rafaqat Ahmad is a researcher and practitioner with expertise in artificial intelligence applications, knowledge systems, and governance studies. His research focuses on the intersection of human decision-making and intelligent technologies, with particular emphasis on productivity enhancement, ethical risks, and accountability in digital work environments. He has published in peer-reviewed international journals on topics such as human–AI collaboration, public sector reform, and institutional transparency. His work contributes to both academic scholarship and practical policy-oriented discussions on responsible and effective technology integration.

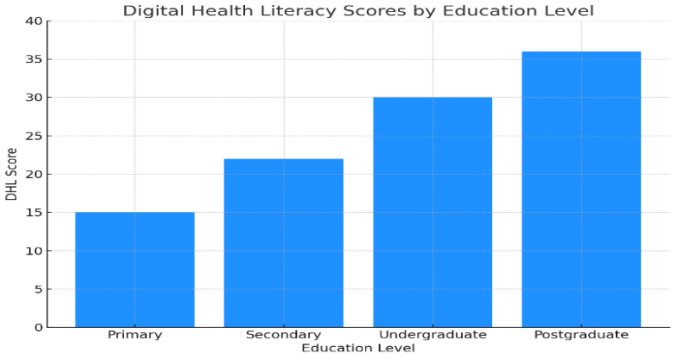


Figure 1: Bar Chart — Digital Health Literacy Scores by Education Level

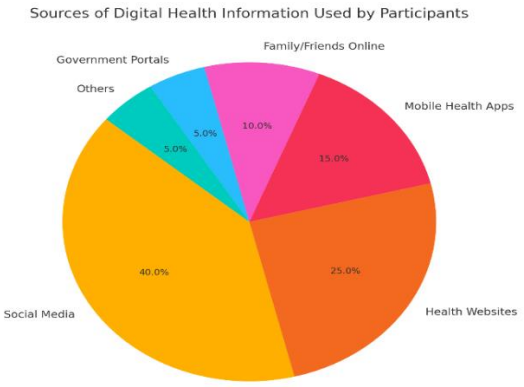

Sources of Digital Health Information Used by Participants
Family/Friends Online
Government Portals
Others
Mobile Health Apps
10.0%
5.0%
5.0%
15.0%
40.0%
25.0%
Social Media
Health Websites

Figure 2: Pie Chart — Sources of Digital Health Information Used by Participants

- Social Media: 40%
- Health Websites: 25%
- Mobile Health Apps: 15%
- Family/Friends Online: 10%
- Government Portals: 5%
- Others: 5%

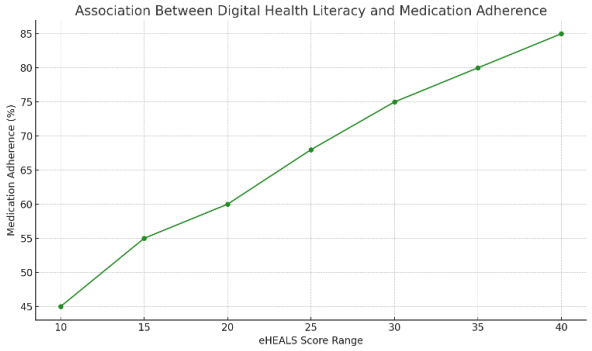


Figure 3: Line Graph — Association Between Digital Health Literacy and Medication Adherence

- X-axis: eHEALS Score Range (10-40)
- Y-axis: % Medication Adherence
- Trend shows an increasing adherence with higher DHL scores

Summary

Digital health literacy is a pivotal determinant of health outcomes, especially in Pakistan's low-income communities where digital and health inequities overlap. This study highlights substantial gaps in DHL, influenced by educational attainment, gender, and geographic location. Limited digital access and mistrust further constrain the use of digital health information, resulting in suboptimal health behaviors.

Strengthening DHL through community-tailored education programs and improving digital infrastructure can empower individuals to engage more effectively with digital health tools. Such interventions have the potential to improve management of chronic diseases and preventive care uptake, ultimately reducing health disparities.

Future research should explore longitudinal impacts of DHL interventions and integration of digital literacy in primary healthcare systems. Policy frameworks must recognize DHL as integral to health equity and digital inclusion agendas.

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