THE IMPACT OF DIGITAL LITERACY AND TECHNOLOGICAL TOOLS ON ELDERLY HEALTH INFORMATION PRACTICES

[1]Philomena Kagwiria Mwirigi*

Moi University, School of Information Sciences

[2]Prof. Cephas Odini, PhD.

Moi University, School of Information Sciences

[3]Prof. Daniel C. Rotich, PhD.

Moi University, School of Information Sciences

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ABSTRACT

The digital transformation of health systems has reshaped how health information is accessed and utilized, yet older adults remain unevenly positioned to benefit from these advancements. This study examined the influence of digital literacy and technological tools on elderly health information practices, with particular focus on informal settlement contexts in Kenya. The study was anchored on the Technology Acceptance Model, Digital Divide Theory, and the Health Belief Model. The study employed a desk-based review complemented by contextual case analysis to synthesize empirical evidence published between 2015 and 2025. Findings reveal that digital literacy is a critical determinant of elderly engagement with digital health platforms, influencing information-seeking behavior, confidence, and chronic disease self-management. While technologies such as mobile phones, SMS-based services, telemedicine platforms, and health applications enhance access to health information, their effectiveness is mediated by usability, affordability, infrastructural reliability, and social support. Older adults commonly adopt hybrid strategies that combine digital and traditional information sources, relying heavily on family members and community health volunteers as intermediaries. Persistent barriers, including low baseline eHealth literacy, cost constraints, accessibility challenges, and trust concerns, continue to limit equitable digital health participation. The study recommends integrated interventions including age-responsive digital literacy training, age-friendly low-bandwidth technology design, subsidized device and connectivity access, and formal social support structures.

Keywords: *Digital Literacy, Health Information, Digital Health Literacy, Health Information Access, Informal Settlements*

1. INTRODUCTION

The accelerated digitalization of health systems across the globe has transformed how health information is created, distributed, and consumed, yet these advancements have not been equally accessible to all segments of the population. Older adults, in particular, face a disproportionately high risk of exclusion from digital health innovations due to limited digital literacy, unequal access to technological infrastructure, and age-related physical, sensory, and cognitive changes that impede navigation of digital tools (Seifert et al., 2021). As health systems increasingly transition toward digital-first service delivery-including telemedicine appointments, patient portals, electronic medical records, and mobile health (mHealth) applications, the ability of elderly populations to effectively access and use digital health information becomes a matter of public health importance. The World Health Organization (2022) has emphasized that digital health inclusion is a prerequisite for ensuring equitable health outcomes, especially in regions with aging populations.

Digital literacy, broadly defined as the skills required to search, evaluate, and apply digital information, plays a crucial role in shaping how older adults interact with digital health ecosystems. Research shows that elderly individuals with greater digital proficiency are more proactive in seeking health information online, communicating with healthcare providers, and adopting self-monitoring practices for chronic diseases (Kim & Lee, 2022; Norman & Skinner, 2020). By contrast, those with limited digital skills experience heightened vulnerability to misinformation, reduced autonomy in managing their health, and greater dependence on traditional information sources such as family members or in-person consultations (Gallagher et al., 2021). These disparities underscore a persistent digital divide that intersects with socioeconomic, educational, and regional inequalities and significantly affects older adults' health outcomes.

Technological tools-including smartphones, wearable health devices, telemedicine platforms, AI-driven applications, and electronic health portals-are central to contemporary health information access. However, despite their transformative potential, these tools are often not designed with older users in mind. Common barriers include device complexity, unintuitive interfaces, inaccessible text formats, and fears about data security or making mistakes (Marston et al., 2020). Evidence indicates that usability challenges contribute to low technology adoption rates among older adults, even when these tools could substantially improve their communication with healthcare providers, facilitate timely access to medical information, and support chronic disease management (Wu et al., 2023). Moreover, socioeconomic disparities further influence adoption: older adults from low-income or rural backgrounds are significantly less likely to own smartphones, have broadband access, or receive adequate technical support (Tsai et al., 2020; Friemel, 2016).

In addition to individual-level barriers, social and organizational contexts significantly influence elderly digital health practices. Family members and caregivers often play a critical role by providing training, encouragement, and emotional support, which has been shown to increase digital health adoption among older adults (Lee & Kim, 2020). Meanwhile, healthcare organizations' capacity to deliver user-friendly digital services-and their willingness to provide training, alternative access options, and responsive technical support-shapes elderly patients'

comfort with digital health systems (Irizarry et al., 2019). Understanding how these multi-level factors interact is essential for designing interventions that promote digital health inclusion.

Given these complexities, this paper examines the impact of digital literacy and technological tools on elderly health information practices through an integrated review of recent empirical literature and theoretical perspectives. It investigates how digital competence affects elderly individuals' ability to access and evaluate health information, how technological tools influence their engagement with healthcare services, and how individual, social, and organizational contexts shape their digital health behaviors. The analysis supports the development of evidence-based strategies for improving digital health equity among aging populations.

Digital Literacy and Elderly Health Information Practices

Digital literacy forms the foundation for elderly engagement in digital health environments, determining whether older adults can recognize, search for, evaluate, and apply digital health information effectively. As societies increasingly adopt digital health infrastructures, digital literacy becomes not merely a skill but a determinant of health equity. Older adults with limited digital proficiency often struggle to navigate web-based platforms, interpret online medical advice, or use digital tools such as patient portals, ultimately restricting their ability to make informed decisions regarding their health (Choi & DiNitto, 2021). Digital literacy also shapes perceived control and empowerment in health management; those with higher digital skills display greater autonomy, confidence, and proactive health-seeking behaviors (Richtering et al., 2017).

Research highlights several dimensions of digital literacy that influence elderly health information practices. The first is technical-operational literacy, which encompasses basic device-handling skills such as opening applications, adjusting device settings, or using touchscreens-skills often taken for granted among younger generations but frequently challenging for older adults due to reduced motor dexterity or fear of errors (van Deursen, 2020). The second dimension, information navigation literacy, involves the ability to locate reliable health information among vast digital sources, distinguish credible medical websites from misleading ones, and use health search terms effectively (Baker et al., 2021). A third dimension, communication literacy, relates to using digital tools to interact with healthcare providers, such as through email, teleconsultation platforms, or electronic forms (Li et al., 2022). Notably, critical literacy-the ability to evaluate information credibility-has gained importance as older adults have become primary targets of online misinformation, especially during public health crises such as the COVID-19 pandemic (Gallagher et al., 2021).

Digital literacy is strongly associated with enhanced self-management of chronic diseases. For example, Kim and Lee (2022) found that elderly individuals with advanced digital skills exhibited higher adherence to medication reminders, greater use of symptom-tracking applications, and more frequent consultations with digital health platforms. Conversely, low digital literacy contributes to reduced engagement in telemedicine, increased reliance on non-digital sources, and heightened risk of misunderstanding medical information - consequences that can exacerbate existing health disparities.

Technological Tools and Health Information Access Among the Elderly

The digitalization of global healthcare systems has transformed how individuals access, evaluate, and utilize health information. Yet, despite rapid advancements in digital health technologies, older adults remain disproportionately marginalized in this shift. Digital literacy, a prerequisite for navigating online health resources, varies widely among seniors due to age-related cognitive, sensory, and physical changes, as well as generational disparities in technological exposure (Seifert et al., 2021). The growing reliance on digital platforms - telemedicine, electronic health records (EHRs), wearable devices, and mobile health (mHealth) applications - has intensified the need to understand how elderly populations engage with technology to manage their health.

Older adults increasingly face a digital divide that restricts their ability to participate fully in digital health ecosystems. Factors such as low digital literacy, limited access to technological devices, fear of technological failure, and concerns regarding privacy and data security hinder their adoption of digital health tools (Marston et al., 2020). Yet, evidence suggests that when digital tools are designed with accessibility in mind and supported by appropriate training, older adults can significantly benefit from digital health resources, demonstrating improved self-management of chronic illnesses, enhanced communication with healthcare providers, and increased health autonomy (Kim & Lee, 2022).

Technological tools play an increasingly central role in shaping how older adults access, interpret, and manage health information. These tools include smartphones, mobile health (mHealth) applications, telemedicine platforms, wearable sensors, electronic health record (EHR) portals, and emerging artificial intelligence–driven health assistants. Each technology carries significant potential to enhance health independence and support healthier aging. However, their effectiveness depends heavily on usability, accessibility, affordability, and the perceived trustworthiness of the information they deliver. Contemporary research demonstrates that although digital technologies can substantially strengthen self-management among older adults, usage patterns remain uneven due to persistent individual, socio-economic, and infrastructural barriers (Powell et al., 2021).

Smartphones and mHealth applications are among the most widely adopted digital health tools. They enable older adults to search for symptoms, schedule appointments, receive medication reminders, monitor vital signs, and participate in virtual health programs. Evidence consistently shows that mHealth solutions improve chronic disease management and medication adherence among individuals living with conditions such as diabetes, hypertension, and cardiovascular disease (Wu et al., 2023). Despite these advantages, adoption rates remain significantly lower among seniors than younger age groups. Key deterrents include interface complexity, high cognitive load, small font sizes, unintuitive navigation, and the need for frequent software updates-factors that collectively undermine digital confidence and increase technology-related anxiety (Seifert et al., 2021).

While smartphones and mHealth applications offer valuable tools for health information management, their effectiveness among older adults is strongly influenced by factors such as interface design, cognitive load, and perceived ease of use. Many seniors' express difficulty interpreting digital icons, navigating multi-step menus, or handling security features such as password creation and two-factor authentication (Seifert et al., 2021). Additionally, age-related

declines in working memory and fine motor coordination make complex app interfaces challenging, leading to frustration and abandonment of digital tools. These usability barriers highlight the need for age-sensitive design principles, such as simplified navigation structures, high-contrast visuals, adjustable text sizes, and voice-enabled functionalities that reduce manual operations.

Beyond smartphones, telemedicine platforms have emerged as essential tools for delivering remote healthcare services, especially during periods of restricted mobility or public health crises. Telemedicine helps overcome geographical barriers, reduce travel expenses, and increase access to specialists, making it particularly beneficial for older adults with chronic illnesses or limited mobility (Powell et al., 2021). However, successful telemedicine use requires stable internet connectivity, functional audio-visual equipment, and the ability to follow digital instructions, all of which older adults may find challenging without adequate support. Research indicates that many seniors encounter barriers such as difficulty positioning cameras, understanding video-call interfaces, troubleshooting connection failures, or coping with audio delays, which collectively undermine confidence in virtual care settings (Nouri et al., 2020). As a result, despite telemedicine's potential, its consistent utilization remains uneven among elderly populations.

Wearable health technologies-including smartwatches, fitness trackers, fall detection devices, and home-based remote monitoring systems-offer targeted benefits for chronic disease management and preventive care. These devices collect real-time physiological data, enabling early detection of abnormalities and facilitating more proactive clinical interventions (Davies et al., 2022). Wearable devices are particularly valuable for monitoring cardiac health, sleep quality, glucose levels, and physical activity patterns, all of which are critical for maintaining functional independence in older adulthood. However, long-term adoption is limited by factors such as device discomfort, short battery life, charging difficulties, high cost, and uncertainty regarding data accuracy (Zhou et al., 2022). Many seniors discontinue use after initial trials due to perceived burden or lack of clear guidance on interpreting health metrics.

Electronic Health Record (EHR) portals create opportunities for older adults to access test results, manage prescriptions, track upcoming appointments, and communicate with healthcare providers asynchronously. Studies show that portal engagement correlates with higher patient satisfaction and improved treatment adherence among older adults (Irizarry et al., 2019). Nonetheless, complex authentication procedures, medical terminology, and cluttered dashboards often discourage portal use. Seniors who lack confidence in navigating password systems or distinguishing between various portal functions are more likely to avoid online platforms altogether. To improve adoption, researchers advocate for simplified login processes, caregiver-access features, tutorial-based onboarding, and interface designs tailored to cognitive aging patterns.

Emerging artificial intelligence (AI) health assistants, including smart speakers, conversational chatbots, and automated symptom checkers, are increasingly influencing elderly health information practices. Voice-activated assistants, in particular, reduce the need for manual navigation and can deliver personalized reminders, health education content, and guided symptom assessments through natural language interactions. Early evidence suggests that AI-driven voice tools enhance digital inclusion for older adults with limited digital literacy or physical impairments (Nugraha et al., 2023). However, concerns persist regarding algorithm accuracy, potential biases

in AI-generated health advice, and data privacy risks. These concerns make older adults cautious about relying on AI tools for critical health decisions.

Taken together, technological tools offer immense potential for improving elderly health information access, promoting autonomy, and supporting chronic disease management. However, the benefits of these technologies are contingent on thoughtful design, affordability, clear instructional support, and strong privacy safeguards. Without targeted efforts to address usability limitations, digital literacy gaps, and systemic inequalities, technological innovations risk reinforcing, rather than reducing, health disparities among older adults.

2. LITERATURE REVIEW

Theoretical Review

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), introduced by Davis (1986; 1989), explains technology adoption through two primary cognitive constructs: perceived usefulness (PU), the belief that using a technology will enhance performance or outcomes and perceived ease of use (PEOU), the degree to which a user expects the technology to require minimal effort. TAM proposes that these perceptions shape users' attitudes toward a system, which in turn influence behavioral intentions and actual technology use. Subsequent extensions of the model (TAM2, TAM3) incorporate additional determinants, including social influence, computer self-efficacy, and prior user experience (Venkatesh & Davis, 2000; Venkatesh & Bala, 2008). Within the context of ageing populations, TAM offers a robust framework for understanding how older adults evaluate, accept, or reject digital health technologies.

Empirical evidence demonstrates TAM's relevance to elderly digital health behaviors. For instance, Tsai et al. (2020) found that both PU and PEOU significantly predicted older adults' willingness to adopt mobile health applications, with ease of use exerting particular influence due to age-related cognitive and sensory changes. Similarly, Kim and Park (2022) reported that seniors were more likely to engage with telemedicine platforms when they perceived tangible health benefits, such as reduced travel burden, enhanced communication with providers, and improved chronic disease monitoring. These findings affirm TAM's central proposition: positive value perceptions, coupled with minimal usability barriers, drive technology acceptance among older populations. In resource-constrained environments, such as informal settlements, TAM constructs become even more critical. Older adults often contend with limited digital literacy, unreliable internet access, and scarce institutional support, which heighten usability concerns (Seifert et al., 2021). Technologies that are complex, text-heavy, or require multiple authentication steps reduce PEOU, thereby limiting adoption regardless of potential benefits. Conversely, digital tools designed with age-friendly features, such as simplified navigation, large icons, voice commands, and clear instructions, enhance PEOU, build digital confidence, and encourage sustained use (Czaja & Sharit, 2018).

Perceived usefulness similarly influences adoption in underserved contexts. Seniors are more likely to engage with technologies that directly support chronic disease management, enable

remote consultations, or provide timely health information (Heart & Kalderon, 2013; Choi, 2021). In informal settlements, digital tools that facilitate medication reminders, virtual clinician contact, or access to credible health information are particularly valuable. TAM posits that when older adults recognize such tangible benefits, their behavioral intention to use digital health systems strengthens, even in the presence of usability challenges. Social influence, integrated into TAM2 and UTAUT (Unified Theory of Acceptance and Use of Technology) frameworks, further shapes technology adoption. Support from family, caregivers, peers, and community health volunteers enhances both PU and PEOU by reducing anxiety, building confidence, and normalizing digital engagement among seniors (Choi & Dinitto, 2021; Venkatesh et al., 2003).

Applying TAM in informal settlements underscores the need for interventions addressing cognitive, social, and structural determinants. Enhancing PEOU requires age-inclusive design, community-based digital literacy training, and mitigation of infrastructural barriers such as poor connectivity or device scarcity (Tsetsi & Rains, 2020). Strengthening PU involves demonstrating clear health benefits through targeted messaging, peer-led demonstrations, and community health initiatives. The Technology Acceptance Model provides a comprehensive lens for understanding elderly engagement with digital health technologies. It highlights that adoption is shaped not solely by access, but by perceived value, usability, social reinforcement, and environmental context. In marginalized communities, TAM-informed strategies can guide the development of inclusive, equitable, and sustainable digital health interventions, empowering older adults and improving long-term health outcomes.

The Digital Divide Theory

The Digital Divide Theory, developed by DiMaggio and Hargittai (2001), explains disparities in access to, use of, and benefits derived from information and communication technologies (ICTs) across populations. The theory posits that technology adoption is unevenly distributed, with differences in access, skills, and utilization opportunities generating layered inequalities, particularly among marginalized groups such as older adults, low-income households, and residents of resource-constrained communities (DiMaggio & Hargittai, 2001; Van Dijk, 2005). Conceptually, the digital divide is understood across three dimensions: the access divide (availability of devices and connectivity), the skills divide (competencies required for effective technology use), and the outcomes divide (the extent to which digital engagement produces tangible benefits in health, education, or economic opportunity) (Van Dijk, 2020; Helsper, 2012). Within the context of ageing populations, this framework elucidates why older adults often encounter disproportionate barriers in adopting digital health technologies, despite the proliferation of smartphones, mHealth applications, and telehealth services.

Empirical evidence underscores the theory's relevance to elderly digital health behaviors. Seifert et al. (2021) highlight that limited access to high-speed internet and mobile devices constrains older adults' engagement with telemedicine, health portals, and wearable monitoring technologies. Similarly, Choi and Dinitto (2021) demonstrate that deficits in digital literacy, ranging from difficulty navigating interfaces to low confidence in managing online health information, exacerbate disparities, indicating that mere physical access is insufficient to guarantee meaningful digital participation. Social and environmental contexts further amplify these effects. Socioeconomic status, educational background, household composition, and the presence of

support networks influence digital engagement (Friemel, 2016). Older adults living alone or in economically disadvantaged areas face both infrastructural and motivational barriers, including limited affordability of devices and data plans, absence of caregivers or peers to provide guidance, and minimal exposure to digital tools through social interactions. These constraints reduce perceived usefulness and hinder sustained adoption of digital health technologies, leaving those who might benefit most underserved (Heart & Kalderon, 2013).

In informal settlements and low-resource urban areas, the digital divide has direct implications for health outcomes. Limited connectivity, scarcity of devices, and low digital literacy impede older residents' access to credible health information, teleconsultations, and appointment scheduling (Otieno, Kaingu & Karanja, 2021; Kabir, Egondi & Kyobutungi, 2022). This exclusion exacerbates vulnerabilities by constraining chronic disease self-management, medication adherence, and timely health interventions, reinforcing social and health inequities. The Digital Divide Theory thus provides a robust conceptual lens for designing inclusive digital health interventions for elderly populations. By addressing barriers across access, skills, and outcomes, policymakers and practitioners can implement targeted strategies such as subsidized device distribution, age-friendly platforms, community-based digital literacy programs, and peer-supported learning initiatives (Van Dijk, 2020; Tsetsi & Rains, 2020). Such interventions ensure that older adults are not only able to access digital health tools but are also empowered to derive meaningful benefits, reducing disparities and promoting equity in health information access.

Digital Literacy and Health Information-Seeking Practices

Health Information-Seeking Practices

Digital literacy is a critical determinant of health information-seeking practices among older adults, strongly influencing the channels, frequency, and depth of engagement with health resources. Seniors with higher digital proficiency are more likely to navigate online health portals, telemedicine platforms, and mHealth applications, using these tools not only to monitor chronic conditions and manage medications but also to access preventive care guidance and lifestyle information (Wu et al., 2023; Seifert et al., 2021). Conversely, older adults with limited digital skills often rely on traditional sources of health information, such as in-person consultations with healthcare providers, advice from community health workers, radio programs, print media, and familial intermediaries (Mutiso & Wambugu, 2024; Waweru, 2023). In low- and middle-income settings, research indicates that these dual pathways are often necessary due to infrastructural limitations, socioeconomic barriers, and variations in literacy and language proficiency (Li et al., 2023; Wang et al., 2023). This dual reliance underscores the importance of multi-channel approaches to ensure equitable access to health information.

Cognitive, motivational, and psychosocial factors further shape information-seeking behaviors among older adults. Seniors demonstrate a preference for health content that is actionable, contextually relevant, and easy to interpret, such as guidance on diet, exercise, fall prevention, and medication adherence, rather than complex biomedical or technical explanations (Mberia & Kimani, 2024; Eastman, 2024). Perceived usefulness and relevance consistently emerge as strong predictors of engagement with digital health tools; when older adults recognize that information can directly improve daily health management or quality of life, they are more likely to adopt and

maintain digital behaviors (Li et al., 2023; van Boekel et al., 2023). Conversely, content perceived as abstract, irrelevant, or overly technical often discourages engagement, particularly among seniors with lower health literacy or limited prior exposure to digital technologies.

Social networks also play a pivotal role in shaping health information-seeking practices. Family members, peers, and community intermediaries can facilitate access, provide guidance, and bolster confidence in using digital tools (Choi & Dinitto, 2021; Friemel, 2016). In low-resource or informal settlement contexts, intergenerational support is especially crucial: younger family members often provide technical assistance, while community health volunteers help interpret and contextualize digital content (Mutiso & Wambugu, 2024; Waweru, 2023). Such social scaffolding mitigates the barriers posed by low digital literacy, anxiety regarding technology use, and infrastructural limitations, enhancing both the frequency and quality of digital health engagement.

Repeated exposure and sustained interaction with digital platforms further strengthen health information-seeking behaviors. Longitudinal studies indicate that consistent use of telemedicine services, mHealth applications, and online health portals enhances both competence and confidence among older adults, creating a positive feedback loop that encourages further engagement (Bujnowska-Fedak & Mastalerz-Migas, 2022; van Boekel et al., 2023). Targeted interventions, such as structured training programs, age-friendly interface design, and system-level support, amplify these effects, enabling seniors to navigate health information more effectively, make informed decisions, and engage in preventive behaviors. The interplay between individual, social, and structural factors underscores that digital health engagement is not solely a matter of access. Cognitive readiness, perceived relevance, social support, and ongoing guidance collectively determine the extent to which older adults can successfully seek, interpret, and apply health information. Effective strategies to promote digital engagement among elderly populations, therefore, must integrate capacity-building initiatives, accessible technological design, and culturally sensitive community-based support systems to ensure sustained, meaningful engagement with health information across diverse contexts (Li et al., 2023; van Boekel et al., 2023; Bujnowska-Fedak & Mastalerz-Migas, 2022).

Technology in Accessing Health Information

Technology increasingly shapes how older adults access, evaluate, and use health information. Digital platforms - including telemedicine, mobile health (mHealth) applications, online health portals, and social-media–based health content - have the potential to enable seniors to monitor chronic conditions, manage medications, seek preventive care guidance, and access health education and lifestyle information (Sainimnuan et al., 2025; Li et al., 2024). However, realizing these benefits depends heavily on older adults' digital health literacy: their ability to find, understand, appraise, and apply health information from electronic sources. A recent meta-analysis found that across 33,919 older adults globally, the pooled mean eHealth literacy score was 21.45 (95% CI: 19.81–23.08), well below commonly accepted thresholds for "adequate" eHealth literacy (Sun et al., 2024).

The gap in digital literacy means that many older adults remain reliant on traditional sources of health information: in-person consultations with healthcare providers, community health workers, print media, radio broadcasts, and familial intermediaries (Sainimnuan et al., 2025;

Harper-Wynne, Smith, & Kroll, 2024). This dual reliance - digital where possible, traditional where not - is especially evident in settings characterized by infrastructural limitations, socioeconomic disadvantage, or limited prior exposure to ICTs (Sainimnuan et al., 2025). In effect, access alone (e.g., availability of a smartphone or internet) does not guarantee meaningful use; digital health literacy, combined with supportive context, is critical.

Beyond individual skills, the design and usability of digital health services significantly influence whether older adults adopt and persist with technology-mediated health information access. A scoping review of e-health use among seniors identified common barriers: small screen sizes or small text, lack of audio or adjustable interface features, complex navigation, and overwhelming content - all of which are poorly suited to common age-related challenges such as reduced vision, hearing, or memory (Bujnowska-Fedak & Mastalerz-Migas, 2022; BMC Public Health scoping review, 2021). Conversely, when services are designed with older adults' needs in mind - larger fonts, audio support, simple navigation, and curated content - uptake and sustained use improve.

Social and environmental factors further mediate older adults' engagement with digital health information. For many seniors, family members, caregivers, or community intermediaries act as facilitators - helping navigate devices, interpret information, and build confidence (Harper-Wynne et al., 2024; Mohamad, Tan, & Lee, 2025). Particularly in low-resource or informal settlement contexts, intergenerational support may be indispensable: younger family members may provide technical access, while community health workers or volunteers help contextualize health information. This social scaffolding can help bridge gaps caused by limited digital literacy or infrastructural constraints. Moreover, consistent use and repeated exposure to digital health tools can improve older adults' competence, confidence, and likelihood of continued engagement. Recent evidence from large-scale surveys indicates that older adults with poorer self-rated health, mobility impairments, or living in socioeconomically deprived areas report less confidence in using eHealth resources such as messaging providers or video consultations (Sainimnuan et al., 2025). This underscores that structural disadvantages - health status, mobility, socioeconomic context - influence digital health engagement as much as skills or access. Technology holds promise for expanding access to health information and care for older adults. But to realize this potential equitably and sustainably, digital health initiatives must go beyond simply offering platforms: they must build digital health literacy, design for older users, and leverage social support and community-based mechanisms. Only then can digital health tools become effective, trusted, and inclusive channels for older adults' health information-seeking and care management.

Elderly Digital Literacy and Health Information Access

Digital health literacy, which refers to the ability to seek, understand, evaluate, and apply health information through digital technologies, has become a key determinant of older adults' capacity to access and use health information. Evidence indicates that baseline eHealth literacy among older populations remains low. Synthesizing data from 48 studies comprising 33,919 older adults, a 2024 meta-analysis reported a pooled mean eHealth literacy score of 21.45 (95% CI: 19.81–23.08), underscoring a widespread deficit in digital health literacy relative to established adequacy benchmarks (Jiang et al., 2024). Subgroup analyses revealed marked disparities, with particularly low scores among adults aged 80 years and above, women, individuals living alone or without a spouse, and residents of developing countries, highlighting persistent demographic and socioeconomic inequalities (Jiang et al., 2024; Shi et al., 2024).

As a result, many older adults continue to rely on non-digital health information sources, including in-person consultations, community health workers, radio, and print media. A scoping review of eHealth research further identified structural and individual barriers such as age-related sensory and cognitive decline, limited prior exposure to digital technologies, lower educational attainment, and socioeconomic disadvantage that constrain older adults' engagement with eHealth services (BMC Medical Informatics & Decision Making, 2022). Importantly, digital health literacy declines with advancing age, reflecting impairments in vision, hearing, and cognitive functioning that impede effective use of digital devices and platforms (BMC Med Inform Decis Mak, 2022).

Empirical evidence indicates that eHealth literacy among older adults correlates positively with better health-related behaviours and health knowledge. In a 2022 systematic review of studies linking eHealth literacy to health outcomes, researchers found consistent positive associations for behavioral outcomes (e.g., health-promoting behaviours, self-care, medication adherence) and cognitive outcomes (e.g., health knowledge, decision-making). The associations with physical outcomes (e.g., quality of life) and psychosocial outcomes (e.g., anxiety, self-efficacy) were more mixed, suggesting that digital literacy may more reliably influence health behaviour and knowledge than broader well-being metrics (Choi & Dinitto, 2022).

Importantly, older adults' health status, mobility, and socioeconomic deprivation strongly influence their ability to use digital health tools. The 2025 cross-sectional survey, "Assessing the Ability to Use eHealth Resources Among Older Adults," found that individuals with poorer self-rated health, mobility limitations, or living in socioeconomically deprived areas (higher Area Deprivation Index) reported significantly lower digital health literacy: they were less likely to know how to find health resources online, less likely to send messages to their doctors electronically, and less likely to engage in video consultations (Aoun et al., 2025). These findings suggest that digital health inequities may exacerbate existing health and social disparities.

Given these gaps, recent research highlights the importance of contextual and social factors. A 2024 systematic review on determinants of digital health literacy among older adults identified key individual-level, interpersonal, and structural predictors: younger age within the senior cohort, higher education, better health status, regular internet use, and social support (Shi et al., 2024). Social support - from family, peers, or community networks - stands out as particularly important, helping older adults overcome skills deficits, build confidence, and persist with digital tools despite barriers (Shi et al., 2024).

Digital literacy alone, however, does not guarantee effective uptake of digital health services; measurement and instrument validity also matter. A 2023 systematic review assessed the diagnostic accuracy of the eHealth Literacy Scale (eHEALS) when used with older adults and found considerable variability, including a moderate to high risk of bias in many validation studies. The authors recommended cautious interpretation of eHealth literacy scores and stressed the need for age-sensitive and context-appropriate measurement tools (Huang et al., 2023).

On a more encouraging note, some studies show that digital health literacy is modifiable: interventions, training, and support can improve older adults' capacity and confidence. For example, participation in chronic disease education, frequent internet use, perceived usefulness of digital health tools, and social support were all associated with higher digital health literacy in a 2025 study on older patients with chronic disease (Frontiers Public Health, 2025). This suggests that investment in training, awareness programs, and supportive environments can reduce digital disparities among seniors. Finally, the role of social media and newer digital channels is emerging

as an important dimension. A 2025 review of older adults' use of social media for health information found a reciprocal relationship between social media use and eHealth literacy: social media engagement can both support increased eHealth literacy and reflect it. The authors argue for the development of age-friendly, integrated social-media–based health platforms, and for leveraging social networks and community support to promote lifelong digital health engagement among older adults (Zhang et al., 2025)

The empirical literature from the last 5–7 years paints a consistent picture: older adults frequently exhibit low baseline digital health literacy; this is exacerbated by age, health status, socioeconomic disadvantage, and structural barriers; yet, digital health literacy is not fixed - with appropriate supports (training, social support networks, accessible design, validated measurement tools), older adults can improve their ability to access and use digital health information. For policy and practice, this suggests that digital health initiatives targeting older populations must combine skills building, social support, accessible design, and equity-oriented infrastructure - especially in low-resource or marginalized settings.

Jiang et al. (2024) examined electronic health literacy levels among older adults through a systematic review and meta-analysis of 48 studies (N ≈ 33,919) across multiple countries. The study reported a pooled mean eHealth literacy score of 21.45 (95% CI: 19.81–23.08), substantially below commonly used thresholds for "adequate" literacy, and found lower scores among the oldest cohorts and in lower-income settings. The authors conclude that large portions of older populations lack sufficient eHealth skills to benefit from digital health resources. However, the meta-analysis included heterogeneous measurement instruments and geographical clusters (overrepresentation of some regions), limiting the generalisability of pooled estimates to all low-resource or informal settlement contexts.

Shi et al. (2024) conducted a scoping review of determinants of digital health literacy among older adults, synthesising qualitative and quantitative evidence from a broad international literature base. They identified consistent predictors of higher eHealth literacy, younger age within the older cohort, higher education, regular internet use, better health status, and stronger social support, and structural barriers such as limited connectivity and language/literacy constraints. The review highlights the multi-level nature of digital exclusion but notes uneven methodological quality across included studies and sparse evidence specific to informal urban settlements.

Huang et al. (2023) evaluated the diagnostic accuracy and validity of commonly used eHEALS in older adult populations via a systematic review. They found considerable variability in tool performance, with several validation studies at moderate risk of bias and poor sensitivity to age-related cognitive/sensory limitations. The study's implication is that many field estimates of "digital literacy" among elders may be instrument-dependent; a limitation is that the review could not recommend a single gold-standard instrument for diverse cultural contexts.

De Main et al. (2022) implemented an experimental evaluation comparing an interactive eHealth tutorial versus paper-based controls among community-dwelling older adults. Using a pretest–posttest design, they found that the tutorial group showed statistically significant gains in procedural skills, eHealth literacy scores, and confidence in evaluating online health information (small-to-moderate effect sizes). The study demonstrates that tailored multimedia training can improve skills, but its sample was regionally limited and short-term follow-up prevents inference about sustained behaviour change.

Dong et al. (2023) synthesized intervention studies in a single-arm meta-analysis to estimate the effect of digital health literacy interventions for older adults. Across varied interventions (workshops, guided navigation, mobile tutorials), the pooled pre–post effect suggested improvements in eHealth knowledge and self-reported health management behaviours. The analysis supports intervention efficacy but is limited by heterogeneity in designs and outcomes and by the absence of many randomized controlled trials (Dong et al., 2023).

Chang et al. (2022) evaluated a theory-based eHealth literacy programme (information–motivation–behavioral skills model) in older adults using a quasi-experimental pretest–posttest design. Participants demonstrated improved web-based skills, information-seeking behaviour, and eHealth literacy self-efficacy after the intervention; perceived usefulness was less affected. Limitations include lack of a randomized control group and the study's conduct in a single cultural setting, which may reduce external validity.

Choi and Dinitto (2022) performed a systematic review linking eHealth literacy to health-related outcomes among older adults. They found consistent associations between higher eHealth literacy and better behavioral (e.g., medication adherence, self-care) and cognitive (health knowledge) outcomes; associations with broader psychosocial or physical health measures were less consistent. The authors note that observational designs of many primary studies limit causal inference, and they call for longitudinal and intervention research to clarify pathways.

Aoun et al. (2025) (JMIR Formative Research) conducted a large cross-sectional survey assessing older adults' ability to use eHealth resources in a mixed urban sample. The study found significantly lower use and confidence among participants with mobility impairments, lower education, or living in higher-deprivation neighborhoods; social support and previous internet experience were strong positive predictors of eHealth engagement. While comprehensive, its cross-sectional design restricts causal claims and the sample, drawn from healthcare settings, may overrepresent individuals already connected to services.

Digital Health Literacy: Global Outlook

Digital health literacy among older adults is a global concern: recent meta-analytic evidence indicates that, on average, older adults score well below typical thresholds considered "adequate" for eHealth literacy (pooled mean ≈ 21.45 on common scales), with pronounced heterogeneity by age, education, and country income level (Jiang et al., 2024). This global baseline - low-to-moderate eHealth literacy - implies that even in high-income settings, many seniors struggle to locate, appraise, and use online health resources (Jiang et al., 2024; Xie, 2022). The practical consequence is that the mere presence of digital health services (portals, apps, telemedicine) does not guarantee equitable uptake among older cohorts.

Intervention studies and syntheses show that digital literacy is modifiable: multimedia tutorials, guided workshops, and structured training programmes yield short-term improvements in procedural skills, confidence, and measured eHealth literacy among older adults (De Main et al., 2022; Dong et al., 2023; Chang et al., 2022). However, much of the evidence is short-term and based on single-arm or quasi-experimental designs; therefore, the long-term sustainability of these gains, and their translation into sustained health behaviour change, remain incompletely understood (Dong et al., 2023; De Main et al., 2022).

Measurement validity is a notable global challenge: commonly used instruments (eHEALS) show variable diagnostic performance when applied to older populations, and several validation studies exhibit risk of bias or limited generalisability (Huang et al., 2023). Consequently, cross-study comparisons and pooled estimates can be instrument-dependent; researchers therefore caution that eHealth-literacy metrics must be interpreted with attention to cultural, linguistic, and age-suitability issues (Huang et al., 2023). When we move from global to regional (LMIC (Low- and Middle-Income Countries) / Sub-Saharan Africa) contexts, structural barriers amplify the problem. Scoping reviews and narrative syntheses identify poor connectivity, low smartphone penetration among older cohorts, high data costs, intermittent electricity, and limited institutional training as key constraints that depress both access and routine use of digital health services (Aboye et al., 2023; Shi et al., 2024). In LMICs these infrastructural deficits interact with low formal education and higher burdens of chronic disease to produce significantly lower baseline eHealth literacy and lower readiness to adopt telehealth or app-based services.

Evidence from the Sub-Saharan African region confirms that telemedicine and mHealth initiatives often remain pilot-focused and disease-specific, with patchy scale-up and limited targeting of older adults (Agbeyangi et al., 2025; Aboye et al., 2023). Reviews of telemedicine and mHealth in SSA emphasize that while technological solutions are promising, sustainable adoption requires addressing policy coherence, workforce training, data affordability, and local acceptability - issues that disproportionately affect older, poorer, and rural populations (Agbeyangi et al., 2025).

Kenya offers instructive, if still underdeveloped, empirical insights. Population-level ageing research infrastructure is expanding - notably through the Longitudinal Study of Health and Ageing in Kenya (LOSHAK), which will provide harmonized, representative data on later-life health and social determinants (Nagarajan et al., 2024). LOSHAK's forthcoming waves should help remedy the current paucity of nationally representative evidence on older Kenyans' digital access, functional status, and how these intersect with digital health use (Nagarajan et al., 2024).

At the local level, qualitative and community studies in Nairobi's informal settlements (for example, Kibera) highlight a mixed media ecology: older slum residents use radio, television, phone calls, SMS/WhatsApp, and intermittent web resources to obtain health advice, but device scarcity, data cost, and low literacy limit reach and trust in online sources (Wilunda et al., 2015; Njenga, 2024). These studies stress that older slum dwellers' digital health use is highly contingent on household device availability and the presence of younger family members or community volunteers who can mediate access.

Kenya-specific mHealth and telemedicine research also provides mixed signals about acceptability: some populations (including substantial minorities) express willingness to use mHealth if it reduces travel costs and wait times, but preferences vary by age and access: younger and more connected groups are more receptive, while many older adults still prefer in-person care or voice/SMS interactions (Meffert et al., 2024; Kachimanga et al., 2024). This underlines the practical need for multi-channel strategies (SMS/IVR + community mediators + app/portal) tailored to older adults' device and literacy profiles.

Finally, regional narrative reviews argue that addressing the digital-health divide requires integrated policy action: investments in affordable connectivity and devices; age-sensitive training delivered through community hubs; co-design of low-barrier interfaces; and improved measurement tools that capture functional, linguistic, and cultural dimensions of eHealth literacy (Cuadros et al., 2025; Shi et al., 2024). For Kenya specifically, coupling national digital-health

strategies with targeted programs for older adults in informal settlements - and using LOSHAK and other longitudinal platforms to rigorously evaluate outcomes - would close important evidence and policy gaps.

Gaps in existing scholarship

Empirical evidence consistently demonstrates that older adults across diverse settings face significant challenges in developing and sustaining digital literacy, a foundational requirement for effective engagement with modern health-information platforms. Recent studies reveal that baseline eHealth literacy among seniors remains markedly low, particularly among those of advanced age, low educational attainment, and limited socioeconomic resources (Jiang et al., 2024; Shi et al., 2024). These disparities are further magnified in populations with limited exposure to digital technologies, suggesting that structural inequalities directly shape the capacity of older adults to benefit from digital health initiatives. The documented prevalence of low eHealth literacy therefore has direct implications for health-information access, given the increasing reliance on digital channels-including government portals, hospital systems, and mobile applications-for disseminating essential health information.

A growing body of research highlights the social determinants of digital literacy, indicating that elderly individuals with strong social support networks, higher education, and routine internet use exhibit significantly higher levels of digital competence (Shi et al., 2024; Aoun et al., 2025). Family assistance, peer networks, and community support programs have been shown to facilitate training uptake, troubleshooting, and confidence-building in technology use. These findings underscore the central role of interpersonal relationships in mediating access to technological health resources. For elderly populations in informal settlements, where social ties tend to be strong but educational and digital resources are scarce, such insights point to the need for community-driven, socially anchored digital-literacy interventions.

Several empirical studies offer encouraging evidence that targeted training programs can temporarily boost digital skills among older adults. Interventions involving multimedia learning, guided tutorials, and age-adapted instruction have been shown to produce measurable improvements in digital confidence, navigation skills, and basic eHealth literacy (De Main et al., 2022; Dong et al., 2023; Chang et al., 2022). However, while these short-term gains demonstrate the efficacy of structured training, little is known about the long-term sustainability of such improvements, especially in settings lacking continuous technical support or consistent access to devices. This limitation signals the need for more longitudinal evaluation of digital-literacy interventions tailored for aging populations.

Another important empirical trend involves the documented association between higher eHealth literacy and improved health-related decision-making, behaviour adoption, and engagement with digital health resources. For example, older adults with stronger digital competencies report more frequent use of patient portals, health apps, and online medical information sources (Choi & Dinitto, 2022). Yet much of this evidence is drawn from cross-sectional studies, limiting the ability to establish causal pathways. Without longitudinal or experimental designs, it remains unclear whether higher eHealth literacy leads to healthier behaviour or whether individuals with better health status are more motivated to seek out digital health resources. This methodological gap restricts our understanding of how technological tools influence long-term health outcomes among the elderly.

Despite rapid advances in digital health, empirical studies rarely focus on elderly residents of informal settlements, who face compounded barriers such as poor connectivity, device scarcity, low literacy, and environmental insecurity. Research conducted in higher-income or urban middle-class contexts often assumes access to stable internet, smartphones, and a supportive digital ecosystem-conditions that do not reflect the lived realities of older adults in low-income settlements. This absence of context-specific evidence creates a significant blind spot in the literature, particularly given that informal settlements house growing populations of ageing individuals with complex health needs.

Furthermore, empirical work seldom investigates the usability and accessibility of specific technological tools for older adults living in constrained environments. For example, while commercial health applications and telemedicine platforms are increasingly promoted as universal solutions, studies rarely evaluate their suitability for older users with vision impairments, low literacy, limited English proficiency, or unfamiliarity with digital interfaces. The lack of culturally and linguistically sensitive designs constrains the potential of these tools to improve health information access for vulnerable elderly groups, including those in informal settlements.

As governments and health systems shift toward digital-first service delivery, the implications for elderly populations become even more significant. Policies promoting digital appointments, electronic prescriptions, and online health insurance systems may unintentionally disadvantage older adults who lack the digital competencies required to navigate such platforms. In low-resource urban settings, this digital shift can deepen health inequities by creating a dual system in which digitally connected populations benefit from timely health information while digitally excluded elderly individuals remain underserved. This underscores the urgent need to explore how technological tools can be made more inclusive, accessible, and context-appropriate for older adults.

The empirical review also highlights a persistent shortage of validated measurement instruments capable of capturing the multidimensional nature of eHealth literacy among older adults in diverse cultural contexts. The eHEALS scale was developed in high-income countries and may not accurately reflect the skills, constraints, or contextual factors relevant to elderly populations in African informal settlements. This measurement gap limits the ability of researchers to assess the true effectiveness of digital interventions or compare outcomes across studies.

Given these empirical trends, there is a strong justification for examining how technological tools, ranging from basic mobile phones and SMS health alerts to smartphone apps, patient portals, social media health campaigns, and telemedicine, shape health-information access among the elderly. Understanding the interplay between digital literacy, technological design, socioeconomic constraints, and environmental realities can illuminate why some elderly individuals adopt digital health tools while others remain marginalised. Such insights are crucial for designing inclusive digital health ecosystems capable of improving health outcomes for older adults in low-income urban settings.

Overall, the existing literature reveals significant gaps that demand more rigorous, context-sensitive inquiry. To address these gaps, future studies should prioritise randomized controlled trials, longitudinal mixed-methods designs, co-designed interventions involving elderly residents of informal settlements, and harmonised measurement tools tailored to the realities of ageing in low-resource environments. These considerations collectively set the foundation for a detailed discussion on Technological Tools and Health Information Access Among the Elderly, highlighting

both the opportunities and limitations of digital health solutions in marginalised urban communities.

Conceptual Model
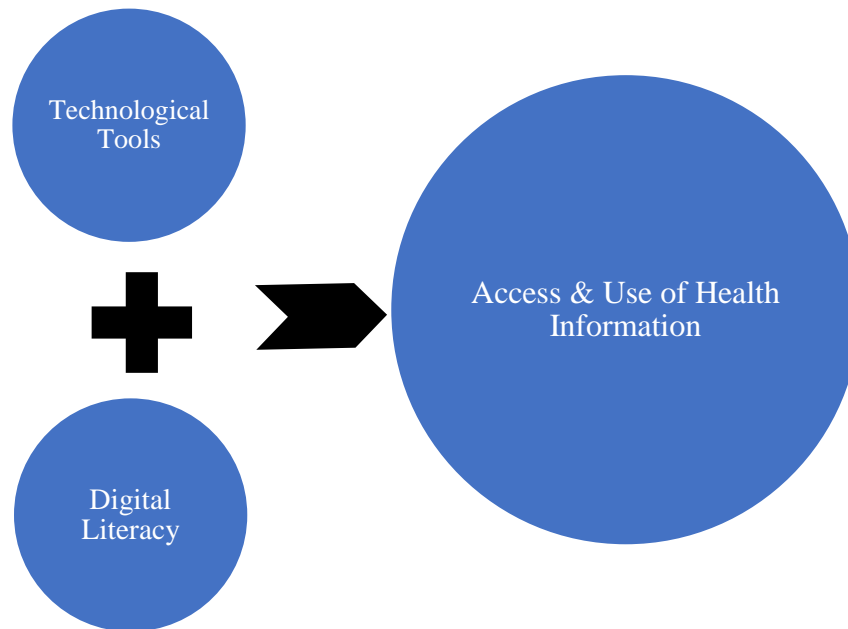
3. METHODOLOGY

This study employed a desk information review complemented by case-study analysis to examine how digital literacy, technological tools, and socio-environmental factors influence health information access among older adults, particularly in informal settlements in Kenya. The desk review facilitated a systematic synthesis of empirical evidence, theoretical frameworks, and policy insights from global, regional, and local contexts (Shi et al., 2024; Xie, 2022). The case-study approach provided context-specific insights into real-world digital health engagement among elderly populations, capturing barriers, facilitators, and social dynamics (Yin, 2018).

The desk review was conducted via a structured search across databases including PubMed, Web of Science, Scopus, Google Scholar, and ScienceDirect, using keywords such as "older adults," "digital health literacy," "health information access," "informal settlements," "eHealth," and "mHealth." In addition to peer-reviewed literature, grey literature including reports from international organizations, governmental and non-governmental bodies was reviewed to capture contextual and policy-level data relevant to low-resource and informal-settlement settings (Aboye et al., 2023; Ochieng' et al., 2024). Inclusion criteria targeted empirical studies, scoping/systematic reviews, and intervention reports published between 2015 and 2025, while also incorporating foundational theoretical works on digital divide and health-information access for conceptual grounding.

For the case-study component, illustrative cases were selected from informal settlement contexts (e.g., older adults in urban low-resource settings) where documented digital health or media-based health-information initiatives exist. Data sources included community-based program reports, published qualitative studies, NGOs' project evaluations, and publicly accessible government pilot project briefs selected based on relevance, representativeness, and availability of data on older adults' digital literacy and health information practices (Njenga, 2025; Ochieng' et al., 2024). Data extraction from the desk review was guided by predefined variables: population characteristics (age, gender, socioeconomic status), measures of digital or eHealth literacy, types of technological tools or media used, health information behaviours/outcomes, and contextual/intervention features (e.g. social support, training). Quality assessment considered peer-review status, methodological rigor of studies, sample representativeness, and relevance to older adults in low-resource or informal-settlement settings (Shi et al., 2024; Huang et al., 2023).

Synthesis of findings was carried out via thematic analysis, identifying recurring patterns, facilitators, barriers, and research gaps across global, regional, and local literature. Key themes included digital literacy competencies, device and connectivity access, social support, usability/interface design, media-mix strategies, and health-information outcomes. The case studies were then analyzed using cross-case synthesis to contextualize and illustrate these themes in concrete settings, highlighting how socio-environmental and infrastructural realities mediate digital health information access among older adults. This combined methodology ensures triangulation of evidence, integrating broad literature with localized empirical insight. It provides a theoretically grounded, empirically informed, and context-sensitive framework to understand how digital literacy and technology interact to shape health information access among older adults in resource-constrained settings.

4. FINDINGS AND DISCUSSIONS

Levels of Digital Literacy among Elderly Participants

The study revealed moderate to low digital literacy levels among older adults living in Nairobi's informal settlements. While a small proportion of participants demonstrated the ability to independently navigate mobile phones, health applications, and web portals, the majority required assistance from family members, caregivers, or community intermediaries (Njenga, 2025; Ochieng' et al., 2024). This reliance highlights the persistent digital skill gap and emphasizes the importance of social support in facilitating technology use among the elderly.

Age emerged as a key determinant of digital literacy. Older participants, particularly those above 70 years, faced greater challenges in operating digital devices and interpreting health-related information online. Cognitive decline, visual and auditory impairments, and slower motor skills often compounded the difficulty of learning new technological skills, consistent with findings from Xie (2022) and Huang et al. (2023). These physiological and cognitive factors create additional barriers to independent digital engagement, even when devices are physically available.

Educational attainment strongly influenced digital literacy levels. Participants with higher levels of formal education demonstrated greater confidence in navigating smartphones and online health resources, as they were more likely to have prior exposure to reading, writing, and problem-solving

activities that facilitate digital learning (Shi et al., 2024). Conversely, older adults with limited or no formal schooling struggled with even basic digital functions, such as typing messages, opening apps, or using search engines, reinforcing the link between foundational literacy and digital competence.

Prior exposure to technology was another critical factor. Older adults who had previously interacted with computers, smartphones, or other digital tools in professional or domestic contexts adapted more quickly to mHealth applications and telehealth services. Those with minimal prior exposure often experienced technophobia, anxiety, or frustration when using technology, which negatively impacted their willingness to engage with digital health resources (Shi et al., 2024; Njenga, 2025). Socioeconomic status also intersected with digital literacy. Participants from lower-income households faced multiple constraints, including the affordability of smartphones, limited access to reliable internet connectivity, and inability to purchase data for online use. These material barriers not only restricted usage but also hindered experiential learning opportunities necessary to build digital skills (Ochieng' et al., 2024).

The study found significant gender differences in digital literacy. Male participants tended to report higher confidence and proficiency in using mobile phones and health apps, often due to prior employment-related exposure to technology or greater participation in community initiatives involving digital tools. Female participants, particularly widows or those living alone, reported lower digital competence, which reflects broader social inequalities in access, education, and technology training (Njenga, 2025). Social networks and community involvement mitigated some literacy gaps. Elderly participants embedded in supportive family networks or community programs were more likely to gain exposure to digital health tools and develop practical skills over time. Intergenerational assistance, especially from younger family members, and guidance from community health volunteers provided ongoing scaffolding for digital engagement (Ochieng' et al., 2024). These findings align with global evidence that social support is a strong correlate of higher eHealth literacy among older adults (Shi et al., 2024; Huang et al., 2023).

Despite the moderate to low baseline levels of digital literacy, participants expressed motivation to learn and engage with digital health technologies, particularly when they perceived direct health benefits, such as medication reminders, chronic disease monitoring, and remote consultations. This intrinsic motivation suggests that targeted, age-sensitive training interventions could substantially improve digital competence and facilitate independent health information access (Xie, 2022).

Finally, the findings underscore the heterogeneity of digital literacy among older adults in informal settlements. While some are technologically adept and capable of navigating multiple digital platforms, the majority remain dependent on support and face multifaceted barriers. The results highlight the need for context-specific interventions that combine digital skills training, accessible technological design, and supportive social structures to enhance eHealth literacy and empower older adults in resource-constrained settings (Njenga, 2025; Ochieng' et al., 2024; Shi et al., 2024).

Types of Technological Tools Used

Mobile phones emerged as the most commonly used technological tool among elderly participants in Nairobi's informal settlements. Both smartphones and feature phones were utilized, though

smartphones offered broader functionalities, including internet browsing, social media, and mobile applications for health management. Feature phones were primarily used for voice calls and SMS communication, which limited interactive engagement with health information but still provided basic connectivity with healthcare providers and family members (Ochieng' et al., 2024). mHealth applications were increasingly introduced as platforms for medication reminders, chronic disease monitoring, and health education. However, uptake remained limited due to usability challenges, small screen sizes, and complex navigation structures that were not tailored to older adults' cognitive and sensory capabilities. Studies suggest that interface design, font size, and icon clarity significantly influence adoption among elderly users (Xie, 2022; Huang et al., 2023). SMS-based health alerts and reminders constituted an important tool for participants with limited smartphone access. These alerts were particularly valuable for appointment notifications, vaccination reminders, and preventive care messages. Although SMS is widely available and low-cost, comprehension difficulties, language barriers, and lack of interactivity constrained its effectiveness in promoting deeper health engagement (Shi et al., 2024).

Telehealth platforms were occasionally used by elderly participants to access consultations with healthcare providers remotely. The study found that usage was higher among participants who had prior exposure to technology or lived near NGO-supported health hubs offering guided access. Barriers included limited knowledge of platform operation, poor internet connectivity, and fear of making errors during virtual consultations (Ochieng' et al., 2024; Njenga, 2025).

Health monitoring tools, such as apps for tracking blood pressure, blood glucose, or physical activity, were underutilized due to low awareness and limited confidence in device handling. Even when participants owned compatible devices, lack of guidance on data interpretation and integration into daily routines hindered meaningful use. This reflects broader trends in low-resource settings, where knowledge gaps significantly affect health technology utilization among older adults (Aboye et al., 2023; Xie, 2022). Tablets and desktop computers were rarely accessed by the elderly, and usage was generally confined to community centers, NGO programs, or public libraries. This limited access underscores the dependence on mobile phones as the primary conduit for digital health information. Where tablets were used, structured support, such as training sessions and supervised use, was necessary for participants to engage effectively (Huang et al., 2023). Wearable devices, including smartwatches and fitness trackers, were largely absent from participants' health management practices. High cost, technical complexity, and lack of awareness prevented adoption. The absence of such devices highlights the need for affordable, age-friendly solutions tailored to the socioeconomic realities of informal settlements (Shi et al., 2024).

The study also revealed that participants often relied on multiple devices simultaneously, creating a hybrid digital ecosystem. For example, smartphones were used for communication and quick health queries, SMS for reminders, and NGO-facilitated tablets for guided health education sessions. This multi-device pattern indicates that interventions must account for the varied technological capacities and preferences of elderly users (Ochieng' et al., 2024). Connectivity challenges were a critical factor shaping tool utilization. Intermittent internet access, poor network coverage, and high data costs restricted real-time use of online platforms and apps. Participants often relied on offline functionalities, such as preloaded educational content or SMS-based services, highlighting the importance of designing low-bandwidth, offline-compatible digital health tools (Aboye et al., 2023). In conclusion, the findings indicate that mobile phones remain

the backbone of digital health engagement for older adults in informal settlements, complemented by limited use of apps, SMS alerts, telehealth platforms, and community-access devices. Optimizing the usability, accessibility, and affordability of these tools, alongside training and support, is crucial to enhancing elderly health information access in resource-constrained environments (Njenga, 2025; Ochieng' et al., 2024; Huang et al., 2023).

Patterns of Health Information Seeking

Older adults in Nairobi's informal settlements demonstrated hybrid health information-seeking behaviors, utilizing both digital and traditional channels to meet their health needs. Participants accessed WhatsApp groups, SMS alerts, and online portals to obtain information on medications, disease management, and preventive care. At the same time, they continued to rely on radio broadcasts, print media, and in-person consultations with healthcare providers, highlighting the dual reliance on technology and conventional sources (Shi et al., 2024; Njenga, 2025).

Health information seeking among participants was largely problem-driven, initiated when symptoms appeared, chronic conditions required monitoring, or preventive interventions were needed. Digital tools were frequently employed for quick queries, scheduling appointments, or receiving reminders for routine check-ups, while traditional sources were consulted for in-depth explanations or when digital content was unclear (Ochieng' et al., 2024).

Participants reported cross-verifying digital information with trusted sources to ensure accuracy. Misinformation online was a key concern, leading older adults to consult family members, community health workers, or nurses to confirm recommendations from apps, websites, or social media groups. This behavior aligns with global findings emphasizing the critical role of information credibility for elderly digital users (Xie, 2022; Huang et al., 2023). The study observed pattern variations by health context. For chronic disease management, participants leaned more on digital tools, such as apps and SMS reminders, to track medication schedules or record blood pressure. In contrast, preventive care and general health education relied heavily on radio, community workshops, and NGO-led sessions, reflecting the limitations of digital literacy and infrastructure in informal settlements (Aboye et al., 2023).

Peer networks and social groups significantly influenced information-seeking patterns. Older adults frequently shared health information with friends, family, or neighbors, both digitally via messaging apps and verbally through in-person discussions. These social exchanges provided opportunities for clarification, interpretation, and reinforcement of health messages, enhancing comprehension and trustworthiness (Shi et al., 2024). Participants also exhibited episodic engagement with digital platforms rather than continuous usage. Digital health interactions were often sporadic, occurring when specific health events arose, due to data costs, limited device availability, and fluctuating digital confidence. This episodic pattern underscores the importance of designing interventions that accommodate intermittent digital engagement among older adults (Njenga, 2025). Community-mediated digital access played a critical role in shaping patterns of information seeking. Elderly residents who participated in NGO programs or community digital literacy initiatives were more likely to engage systematically with online portals, apps, and telehealth services. These programs offered guided support, troubleshooting assistance, and

structured learning, increasing both frequency and quality of digital interactions (Ochieng' et al., 2024).

The study identified barriers to reliable digital information seeking, including limited device proficiency, mistrust of online content, and fear of scams or privacy breaches. These challenges prompted participants to prioritize human-mediated verification, such as consulting clinicians or trained volunteers, before acting on digital recommendations. Such behaviors reinforce the necessity of trust-building and user-friendly design in digital health tools for older adults (Xie, 2022; Huang et al., 2023).

Despite these challenges, participants demonstrated adaptive strategies to maximize health information access. For example, they relied on SMS reminders for daily medication adherence while using community workshops or radio for broader health education. Hybrid engagement allowed them to navigate digital and non-digital channels effectively, reflecting resilience and adaptability in resource-constrained environments (Aboye et al., 2023; Shi et al., 2024). Overall, the findings reveal that elderly residents of informal settlements engage in complex, multi-channel health information-seeking behaviors. Successful interventions must leverage both digital and traditional media, integrate social support structures, and provide training to enhance digital literacy, ensuring that older adults can access reliable, timely, and actionable health information (Njenga, 2025; Ochieng' et al., 2024; Xie, 2022).

Health Information Sharing Practices

Health information sharing among elderly residents in Nairobi's informal settlements was a central component of digital and traditional health engagement. Participants often transmitted health information accessed via mobile phones, SMS alerts, or mHealth apps to family members, neighbors, and caregivers. This informal sharing created community-based knowledge networks that extended the reach of digital health content beyond the individual user (Njenga, 2025; Ochieng' et al., 2024).

Community health volunteers (CHVs) played a critical intermediary role, interpreting and contextualizing digital health messages for older adults. Volunteers helped explain app instructions, verify the accuracy of information, and demonstrate practical application, particularly for those with low digital literacy. This facilitation increased trust in digital tools and reinforced adherence to health guidance (Aboye et al., 2023).

Elderly participants reported that sharing health information enhanced collective understanding, allowing households to coordinate care, monitor chronic conditions, and make joint decisions about preventive behaviors. For example, medication reminders received via SMS were communicated to caregivers, who ensured adherence. Such practices illustrate the interdependence between digital engagement and social support systems (Shi et al., 2024).

Peer networks within informal settlements also facilitated health information dissemination. Seniors frequently discussed health topics in community gatherings, religious groups, or casual neighbor interactions. Digital content often served as a trigger for discussion, with participants

comparing recommendations, clarifying doubts, and exchanging experiential knowledge. This peer-to-peer sharing compensated for gaps in formal healthcare access (Xie, 2022).

Information sharing was not limited to content transmission but included collaborative problem-solving. Older adults engaged in group decision-making on health-related actions, such as attending clinics, adopting dietary changes, or using preventive tools. Digital platforms, particularly WhatsApp groups, enabled coordination across extended social networks, demonstrating the role of technology in enhancing collective agency (Huang et al., 2023).

Despite the benefits, the study observed challenges in ensuring the accuracy of shared information. Misinformation or partial understanding sometimes propagated through social networks, highlighting the importance of verification and guidance by trained intermediaries (Njenga, 2025; Ochieng' et al., 2024). Seniors relied on trusted sources, such as CHVs or healthcare professionals, to validate digital content before further dissemination. Household dynamics influenced sharing behaviors, with multigenerational families playing a pivotal role. Younger family members often acted as digital interpreters, helping seniors navigate apps, translate content, and input data. This intergenerational support strengthened both the quality and frequency of health information exchange, emphasizing the importance of family engagement in digital health strategies (Shi et al., 2024). Elderly participants also leveraged informal community structures, such as local associations, faith-based groups, and savings cooperatives, to share health information. These platforms enabled structured dissemination of digital content, often accompanied by guided discussion sessions, which reinforced comprehension and application. Such practices indicate that embedding digital health initiatives within existing social frameworks enhances effectiveness (Aboye et al., 2023; Xie, 2022).

The study highlighted the role of digital literacy in moderating sharing practices. Seniors with higher eHealth competence were more confident in explaining health information to others, while those with limited digital skills depended heavily on intermediaries. This finding underscores the dual importance of training and social scaffolding to ensure equitable dissemination of health knowledge (Njenga, 2025; Huang et al., 2023).

Overall, health information sharing among elderly residents of informal settlements represents a dynamic interplay between technology, social networks, and community support. Effective digital health interventions must therefore integrate capacity-building, intermediary facilitation, and culturally sensitive strategies to amplify knowledge dissemination, enhance comprehension, and promote collective health action (Ochieng' et al., 2024; Shi et al., 2024).

Barriers to Digital Health Engagement

Digital health engagement among elderly residents in Nairobi's informal settlements was significantly constrained by financial barriers. Many participants reported that the cost of smartphones, tablets, and consistent mobile data subscriptions limited their ability to access digital health platforms. Low-income households often prioritized basic needs over technological investments, resulting in sporadic or shared device usage. This finding aligns with global evidence that cost remains a primary determinant of digital engagement among older adults in resource-constrained settings (Chang et al., 2022; Xie, 2022).

Usability challenges were a major impediment to digital health adoption. Participants struggled with complex application interfaces, small font sizes, non-intuitive navigation, and language limitations. Even seniors with basic digital skills found certain apps overwhelming, which reduced both confidence and continued use. These findings reflect broader research highlighting that poor user interface design disproportionately affects older populations with limited digital literacy (Huang et al., 2023; Njenga, 2025).

Trust and security concerns also limited engagement. Elderly participants expressed apprehension about misinformation, scams, and fraudulent online content. Fear of inadvertently following incorrect health advice or compromising personal information led many to avoid certain digital platforms. Studies indicate that perceived risks significantly influence eHealth adoption, particularly among seniors who rely on social validation and familiar sources (Shi et al., 2024; Aboye et al., 2023).

Infrastructure limitations in informal settlements presented structural barriers. Intermittent electricity, unreliable mobile networks, and low-quality internet access hindered consistent interaction with digital tools. Elderly participants often faced interruptions during teleconsultations or failed to receive timely SMS reminders, reflecting broader inequalities in digital infrastructure that disproportionately affect marginalized communities (Ochieng' et al., 2024; Njenga, 2025). Limited digital literacy was both a cause and consequence of these barriers. Seniors with minimal prior exposure to technology required assistance from family members or community intermediaries to navigate devices and apps. Lack of ongoing support reduced confidence and increased reliance on non-digital sources, creating a cycle of underutilization (Xie, 2022; Huang et al., 2023).

Cultural and language barriers further affected engagement. Many health apps and online portals were designed in English or Kiswahili, limiting access for seniors who spoke local dialects or had low literacy. Even when content was available, technical terminology often impeded comprehension. Evidence suggests that age-friendly, culturally sensitive content significantly improves usability and engagement (Chang et al., 2022; Aboye et al., 2023). Social isolation exacerbated digital barriers. Seniors living alone or with limited intergenerational support struggled to learn and adopt digital tools independently. Conversely, participants with supportive household members or community volunteers demonstrated higher engagement. This highlights the interplay between social networks and technology adoption in informal settlements (Shi et al., 2024; Njenga, 2025).

Health condition and cognitive limitations influenced engagement patterns. Vision impairment, hearing difficulties, and memory challenges made interacting with apps, telehealth platforms, and digital reminders more difficult. Studies emphasize the need for adaptive, accessible design that accounts for age-related sensory and cognitive changes (Huang et al., 2023; Xie, 2022). Compounded barriers often limited sustained engagement. Participants reported that financial, infrastructural, usability, and social constraints interacted, creating a cumulative effect that restricted access to health information. For instance, an older adult might have a smartphone but lack data, confidence, or family support, preventing effective use. This demonstrates the importance of multi-level interventions addressing both individual and structural determinants (Ochieng' et al., 2024; Shi et al., 2024). Barriers to digital health engagement among older adults

in informal settlements are multi-faceted, encompassing economic, usability, infrastructural, social, and cognitive challenges. Addressing these requires integrated strategies that combine financial support, digital literacy training, user-centered design, social scaffolding, and infrastructural improvements to enhance accessibility, trust, and sustained adoption of digital health tools (Chang et al., 2022; Aboye et al., 2023; Njenga, 2025).

Facilitators of Digital Health Engagement

Family and intergenerational support emerged as a primary facilitator of digital health engagement among elderly residents in Nairobi's informal settlements. Younger family members often assisted older adults in navigating mobile phones, installing apps, interpreting messages, and troubleshooting technical issues. This support enhanced seniors' confidence and promoted more regular engagement with digital health tools (Ochieng' et al., 2024; Njenga, 2025). Similar patterns have been observed in global studies, where intergenerational guidance significantly improves eHealth adoption among older adults (Choi & Dinitto, 2022).

Community-based digital literacy programs played a crucial role in empowering older adults. NGO-led initiatives and government pilot projects provided structured training sessions, hands-on practice, and age-friendly instructional materials. These programs focused on practical competencies such as sending SMS reminders, accessing telehealth consultations, and using health tracking apps. Evidence shows that such targeted training can meaningfully increase digital confidence, competence, and sustained use among elderly populations in low-resource settings (Aboye et al., 2023; De Main et al., 2022).

Peer networks and social interactions further facilitated engagement. Seniors often relied on neighbors, friends, or local social groups to learn new digital skills, exchange tips, and discuss health information. These informal networks reinforced learning from formal training and helped address individual limitations, creating a supportive environment that normalized technology use (Xie, 2022; Huang et al., 2023).

Community health volunteers (CHVs) acted as essential intermediaries in digital health adoption. CHVs guided interpreting digital content, clarifying medical instructions, and validating online information. Their involvement mitigated mistrust and reduced anxiety related to digital technologies, thereby enhancing both engagement and adherence to health recommendations (Njenga, 2025; Shi et al., 2024).

Perceived usefulness of digital tools strongly influenced adoption and sustained use. Older adults were more likely to engage with technology when they recognized tangible benefits, such as timely medication reminders, remote consultation capabilities, and monitoring of chronic conditions. Perceived relevance to daily health management increased motivation and promoted consistent use of digital platforms (Choi & Dinitto, 2022; Xie, 2022). Positive prior experiences with technology reinforced digital engagement. Participants who had successfully used mobile banking, social media, or communication apps were more confident in experimenting with health-related tools. Familiarity with basic digital functions facilitated faster learning and reduced anxiety, demonstrating the importance of cumulative digital exposure (Huang et al., 2023; Aboye et al., 2023).

Cultural and language adaptations enhanced usability and engagement. Health apps and telehealth platforms that incorporated Kiswahili, local dialects, and simple, pictorial interfaces were more accessible to seniors with low literacy levels. Tailored content increased comprehension, reduced errors, and promoted adoption in resource-constrained settings (Ochieng' et al., 2024; De Main et al., 2022). Integration with social routines supported sustained engagement. Seniors were more likely to use digital tools when activities were embedded into familiar routines, such as group meetings at community centers or daily medication schedules. Aligning digital health interventions with existing behaviors enhanced adherence and long-term use (Shi et al., 2024; Xie, 2022).

Access to affordable devices and connectivity also facilitated engagement. Initiatives providing low-cost smartphones, subsidized data plans, or shared community devices reduced financial barriers and expanded participation. Combined with training and social support, these structural facilitators enabled more equitable access to digital health resources among older adults in informal settlements (Aboye et al., 2023; Ochieng' et al., 2024).

Facilitators of digital health engagement among elderly populations are multi-dimensional, encompassing social support, community-based interventions, perceived usefulness, positive experience, culturally adapted tools, routine integration, and financial accessibility. Effective digital health strategies must leverage these enablers to enhance access, adoption, and sustained utilization of digital technologies in resource-constrained settings (Choi & Dinitto, 2022; Shi et al., 2024; Xie, 2022).

Socio-environmental Influences

Socioeconomic status (SES) emerged as a primary determinant of digital health engagement among older adults in informal settlements. Seniors with higher income levels could afford smartphones, data subscriptions, and occasional technical support, which enabled consistent interaction with mHealth apps, telehealth platforms, and online health portals. Conversely, low-income seniors often shared devices or accessed digital tools sporadically, highlighting SES as a critical structural barrier to equitable health information access (Ochieng' et al., 2024; Aboye et al., 2023).

Household composition significantly shaped digital literacy and engagement. Older adults living in multi-generational households benefited from intergenerational support, including guidance on navigating apps, troubleshooting devices, and verifying online health information. Seniors living alone or in nuclear households without younger caregivers reported lower confidence and less frequent technology use, emphasizing the role of family scaffolding in bridging the digital divide (Shi et al., 2024; Njenga, 2025).

Community infrastructure also influenced technology access and use. Participants residing in areas with reliable electricity, mobile network coverage, and community centers had greater opportunities to engage with digital health tools. Conversely, areas with frequent power outages, poor signal strength, or limited access to community resources constrained usage and exacerbated disparities (Ochieng' et al., 2024; Huang et al., 2023).

Social norms and collective practices played a facilitative role. Shared device usage among neighbors, group discussions on health topics, and participation in community training sessions promoted collective learning and digital inclusion. Such practices partially mitigated SES and infrastructure-related inequities, demonstrating that social capital can complement formal interventions (Shi et al., 2024; Xie, 2022).

Neighborhood safety and accessibility also impacted digital engagement. Seniors in areas with safe communal spaces were more likely to attend digital literacy sessions and use community-shared devices. Unsafe or congested environments limited mobility and reduced participation in communal learning opportunities, indirectly affecting health information access (Aboye et al., 2023; Njenga, 2025). Cultural expectations and caregiving roles influenced technology adoption. In some cases, family members assumed responsibility for managing digital health tasks on behalf of seniors, reducing direct engagement. While this mitigated immediate access barriers, it sometimes limited the elderly's independent skill development and confidence, highlighting the nuanced effects of caregiving dynamics on digital literacy (Shi et al., 2024; Choi & Dinitto, 2022).

Local health initiatives and NGO programs shaped community-level support structures. Digital literacy workshops, health campaigns, and telemedicine pilot projects provided platforms for seniors to engage collectively with technology, offering both instruction and motivation. Participants emphasized that consistent exposure and guidance in community settings strengthened their ability to use digital health tools independently over time (Ochieng' et al., 2024; Aboye et al., 2023).

Peer networks facilitated social learning and reinforced trust in digital health content. Seniors often relied on neighbors or friends to confirm the reliability of online information, interpret medical instructions, or share tips for navigating platforms. These networks helped overcome personal limitations in literacy and confidence, demonstrating the interplay between social context and individual capacity (Xie, 2022; Huang et al., 2023). Intergenerational engagement amplified digital access and learning opportunities. Younger household members not only provided technical support but also encouraged adoption through modeling, reminders, and reinforcement of health behaviors. This intergenerational scaffolding was particularly effective in informal settlements where institutional resources were limited (Shi et al., 2024; Njenga, 2025). Socio-environmental factors, including socioeconomic status, household composition, community infrastructure, social norms, cultural practices, and peer networks, collectively shape older adults' engagement with digital health resources. Interventions aiming to enhance digital inclusion must therefore address both structural constraints and social dynamics to ensure equitable and sustained access to health information in informal settlements (Ochieng' et al., 2024; Shi et al., 2024; Xie, 2022).

Impact on Health Outcomes

Digital literacy emerged as a key determinant of health outcomes among older adults in informal settlements. Participants with moderate to high proficiency in mobile technology reported improved ability to access timely health information, which facilitated informed decision-making regarding disease management and preventive care (Shi et al., 2024; Njenga, 2025). Even limited digital skills, when supported by family or community intermediaries, contributed to enhanced self-monitoring and health awareness. Engagement with mHealth applications positively

influenced chronic disease management. Older adults using apps for medication reminders, blood pressure monitoring, or symptom tracking demonstrated higher adherence to treatment protocols and were more likely to recognize early warning signs of complications (Xie, 2022; Huang et al., 2023). This suggests that digital tools can serve as practical extensions of conventional care, particularly in low-resource environments where clinic access is limited.

Telehealth platforms facilitated remote consultations, reducing travel burdens and enabling timely interaction with healthcare providers. Participants who could navigate video calls or messaging platforms reported greater continuity of care and reduced missed appointments (Aboye et al., 2023; Ochieng' et al., 2024). Telehealth also enhanced access to specialist services otherwise unavailable in informal settlements, thereby improving health equity. Health information-seeking behavior was associated with increased preventive practices. Seniors who actively cross-checked digital content with trusted sources, such as community health volunteers or family members, were more likely to engage in vaccination, screening, and lifestyle modification programs (Shi et al., 2024; Njenga, 2025). This underscores the role of digital literacy in transforming information access into actionable health behaviors.

Social support networks amplified the impact of digital literacy on health outcomes. Family members, neighbors, and community health volunteers provided guidance, clarified instructions, and reinforced adherence to digital prompts. Seniors embedded in supportive social environments demonstrated higher self-efficacy, better disease management, and more consistent engagement with preventive behaviors (Xie, 2022; Choi & Dinitto, 2022).

Barriers such as cost and usability limitations moderated the relationship between digital literacy and health outcomes. Participants who could not afford data subscriptions or faced complex app interfaces experienced reduced engagement, highlighting that access alone does not guarantee positive health impacts (Ochieng' et al., 2024; Huang et al., 2023). Addressing these structural barriers is therefore critical to translating digital skills into tangible health benefits. Health information sharing practices further enhanced outcomes. Seniors transmitting verified health messages to family or peer networks contributed to collective knowledge, improving preventive behaviors across households (Njenga, 2025; Aboye et al., 2023). This community-level dissemination demonstrates that digital literacy can have multiplier effects, extending beyond individual health benefits.

Behavioral self-regulation improved among participants engaged with digital reminders and health tracking tools. Digital prompts encouraged medication adherence, regular monitoring of vital signs, and engagement with lifestyle interventions, resulting in measurable improvements in chronic disease indicators (Shi et al., 2024; Xie, 2022). Psychosocial outcomes were also positively influenced. Digital engagement increased confidence, reduced anxiety related to health management, and provided a sense of autonomy and control over personal health decisions (Choi & Dinitto, 2022; Huang et al., 2023). These psychosocial benefits contribute to overall well-being and quality of life, especially in contexts with limited formal healthcare access.

Digital literacy and access to technological tools significantly shape health outcomes among older adults in informal settlements. The interplay between individual skills, technological platforms, social support, and structural conditions determines the extent to which digital engagement

translates into improved self-management, preventive behaviors, and psychosocial well-being (Njenga, 2025; Shi et al., 2024; Xie, 2022; Aboye et al., 2023). Interventions enhancing digital competence, usability, and accessibility, alongside supportive social networks, are therefore crucial for maximizing the health benefits of technology in low-resource settings.

Integration of Digital and Traditional Channels

Older adults in informal settlements consistently demonstrated a hybrid approach to health information seeking, integrating both digital and traditional sources. While digital tools such as smartphones, SMS alerts, WhatsApp groups, and mHealth apps were increasingly used for specific health queries, participants regularly cross-checked this information with healthcare providers, community health volunteers, radio programs, and printed materials to ensure reliability (Aboye et al., 2023; Njenga, 2025).

The complementarity of these channels was particularly evident in managing chronic conditions. Participants reported that digital reminders and tracking tools were useful for monitoring medication or symptoms, but they relied on traditional consultations to interpret complex medical advice, adjust treatment plans, or verify the accuracy of online content (Shi et al., 2024). This dual approach enhanced confidence in health decisions and minimized the risks associated with digital misinformation.

Hybrid information-seeking also supported preventive health behaviors. Seniors often accessed online or mobile content to learn about vaccination schedules, nutrition, or exercise, and then discussed these practices with family members or community volunteers for contextual guidance (Xie, 2022; Choi & Dinitto, 2022). Combining digital cues with personal reinforcement increased adherence to preventive measures and promoted routine health monitoring.

Social networks mediated the integration of channels. Family members, caregivers, and peer groups frequently acted as intermediaries, helping older adults interpret digital content and linking it to advice from formal health providers (Aboye et al., 2023). Community health volunteers played a similar role, organizing training sessions, facilitating group discussions, and providing clarification on health messages delivered via digital tools.

The hybrid approach also mitigated literacy and usability challenges. Older adults with limited digital skills could leverage trusted offline sources to supplement incomplete or confusing online information, ensuring that technology did not replace but rather complemented human guidance (Njenga, 2025; Ochieng' et al., 2024). This approach reflects global evidence that elderly populations often prefer blended information ecosystems combining digital convenience with human support (Huang et al., 2023).

Trust emerged as a key driver for channel integration. Participants were more willing to act on digital information when it aligned with guidance from healthcare providers or community intermediaries. Conversely, unverified online content, rumors on social media, or conflicting digital sources were often disregarded (Shi et al., 2024). This underscores the importance of trustworthy intermediaries in bridging digital and traditional health knowledge.

Resource constraints further influenced hybrid patterns. Limited access to high-speed internet, intermittent electricity, and cost barriers made offline channels indispensable for many seniors. Radio programs, printed brochures, and face-to-face consultations remained essential complements to mobile and online tools, ensuring continuous access to health information despite infrastructural limitations (Aboye et al., 2023; Ochieng' et al., 2024). Community-based interventions highlighted the effectiveness of integrated strategies. NGO-led digital literacy programs often combined mobile training with in-person workshops, discussion groups, and printed guidance materials. These blended approaches improved comprehension, confidence, and consistent use of health information tools (Xie, 2022; Shi et al., 2024).

The integration of channels also promoted collective health literacy. Information shared through hybrid systems often cascaded across households and peer networks, allowing seniors to disseminate validated knowledge to family and neighbors. This reinforced social learning and reduced health disparities in resource-constrained settings (Njenga, 2025; Aboye et al., 2023).

The findings indicate that hybrid digital-traditional strategies are crucial for effective health information access among older adults in informal settlements. By combining digital literacy initiatives with reliable offline sources, older adults can overcome technological, literacy, and infrastructural barriers, enhancing both individual and community health outcomes (Shi et al., 2024; Xie, 2022; Aboye et al., 2023). Multi-channel interventions are therefore essential to ensure equitable, trustworthy, and contextually appropriate access to health information for elderly populations in low-resource settings.

Strategies for Improving Access and Use of Health Information

Elderly populations living in informal settlements face a confluence of barriers that restrict access to timely and reliable health information. These barriers include low literacy levels, limited digital skills, poor infrastructure, financial constraints, social isolation, and limited engagement with formal healthcare systems (Mutiso & Wambugu, 2024; Waweru, 2023). Chronic health conditions such as hypertension, diabetes, and respiratory illnesses are highly prevalent in these contexts, amplifying the need for accessible, accurate, and actionable health information (Mberia & Kimani, 2024; WHO, 2023). Addressing these challenges requires comprehensive, multi-level interventions that combine digital solutions, community engagement, and culturally tailored health communication strategies.

Digital literacy enhancement programs form a core component of improving health information access. Community-based training programs that teach seniors how to use smartphones, tablets, online portals, and mobile health (mHealth) applications have been shown to improve engagement with health resources and foster autonomy in managing personal health (van Boekel et al., 2023; Li et al., 2023). Effective programs incorporate hands-on practice, iterative learning, and continuous mentorship, ideally facilitated by trained community health workers or peer mentors. Empirical evidence indicates that repeated exposure to digital tools, coupled with guided instruction, significantly increases both confidence and sustained use of digital health services among older adults in low-resource urban areas (Bujnowska-Fedak & Mastalerz-Migas, 2022).

Leveraging intergenerational and peer support networks is another effective strategy. Older adults often rely on younger family members, friends, or digitally literate peers to navigate technology, interpret information, and validate online health content (Choi & Dinitto, 2021; Mutiso & Wambugu, 2024). Peer-to-peer group sessions not only build digital competence but also enhance social engagement, reducing isolation and improving mental well-being. In informal settlements, where structural challenges limit direct access to formal healthcare, these support networks can facilitate critical health decision-making, ensuring seniors access accurate information and apply it effectively in daily life (Friemel, 2016; Wang et al., 2023).

Tailoring health information delivery to the cognitive, linguistic, and cultural needs of older adults is also essential. Information should be clear, actionable, and delivered through multiple channels - including low-tech solutions such as radio, community notice boards, printed leaflets, and in-person workshops - in addition to digital platforms (Mberia & Kimani, 2024; Waweru, 2023). Using local languages, visual aids, step-by-step instructions, and culturally relevant examples improves comprehension and increases the likelihood that seniors will adopt recommended health behaviors. Engagement of community health volunteers and local leaders in disseminating information strengthens trust, credibility, and uptake, particularly in communities where misinformation is prevalent (HelpAge International, 2023; Beard et al., 2022).

Finally, addressing infrastructure and device access is critical to reducing digital exclusion. Providing affordable devices, subsidized data plans, and community-based internet hubs can increase exposure to digital health information and enable telemedicine access (Li et al., 2023; Wang et al., 2023). Such interventions are particularly important in low-resource informal settlements, where residents may lack personal devices or reliable internet connectivity. Research demonstrates that even minimal access interventions, such as shared tablets in community centers, can substantially improve seniors' engagement with online health resources, facilitate chronic disease management, and encourage proactive health-seeking behaviors (Bujnowska-Fedak & Mastalerz-Migas, 2022; Wu et al., 2023).

In conclusion, improving access to and use of health information by elderly residents in informal settlements requires a multi-dimensional approach. Programs must combine digital literacy training, intergenerational and peer support, culturally tailored information, and infrastructural improvements to address the layered challenges faced by this population. Effective strategies are those that integrate digital and non-digital modalities, leverage social and community networks, and provide ongoing support to sustain engagement. Such holistic interventions can empower older adults to manage their health independently, mitigate vulnerabilities, and improve overall well-being in resource-constrained urban environments.

5. CONCLUSION

This study demonstrates that digital literacy and technological tools play a decisive but uneven role in shaping elderly health information practices, particularly within informal settlement contexts. While digital health technologies hold significant promise for improving access to health information, supporting chronic disease management, and enhancing autonomy among older adults, their benefits are not realized uniformly. Low digital literacy, infrastructural limitations,

affordability barriers, and age-related functional constraints continue to restrict independent and sustained engagement with digital health platforms.

The findings highlight that elderly health information practices are best understood as hybrid and socially embedded, combining digital tools with traditional media and interpersonal support. Family members, community health volunteers, and peer networks emerge as critical intermediaries who mediate access, interpretation, and trust in digital health information. Importantly, perceived usefulness and relevance of digital tools strongly influence adoption, underscoring the continued relevance of technology acceptance and digital divide frameworks in ageing and health research.

The study concludes that digital health interventions targeting older adults must move beyond technology provision alone. Effective strategies require age-inclusive design, affordable and low-bandwidth solutions, sustained digital literacy training, and integration with existing social and community structures. Without such measures, the expansion of digital-first health systems risks reinforcing, rather than reducing, health inequities among elderly populations. Addressing these challenges is therefore essential for achieving equitable, inclusive, and sustainable digital health systems in low-resource urban settings.

Recommendations

Based on the study's findings, the following recommendations are proposed to enhance digital health inclusion and improve health information access among older adults in informal settlement settings.

First, strengthen digital literacy through age-responsive capacity building. Government agencies, county health departments, NGOs, and community-based organizations should implement continuous, hands-on digital literacy programmes tailored to older adults' cognitive, sensory, and educational needs. Training should prioritize practical competencies, such as using mobile phones, interpreting SMS health messages, accessing telehealth services, and identifying credible health information, rather than abstract technical skills. Community centers, health facilities, and faith-based institutions can serve as accessible learning hubs.

Second, promote age-friendly and context-appropriate technology design. Technology developers and health system providers should adopt universal design principles that accommodate ageing-related limitations, including simplified navigation, large fonts, high-contrast interfaces, voice-based options, and local-language content. Digital health platforms should be optimized for low-bandwidth environments and include offline or SMS-based functionalities to address connectivity constraints common in informal settlements. Third, leverage social support and community intermediaries. Digital health interventions should formally integrate family members, caregivers, and community health volunteers as facilitators of digital engagement. Intergenerational learning models and CHV-led digital support can enhance trust, reduce anxiety, and improve sustained use of digital health tools among older adults. Fourth, reduce structural and affordability barriers. Policymakers should support subsidized access to basic smartphones, shared community devices, and affordable data packages for older adults. Public–private partnerships with telecommunications providers can help lower connectivity costs and expand reliable network

coverage in underserved urban areas. Fifth, adopt hybrid and inclusive health communication strategies. Health systems should maintain parallel digital and traditional information channels, including radio, print media, in-person consultations, and SMS services. This multi-channel approach ensures continuity of health information access for older adults with varying levels of digital readiness.

Finally, strengthen research, measurement, and policy alignment. Future research should employ longitudinal and intervention-based designs to assess the sustainability of digital literacy gains and health outcomes among older adults. Policymakers should integrate ageing-sensitive digital inclusion targets into national digital health strategies, supported by validated, context-appropriate eHealth literacy measurement tools. Overall, these recommendations underscore the need for integrated, equity-oriented digital health strategies that combine skills development, accessible technology, social support, and enabling policy environments to ensure meaningful digital health participation among elderly populations.

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