Research Article

eHealth Literacy and Gender Disparities: Insights from an Internal Survey

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Abstract

The increasing reliance on digital health services, particularly in light of recent global health crises, has highlighted the importance of eHealth literacy. This study explores the role of eHealth literacy in managing health outcomes, with a specific focus on gender disparities. Using data from the "Truck Tour-Banca del Cuore 2023" survey, which included 354 participants, we examined how integrated technology influences health monitoring and management strategies. Our findings underscore the critical role of eHealth literacy in improving health outcomes and reducing gender disparities, particularly in the context of digital health interventions.

Introduction

Recent global health crises have intensified the demand for digital health services, underscoring the importance of eHealth literacy. This entails the ability to proficiently locate, understand, assess, and utilize online health information to address health-related concerns. eHealth literacy not only facilitates navigation through the digital health landscape but also broadens the understanding of the digital divide within the context of health information accessibility. Individuals possessing advanced eHealth literacy tend to engage more actively with digital health information, employ more refined search techniques, and benefit more substantially from the information accessed. This dynamic contributes to the reinforcement of social disparities, as those with elevated eHealth literacy levels—typically younger, more educated, and with superior digital health management capabilities—experience enhanced healthcare outcomes [1]. Such observations underscore the need for targeted strategies to bridge eHealth literacy gaps, thereby mitigating the amplification of existing health inequities through digital means.

The crucial role of ehealth literacy in managing the COVID-19 pandemic

The COVID-19 pandemic has highlighted the essential role of eHealth literacy, as digital platforms became the primary channels for disseminating health information during this period. Lorini, et al. (2022) highlighted the significance of digital health literacy in mitigating the challenges of the "infodemic"—the overabundance of both accurate and misleading information online—particularly among university students, a demographic significantly vulnerable to such phenomena [2]. Through a meticulous cross-sectional study involving 3,985 participants from two leading Italian universities, the researchers aimed to validate the Italian version of the COVID-19 Digital Health Literacy Instrument

(DHLI). Employing a robust methodological framework, including item analysis, internal consistency evaluation, Principal Component Analysis (PCA), and Confirmatory Factor Analysis (CFA), the study affirmed the instrument's psychometric reliability, notwithstanding the exclusion of the "protecting privacy" subscale due to validation challenges. Further research has linked higher eHealth literacy to improved adherence to infection prevention and control measures among healthcare workers, healthier lifestyles, and a reduced incidence of suspected COVID-19 symptoms, thus underscoring its significance in promoting health guideline compliance across both professional and public spheres [3]. Moreover, studies have demonstrated a positive correlation between eHealth literacy and COVID-19-related Knowledge, Attitudes, and Practices (KAPs), with higher literacy levels independently associated with enhanced knowledge and adherence to protective behaviors [4]. Socioeconomic disparities in eHealth literacy and preventive actions were also observed, indicating the need for inclusive literacy initiatives that bridge the digital divide [5]. Additionally, eHealth literacy has been inversely related to anxiety and depression, suggesting its potential role in alleviating the pandemic's adverse psychological effects [6]. The global acknowledgment of eHealth literacy's significance, as evidenced by research across various regions, emphasizes its universal relevance in health crisis management [7]. Thus, eHealth literacy emerges as a crucial element in navigating the pandemic's health challenges, enhancing individual and collective health outcomes through improved access to accurate information, source discernment, and the empowerment of appropriate health actions. Current investigations into the diagnostic accuracy, validation, and cultural adaptability of eHealth literacy assessment tools among older adults have revealed significant insights and identified areas necessitating further research.

Gender disparities in health literacy: implications for healthcare interventions

Recent research highlights a notable deficiency in eHealth literacy interventions, especially concerning health outcomes in older demographics. Watkins, et al. (2014) pinpoint an exigent demand for theory-driven, methodologically rigorous research to ascertain the efficacy of such interventions [8]. This need is amplified in Low- and Middle-Income Countries (LMICs), where the adaptation and validation of instruments to gauge cognitive impairment—a facet of eHealth literacy in older adults—are crucial. Huang YQ, et al. (2021) observed that measures tailored or adapted for LMIC contexts exhibit moderate to superior diagnostic accuracy, emphasizing the necessity for culturally sensitive, gender- and literacy-bias-conscious tools [9]. A systematic review by Slayter, et al. (2020) highlighted a prevalent limitation in digital literacy instruments for older adults, with most tools assessing only a fraction of the dimensions outlined by the European Commission's Digital Competence Framework [10].

Contrastingly, the Mobile Device Proficiency Questionnaire (MDPQ) evaluates all five dimensions, presenting a potentially more holistic approach to digital literacy assessment—an integral component of eHealth literacy. Similarly, Slatyer, et al. (2020) found that the Health Literacy Questionnaire (HLQ) scored highest in measurement properties among older individuals, suggesting its utility as a prime instrument for health literacy evaluation. Research gaps persist within underserved populations in the U.S., especially among older adults in rural areas, indicating a critical need for focused eHealth literacy improvement initiatives [11]. Chang, et al. (2020) advocate for interventions rooted in comprehensive theoretical frameworks to address the multifaceted influences on eHealth literacy among the elderly effectively [12]. The exploration of gender disparities in health literacy reveals nuanced differences impacting health outcomes, behaviors, and attitudes. Studies, such as that by Chakraverty, et al. (2022), show that women with migration backgrounds may possess slightly higher health literacy levels than their male counterparts, though these findings necessitate cautious interpretation due to potential biases [13]. Lee, et al. (2020) further elucidate significant gender variances in mental health literacy, with implications for attitudes towards mental health across genders. In Korea, gender-specific health literacy trends suggest that interventions tailored to address these disparities may be beneficial [14]. Occupationally, Milner et al. (2020) observed lower health literacy levels among Australian men in male-dominated sectors, highlighting the need for workplace-targeted literacy programs [15]. Additionally, gender differences in managing HIV medication regimens and online health information-seeking behaviors underscore the critical role of numeracy and eHealth literacy interventions tailored by gender [16,17]. These findings accentuate the multifaceted nature of health literacy disparities across genders, necessitating gender-specific approaches in the development and implementation of health literacy interventions. The collective evidence calls for a more nuanced understanding and approach to enhancing eHealth literacy, leveraging comprehensive, theory-based research to address these disparities effectively and equitably.

Advancements in eHealth literacy measurement and tools

In today's digital health landscape, effectively navigating online health information is crucial, requiring reliable tools to assess eHealth literacy. Two significant contributions to this field are the eHealth Literacy Scale (eHEALS) and the Transactional Model of eHealth Literacy (TMeHL), which together offer a comprehensive framework for evaluating individuals' interactions with digital health information. Developed by Norman and Skinner (2006), the eHEALS is designed to measure consumers' combined knowledge, confidence, and perceived skills in finding, evaluating, and applying electronic health information to health problems [18]. This scale, pivotal in assessing self-efficacy within digital

health contexts, has been instrumental in highlighting the critical role of eHealth resources in modern healthcare. A notable study by Bravo, et al. validated the Italian version of the eHealth Literacy Scale (IT-eHEALS), demonstrating its reliability with good internal consistency (Cronbach's alpha = 0.90) and a unidimensional structure [19]. This validation signifies the scale's adaptability across diverse linguistic and cultural landscapes, enhancing its utility in global health literacy research. Expanding the conceptualization of eHealth literacy, the Transactional Model of eHealth Literacy (TMeHL), introduced by Paige, et al. presents a multidimensional instrument that encapsulates functional, communicative, critical, and translational literacies [20]. Developed through extensive consultation with both eHealth experts and end-users, TMeHL reflects the dynamic interactions between individuals and digital health information, underscoring the influence of social affordances on eHealth literacy. Recent analyses, such as the systematic review by Huang, et al. (2023), have scrutinized the diagnostic accuracy of these tools among older adults, revealing a digital divide exacerbated by the rapid integration of virtual care [21]. This work highlighted moderate to high correlations between eHEALS and TMeHL scores and direct measures of digital literacy skills but also pointed to gaps in their external validity and the comprehensive assessment of eHealth literacy dimensions. Furthermore, Yoon, et al. introduced the Digital Health Technology Literacy Assessment Questionnaire (DHTL-AQ), a novel tool developed through rigorous methodology to assess digital health technology literacy across functional and critical domains [22]. Demonstrating excellent reliability and validity, the DHTL-AQ represents a significant advance in measuring individuals' capabilities to utilize digital health technologies effectively. These models and instruments are invaluable in advancing the field of eHealth literacy, providing essential insights for researchers, healthcare practitioners, and policymakers. They underscore the necessity of developing accessible, user-friendly digital health tools and interventions that accommodate diverse literacy levels, ensuring equitable benefits from digital health technologies across populations.

Methods

The 'Truck Tour-Banca del Cuore 2023' survey was carefully designed to collect comprehensive data on participants' integration of technology into their daily lives and its impact on their health monitoring and management practice. The survey was offered to all attendees who met the selection criteria. Participants were eligible if they were 18 years or older, agreed to participate voluntarily, and provided informed consent. Exclusion criteria included individuals unable to complete the survey independently or those without access to digital devices for related questions. The form starts by asking for essential demographic details. Participants fill in their age and select their gender (male or female). Spaces are provided for participants to list their educational qualifications and current occupations. Participants are then asked to record their height

and weight. They indicate whether they use the internet, the frequency of their usage (daily, weekly, or monthly), and whether they own a smartphone. If they do not own one, the questionnaire probes the reason—lack of interest, cost concerns, or lack of familiarity with technology—and whether a caregiver who has a smartphone accompanies them. For those owning devices, the form asks how long they have had their smartphone or tablet, with options ranging from less than 6 months to more than 5 years. It further explores the participant's ability to perform specific tasks using their smartphone or tablet, such as making calls, sending texts or photos, emailing, installing and using apps, and browsing the internet. Questions are posed about prior usage of health-related apps and the willingness to use a free app for health monitoring. Concerns such as privacy, lack of assistance, time constraints, or forgetfulness are addressed through multiple-choice responses. The questionnaire includes a section where participants check which common technology symbols like Wi-Fi, Bluetooth, QR codes, app download icons, and internet symbols they recognize and use. Data was collected through structured surveys administered on-site during the Truck Tour. Trained personnel guided participants in filling out the forms to ensure clarity and accuracy. Descriptive statistics were employed to explore relationships between demographic factors and eHealth literacy. Data analysis was conducted using Phyton to ensure robust and accurate interpretations.

Results

192 females and 162 males participated in the questionnaire. The average age across the population was approximately 62.3 years, with a standard deviation of 12.66 years, indicating a broad age range among participants from 21 to 90 years old. The average height recorded is 165.76 cm. Participants have an average weight of 74.44 kg, with a range extending up to 168 kg, reflecting significant variability in body weight within the population. The mean BMI is 26.98, which typically categorizes individuals as slightly overweight according to global health standards. Males were older, with an average age of 64.95 years compared to females (Figure 1). They had a higher BMI, averaging at 27.21. Females were younger with a lower average age of 60.1 years and exhibited a slightly lower BMI of 26.79. Males exhibit a slightly higher prevalence of both diabetes and ischemic heart diseases compared to females. Males also have a higher percentage of smokers. Females show a higher incidence of reported arrhythmias compared to males (Figure 2).

In the analysis of educational qualifications by gender, the data reveals a nuanced landscape of educational attainment across different levels. Females slightly lead in higher educational qualifications, holding a marginally greater percentage of university degrees (14.44%) compared to males (13.82%). This trend is also evident at the elementary school level, where 23.53% of females hold such qualifications versus 20.39% of males. Conversely, males exhibit a slightly higher
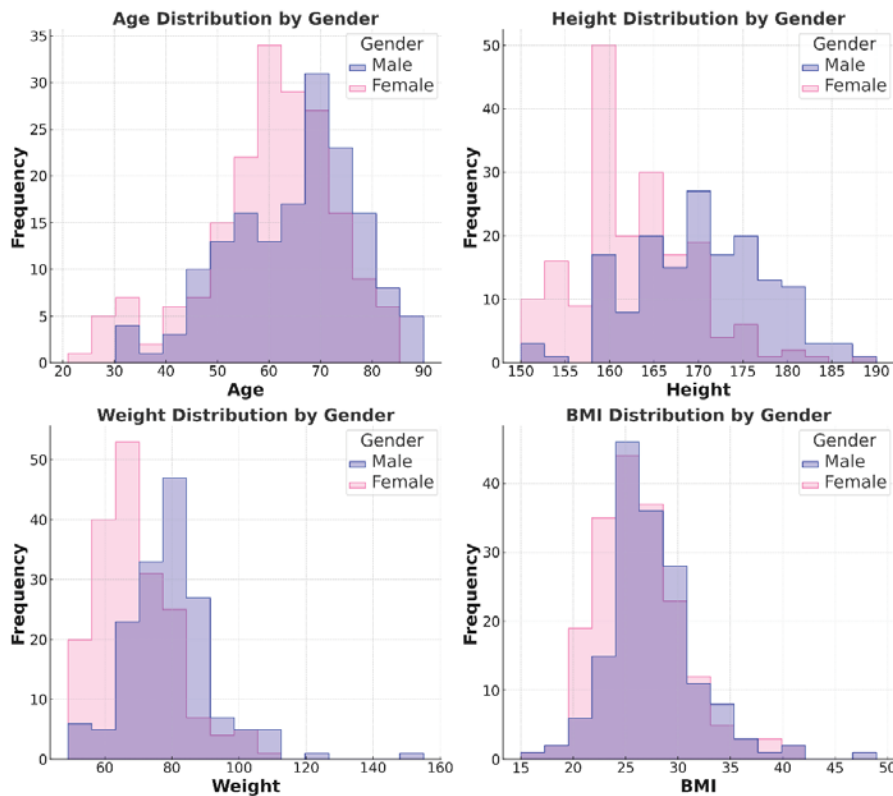
Figure 1: Distribution of Age, Height, Weight, and BMI by Gender. Each panel displays a histogram comparing the distribution of (a) Age, (b) Height, (c) Weight, and (d) BMI between male (blue) and female (pink) participants. Data points are plotted as step elements with transparency to differentiate overlapping regions. These histograms highlight differences in frequency distributions across genders for each measured parameter.
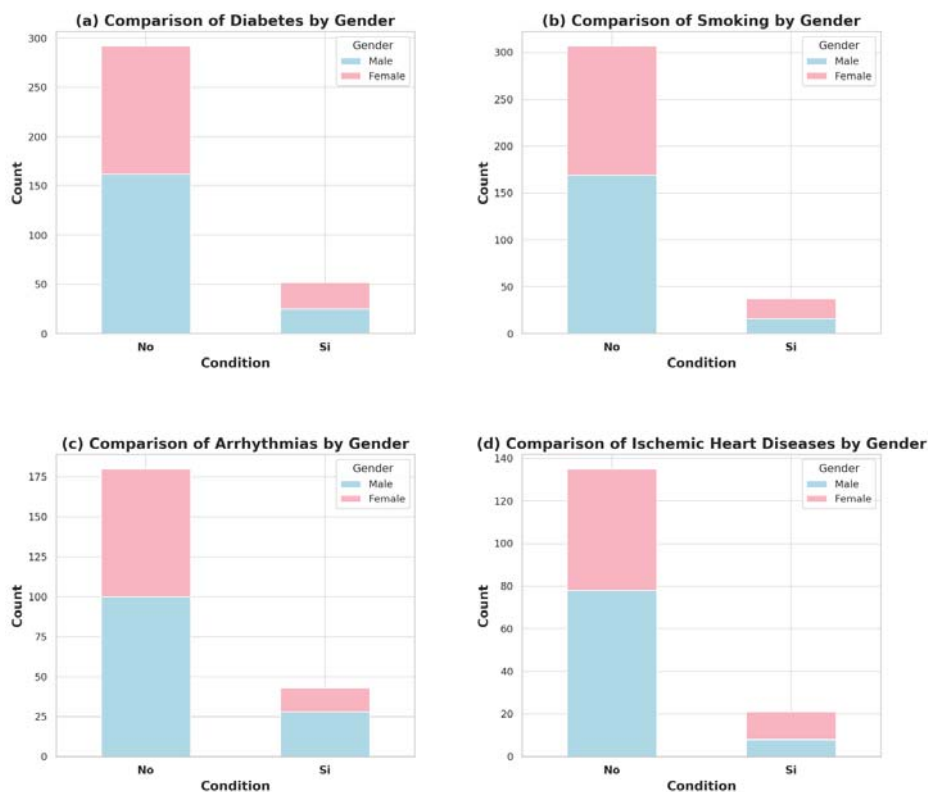

Figure 2: Gender-Based Health Condition Comparison. Subfigures (a) through (d) display the prevalence of various health conditions categorized by gender. Subfigure (a) illustrates the distribution of diabetes, (b) shows the prevalence of smoking habits, (c) details the occurrence of arrhythmias, and (d) outlines the presence of ischemic heart diseases. Each category is compared between male (light blue) and female (light pink) participants, highlighting disparities in health-related conditions across genders.

representation at the middle school level, constituting 34.21% compared to 29.95% for females. The proportions are nearly balanced at the high school diploma level, with males at 30.26% and females at 29.41%. Interestingly, fewer males (1.32%) than females (2.67%) have no educational qualifications at all. These figures suggest a broadly similar level of educational attainment between genders, with slight variations favoring females in higher education and males in middle educational levels. As shown in Figure 3, the distribution of educational qualifications by gender highlights nuanced differences in attainment levels. Females slightly lead in higher educational qualifications, holding a marginally greater percentage of university degrees (14.44%) compared to males (13.82%). This trend, observed in the visual representation, underscores the subtle gender-based distinctions in educational attainment within the study population.

A notable gender difference in technology usage and preferences was found. A significant observation is the higher internet engagement among females, with 65.61% reporting usage compared to 58.39% of males (Figure 4a). This trend extends to smartphone ownership, where 86.49% of females own a smartphone, slightly higher than 87.10% of males (Figure 4b). Moreover, daily internet use is more prevalent among females (54.13%) than males (45.12%), indicating a higher frequency of engagement with digital technologies among females (Figure 4d). Females also show a greater willingness to use health apps, with 67.88% open to them, compared to 61.03% of males (Figure 4c). This suggests a potential gender disparity in the adoption of health-related technologies. These findings could inform targeted digital literacy and technology adoption strategies to address gender-specific needs and preferences.

Discussion

This research offers important perspectives on how eHealth literacy influences health management behaviors and outcomes, demonstrating notable links between digital engagement and enhanced health literacy. Our findings indicate that participants with higher eHealth literacy were better equipped to manage their health conditions, often engaging more frequently with digital health tools, such as health apps and online health resources. This pattern reflects the broader shift toward digital health technologies as integral to healthcare, especially as these tools become essential for accessing information, managing chronic conditions, and tracking health metrics in real-time. The study further highlights that increased eHealth literacy is linked to higher rates of smartphone ownership and daily internet use, illustrating how digital literacy can facilitate proactive health behaviors. The variation in digital engagement across age groups also suggests the need for age-appropriate eHealth resources, as older participants displayed somewhat lower digital literacy levels. These insights underscore the need for targeted interventions, particularly for older populations, to enhance digital health adoption and ensure equitable access to healthcare resources across age demographics.

A major finding in this study concerns gender-based differences in eHealth literacy, with women demonstrating higher engagement with digital health tools compared to men. This aligns with research by Chakraverty, et al. which observed slightly higher health literacy levels among immigrant women than their male counterparts, suggesting that women may have a stronger inclination toward utilizing health resources and digital tools for self-care. In our sample, women exhibited
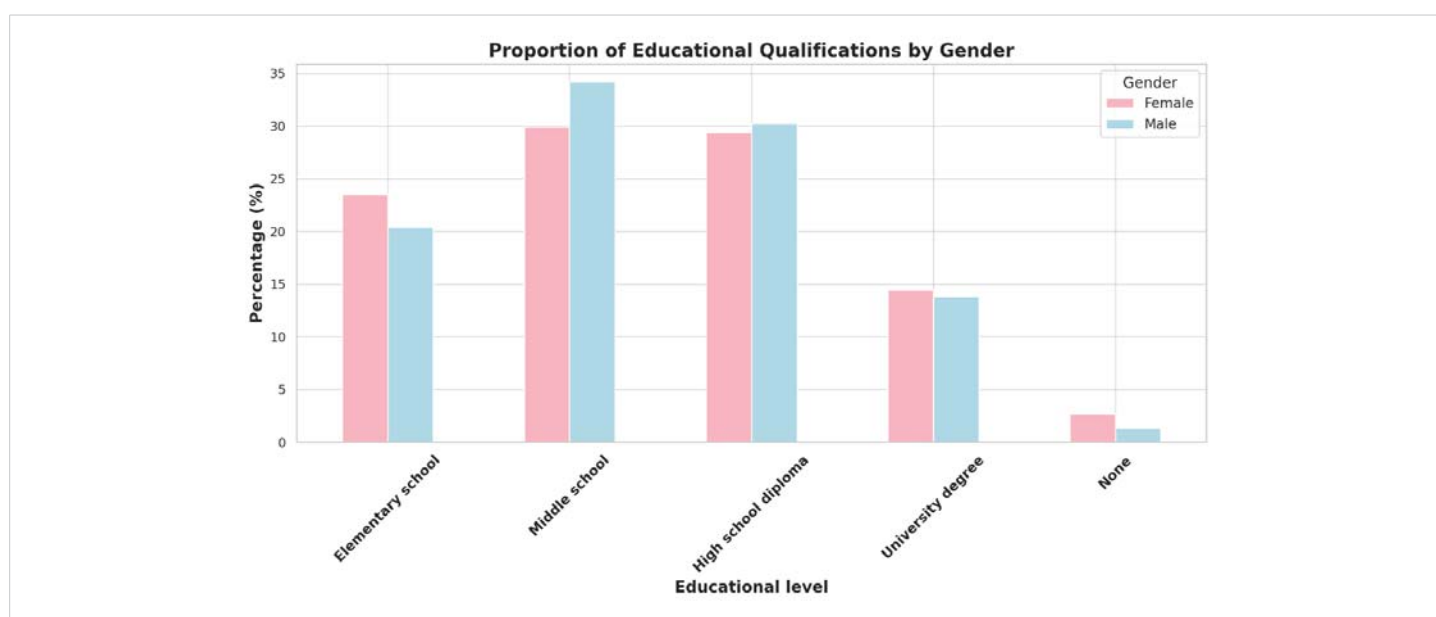

Figure 3: Educational Qualifications by Gender. Distribution of educational qualifications by gender, with light blue representing males and light pink representing females. The data highlights distinct educational attainment. Levels, including elementary school, middle school, high school diploma, university degree, and none, indicate the prevalent educational trends among the genders.
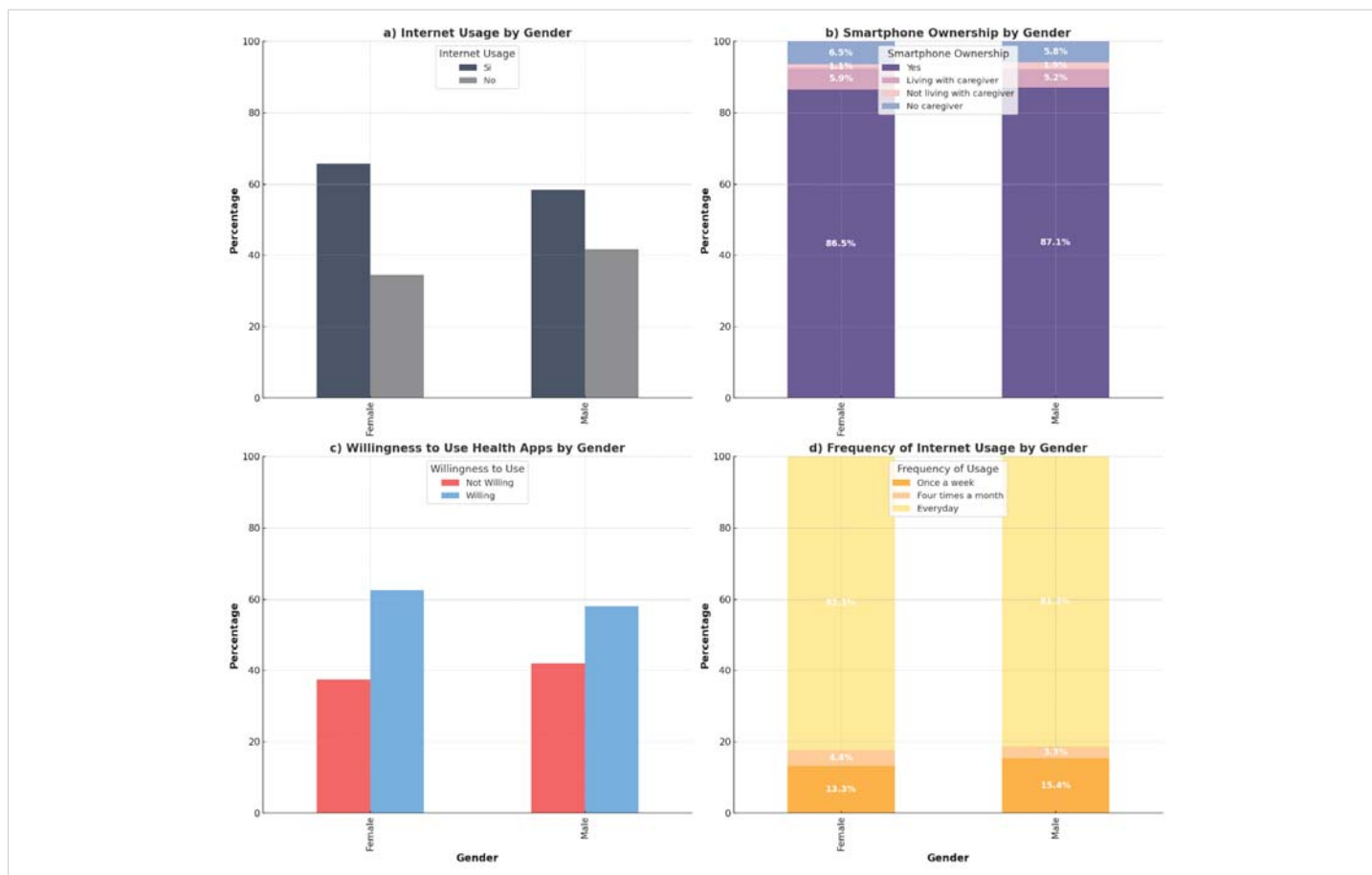
Figure 4: Gender-Based Differences in Internet Engagement, Smartphone Ownership, and Willingness to Use Health Apps. Comparison between male and female participants in terms of their internet engagement, smartphone ownership, and willingness to use health-related apps.

a greater willingness to use health apps and reported higher daily internet usage. These results imply that women's increased engagement in digital health may contribute to their ability to manage and monitor health conditions more effectively. However, this disparity also highlights the potential barriers men may face in adopting similar tools. Consistent with findings from studies in Korea and Australia, where men in male-dominated sectors displayed lower health literacy, our results suggest that men may benefit from targeted interventions that address the unique challenges they face in digital engagement [23]. Developing digital health literacy programs tailored to men's preferences and settings, such as workplace initiatives in high-risk industries, could promote greater eHealth engagement among male populations, particularly those dealing with chronic conditions.

Another critical gender-specific finding relates to the prevalence of chronic health conditions, with men in our study reporting higher rates of conditions such as diabetes and ischemic heart disease. This aligns with global health data indicating that men often experience higher rates of chronic illnesses, potentially compounding their need for effective health management tools [24,25]. Yet, their lower levels of eHealth literacy and digital engagement suggest a disparity in accessing and utilizing these tools effectively. This

reinforces findings from studies by Milner, et al. which showed that workplace-based health literacy interventions can be particularly beneficial for men, enhancing their engagement and improving health outcomes. Our results support the notion that implementing gender-specific, context-sensitive eHealth literacy interventions may be a viable strategy to bridge these gaps and promote healthier behaviors across genders.

Moreover, these findings contribute to the growing understanding that eHealth literacy is not a one-size-fits-all solution; instead, it requires a multifaceted approach that accounts for demographic factors such as gender, age, and socioeconomic background. With digital health technologies continuously evolving, it is essential to recognize the digital divide that may prevent certain groups from benefiting equally. Socioeconomic disparities, for example, were observed in the general lower engagement among older adults, a group that could particularly benefit from enhanced digital health support given the higher prevalence of chronic diseases. Future digital health programs should prioritize inclusivity by offering tools and resources that are both accessible and adaptable to the needs of diverse populations.

In the context of the COVID-19 pandemic, the study's findings take on even greater relevance. The pandemic has accelerated reliance on digital health tools, making eHealth

literacy a necessary skill for accessing accurate information and making informed health decisions. Studies have shown that higher eHealth literacy is associated with better adherence to preventive health measures and lower psychological distress, further underlining the importance of accessible digital health resources. Our findings, particularly regarding gender differences, suggest that men may be at a disadvantage in navigating digital health resources, which could hinder their response to health crises that require prompt information access and adherence to health guidelines. Addressing these disparities through targeted eHealth literacy interventions could thus play a role in bolstering public health resilience in future crises.

This study has several limitations. First, the sample size, while adequate for the current analysis, was relatively small and derived through convenience sampling, which may introduce selection bias. Second, the reliance on self-reported data could affect accuracy due to recall bias or subjective interpretations of survey questions. Third, the cross-sectional design limits the ability to infer causality or changes over time. Finally, while the study results are based on data from older adults, its generalizability to younger or more diverse populations may be restricted. Future research should address these limitations by employing larger, more diverse samples and longitudinal designs.

Conclusion

In summary, this study underscores the pivotal role of eHealth literacy in influencing health management behaviors, highlighting both overall and gender-specific differences in digital health engagement. The observed gender differences suggest that while women may lead in eHealth adoption, men, particularly those with chronic conditions, could benefit from targeted interventions that address their unique health literacy needs. As digital health technology continues to grow, implementing accessible, gender-sensitive eHealth literacy programs will be essential in reducing health disparities and fostering equitable health outcomes across populations. Future research should aim to further delineate these gendered patterns and explore how tailored interventions might enhance eHealth literacy for all, promoting equal access to digital health benefits.

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