Psychological Determinants of Digital Health Literacy among Older Adults in Nigeria: A Cross-Sectional Study

Digital health literacy (DHL) is increasingly essential for effective engagement with contemporary healthcare systems. Despite increasing digitilisation of health services, older adults, who typically require greater healthcare needs, remain disproportionately disadvantaged. While structural barriers have been widely examined, less attention has been given to psychological determinants of DHL. This study examined psychological determinants of digital health literacy among older adults in Ondo Town, Nigeria. A cross-sectional survey design was employed. A total of 258 older adults aged ≥ 60 years (mean=65.0, SD =3.7) were recruited from a State-owned hospital in Ondo town, Nigeria. Participants completed Digital Health Literacy Instrument (DHLI), the Multidimensional Health Locus of Control (MHLC) Scale, the General Self-Efficacy Scale (GSES), and a self-structured questionnaire on Attitude toward Digital Health Literacy. Multiple regression analysis revealed that psychological factors jointly explained 28.9% of the variance in DHL (adjusted R^2=.289, F(4,253) =27.06, p<.001). Attitudes toward digital health technology emerged as the strongest unique predictor (β=.335, p<.001), followed by self-efficacy (β=.214, p<.001) and internal health locus of control (β=.189, p<.001). External locus of control was not statistically significant (β=-.097, p=.076). These findings emphasize the need for interventions that aimed at improving digital health literacy among older adults, strategies to foster positive attitudes, build self-efficacy through hands-on experience and social support and as well strengthen internal health locus of control through empowerment-based education.

Keywords: *Digital health literacy; attitudes; self-efficacy; health locus of control; older adults*

Introduction

The present evolution of digital technology has transformed domains of human life, with healthcare inclusive, by enhancing easy access and efficient delivery of health services. The emergence of digital health resources which include mobile health applications, online portals, telemedicine services and wearable technologies offer unprecedented opportunities for individuals and communities to maintain maximum well-being more proactively (World Health Organisation, [WHO] 2020, Crawford & Serhal, 2022). These technologies have been shown to facilitate patients' participation, enhance self-care and healthy lifestyles (Van der Mispel et al. 2017). However, the benefits of these advancements are unevenly distributed, as digital health literacy (DHL), defined as the capability to search, understand and appraise health information from electronic sources to make informed health decisions (Norman & Skinner, 2006), remains uneven, particularly among older adults in Nigeria. Older adults often report fears about complex functionalities of smart devices and digital interfaces, leading to hesitation or avoidance of digital health tools (Ezeudoka &

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Fan 2024). Yet, this unique older adult population stand to benefit most from digital health innovations due to their frail health conditions, frequent use of health services and health-related information needs (Chesser et al. 2016, Neter & Brainin 2012). As such, examining the psychological factors that influence DHL among older adults in Nigeria is critical to bridging existing gaps and fostering health equity in this digital era.

DHL is a subset of general health literacy that focuses on extent to which an individual has the capacity to interact with digital health resources to make health informed decisions. According to Norman and Skinner (2006), DHL involves six core literacies which are traditional, health, information, scientific, media, and computer literacy. Higher level of DHL is associated with increased health knowledge, better self-care, and improved communication with healthcare providers (Paige et al. 2017), while lower level of DHL is associated with reluctance to engage with digital health services and not seeking health information from reliable digital sources (Fan et al. 2024), thus limiting the individual's access to essential health benefits.

In Nigeria, despite the increase in internet and smartphone penetration recently, internet penetration stood at approximately 45.5%, remains uneven, with rural areas significantly underserved (Kepios 2024). Poor broadband infrastructure, unstable power supply, existing service delivery, inadequate experienced health practitioners and insufficient integration of operational and cultural consideration necessary for scalable implementation exacerbate low digital health services (Aranda-Jan et al. 2014, Adebayo & Ofoegbu 2014). The effort made to initiate Nigeria's Digital Health Vision between 2015 -2020 to address these challenges has been slow and fraught with implementation and systemic issues (WHO 2020, Aririguzoh et al. 2021, Idoga & Toycan 2016).

DHL is immensely crucial, especially for the older adults to support autonomy and effective communication with healthcare providers (Van der Vaart & Drossaert 2017). A plethora of studies have demonstrated the significance of DHL and internet use in facilitating overall health of older adults **(**Wen et al. 2023, Schoeppe et al. 2016**)**. Despite its efficacy, research reveals a digital divide among older populations due to age-related changes which include sensory deficit, decreased motor abilities, and cognitive decline, lower levels of education and limited digital experience and habits (Kontos et al. 2014, Heart & Kalderon 2013). Research indicates that older adults can develop digital competence when provided with needed guidance and motivation to enhance their integration in the present digital age (Kim 2015). Identifying psychological factors that underlie the involvement of older adults' digital health resources is essential for designing inclusive interventions and promoting their integration into the digital health ecosystem. Among these psychological factors are attitudes, health locus of control (HLC), and self-efficacy.

Attitude, as a psychological factor, represents an individual's predisposition toward particular behaviours or technologies. Attitudes influence motivation, willingness to learn and openness to new experiences, which can lead to the adoption of digital health resources among older adults. Attitudes toward digital health technology encompass beliefs about its usefulness, perceived ease of use,

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safety, and trustworthiness (Or & Karsh 2009). Positive attitudes have been correlated with increased intention to use and actual use of digital health technologies among older adults (Heart & Kalderon 2013). Di Giacomo et al. (2020) indicated that positive experiences with electronic services can foster positive attitudes and future usage. Negative perception such as concerns about privacy, fear of technology, and skepticism toward online information often serve as barriers to DHL (Czaja et al. 2006). A recent scoping review by Shi et al. (2024) revealed that attitudes toward online health source of information greatly impacted older adults' DHL. Previous studies found that interest in application of internet, easy to use electronic gadgets and no pressure to use affected older adults' attitude toward DHL (Arcury et al. 2020, Price-Haywood et al. 2017, Cajita et al. 2017).

Health locus of control (HLC) is another psychological factor that plays a vital role in shaping health outcomes, including digital health information-seeking behaviour. HLC refers to individuals' beliefs regarding the extent to which their health is influenced by internal factors (e.g., personal actions), powerful others (e.g., doctors), or by chance/luck (Wallston et al. 1978). The individuals with a high internal HLC are more likely to proactively search for health information and engage in health preventive behaviours, and they are often self-directed learners who utilize online resources to manage their health effectively (Hairaty et al. 2019, Seçkin et al. 2016). Conversely, individuals with an external HLC (especially chance-based) may view health as outside their control, leading to reduced motivation to seek health information or adopt new technologies as they may rely on doctors or fate (Helmer et al. 2012). Research indicates a positive correlation between internal HLC and both general and DHL (Purcell 2021).

Self-efficacy, another key psychological construct, refers to individuals' beliefs in their capacity to execute behaviours necessary to produce particular outcomes (Bandura 1997), also plays a vital role in digital engagement. Digital self-efficacy encompasses confidence in application of electronic devices, navigating digital platforms and appraising online health information (Kim & Xie 2017). Studies have consistently shown that digital self-efficacy predict better DHL among older adults (Liu et al. 2023, Chung & Nahm 2015). Those with high digital self-efficacy are autonomous, adaptable and proactive in engaging with digital health resources (Luo et al. 2025, Korkmaz Aslan et al. 2021). Also, Liu et al. (2023) found that self-efficacy directly influenced health literacy and indirectly mediated the relationship between social support and health literacy.

With the evolution and transformation of digital health utilization and increased DHL worldwide, Nigeria, the most populous country in Africa exhibit relatively low levels of DHL, with significant disparities between urban and rural regions influenced by several factors (Babalola et al. 2019). While there is growing public interest in digital health services, particularly among younger populations, older adults remain at a distinct disadvantage (Aririguzoh, et al. 2021). Previous studies have shown that while patients generally expressed their interest toward digital health adoption, structural and economic barriers limit

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their use (Onumajuru et al. 2024, Itanyi et al. 2023, Olamoyegun et al. 2020). Similarly, healthcare professionals in Nigeria exhibited varied attitudes toward digital integration, often constrained by systemic and knowledge-related issues (Onumajuru et al. 2024, Ojo et al. 2022). Therefore, examining the psychological determinants of digital health literacy in older Nigerian adults is essential to developing age-sensitive digital health strategies and promoting health equity in this digital era. This study hypothesized that:

1. Psychological factors of attitudes towards digital health technology, health locus of control and self-efficacy will jointly determine DHL among older adults in Ondo Town, Nigeria
2. Psychological factors of attitudes towards digital health technology, health locus of control and self-efficacy will independently determine DHL among older adults in Ondo Town, Nigeria

Methods

Participants

This study employed a cross-sectional quantitative survey method. A total of 258 (male =90; female =168) older adults aged 60 years and above (mean = 65.0, SD = 3.7), who resides in Ondo town, possessing basic literacy in English or a local Nigerian language, attending a State-owned hospital in Ondo, South-west, Nigeria and showed willingness to participate voluntarily were recruited for the study. Convenient sampling technique was employed to select the participants for the study. Purposive sampling technique was also utilized to recruit individuals, who have not travelled abroad before (especially to developed nations) who could have been well-exposed to compulsory utilization of advanced health digital tools.

Measures

Digital Health Literacy Instrument (DHLI)

The Digital Health Literacy Instrument (DHLI), developed by van der Vaart and Drossaert (2017), was employed to evaluate respondents' digital health literacy levels. The DHLI comprises seven skill domains, assessed through 21 self-reported items and 7 performance-based items, encompassing: (1) operational skills, (2) navigation skills, (3) information searching, (4) evaluating reliability, (5) determining relevance, (6) content creation, and (7) privacy protection. Illustrative items include: “How easy or difficult is it for you to use buttons, links, and hyperlinks on websites?” and “When searching the Internet for health-related information, how easy or difficult is it for you to make a selection from the available options?” Self-report items required participants to

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rate the perceived difficulty of specific tasks and the frequency with which they encountered internet-related challenges. Responses were captured using a 4-point Likert scale, ranging from "very easy" to "very difficult" and from "never" to "often." All item scores were reverse-coded such that higher scores indicated greater levels of digital health literacy. In this present study, DHLI demonstrated Cronbach alpha coefficients of .81.

Attitudes toward Digital Health Literacy

A self-structured questionnaire of 15-items based on constructs from the Technology Acceptance Model (TAM) (e.g., perceived usefulness, perceived ease of use, attitude toward use, behavioural intention to use and actual use), was used to assess the participants' attitudes toward digital health literacy. Examples of the items include, "digital health tools help me to access health information more quickly" "interacting with digital health platforms does not require a lot of mental effort" and "I like the idea of using digital health tools to monitor my health. The questionnaire is rated on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). The questionnaire demonstrated acceptable internal consistency of Cronbach alpha .79

Multidimensional Health Locus of control (MHLC) Form A

Health locus of control of the participants was assessed using MHLC scale Form A developed by Wallston et al. (1978). The beliefs of the older adults about internality, chance and powerful others in relation to health outcomes were assessed. The scale consists of 18-items questionnaire classified into three subscales with six items each: internal (e.g., If I get sick, it is my own behaviour which determines how soon I get well again), powerful others (e.g., having regular contact with my physician is the best way for me to avoid illness) and chance (e.g., Luck plays a big part in determining how soon I will recover from an illness). The items under powerful others and chance subscales were collapsed to be external health locus of control. The scale is rated on a 6-point Likert scale, which ranges from strongly disagree (1) to strongly agree (6). MHLC demonstrated internal consistency of Cronbach alpha .84 and .77 for both internal and external health locus of control respectively

General Self-Efficacy Scale (GSES)

Participants' self-efficacy beliefs were assessed using the General Self-Efficacy Scale (GSES), a 10-item instrument developed by Schwarzer and Jerusalem (1995). The GSES utilizes a 4-point Likert scale, with response options ranging from "Not at all true" (scored as 1) to "Exactly true" (scored as 4). Total scores range from 10 to 40, with higher scores indicating higher self-efficacy. The scale demonstrated internal consistency of Cronbach alpha .87

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Procedure

Upon research ethical approval from the first author's institution, permission to conduct the study was sought from the authorities of the State-owned hospital used to have access to the participants, after which data were collected on different occasions with the supports of the authorities. Data were collected within four weeks of patients' patronage to the hospital. Administration of questionnaire was conducted via online Google Form and paper filling. 217 older adults completed the online Google Form while 41 completed the paper form questionnaire. Participation was voluntary. The response to the questionnaire was about 20-25 minutes.

Data Analysis

Descriptive statistics frequency count, percentage, mean and standard deviation were employed to summarize demographic results, while multiple regression analysis was utilized to examine the psychological determinants of DHL. All analyses were performed using Statistical Package for Social Sciences (SPSS) (version 26.0, IBM, New York, US). Statistical significance was set at $p < .05$.

Results

Table 1. *Demographic characteristics of the respondents*

Variable		Frequency	Percentage
Gender	Female	168	65.1
	Male	90	34.9
Age	Mean = 65 ± 3.7		
Highest Level of Education	No Formal Education	2	.8
	Primary	6	2.3
	Secondary School	23	8.9
	Tertiary	172	66.7
	Master	37	14.3
	PhD	18	7
Frequency of Internet usage	Never	6	2.3
	Several days a week	54	20.9
	Every day	198	76.7
Mean of Internet Access	Mobile phone	234	90.7
	Laptop	24	9.3

Table 1 presents the demographic characteristics of 258 older adults (aged 65 and above) in Ondo, Nigeria. From Table 1, it can be seen that most of the respondents were older adult women making up nearly two-thirds (65.1%) compared to just over a third (34.9%) who were men. Based on the educational

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level of the respondents, the vast majority had tertiary education (66. 7%), with additional representation at postgraduate levels (Master's; 14.3%; PhD: 7%). Very few participants reported low educational attainment (no formal education: 0.8%; primary: 2.3%). Internet use among the respondents was very high. Over three-quarters (76.7%) reported daily use of internet and another 20.9% reported using it several days a week. Only a very small minority (2.3%) never used it. Mobile phone was reported as the dominant device for accessing the internet by an overwhelming 90.7% of the respondents. While 9.3% reported using laptops

Table 2. *Results of multiple regression on joint contribution of psychological factors on digital health literacy among older adults*

R = .547 Adj R^2 = .289 R^2 = .300 Std. Error = 5.41						
Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	3169.969	4	792.492	27.056	.000[b]
	Residual	7410.682	253	29.291		
	Total	10580.651	257			

As shown in the Table 2, the joint contribution model showed that the psychological factors (attitudes towards digital health technology, health locus of control (internal and external) and self-efficacy) jointly had a significant impact on DHL; $F(4,253) = 27.06$, $p < .001$. The adjusted R^2 of .289 showed that after adjusting for the number of predictors and sample size, the model accounted for 28.9% variance in DHL. Variables accounting for the remaining variance were not included in this study. This implies that there was a significant joint contribution of psychological factors on digital health literacy among older adults.

Table 3. *Results of multiple regression on relative contribution of psychological factors of attitudes towards digital health technology (ATDHT), health locus of control (internal and external) and self-efficacy on digital health literacy among older adults*

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
	(Constant)	17.474	3.025		5.777	.000
	ATDHL	.237	.042	.335	5.685	.000
	Internal LOC	.208	.064	.189	3.271	.001
	External LOC	-.075	.042	-.097	-1.783	.076
	Self-efficacy	.301	.083	.214	3.638	.000
a. Dependent Variable: DHL						

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Table 3 presents the standardized coefficients, showing the relative contribution of each predictor to digital health literacy (DHL). Holding all other variables constant, attitude towards digital health technology (ATDHL) was the strongest predictor ($\beta = .335$, $p < .001$). The second strongest relative contributor was self-efficacy ($\beta = .214$, $p < .001$), followed by internal health locus of control ($\beta = .189$, $p = .001$). In contrast, external health locus of control did not make a statistically significant unique contribution ($\beta = -.097$, $p = .076$). This suggests that beliefs attributing health control to external factors, such as chance or powerful others, were not a significant independent predictor when the effects of attitudes, self-efficacy, and internal locus of control were accounted for. In summary, positive attitudes, greater self-efficacy, and a stronger internal locus of control each uniquely and positively determined digital health literacy, with attitudes being the most influential factor.

Discussion

The present study examined psychological determinants of digital health literacy among older adults. In addition, the study investigated both joint and relative contributions of selected psychological factors of attitudes towards digital health technology (ATDHL), health locus of control (internal and external) and self-efficacy on digital health literacy among older adults. The results revealed that selected psychological factors jointly exerted a statistically significant influence on digital health literacy. This indicates important role of psychological characteristics in determining how older adults engage with digital health resources. This result aligns with existing literature that emphasize the multidimensional nature of digital health engagement. Prior research has consistently highlighted that positive attitude towards technology, a sense of personal control over health and confidence in one's digital abilities are critical enablers of health-related technology use among older populations (Kim & Xie, 2017; Heart & Kalderon 2013). Our results extend these findings to the Nigerian setting, where digital infrastructure and literacy remain uneven (Kepios 2024, Aririguzoh et al. 2021).

Moreover, the study found that attitude toward digital health technology, self-efficacy and internal locus of control each uniquely and positively predicted digital health literacy among older adults, with attitudes being the most influential factor in this present study. That is, older adults who held more positive attitudes toward digital health devices as beneficial, accessible and trustworthy demonstrated significantly higher levels of DHL. This finding corroborates the previous findings by Price-Haywood et al. (2017), Heart and Kalderon (2013) that positive attitudes have shown to predict not only initial adoption but also sustained engagement with digital health platforms. Positive attitude can possibly function through intertwined factors. For instance, favourable perceptions can reduce psychological resistance, technophobia and anxiety associated with digital technologies. Also, attitudes can influence motivational orientation, shaping whether individuals perceive digital tools as

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empowering resources or intimidating obstacles. In addition, attitude can affect learning behaviour, as individuals are more interested to training and learning skill acquisition opportunities. Though prior study by Ezeudoka and Fan (2024) indicated that, older adults were particularly susceptible to technophobia, skepticism toward online information and concerns about data privacy and gadget complexity, leading to hesitation or avoidance of digital health tools. These negative perceptions are not unfounded; they revealed the genuine usability challenges encountered and a fail to accommodate age-related sensory and cognitive changes (Czaja et al., 2006). However, the present findings suggest such perceptions are not immutable. Di Giacomo et al. (2020) indicated that positive experiences with electronic services can foster more favourable positive attitudes and increase future usage intentions among older adults.

Internal locus of control was identified as a significant determinant of digital health literacy, indicating that beliefs regarding personal control over health outcomes influence digital health competencies. This result demonstrates that older adults who believe their health outcomes are largely contingent upon their own behaviours, decisions and efforts exhibit greater competence in engaging with digital health resources. Similarly, older adults with stronger internal locus of control are more active in taking decisions that positively affect their well-being. Internal locus of control may foster intrinsic motivation for digital engagement which may indirectly serve as instrumental resources for self-management rather than optional conveniences. This corroborates with the findings of Purcell (2021) that stronger internal locus of control (belief that one controls their own health outcomes) is significantly related to higher electronic health literacy, positive attitudes towards healthcare providers, higher trust in physicians and medication adherence. It was added that internal locus of control act as a significant mediator between electronic health literacy and key patient outcomes. Similarly, Seçkin et al. (2016) indicated that individuals with stronger internal locus of control beliefs were more likely to actively seek and critically assess online health information and as well utilize electronic health resources as mechanisms of self-regulation.

In contrast, external locus of control did not demonstrate a statistically significant independent contribution to DHL when controlling for other psychological variables. This finding suggests that attributing health outcomes to chance or powerful others such as healthcare providers does not independently determine digital health literacy among older adults in this present study. This finding is consistent with prior research indicating that external locus of control may be associated with passive health behaviours and reduce the motivation to seek health information independently (Helmer et al. 2012).

In addition, self-efficacy demonstrated a significant positive contribution to DHL. Older adults with higher self-efficacy were more likely to report greater competence in navigating digital platforms searching for health information and assessing online health contents. This is consistent with Bandura's (1997) assertion that individual's beliefs in their capabilities strongly influence their behavioural engagement and persistence when facing challenges. Digital health literacy inherently involves tasks that require confidence in surfing the internet

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by navigating unfamiliar systems, troubleshooting errors and interpreting complex information. This is in accordance with the finding of Liu et al. (2023) that self-efficacy has a significant positive relationship with health literacy which indicates that patients with higher self-efficacy tend to have higher health literacy. It was further found that self-efficacy mediated the relationship between social support and health literacy. Similarly, Luo et al. (2025) finding revealed a statistically significant positive relationship between self-efficacy and e-Health literacy among older adults. That is, older adults with higher self-efficacy tended to have higher e-Health literacy.

Limitations

While this study provides valuable insights into the psychological determinants of digital health literacy (DHL) among older adults in Ondo, Nigeria, several limitations should be acknowledged. First, the cross-sectional design employed in this study limits the ability to infer causal relationships between the psychological factors (attitudes, health locus of control and self-efficacy) and digital health literacy. Although significant associations were identified, the directionality of these relationships cannot be definitively established. Longitudinal or experimental research is needed to determine whether changes in these psychological constructs precede improvements in DHL.

Second, the study relied on self-reported measures, which may be subject to social desirability bias, recall bias, or overestimation of digital competencies. Participants may have provided responses they perceived as favourable or may have inaccurately assessed their own digital skills. Future studies should consider incorporating objective assessments or performance-based tasks to complement self-report data. Third, the sample was drawn from a single State-owned hospital in Ondo town, using a convenient sampling technique and also excluded individuals who had travelled abroad. This may limit the representativeness and generalizability of the findings to older adults in other regions of Nigeria, particularly those in rural or underserved areas with limited access to digital infrastructure.

Lastly, the use of a self-developed scale to assess attitudes toward digital health technology, although demonstrating acceptable internal consistency, this has only been used in this study. This could affect the comparability of findings across studies. Future research should consider using standardized validated instruments.

Conclusion

This study examined the psychological determinants of digital health literacy among older adults in Ondo, Nigeria, focusing on attitudes toward digital health technology, health locus of control (internal and external), and self-efficacy. The findings revealed that these psychological factors jointly and

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significantly predicted digital health literacy. Specifically, attitudes toward digital health technology emerged as the strongest predictor, followed by self-efficacy and internal health locus of control. In contrast, external health locus of control did not make a statistically significant unique contribution to DHL. These results emphasize the importance of addressing psychological readiness in efforts to enhance digital health literacy among older adults. Positive attitudes toward digital tools, confidence in one's ability to use them, and a sense of personal control over health outcomes are key drivers of engagement with digital health resources. Interventions aimed at improving digital health literacy among older adults should go beyond basic digital skills training. Strategies that foster positive attitudes, build self-efficacy through hands-on experience and social support, and strengthen internal health locus of control should be designed and incorporated into health programmes. Health policymakers and programme designers should consider these psychological dimensions when developing inclusive digital health strategies tailored to the needs of aging populations.

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