

Consumer Health Empowerment and Digital Health Application Adoption: Examining the Roles of Health Literacy, Digital Trust, and User Engagement.

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ABSTRACT

The reshaping of healthcare delivery is being affected by digital health technologies. Health-related searches have contributed to the overall rise in internet searches. According to an eMarketer report. This study examines the role of health literacy, digital trust, user engagement on consumer health empowerment and the adoption of application in digital health. Data were collected from the 300 users of digital health applications through a structured questionnaire. Through a descriptive statistic, correlation analysis and SEM the data collected were analyzed. As indicated by the findings, health literacy, digital trust, and user engagement all have a significant positive effect on consumer health empowerment. In addition, research shows that consumer health empowerment has a positive and strong impact on the developmental and adoption of digital health applications. User engagement was the most powerful predictor of consumer health empowerment. Digital health technologies and the internet are important. Therefore, developing digital competencies, knowledge and trust are essential for enhancing adoption rates and improving healthcare outcomes..

Keywords: Consumer Health Empowerment, Digital Health Application Adoption, Health Literacy, Digital Trust, User Engagement, Digital Healthcare, eHealth Literacy, Technology Adoption...

INTRODUCTION

Consumer empowerment in health refers to a belief in one's ability to make informed decision making on health issues and engage in the management of health condition. As a result, an empowered consumer is one who has a sense of control in interactive healthcare processes (Matsuoka et al., 2023). Self-efficacy is an important part of consumer health empowerment that helps them determine how realistic it is that they can effectively do a specific task. For instance, they will be able to use digital apps for self-care with self-efficacy. Moreover, perceived control assists in consumer health empowerment which denotes the person's belief that they can control the health outcomes through their interaction with the healthcare establishment. Also, a person's commitment in the healthcare context promotes engagement and involvement in decision-making paving the way for empowerment of consumer health (Zhao et al., 2023).

Consumer health empowerment (CHE) refers to the process by which people gain greater control over their health. In other words, empowered consumers will take an active part in seeking health information, performing self-management behaviour, participating in shared decision-making, and using available resources for positive health outcomes. At first, this process was a difficult one.

However, with the advent of digital health technologies, it is strengthened further. For example, using digital technology allows people to quickly access health-related information, services, products and personalized health care. However, for the successful adoption of digital health applications, merely the availability of digital technology will not suffice. Instead, it refers to the capabilities and perceptions of individuals which assist in technology acceptance and continued use.

Another factor influencing digital health adoption is digital trust. The term refers to the faith about reliability, security, privacy and effectiveness of care as well as the technology on which the digital technology is based. Most health care information is sensitive and beliefs about data privacy, cybersecurity, and quality of information may influence the adoption process. Similarly, past studies have shown that if consumers mistrust a digital health technology, this will not only impact their intention to use it, but also to continue using it. In addition, people trust those websites more that they feel safe and secure (Liu et al., 2025).

User engagement is an important factor that affects the success of digital health applications. Engagement refers to the level of cognitive, emotional and behavioural effort deployed by users in a digital environment. The initial uptake and ongoing usage of health applications is

influenced by engagement. When patients are highly engaged, it can lead to positive health outcomes for them in that they follow treatment advice, regularly measure readings and continue to engage with DHIs over extended periods of time. Research has shown that personalized content, interactivity, social support, and ease of use affect engagement levels in digital health contexts (Olaniyi et al., 2022).

Theoretically, the adoption behaviour of Digital Health is supported by the following theories, namely TAM, UTAUT, and Health Empowerment model. In the above mentioned models, the pictures that seek to show how useful, ease of use, trust and competencies affect the behavioural intention for adoption. The CHE framework on health literacy, digital trust and active user involvement provides a powerful valid voice for the adoption of digital health applications.

Although there has been some uptake in popularity of health technology, there are varying ways of doing that. Current mistrust and access/engagement issues have prevented users from embracing digital health. Hence, to underpin successful digital health strategies and health outcomes, it is critical to understand health literacy; feelings of trust in the digital; and the empowerment of digital health users.

To enhance CHE and the adoption of digital health application the roles of health literacy, digital trust and user engagement were investigated. This research adds to the increasing literature on digital health. Furthermore, it provides a distinctive lens for healthcare workers, policy makers, application developers and researchers to better understand and enhance the effectiveness and inclusiveness of digital health interventions.

Literature Review

The idea of CHE has a great deal of academic literature because this idea has better health outcomes and more health management involved by patients. Aujoulat et al. (2007) proposed that health empowerment enables the individual to acquire skills, confidence and knowledge to make necessary health choices. Digital health technologies give consumers access to personalized information, remote healthcare services and self-monitoring tools, providing greater opportunities for empowerment. Stoumpos et al. (2023) indicate that the digital transformation has shifted healthcare service delivery away from provider-centred approaches to more interactive, participatory and consumer-oriented.

Digital trust is another determinant of acceptance of digital health technology. In the context of health care importance of trust is much more since health care users tend to disclose a lot of sensitive personal and medical information on digital health care platforms. According to McKnight et al. (2011), "Trust allows reduction of uncertainty and related perception of risk" (Lau et al., 2023).

The Davis (1989) model is one of the most popular models to explain technology adoption. According to the model, two main factors greatly influence the user's intention to

use the technology, which are the usefulness and easy use. Numerous studies in digital health have established the applicability of the TAM framework. For instance, the study done by Mechta et al (2024) revealed usefulness and ease of use to be significant predictors of the adoption of digital health services. As suggested in the findings, ease of use of the users was most strongly predictive of useful adoption behaviour. Many other digital health services have shown similar findings. Telemedicine may include everything from wearables to digital Health apps.

The process of user engagement is a key driver that connects digital health adoption to improved outcomes. The researchers Perski et al. have defined engagement in 2017 as the measure of usage and/or interaction with an intervention. Engagement is said to be characterized by attention, interest and affect. According to Olaniyi et al. (2022), the use of mobile health applications is contingent on the level of engagement the applications foster. Engagement means getting interested and involved in something, like a social phenomenon through social activities and computerised components (Ikwunne et al., 2021). Research indicates that features such as personalization, interactive feedback, gamification and social support improve engagement and enhance retention rate.

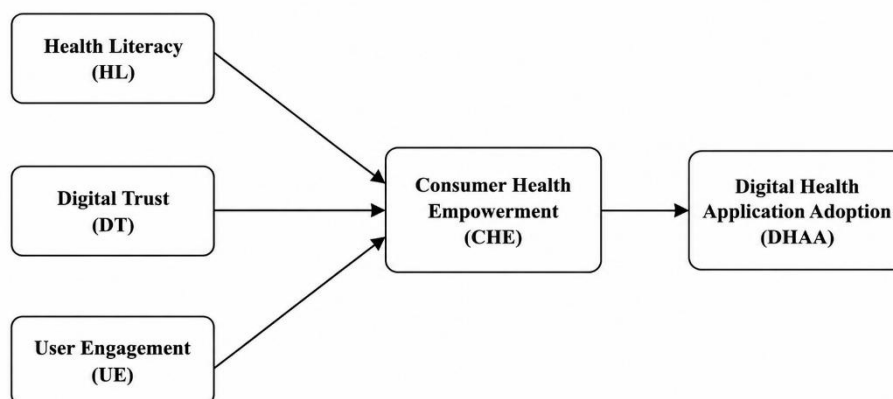
The self-management and patient-centered views have also received attention with regard to consumer empowerment and digital health adoption. Greene and Hibbard studied the results of patient activation and patient-centred care in the face of chronic illness. Patients' empowerment can facilitate the practice of preventive health behaviours and proper management of the course of a chronic disease, they reported. The empowerment of consumers to self-manage their health on an active basis, and play an active role in their healthcare has also been argued. Digital health technologies can empower patients as individuals can more easily.

Recent findings show how health literacy can help consumers assess the credibility of health information and influence their trust in digital health. When users are afforded higher levels of trust in technology, they show heightened engagement and usage intent. The sequential mediation effects illuminate how health literacy, trust, and engagement collectively work to enhance CHE and technology outcomes.

The existing literature provides evidence of determinants of digital health adoption. However, few studies examine health literacy, digital trust, and user engagement in one consumer empowerment model to understand one adoption behavior. Earlier research studied one or two predictors but not all predictors together. For that reason, to fill this gap, this paper empirically examines the joint effect of health literacy, digital trust, and user engagement on CHE and the adoption of digital health apps.

Conceptual Framework

Figure 1. Conceptual Framework



The proposed conceptual framework of the study is presented in the Figure 1 which shows a relationship between main factors of digital health application adoption. The framework suggests that the three variables, Health Literacy (HL), Digital Trust (DT) and User Engagement (UE) are direct factors that positively impact Consumer Health Empowerment (CHE). Higher levels of health literacy enable individuals to access, understand and use digital health information, and digital trust facilitates trust in the reliability, security and privacy of a digital health platform. Likewise, consumer engagement with digital health products fosters ongoing engagement with the technology and increases users' trust and ability to take an active role in their health. All these are proposed as potential mediators, namely Consumer Health Empowerment, which is the mediator between all these factors and increased DHAA. Therefore, it is hypothesized that if a person is empowered, they are more willing to use and stick to digital health apps to make healthy decisions and better health. Therefore, empowered consumers are expected to be more willing to embrace and remain in use of the digital health application to make healthy choices and to have better health outcomes as a result. The relationships proposed are tested empirically using SEM.

Objectives:

The purpose of this study is to find out the impact of health literacy on CHE of the respondents, the impact of digital

trust of the respondents in the adoption and continued use of digital health application. The ultimate goal is to examine whether user engagement affects one's willingness to engage in this application and whether one continue with it for better decision-making about healthcare services and good health as final purpose.

Hypothesis:

H1: Health Literacy has a significant positive effect on Consumer Health Empowerment.

H2: Digital Trust has a significant positive effect on Consumer Health Empowerment.

H3: User Engagement has a significant positive effect on Consumer Health Empowerment.

H4: Consumer Health Empowerment has a significant positive effect on Digital Health Application Adoption.

Methodology

Data were collected to examine the impact of health literacy, digital trust, and user engagement on CHE and the adoption of digital health apps. The data collected were analysed with different methods of analysis that are descriptive statistics, reliability analysis, correlation analysis and ultimately SEM. Data of 300 users who regularly use digital health applications were collected.

Table 1 Reliability Analysis

Construct	Number of Items	Cronbach's Alpha
Health Literacy	5	0.861
Digital Trust	5	0.884
User Engagement	5	0.903
Consumer Health Empowerment	5	0.892
Digital Health Application Adoption	5	0.917

Consequently, it becomes possible to use the questionnaire.

Each construct has indicated a value exceeding 0.8. The internal consistency and reliability scores of the questionnaire with alpha indicate excellent reliability.

Table 2 Descriptive Statistics

Variable	Mean	Standard Deviation
Health Literacy	4.08	0.61
Digital Trust	3.95	0.72
User Engagement	4.12	0.58
Consumer Health Empowerment	4.05	0.63
Digital Health Application Adoption	4.18	0.57

The mean values indicate that those surveyed have relatively high health literacy, digital trust, user engagement, consumer empowerment and adoption of digital health applications. These were the highest scoring

variables in terms of user engagement (Mean = 4.12) and application adoption (Mean = 4.18).

Table 3 Correlation Matrix

Variables	HL	DT	UE	CHE	DHAA
Health Literacy (HL)	1.000				
Digital Trust (DT)	0.621**	1.000			
User Engagement (UE)	0.598**	0.687**	1.000		
Consumer Health Empowerment (CHE)	0.704**	0.669**	0.732**	1.000	
Digital Health Application Adoption (DHAA)	0.687**	0.716**	0.755**	0.792**	1.000

$p < 0.01$

Table 4 Structural Equation Modelling Results

The correlational findings reveal that there is a strong correlation between all the variables of the study. CHE correlates most highly to the use of digital health application ($r = 0.792$).

H₁: Consumer health empowerment significantly influences digital health application adoption through health literacy, digital trust, and user engagement.

Path Relationship	Standardized Beta	t-value	p-value	Result
Health Literacy → Consumer Health Empowerment	0.412	7.824	0.000	Supported
Digital Trust → Consumer Health Empowerment	0.336	6.291	0.000	Supported
User Engagement → Consumer Health Empowerment	0.458	8.917	0.000	Supported
Consumer Health Empowerment → Digital Health Application Adoption	0.623	11.432	0.000	Supported

Table 5 Model Fit Indices

Fit Index	Recommended Value	Obtained Value
χ^2/df	< 3.00	2.18
GFI	> 0.90	0.931
AGFI	> 0.90	0.918
CFI	> 0.90	0.957
TLI	> 0.90	0.949
RMSEA	< 0.08	0.054

The results from Structural Equation Modelling (SEM) confirm the conceptual framework proposed, with high levels of empirical support. Health Literacy had a significant positive correlation with Consumer Health Empowerment ($\beta = 0.412$, $t = 7.824$, $p < 0.001$), and this means that a higher level of health literacy among the respondents facilitated them to manage their health. Likewise, Digital Trust ($\beta = 0.336$, $t = 6.291$, $p < 0.001$) positively affected Consumer Health Empowerment, indicating that higher levels of Digital Trust are associated with higher levels of Consumer Health Empowerment. User Engagement had the most significant estimate of Consumer Health Empowerment ($\beta = 0.458$, $t = 8.917$, $p < 0.001$), indicating that consumers' active participation in the use of digital health solutions positively affects their

confidence and involvement in managing their health. Further, the link between Consumer Health Empowerment and Digital Health Application Adoption was found with significant relation and positive direction ($\beta = 0.623$, $t = 11.432$, $p < 0.001$), meaning that by increasing the levels of Consumer Health Empowerment, the likelihood of Digital Health Application Adoption increases and continues even further. Overall, the results substantiate all the proposed hypotheses and support the conceptual model and its findings show the importance of the three factors: health literacy, digital trust, and user engagement for an increase of consumer empowerment and the adoption of digital health products and services.

Table 6. Hypothesis Testing Summary

Hypothesis	Hypothesized Relationship	Path Coefficient (β)	t-value	p-value	Decision
H1	Health Literacy $\rightarrow$ Consumer Health Empowerment	0.412	7.824	< 0.001	Supported
H2	Digital Trust $\rightarrow$ Consumer Health Empowerment	0.336	6.291	< 0.001	Supported
H3	User Engagement $\rightarrow$ Consumer Health Empowerment	0.458	8.917	< 0.001	Supported
H4	Consumer Health Empowerment $\rightarrow$ Digital Health Application Adoption	0.623	11.432	< 0.001	Supported

SEM analysis confirms the support of the four hypotheses. Among the three antecedent variables, Health Literacy and Digital Trust have significant strong positive effects on Consumer Health Empowerment, with Digital Trust having the strongest ($\beta = 0.458$). Moreover, the adoption of digital health applications is significantly and positively affected by Consumer Health Empowerment ($\beta = 0.623$), meaning an empowered consumer is more likely to adopt and persist in use of digital health applications. Below the P value-less than 0.001, significant path coefficients confirm that the conceptual framework in this study is valid and the importance of the factors of health literacy, digital trust and user engagement in raising consumer empowerment and adopting digital health technologies is confirmed.

Discussion

The findings of this research reflect a strong signal of the effects of CHE on consumer adoption of digital health applications. The results of the study showed that there is a high positive correlation between each of the dimensions of health literacy, digital trust, and digital engagement

with CHE, respectively, and that there was a high positive correlation between CHE and consumers' readiness to use and continue using digital health technologies. The results are in line with the emerging literature that highlights the impact of individual luminance and perceptions on technology acceptance in healthcare domain.

While grounded in scientific evidence, health literacy is potentially a great tool to empower consumers through health. Health literate consumers can better understand health information, navigate a complex web of information and choose health care plans that make sense to them. Health literacy is vital to the use of digital resources. As pointed out by the authors (Labs, 2005; Nutbeam, 2000; Norman and Skinner, 2006) the key demands of digital resource utilization are health literacy and eHealth literacy. This leads to consumers who can confidently read and use health information to use digital health interventions to manage their health needs.

Additionally, digital trust had a key role in predicting CHE. The most empowered respondents who intended to adopt digital health applications were those who found

them safe, reliable, and trustworthy. Trusting consumers can reduce certainty that reduces consumer ability to deal with risks and dangerous. This finding is consistent with previous research. Furthermore, potential users of GSCM deem it an important application as the use of this digital health application as well as Developing and Existing Health Care settings involves manipulation of patient data and information.

User engagement might be the strongest indicator of success. Health empowerment of consumers increased as the consumers were regularly using the digital health app, engaging with personalized features and interacting with the application frequently. Perski et al. argue that sustained engagement is a vital predictor of effectiveness and digital health apps' long-term success (2017) and Olaniyi et al. (2022). Interactive features, personalized recommendations, reminders, and real-time feedback seem to enhance user engagement.

There was a strong positive relationship between CHE and digital health application adoption, the study found. As a result, consumers empowered by products or services will use digital health applications for self-management, health monitoring and informed decision-making. The goal of patient-centered health care theory is achieving empowerment to promote self-management, monitoring of one's health and decision-making. The result shows that if consumers have the perception of being capable and informed, they show a greater willingness to adopt digital technologies for their use.

Correlation analysis, followed by structural equation modeling, indicates that health literacy, digital trust, and user engagement are complementary constructs which predict digital health application adoption through the consumer empowerment dimension. The constructs are complementary as the conceptual model is validated by the significant path coefficients, and the good fit indices.

The results of this research paper have significance in practice for practitioner institutes, Governments and software developers of digital health applications. Health literacy initiatives for healthy people and consumers should be enhanced in educational programs, digitally facilitated training exercises, as well as ensures access to accessible health information. Afterward, similar undertakings governing cyber security, data transparency, and technology ethics can help engender greater digital trust. Also, develop applications that are user-centred and bolster user engagement through individualisation, interactive communications and behaviour support features, to facilitate long-term adoption.

The study found that the three mechanisms linking health literacy and digital health empowerment to the uptake of digital health apps are user engagement, building digital trust and empowerment, and empowering consumers. The study found that empowering consumers, building digital trust and empowerment and user engagement are all important links between health literacy and digital health empowerment and uptake of digital health apps. A critical mechanism which is an important issue in the literature is pointed out here. Results reinforce the perception that digital health transformation is not only about technology but also investing in the consumer's management skills

and their capacity to interact with digital technologies and services they trust for better health.

Conclusion

This study contributes to the growing body of digital healthcare information and quantifies consumer empowerment as an enabler in the process of adopting digital health. The findings indicate that health literacy, digital trust, and user engagement have a significant impact on the consumers' ability to engage in more informed health decisions and utilize digital health technologies. Further, user engagement and health literacy and digital trust were the top three predictors of CHE, according to the results. The research shows that empowered consumers have greater intentions of continual adoption and use of digital health applications for health monitoring, to access health information and to seek healthcare interventions. Overall, the findings validate the conceptual framework proposed in the study that integrates three closely interrelated aspects: educative, technological and behavioural aspects to promote digital health adoption.

Recommendations

The study's results show that health care practitioners and policymakers must organize programs to enhance the consumer health literacy through conducting awareness programme, digital health literacy campaign, and easy access to health information. Digital health application developers can benefit from understanding consumers' needs to develop strategies successfully. For attracting consumers, the developer has to add new personalization and interaction as function within their Digital healthapps. Therefore, organizations can hit at the digital trust of consumers by implementing a consumer data security strategy, a privacy policy and a consumer health information management strategy. To make digital health applications more relevant and familiar for consumers, health institutions should encourage their use, making it a part of the health services. The Author's research model can also be applied for future research of independent variables such as perceived usefulness, technological self-efficacy, social influence or AI-based health care services. Research can also be done on various demographic and geographic areas for more generalised results; in terms of size and diversity of sample...

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