"Adoption of Digital Health Technologies by Consumers: Investigating the Factors that Influence the Usage of Digital Health Tools "

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Abstract

This study investigates the factors influencing the adoption of digital health technologies among consumers, with a focus on how technology acceptance mediates the relationship between digital health adoption and usage behavior. The study aims to enrich the understanding of digital health usage patterns, particularly in the Egyptian context. A cross-sectional survey was conducted with 394 participants from three Egyptian governorates: Cairo, Giza, and Alexandria. Data were collected through a combination of paper-based and online questionnaires, targeting individuals with varying levels of interaction with digital health technologies. The survey employed a five-point Likert scale to assess digital health adoption, technology acceptance, and usage behavior. Data were analyzed using SmartPLS software, employing PLS-SEM for hypothesis testing.

The results indicate a significant positive relationship between the adoption of digital health technologies and both technology acceptance and usage behavior. Moreover, technology acceptance was found to mediate the relationship between digital health adoption and usage behavior, underscoring its critical role in the effective utilization of digital health tools.
This research extends existing theories such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) by examining how technology acceptance moderates the adoption and usage behavior of digital health technologies. It contributes to the limited literature on digital health adoption in developing countries, particularly in Egypt, offering valuable insights for healthcare providers, policymakers, and technology developers aiming to improve digital health engagement.

Keywords Digital Health Adoption, Consumer Health Technology, Technology Acceptance, Health Behaviour

1. Introduction

Technological advancements in the 21st century have brought about drastic changes in almost all fields, including healthcare. The process of digitalization has transformed the healthcare landscape, offering both immense opportunities and challenges. Today's healthcare consumers are entering a world of unprecedented access

to digital health tools, driven by technologies such as Artificial Intelligence, Internet of Things, and advanced data analytics. This digital evolution is redefining how healthcare is delivered, how value is created and captured, and how consumers interact with health services, thus putting pressure on both healthcare providers and consumers to adjust quickly to these new realities (Agarwal et al. 2020; Keeling et al. 2021).

This paper aims to examine the relationship between technological advancement and consumer health behaviour. It investigates how various stakeholders, particularly consumers, orient themselves in the new world of digital health environments, perceive value, and adapt to factors that disrupt traditional healthcare delivery. As more digital health tools become available and new horizons open in healthcare, consumers must develop new capabilities and immerse themselves in fast, rapid, and consistent learning processes to effectively manage their health (Viswanathan and Sreekumar, 2019).

While there is a growing body of knowledge about digital health, there is still a lack of literature concerning the relationship between technological changes in healthcare and consumer adoption, usage behaviour, and technology acceptance. Previous research has examined the general impact of digitalization on healthcare delivery, but there is still insufficient research on how consumers need to adapt to this digital health economy especially for Egypt.

This research enriches the existing literature in the field of digital health by incorporating and further developing the idea of technological change and consumer health behaviour based on theories like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Marikyan and Papagiannidis, 2021; Rafique et al. 2020). Particularly, it sheds light on how digital health technologies affect the adoption, usage behaviour, and technology acceptance among consumers. Additionally, it presents a new approach by emphasizing the interaction between technological change and consumer health behaviour while incorporating mediational variable of technology acceptance. In addition to contributing to theory development, this research provides useful recommendations for healthcare providers, policymakers, and technology developers in the context of a continuously growing digital health environment (Benis et al. 2021).

The social aspect of this study lies in the fact that the digital age presents both opportunities and challenges for healthcare consumers. It opens up wonderful opportunities for improved health management, access to health information, and personalized care. Digital health infrastructure facilitates consumers' access to healthcare services, use of health resources across borders, and employment of ICT-based information that supports enhanced health outcomes (Alunyu et al. 2024).

However, it is important to note that it also poses certain problems due to the rate and extent of change in digital health technologies, as well as concerns about privacy, data security, and the digital divide. Consumers of modern digital health tools face ever-shorter technology lifecycles, the possibility of being overwhelmed by technological advancements, and the constant pressure to develop new digital health literacy skills (El-Shihy et al. 2024; Duha, 2024). In this respect, it is possible to identify the factors that determine the successful adoption and usage of digital health technologies by consumers. The suggested research question is: How the adoption of digital health technologies influence consumers' usage behaviour, and does technology acceptance play as a mediator in this relationship?

Based on the research questions, the study formulates hypotheses which depict the direct influence of digital health adoption on usage behaviour, as well as the mediator role of technology acceptance in this relationship. Therefore, the relevance of this research goes beyond the confines of theoretical research. Priorities vary for different countries, but as global health systems seek to better understand the social impact of digital health, a key priority is encouraging consumer engagement which creates an environment for improved health outcomes (Harrison et al. 2019). Due to this, this study will help policymakers, healthcare providers, and technology developers to understand the different hurdles and possibilities in the digital health environment so that they can design

ways of promoting the successful adoption of such technologies. In addition, it will assist the start-up firms to understand how consumers react accordingly to digital health adoption withing technology acceptance.

In addition, the outbreak of COVID 19 has impacted the delivery of care across various sectors within the health system and it becomes crucial for the consumer to understand technological disruption in the health sectors. Therefore, it would be possible to state that individuals who are able to maximize the usage of digital health technologies and develop the competence that is corresponding to it will become better prepared for managing their health, identifying such potential of the health care process, and adapting to the changes in the context of the developing and progressive field (Eriksen et al. 2021).

In order to achieve these objectives, the rest of the paper is as follows. Section 2 is the literature review and hypotheses section in which prior empirical evidence and theoretical work on factors that may influence the audit committee's effectiveness is presented and hypotheses are developed based on these. As for methodology used, Section 3 contains information on that. Last of all, Sections 4 and 5 highlight the result and discussion and is followed by the conclusion section.

2. Literature Review

2.1 Adoption of Digital health

The concept of digital health adoption can therefore be defined as the extent to which individuals, caregivers or organizations accept to embrace or use new technologies into management of their health or delivery of health services. Some of the most common examples of digital health can be categorized into the following: Mobile health or mHealth apps, wearable devices, Specifically, regarding consumer adoption, it can be perceived as consumer's desire and capacity to integrate the technologies of digital health into the framework of his or her health management. In this process individuals need to overcome some barriers and get acquainted with new knowledge because generally such tools should be used in practice (McGrath et al. 2024). Consumers' engagement with these technologies is essential for actualizing positive changes including better health, enhanced knowledge in health matters and individualized services. There are various theories which can analyze the different aspects of digital health technology adoption. Tentative theories enable understanding not only about adoption factors and determinants but also about mechanisms of adoption as well (Ahmad et al. 2020).

Davis (1989) came up with one of the most common theories in understanding technology adoption known as the

Technology Acceptance Model (TAM). TAM posits that two primary factors influence an individual's intention to use a technology: perceived usefulness (PU) and perceived ease of use (PEOU). PU refers to the degree to which a person believes that using a particular system will enhance their performance or outcomes, while PEOU reflects the degree to which a person believes that using a system will be free of effort. In the context of digital health, TAM suggests that consumers are more likely to adopt health technologies if they perceive these tools as beneficial to their health management and easy to incorporate into their routines (Natasia et al. 2022).

Building on TAM, the UTAUT, proposed by Venkatesh et al. (2016), offers a more comprehensive framework for understanding technology adoption. UTAUT includes four key constructs: performance expectancy (similar to perceived usefulness in TAM), effort expectancy (similar to perceived ease of use in TAM), social influence (the degree to which an individual perceives those important others believe they should use the new system), and facilitating conditions (the degree to which an individual believes that organizational and technical infrastructure exists to support system use) (Bayaga and du Plessis, 2024); Howard et al. 2017).

UTAUT also considers moderating factors such as age, gender, experience, and voluntariness of use. This model is particularly relevant to digital health adoption as it accounts for the

social and environmental factors that can influence an individual's decision to use health technologies (Lu and Tsai-Lin, 2024). According to Orr (2003) rogers theory of Diffusion of Innovations offers another valuable perspective on the adoption of digital health technologies. This theory describes how, why, and at what rate new ideas and technologies spread through cultures, categorizing adopters into five groups: innovators, early adopters, early majority, late majority, and laggards (Dhaked, 2024).

Rogers' theory identifies five factors that influence adoption rates: relative advantage (the degree to which an innovation is perceived as better than the idea it supersedes), compatibility (the consistency of the innovation with the values and needs of potential adopters), complexity (how difficult the innovation is to understand and use), trialability (the extent to which the innovation can be tested on a limited basis), and observability (the degree to which the results of an innovation are visible to others). In the context of digital health, this theory helps explain why some technologies are adopted more quickly than others and why certain individuals or groups may be more inclined to adopt them (Nabhan et al. 2024; Tanye, 2016).

Although not specifically a technology adoption theory, the Health Belief Model (HBM), proposed by Janz and Becker (1984), offers valuable insights into health-related behaviors that can be applied to digital health adoption. HBM suggests that health-related actions are influenced by perceived susceptibility

(an individual's assessment of their risk of developing a condition), perceived severity (their assessment of the seriousness of the condition and its consequences), perceived benefits (their assessment of the positive outcomes of adopting the recommended behavior), perceived barriers (their assessment of obstacles to behavior change), cues to action (factors that trigger the behavior), and self-efficacy (confidence in one's ability to perform the action successfully) (Jadgal et al. 2024; Tarkang and Zotor, 2015).

2.2 Usage behaviour

In the context of digital health technologies, the term usage behaviour discusses how the end users are capable of utilizing the various tools pertaining to health care throughout time. This idea entails all the elements that can be categorized as the intensity of use, including how often, how long, and in what pattern the user engages with and the specific features or functionalities that are touched during the interaction. This goes well beyond the extent of examining the early stages of use and extends towards the aspect of how people incorporate digital health technology into their everyday lives as well as how it fits into their paradigm of health behavior. Thus, understanding the usage behaviour is crucial for the purpose of evaluating the effects and a long-term relevance of such technologies to

enhance the health of individuals (Bertolazzi et al. 2024; Meskó et al. 2017).

Theoretically, UGT can be used in the explanation of the utilisation of digital health technologies although the model was originally created for the analysis of media consumption. UGT stands for usage theory which was devised by Katz et al. (1973) that people actively look for specific media in order to fulfil their needs or to achieve specific goals. In digital health context, this theory helps describe why users could use specific feature or function of the intervene health technology depending on their personal goals or infortune of interest. For instance, some users will for example use the application to record the physical activity needed to meet the fitness goals they have set for themselves while others will use the application to gain medical information that will assist them manage conditions such as diabetes for example (Chiu et al. 2024; Rice et al. 2021).

2.3 Technology acceptance

Technology acceptance means one's attitude towards the use of a particular technology for specific purposes. In reference to the use of digital health, this concerns the psychological condition where a user perceives attributes of a health technology as beneficial for adoption and utilisation in his/her daily life. The continued use of digital health technologies for the purpose of improving healthcare depends on identifying characteristics

which define the factors that influence the use of technology in organizations (Klaic et al. 2024; Kemp et al. 2019).

A number of theories and models have been postulated in the attempt to understand technology acceptance. Among them, TAM proposed by Davis in 1989 deserves far more attention. TAM however holds that two variables, perceived usefulness and perceived ease of use are the main predictors of an individual's behavioral intention with regards to using a given technology and thus its usage. The implication in the context of digital health is that people are more likely to use a technology where it enhances self-care and is easy to use (Tam et al. 2024; Leso and Cortimiglia, 2022).

Extending the concept of TAM, the UTAUT, has been proposed by Venkatesh et al. (2016) that includes two other factors called 'social influence' and 'facilitating condition'. Hence, UTAUT offers additional categories for the prediction of technology acceptance across different domains, including digital health. It implies that the use of a particular technology is not determined by the perceived utility of the technology only, but by force, resource and support (Sharma et al. 2024).

2.4 Adoption of digital health and Usage behaviour

Digital health technologies' adoption and usage behavior dynamics are complex and cannot be fully explained by a single

variable. The first step within the model, or the decision to take up a new digital health tool, paves the way for usage behaviour but does not predict the volume and effectiveness of that usage. The User – Technology Fit is thus a function of the user expectations at the start of engagement; the perceived value of using the technology during the first few interactions; and the flexibility of adapting the technology to the existing practice of health management (Pathania et al. 2024; Dash and Sahoo, 2021).

Some studies have found that use of technology adopted is crucial but the most essential factor determining the impact of health interventions is the level of appropriate usage. Research has revealed that the change from adoption to usage is moderated by factors such as users' perceived satisfaction, perceived usefulness, received technical support and the perceived goals/goals congruency of the technology. Furthermore, it is revealed that there is always a moderating effect in between the adoption and usage behaviour by such factors as digital literacy, health motivation and facilitating conditions available in the users' environment (Rangel and Humphrey Murto,2024; Jacob et al. 2022).

2.5 Adoption of digital health and Technology acceptance

As has been observed, the availability of technology and technology acceptance remain closely related to the use of Digital Health Technologies. An acceptance of technology comes before the first use and is usually explained by theories such as

TAM and UTAUT. The technology acceptance model which classifies perceived usefulness and perceived ease of use can play a huge role in reaching a decision towards the utilization of a digital health tool (Bao and Lee, 2024; Nadal et al. 2020).

On the other hand, adoption can also influence the construction of a technology acceptance model. When using a certain digital health tool, the perceived usefulness and ease of use change over time as new real-life experiences are gained and this cause the change of the acceptance status. The shown positive dynamic in the changes of attitudes towards different types of technologies reflects the fact that the combination of pre- and post-adoption factors should be taken into consideration in order to understand the overall acceptance and integration of the digital health technologies into the life of users (Tang and Tsai, 2024; Caron-Fasan et al. 2020).

2.6 Technology Acceptance and Usage behaviour

In this study, usage behaviour of digital health tools is influenced greatly by Technology Acceptance Model. User acceptance of a technology largely arises from aspects like perceived usefulness, ease of use and whether the technology is compatible with the tasks users perform, hence predict the frequency, duration and quality of use of the technology. A high level of acceptance makes a tool more likely to be used frequently and, in the way, intended since individuals have

incorporated the tool into his/her health management practice (Kamar et al. 2024; Rafique et al. 2020).

Nevertheless, it is crucial to observe in such a context that technological acceptance does not always lead to the intended usage behavior. This 'intention-behavior gap', that has been identified in many studies, means that even though positive acceptance of a system may be built from the intention to use a certain digital health tool, there are many factors that may hinder usage of the tool. Such reasons may range from other considerations that have more priority, technical challenges, alteration in health state, or altered motivation. This distinction between acceptance and usage is important in order to optimise digital health interventions, which should be not only accepted, but also actually used to their full potential by the target population (Tırpan and Bakırtaş, 2024; Granić and Marangunić, 2019).

Conclusion and Future Research Directions

The integration of this research work focuses on the complex dynamics that exist between digital health technologies, technology acceptance and usage behaviour of consumers. Knowledge on factors that influence adoption and use of digital health tools has been obtained from application of theoretical models such as TAM, UTAUT, and DT. In this sense, literature contributes to understanding why the uptake of digital health is

far from a simple process. Despite the adage 'early adopter,' these innovations are irrelevant since they represent the first but not the biggest adopter market; what truly matters must be sustained and effective technology use. In this context, the factors that define the transition from adoption to use comprise users' satisfaction, a perceived value, technical support, and the appropriateness of the technology to users' health goals and aspirations. Further, the study taps on the moderating effect of technology acceptance as being a key factor in between adoption and usage behaviour.

It also raises questions on how consumers' behaviour and engagement and their concerns such as privacy and data security affect their ability to engage in and adhere to the use of Digital Health technologies to its optimum. These implications are astounding for the healthcare sector for Egypt and other countries where researchers pay scarce attention to the adoption of digital health. Most critically, this study helps to create new knowledge in this field, and more specifically, the study addressed the research questions in the context of the Egyptian culture, society, and technology. Therefore, the suggested research model and hypothesis as follows:

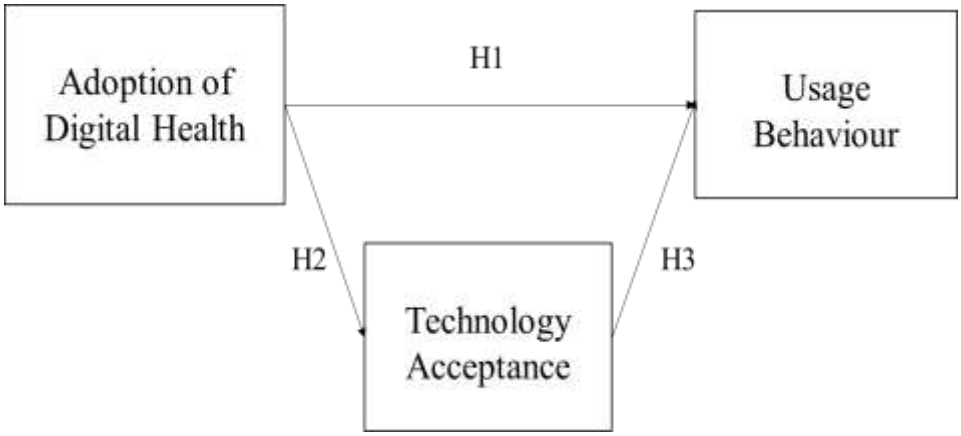

Figure (1): Research Model

Source: Developed by the author

As demonstrated in Figure (1) the proposed research model analyses the complex interconnection of the adoption of digital health technologies, technology acceptance and usage behaviour. Technology acceptance is proposed to translate the adoption to usage behaviour and moderates the relationship between adoption and usage. In the following literature, some theoretical frameworks offer a satisfactory conceptual groundwork to explicate these relationships more systematically.

Drawing from the works of Davis (1989), the study is anchored on the Technology Acceptance Model (TAM). TAM posits that an individual's intention to use a technology is determined by two primary factors: Attitude includes two constructs; perceived usefulness & perceived ease of use. In the context of digital health

adoption, TAM suggests that consumers are more likely to adopt and use digital health technologies if they perceive them as useful for managing their health and easy to use.

The idea here is that, through the adoption of digital health technologies, new opportunities for health management may be created that can help or hinder the acceptance of these technologies. For example, with the emergence of wearable health devices, it may be claimed that people require new levels of digital competence to deal with the new technologies. This shall enhance technology acceptance and subsequently the usage behaviour so as to arm the consumer with competencies in using a given digital health tool.

Based on the aforementioned TAM, a more comprehensive theory as the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh et al. (2003). Additional aspects also exist in UT–AUT which include social influence, facilitating conditions and the output of factors such as age, gender and experience. In the context of digital health adoption, UTAUT can help explain how factors beyond just usefulness and ease of use—such as social norms around health technology use or the availability of technical support—influence both technology acceptance and usage behaviour.

Rogers' Diffusion of Innovations Theory (2003) provides another valuable perspective on the adoption and spread of

digital health technologies. This theory divides the adopters into categories (innovators, early adopters, early majority, late majority, and laggards) and gives details about the nature of innovations that determines the rate of adaptation. Thus, for the digital health technologies, characteristics like, perceived relative advantage over traditional health management procedures, tolerance level for incorporating digital health technologies into the existing work culture, and the magnitude to which users could easily observe the advantages of using it, greatly determine both the adoption and usage behaviour.

Among the non-technology adoption theories, we have the HBM which was developed by Rosenstock in 1974 and focuses on health-related behaviours as can be adopted to digital health. The second perspective, the HBM posits that health-related behaviours are determined by perceived risks to health, perceived risks to conditions, perceived benefits of action, perceived impediments to action and prompts to action. In the context of digital health this kind of model can aid in understanding why some people may be more prone to engage and utilize electronic health technologies and in a steady manner according to their health beliefs and perceptions.

Bandura's Self-Efficacy Theory (1977) can be particularly relevant when considering technology acceptance as a mediator between adoption and usage. Self-efficacy refers to an individual's belief in their ability to successfully perform a

particular behaviour. In the context of digital health, an individual's technology self-efficacy—their confidence in their ability to use digital health tools effectively—can significantly influence both their acceptance of the technology and their actual usage behaviour.

Through the assimilation of these multiple theories, the proposed research model is capable of providing a synthesis of the numerous correlations between digital health adoption, technology acceptance, and usage behaviour. Such an approach offers a complex research angle on how consumers interact with, accept, and utilize digital health technologies in an evolving healthcare landscape. This integration of the theories indicate that digital health technologies should improve the acceptance of technology through perceived utility, operational simplicity and proficiency. Higher levels of technology acceptance are anticipated to support higher usage behaviour as the consumers gain familiarity and confidence with the digital health technologies. Lastly, it can be observed that higher usage behaviour can result in better health and even an empowered health care consumer.

The conceptual model adopted in this research contributes significantly to developing an understanding of how the integration of DHTs affects usage behaviour with technology acceptance as a key moderating variable. They enable consideration of factors that facilitate consumer interaction with

health technology; this is critical for those in the health sector, policy makers, and technology developers who wish to advance the uptake and effective heath care solutions from digital health technologies.

The proposed Research Hypotheses as follows:

H1: Adoption of digital health technologies has a significant effect on usage behaviour

H2: Adoption of digital health technologies has a significant effect on Technology Acceptance

H3: Technology Acceptance has a significant effect on Usage behaviour

H4: Technology acceptance mediates the relationship between Adoption of digital health technologies and Usage behaviour

3. Methodology

3.1. Data Collection and Sampling

In order to minimize errors, a cross-sectional survey was designed and piloted before the actual data collection exercises were undertaken. The survey was self-complete, and it included people with variation in socio-demographic characteristics. Since this study aims to investigate the factors that influence the

adoption of digital health technologies, the respondents chosen herein had prior knowledge or interaction with digital health tools including m- health applications, telemedicine solutions or wearing gadgets. The participants were recruited from the three governorates of Cairo, Giza and Alexandria whereby these are the most important urban centers for the provision of health care in Egypt and consist of the highest population density. The participants were persons who were 18 years and above and with varying levels of usage of technologies in the health sector.

Convenience sampling technique was used in the current study by intercepting respondents through social media platforms and at the entry and exit points of the hospitals, clinic and other health facilities. Three survey locations were found in each of the cities; the low-income range, middle-income, and the high-income earners in each city were covered so as to facilitate a diverse sample. To counteract the above problem, each respondent potential was asked for their permission to take part in the study at each survey stage. Following the removal of incomplete response entries and outliers for all the variables, 394 actual responses were received during June to August 2024. Online data was collected using Qualtrics link while paper-based survey was completed by the respondents and then data was manually transferred to Qualtrics.

3.2. Measures

A five-point Likert-scale survey (1 = strongly disagree; 5 = strongly agree) was used to evaluate the constructs related to digital health technology adoption, usage behaviour and technology acceptance. Key construct for the study perceived ease of use was adapted from prior research based on the UTAUT model (Abu-Dalbouh, 2013; Dash and Sahoo, 2021; Davis, 1989; Venkatesh et al. 2003). Items to measure these constructs were tailored to the context of digital health technologies and technology acceptance, including questions about how useful and easy to use respondents found tools such as telemedicine platforms and mobile health apps.

3.3. Data Analysis

The data that were collected were subjected to analyses using SmartPLS software and based on the PLS-SEM analysis (Ringle et al. 2015; Sarstedt and Cheah, 2019). Therefore, PLS-SEM was selected considering the fact that it is ideal for prediction premises in addition to the fact that it is capable of handling intricate relationships such as presence of higher order formative constructs.

To test internal consistency and validity of the constructs, reliability and validity of measurement model were analyzed employing Cronbach's alpha (α), composite reliability (CR),

average variance extracted (AVE), and rho_A values. Path analysis was then carried out to determine between the constructs; path coefficients (β), t-values, and p-values for the hypotheses of the study were thereafter computed.

4. Results

4.1 Confirmatory Factor Analysis

Table (I): Reliability and Validity Measures of Variables

	Item	Loadings	VIF	Cronbach's Alpha	rho_A	CR	AVE
Adoption of Digital health	ADH1	0.797	1.744	0.825	0.842	0.876	0.586
	ADH2	0.895	1.827				
	ADH3	0.706	1.900				
	ADH4	0.802	2.124				
	ADH5	0.819	2.097				
Usage Behaviour	UB1	0.751	1.459	0.868	0.882	0.900	0.601
	UB2	0.883	1.451				
	UB3	0.802	1.656				
	UB4	0.731	1.562				
	UB5	0.887	1.187				
Technology Acceptance	TA1	0.756	2.007	0.760	0.768	0.839	0.513
	TA2	0.796	2.747				
	TA3	0.900	1.954				
	TA4	0.828	2.163				
	TA5	0.804	2.097				
	TA6	0.778	1.870				

Source: Calculations based on sample collected through surveys using SmartPLS

After considering the presence of multicollinearity, it was determined that the VIFs have a value that is lower than five in each of the Adoption of digital health (Shrestha, 2020). According to Taber (2018), the Cronbach Alpha value was greater than 0.7, which indicates extremely high levels of internal consistency when seen from the perspective of measurement

reliability indices. Composite reliability (CR) with a value larger than or equal to 0.7 and Average Variance Extracted (AVE) with a value greater than or equal to 0.5 should be used for validity measurement and internal consistency reliability, according to Shrestha (2021). In light of this, it is possible to assert that the statements are both dependable and authoritative.

Table (II): Inner VIF Values for Multicollinearity

	Adoption of Digital Health	Technology Acceptance	Usage behaviour
Adoption of Digital Health	**0.766**		
Technology Acceptance	**0.656**	**0.775**	
Usage behaviour	**0.770**	**0.659**	**0.716**

Source: Calculations based on sample collected through surveys using SmartPLS

Since all the values are below 0.90, as explained by Voorhees (2016), it establishes the presence of discriminant validity. Consequently, further employment of SEM is warranted.

4.3 Structural Equation Model

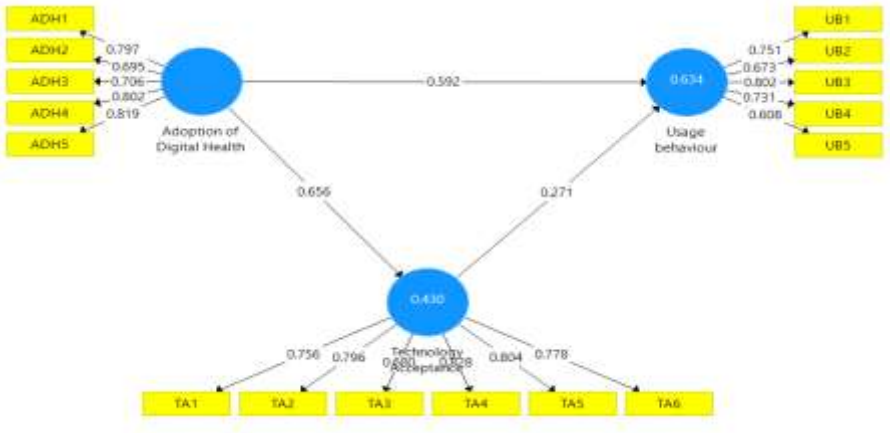

Figure (3): Structural Equation Model for phenomenon

An explanation of the phenomenon of the Digital health technologies in Figure 3, which also shows the linkages and interactions between the various variables. Notably, every loading shown in the figure is greater than 0.6 (Wong, 2013).

Table (III): Path Coefficients for Phenomenon

Hypothesis		Original Sample	Standard Deviation	T Statistics	P Values	Result of Hypothesis Testing
H1	Adoption of Digital Health -> Usage behaviour	0.656	0.036	18.290	0.000	Supported
H2	Adoption of Digital Health -> Technology Acceptance	0.592	0.040	14.913	0.000	Supported
H3	Technology Acceptance -> Usage behaviour	0.271	0.045	6.007	0.000	Supported
	Mediation Effects					Supported
H4	Adoption of Digital Health -> Technology Acceptance -> Usage Behaviour	0.177	0.031	5.738	0.000	Supported

Source: Calculations based on sample collected through surveys using SmartPLS

Table 3 presents significant positive impacts of Adoption of Digital health on Usage behaviour and Technology acceptance by (β=0.036 and 0.040) at a 99% confidence level. While also Technology acceptance demonstrates a significant positive impact on Usage behaviour by (β=0.045). Thus, Technology mediates the relationship between Adoption of digital health and Usage behaviour by (0.031). All hypotheses are accepted H1, H2, H3 and H4 at a 99% confidence level.

Table (IV): Model Goodness of Fit for Data

	SSO	SSE	Q^2	R Square	R Square Adjusted
Usage Behaviour	267.736	180.184	0.327	0.634	0.632
Technology Acceptance	299.452	234.568	0.217	0.430	0.428

SRMR=0.109, d_ULS=1.606, d_G=0.461, Chi-Square=880.851, NFI=0.709

Source: Calculations based on sample collected through surveys using SmartPLS

Examining the model's performance, Table V reveals an R2 value of 0.634 and 0.430 indicating that 63.2% of the variation in Usage Behaviour and 43.0% of the variation in Technology acceptance. The model's predictive relevance is evaluated using the cross-validated redundancy measure (Q2). Since Q2 > 0, it signifies that the model exhibits good predictive relevance (Sharma, 2021). The goodness of fit is measured by the Standardized Root Mean Square Residual (SRMR). With an

SRMR value of 0.109, the model can be considered a relatively acceptable fit (Kock, 2020).

4.2 Discussion

In light of the current study's results, this work makes a unique contribution to the research on the factors influencing the choice and patterns of digital health adoption. Other prior works like Davis, Bagozzi, and Warshaw (1989) noted that technology acceptance plays a crucial role in determining the user behavior which is echoed by this study whereby it was found that Technology acceptance has a positive relationship with usage behavior (β= 0. 045). Moreover, this study contributes to this literature since it provides empirical evidence in support the technology acceptance model in predicting the mediating role between digital health adoption and usage behaviour indicated by the mediation effect of 0. 031. This puts accent on the aspect that the acceptance of users is a critical factor because it impacts on how often users engage and utilize digital health technologies.

As compared to previous research about the factors affecting technology acceptance as identified by Venkatesh et al (2003), this study's contribution is proved that the adoption of the digital health systems has a substantial impact on both usage conduct and acceptance and the results confirmed all hypothesis at 0. 999 level of confidence. The above studies support the hypothesis for the correlation between the use of digital health

and its impact on users' engagement with the technology and again emphasizes on the theory of user acceptance influence on effective usage of the technology.

Hence, the current research provides the model's statistical results that provide some new perspectives on the digital health adoption environment. It means that, the regression model has an R-squared of 0. 634 For usage behaviour =0. 430 for technology acceptance, this work establishes that a significant amount of variation in these outcomes is accounted for by the model. Furthermore, the values of Q^2 ensure that the model is predictive since the $Q^2 > 0$ means that the model is predictive (Sharma, 2021). In previous research, adoption, and acceptance in technology have been looked at; however, the high predictive relevance in this study makes additional solidity to the based relations.

Furthermore, an examination of the SRMR of the various models confirmed that the proposed model had a good fitness: SRMR = 0. The index 109 stands for an acceptable level of fit. It is, however, not exaggerated perfect but is deemed to fit the model standard defined by Kock (2020) as moderate to best model fit. This value indicates that despite the ability of the model to predict adoption, technology acceptance, and usage behaviour, there is still the possibility of redefining the model by coming up with improved frameworks for the model that captures other factors that dictate the usage behaviour.

Thus, this study supports previous theoretical propositions but extends the knowledge in the technology acceptance and digital health domain by investigating the mediating role of technology acceptance. Therefore, this study offers significant contributions to the streams of digital health studies by enriching the existing knowledge about the effects of adoption on usage behaviour and acceptance.

5. Conclusion

In this paper, the authors have described and explained technology adoption, technology acceptance, and usage behavior in relation to the use of digital health technologies as well as offered crucial empirical evidence that can be applied to digital health systems. Altogether, the findings support the hypothesis that the level of technology acceptance and usage behavior are influenced by the use of digital health technologies positively (Technology acceptance: β=0. 040; Technology usage: β=0. 036); whereby the information supports the need to encourage the use of such technologies in order to foster interaction with the target group. Additionally, technology acceptance is shown to have a strong influence on usage behavior (β=0.045), and it mediates the relationship between digital health adoption and usage behavior, further underscoring its critical role in the effective use of digital health systems.

The statistical results, with an R^2 of 0.634 for usage behavior and 0.430 for technology acceptance, indicate that a substantial proportion of the variance in these constructs is explained by the model. Moreover, a desirable level of practical model fit has been achieved according to the SRMR at the value of 0. 109, which can be considered as an acceptable level of fit, but there is nothing more than that concerning the fit and improvement. The predictive relevance of the model ($Q^2 > 0$) also underlines the stability of the model in predicting the users' behaviors and acceptance towards the digital health technologies. Therefore, these studies support the existing theories but are an advancement in the sense of mediating technology acceptance.

Academic and Practical Recommendations

Academic Recommendations

There is a clear theoretical framework in this study that can support the investigation of the relationship between digital health adoption and usage behavior with emphasis on technology acceptance. But the future empirical work should extend upon that by testing other variables that could have an impact on the user's activity. Some variables, like perceived risk, perceived trust in technology, age, gender, and education could reveal more about customers' intentions regarding technology consumption and usage patterns. By incorporating these factors into the expanded models,

one is able to come up with what may be referred to as a more holistic approach as far as understanding what leads to the utilization of digital health services is concerned.

Furthermore, future cross-sectional studies within other types of sectors or across different geographical locations would complement these results. It is possible to examine whether there are differences of digital health adoption between the urban and rural population or between various sectors of healthcare in the developed and developing countries. Without such comparisons, one would be blinded to the various factors that affect adoption and usage behaviour, on which meaningful and directional pointers for context-sensitive interventions could be derived.

Finally, there is a need to conduct longitudinal studies in order to observe how the technology acceptance and usage behaviour changes as time progresses. This could be due to the changes in the health care delivery system or changes in the newer technologies that are developed. Such tracking over time would give insights of the long-term orientating impact and sustainability of the adoption of digital health.

Practical Recommendations

Based on the study's conclusion, it is evident that healthcare providers and developers of technologies in the digital health sector need to shift towards enhancing acceptance of the

technologies given that it is a key determinant of the usage behavior. To this effect, focus should be placed on improving the adoption of digital health technologies which calls for improving user experience and handling of their worries revolving around data privacy and security. Hearing both patients and healthcare professionals accept technology during training programs also &Training related programs that can be done for patients as well as the health professionals might also enhance acceptance since human beings will be comfortable using these technologies.

Awareness should be created to offer people a better understanding of the features and usefulness of using such technologies. One way that healthcare organizations can increase adoption rates is if the practical application and health repercussion associated with these technologies are made known to both the healthcare provider and the patient. Such campaigns should highlight how digital health can help to make the delivery of care and treatment easier, bring better results and generally increase the performance of the health sector thus generating more users.

Finally, the stakeholders, especially the policymakers, have a major responsibility of ensuring digitization is enhanced as a key component of healthcare systems. It is equally important to create more guidelines and incentives that can push health-care organizations to take advantage of digital systems. Such policies should give direction on integration of digital health and also

recommend equal sharing of such technologies in all kinds of health facilities. This will also ensure that the right policy environments are developed to support vast shifts towards digital health hence improving the efficiency and technological readiness of the health systems.

Further research could investigate other mediating or moderating variables like organisational culture, availability of resources or kinds of technologies (Hassan, 2014). Previous studies like (El-Shihy and Mohamed, 2023), have investigated how start-ups can be influenced by digital marketing adoption due to Technology, Organization, and Environment (TOE) and this could also benefit the start-ups that work on digital health technologies to increase technology acceptance that might influence usage behaviour.

By leveraging the insights from this research, both academics and practitioners can contribute to the effective implementation and adoption of digital health technologies, leading to improved healthcare outcomes and more efficient systems of care delivery.

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Appendix

Appendix A

Measurement Development

Variable	Statements	source
Adoption of Digital Health	1. I am addicted to using digital health consultation services 2. I must use digital health consultation 3. Using digital health consultation has become natural to me 4. I intend to continue using digital health consultation in the 5. future	5 statements A 5-point Likert scale. Dash and Sahoo (2021)
Usage behaviour	6. I will always try to use digital health consultation in my daily life 7. I plan to continue to use digital health consultation frequently 8. I intend to use digital health consultation if I have access to the internet facility 9. I often use digital health consultation to perform my job 10. I frequently use digital health consultation 11. I use digital health consultation regularly	6 statements A 5-point Likert scale. Dash and Sahoo (2021)
Technology Acceptance	12. Learning to operate mobile tracking on patient progress system would be ease for me 13. I would find it easy get mobile tracking on patient progress system to do what I want it to do 14. My interaction with mobile tracking on patient progress system would be clear and understandable 15. I would find mobile tracking on patient progress system to be flexible to interact with 16. It would be easy for me to become skilful at using mobile tracking on patient progress system	5 statements A 5-point Likert scale. Abu-Dalbouh, (2013)