

Acceptance of Consumer-Oriented Health Information Technologies (CHITs): Integrating Technology Acceptance Model with Perceived Risk

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This paper is focused on understanding the growing demand for consumer-oriented health information technologies (CHITs) wearable and adult healthcare management apps. This study utilised the Technology Acceptance Model (TAM) and integrated the concept of perceived risk. The structural Equation Modelling (SEM) technique was applied to test the research hypotheses based on the 450 quantitative responses. This study confirms significant relationships between perceived usefulness, perceived ease of use, perceived risk, attitude, behavioural intention, and actual intention in using CHITs. The findings also showed no evidence to conclude that age and education influenced respondents perceived usefulness and perceived ease of the CHITs. This study incorporated the perceived risk to fill a gap in the literature and broaden the current TAM theoretical application in the public health setting. The study findings fill the health-related technology acceptance literature gap and broaden TAM's present application in the public health realm.

Povzetek: Študija CHITS - uporabniško usmerjenih zdravstvenih informacijskih tehnologij za zdravstvene aplikacije, se ukvarja z analizo več lastnosti, med drugim preprostostjo uporabe, tveganjem in uporabnostjo.

1 Introduction

Since the early 21st century, there have been noticeable changes in technological development in the field of healthcare. There is an increased number of well-connected and well-informed users for information dispersal, especially in healthcare. Recently, demographic changes such as the ageing population with an increasing chronic disease mean a growing demand for health care services [1,2]. Moreover, healthcare services are changing due to various technological advancements [3,4]; thus, a pressing need to adopt technological innovations in the coming years. These technologies modified and changed the healthcare operational model and people's perception of how they should be treated as patients and customers [5,6,7].

One of the most popular innovative adult healthcare technologies is health information technologies (HITs). HITs are defined as healthcare provider organisations' technologies in the patient care setting [5]. It deals with a broad range of technologies that store, share, and analyse patients' health information [8,9]. Most recent studies on HIT focus on service quality and how healthcare providers deal with patient's data handling [7,10] and how its

adaptation improves medical care as per commonly advertised [5,6,11]. However, studies on users' perceptions and use of HITs are limited as most of the studies focused on health care providers' perceptions rather than the end-user themselves [12,13,14].

Consumer-oriented health information technologies (CHITs) are electronic tools, including patient portals, wearable technology, and mobile apps that make health information available directly to patients and the caretakers [15]. As the CHITs can improve health management and outcomes, such benefits would increase the consumer acceptance and usage of CHITs. Shockingly, even though numerous CHITs were developed, most were rejected or abandoned for various reasons [15,16,17]. Studies found that the rejection reasons include the poor design of technology, lack of functional value, hard to use, and offering technology features that have functional ability [18,19,20]. It is a significant concern because the non-acceptance or non-usage behaviour means the CHITs do not benefit user well-being. Moreover, this phenomenon leads to

inadequate knowledge of the adoption intention of users of CHITs, resulting in research gaps.

This paper's remainder provides an overview of the existing research, hypotheses propositions, the methodology used, and empirical analysis. It is followed by a discussion of the study implications, followed by the concluding remarks.

2 Literature review

Consumer-oriented Health Information Technologies (CHIT)

As CHITs have become much more widely available, health-oriented apps designed for patients have exploded in recent years. Wearable devices are becoming very common, defined as computers, which reside on clothes or accessories (such as eyeglasses and rings) comfortable to wear [21]. The emergence of advanced communication technology made smartphones a medium to achieve health goals through various mobile health applications [22]. Different CHITs apps were offered through the Apple Store and Google Playstore for various health concerns [23]. Recently CHITs apps and accessories such as smart bands and wristwatches became available and favoured among health-conscious consumers [24,25]. The available CHITs apps and accessories perform health monitoring, physiological activity tracking, notification, heart rate recording, and sleep and mental health monitoring [3,4,5, 15,17,24, 26,27, 29,30]. A complete and detailed report can be quickly produced to help users monitor their health conditions [29]. Currently, the demand for CHITs wearable devices for health monitoring and management combined with modern aesthetics and fashion design continues to grow [27].

Technology Acceptance Model (TAM)

Ajzen [31] developed the technology acceptance model (TAM) in 1989 to understand human interaction with technology. The TAM models postulate the relationship between an individual's intention towards a specific behaviour and his actual behaviour [32,33,34,35]. TAM speculates two specific cognitive beliefs, namely perceived usefulness and perceived ease of use. Due to its adequate explanatory power and popularity, many studies utilised TAM in the technology acceptance and adoption of various information systems (IS) [36,37,38,39,40]. Although various factors affecting user acceptance of technology have been proposed and tested, the limited study focused on the consumer acceptance of CHITs. Also, most of the researchers did not consider the effect of perceived risk as a predictor.

Perceived Risk

This study explores the enabling factors adopted from the literature on consumers' adoption intention for CHITs. First, this study adopted the revised TAM model by [41] that included the risk perception dimension in the original TAM framework. This study postulated that user perceptions of CHITs' ease of use, usefulness and perceived risk were the critical factors affecting an

individual's adaptation of CHITs. Perceived risk is defined as a consumer's perceptions of the adverse consequences and uncertainty associated with their action [42,43]. Accordingly, customers will reduce or even refuse technology usage if they subjectively perceive an injury or a loss (risk perception) while using the technology, thus making perceived risk a vital factor affecting usage behaviour [37,44]. Besides, the opportunities to engage with their health information directly over CHITs also put the users' private information at risk [45]. This paper's remainder provides an overview of the existing research, hypotheses propositions, the methodology used, and empirical analysis. It is followed by a discussion of the study implications, followed by the concluding remarks.

3 Study hypotheses

Numerous studies revealed a strong influence of the perceived usefulness (PU) on consumer intention and attitude towards technology usage [26,46,47]. Besides, Zhang et al. [48] claimed that perceived usefulness would predict adoption intention if relevant technologies fit consumers' lifestyles. The introduction of CHITs to consumers has proven difficult, and rates of technology use have been limited as various researchers reported various reasons CHITs were abandoned by consumers [49,50,51,52,30]. However, when consumers perceived CHITs as useful, they would be more likely to accept CHITs [52,30].

A vast number of studies show the significant effect of perceived ease of use (PEOU) on technology usage. Abdullah et al. [32] report a substantial impact of PEOU and PU on electronic commerce adoption. Furthermore, Leong et al. [53] and Sternad and Bobek [54] also show the significant effect between PEOU and PU in their technology acceptance study. In agreement with past research, various researchers claimed that ease of use is a strong determinant of perceived usefulness in adopting technological products [50,51,30]. When consumers believe that using CHITs is easy and effortless, they would be more likely to accept and further use CHITs [52, 30].

Meanwhile, studies found that personal anxiety or stress and having little self-confidence were the two main obstacles in adopting technologies [42]. Consumers tend to avoid risk and prefer accuracy over speed in making decisions, which, when left unsure, they will neither act nor make a decision [43]. The difficulty of interpreting the information and the perceivably risky purchase will ultimately make them choose to abandon the product rather than taking the risk [45]. Various empirical studies demonstrated the negative impact of consumers' privacy concerns on their intention to accept technology products [42,37]. In the CHITs contexts, when consumers believe CHITs perceived risk is minimal, they are more likely to adopt the technology [46].

Technology usage's intention plays a crucial role in consumer acceptance of any technology and its continuous usage. A person's intention is governed by several factors like prior experience using technology purchase capacity and goal orientation [46,55]. Thus, various researchers

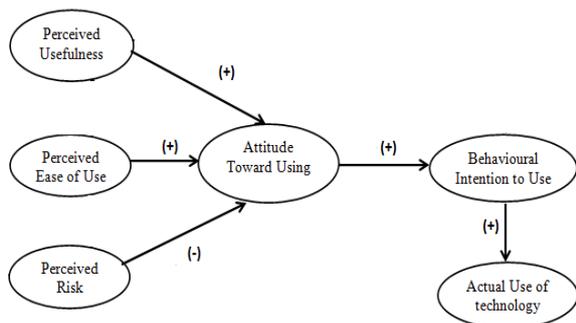


Figure 1: Revised TAM with perceived risk.

used behavioural intention to surrogate actual behaviour and were defined as consumers’ intent to use the new technology or medium [46,56]. On the other hand, positive attitudes toward a new system resulted in solid intentions to use that system, and this relationship has been proven in the various research setting [34,48,57,58]. In the context of CHITs, when the consumers favour its usefulness, ease of use, and offer low risk, their intention to use and actual usage would increase [52,30]. Thus, this study hypothesised that:

- H₁: PU positively influences the user attitude towards using CHITs.
- H₂: PEOU positively influences the user attitude towards using CHITs.
- H₃: Perceived risk negatively influence the user attitude towards using CHITs.
- H₄: User attitude positively influences their behavioural intention to use HIT.
- H₅: Behavioural intention positively influences their actual intention to use HIT.

In line with the study hypotheses, the purpose of this study is to investigate the factors influencing consumer behaviour towards CHITs. This study empirically assesses the relationship between CHITs perceived usefulness, perceived ease of use, perceived risk and consumer attitude, behavioural intention, and actual usage. Figure 1 depicts the revised TAM model employed in the present research.

4 Study methodology

This study opted for the cross-sectional research design using a quantitative research survey. In the current study, a total of 22 Likert based questions adopted from Li [41] assessed the respondents’ feedbacks on CHITs perceived usefulness, perceived ease of use, perceived risk and consumer attitude, behavioural intention, and actual usage. Hair et al. [59] recommended a minimum sample size of 200 for maximum likelihood estimation (MLE). Other authors also suggested larger sized samples of 400 or more would be sufficient for SEM analysis [60,61]. The choice of the respondents was established through the purposive sampling approach. In this study, the respondents were experienced users of CHITs (wearable or/and apps).

A total of 450 respondents were interviewed via the structured online questionnaire. The sample respondent’s characteristics revealed that 17 percent of the respondents

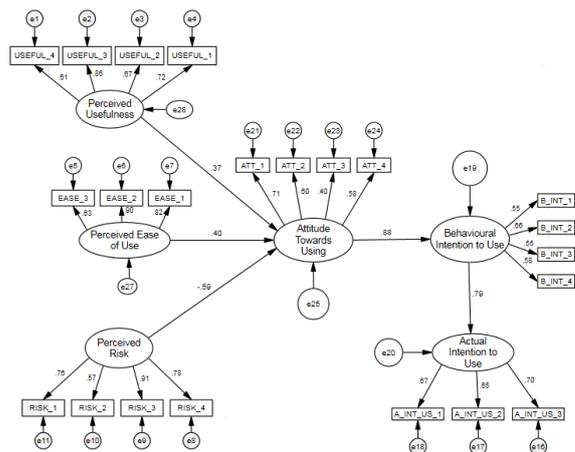


Figure 2: Structural Model Assessment.

belonged to the age group of fewer than 30 years, 59 percent were between 30 to 50 years of age, and 24 percent represented more than 50 years of age. Meanwhile, 35 percent of the respondents completed their graduation on the educational front, while 53 percent completed their post-graduation. Notably, 12 percent of the respondents were medical professionals and PhD holders of both science and management streams.

The data analysis was conducted using the SPSS version 24 and Analysis of Moment Structures (AMOS) statistical software.

5 Analysis and results

Measurement Model

Table 1 presents the relevant items, standardised loading, composite reliability, and Cronbach Alpha results through Confirmatory Factor Analysis (CFA) technique.

First, the Cronbach’s alpha reliability coefficient was calculated to assess the survey instrument’s reliability and psychometric properties [62]. Concerning composite reliability, most of the survey items demonstrated a greater loading value than 0.60, indicating the research model’s convergence validity. Similarly, the Cronbach alpha values of each dimension were all above 0.7 – depicting model reliability.

Structural Model: Goodness-of-fit

After confirming the measurement model reliability and validity, the defined research hypotheses were tested using the structural model technique as shown in the conceptual framework (Figure 1). Next, Figure 2 reports the structural model assessment outputs.

The model results in Table 2 yielded acceptable goodness-of-fit indices, which indicated that the model fits the observed data. The results presented were below the cut-off (accepted) values, which revealed a good fit for the present model.

Table 3 reports the path analysis result. The analysis results confirm that PU ($\beta=0.371$; $p<0.05$) and PEOU ($\beta=0.400$; $p<0.05$) had a significant (statistically) influence on attitude towards using CHITs; hence, hypothesis one and hypothesis two can be accepted. On

the other hand, perceived risk ($\beta=-0.586$; $p<0.05$)

impact on the behavioural intention to use CHITs, which asserted hypothesis five.

	Measurement model	Structural model	Threshold value
χ^2	315.80	576.76	
df	194	243	
Chi-square/df (χ^2/df)	1.628	2.168	< 3.0
GFI	0.802	0.825	> 0.90
AGFI	0.842	0.860	> 0.80
CFI	0.895	0.857	> 0.90
NFI	0.872	0.835	> 0.90
RMSEA	0.080	0.091	< 0.10
PCFI	0.751	0.667	< 0.50
PNFI	0.649	0.559	< 0.50

Table 2: Goodness-of-fit and incremental indices for measurement and structural models.

significantly negatively affects consumer attitude towards using CHITs as a health caretaker. Thus, hypothesis three could be fully asserted. Furthermore, the path analysis also confirms that the attitude towards using CHITs positively and significantly ($\beta=0.211$; $p<0.05$) influences behavioural intention to use CHITs. Hence, hypothesis four is fully asserted. Finally, behavioural intention to use CHITs had a positive and significant ($\beta=0.786$; $p<0.05$)

6 Conclusion

The study findings fill the literature gap and broaden TAM’s current theoretical application in the public health realm. This study tested an extended TAM framework to consumer acceptance towards the CHITs system. This study’s main contribution is the verification of consumers’ attitudes, perceived risk, and behavioural intention to adopt and use CHITs. The study findings have enriched research on the relationship between technology acceptance, perceived risks and behavioural intentions, which could shed light on future research on the application of consumer acceptance theories. This study also highlights that CHIT is a promising concept to improve the personal care experience and improve population health. The finding of this study shows that smartphone is a powerful predictor of interest and usage in CHITs due to the ease of use, mobility, and connectivity of smartphones. It offers an excellent opportunity for CHITs providers to improve their mobile-based products and apps, focusing on usability and features that consumers expect.

The findings showed that perceived ease of using CHITs is more important than the aspects of perceived usefulness. Our research found that ease of use of CHITs is another critical factor that affects consumers’ health information-seeking behaviour. Therefore, mobile

Items	Loading	Construct Reliability	Cronbach Alpha	Average Variance Extraction
<i>Perceived Usefulness</i>				
		0.811	0.812	0.519
I will use the CHIT if it helps my personal health management (USEFUL_1)	0.749			
I will use CHIT if it helps me develop healthy habits (USEFUL_2)	0.649			
I will use the CHIT if it helps me maintain a healthy status (USEFUL_3)	0.804			
<i>Perceived Ease of Use</i>				
		0.834	0.835	0.628
I will use the CHIT if learning to operate the technology is easy for me (EASE_1)	0.841			
I will use the CHIT if the user interface is clear and intuitive (EASE_2)	0.849			
I will use the CHIT if it is flexible to interact with it (EASE_3)	0.676			
<i>Perceived Risk</i>				
		0.847	0.849	0.585
CHIT does not provide adequate protection of my personal health information (RISK_1)	0.803			
CHIT does not protect the privacy of its users (RISK_2)	0.607			
CHIT will share my personal health information without my authorisation (RISK_3)	0.862			
<i>Usage Attitude</i>				
		0.758	0.763	0.446
I will use the CHIT only if I can utilise it (ATT_1)	0.790			
I will use the CHIT if I find it rewarding to use (ATT_2)	0.685			
I will use CHIT if it is reasonably priced (ATT_3)	0.661			
<i>Behavioural Intention</i>				
		0.767	0.767	0.452
I prefer to use the CHIT both at home and office (B_INT_1)	0.665			
I prefer to use CHIT if most people around are using it (B_INT_2)	0.635			
I prefer to use CHIT if it is easy to obtain (B_INT_3)	0.733			
<i>Actual Intention to Use</i>				
		0.769	0.770	0.527
Assuming I have access to the CHIT, I intend to use it. (A_INT_US_1)	0.714			
Given that I have access to CHIT, I will use it more frequently (A_INT_US_2)	0.708			
I intend to recommend the CHIT to my friends (A_INT_US_3)	0.754			

N=450

Table 1: Measurement model – Factor Loadings.

healthcare providers should focus on improving the ease of use of CHITs apps and services. Nonetheless, the

Hypotheses	Standard estimate	Standard error	P-value
H ₁ : Perceived usefulness → Attitude towards using CHIT	0.371	0.116	0.000***
H ₂ : Perceived ease of use → Attitude towards using CHIT	0.400	0.124	0.000***
H ₃ : Perceived risk → Attitude towards using CHIT	- 0.586	0.103	0.000***
H ₄ : Attitude towards using CHIT → Behavioural intention	0.877	0.132	0.000***
H ₅ : Behavioural intention → Actual intention in using CHIT	0.786	0.272	0.000***

*** Significance at a 95% confidence interval

Table 3: Path analysis.

CHITs design, ergonomic and implementation could be improved only by understanding the consumer wants and needs. On the other hand, this study also highlighted how perceived risk in CHITs influence consumer adoption and usage. It is reasonable to assume that a large number of consumers are still intimidated by CHITs. Based on the study findings, given that the perceived risks negatively impact consumers' attitudes, CHITs providers should focus more on enhancing the reliability and validity of health information provided by them.

This study also offers significant inputs to the practitioner; perceived usefulness and ease of use are factors that managers and policymaker consider before introducing health information technology. The study results highlight the need for further research by including people with various cultural identities and socioeconomic statuses, and cultural dynamics in CHITs better understand consumer acceptance of such technologies. Understanding the factors affecting the acceptance of CHITs as personal health caretakers is necessary to ensure a sustainable adoption, which would result in people's continuous dependence on human health caretakers in the future. Future research should test more complex predictive models and add other consumer behavioural attributes and preferences to optimise CHITs acceptance and usage further. This idea also aligns with SDG nine, which to enhance technological capabilities among the world population to achieve community well-being.

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