INVESTIGATING THE SUCCESS FACTORS FOR THE ACCEPTANCE OF MOBILE HEALTHCARE TECHNOLOGY

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Abstract

This study provides a theoretical and empirical analysis to explain factors influencing the elder persons’ adoption of mobile healthcare devices. The proposed model was extended from two well-known intention-based theories: the theory of reasoned action and the technology acceptance model. Other individual differences and technological characteristics factors were integrated. As a result, the proposed model accounted for 67% high of the variance explained in behavioral intention, thus providing researchers and practitioners with an in-depth understanding of the introduction of new healthcare technology devices.

Keywords: Healthcare Technology Acceptance, Theory of Reasoned Action, Ubiquity, Health Knowledge.

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INTRODUCTION

The worldwide population of the elderly over 65 years old is on the rise and is expected to reach 761 million by 2025 (Tablado et al., 2003). Accompanying this phenomena of the “graying of the globe” are the exponentially increasing healthcare costs for long-term care and hospitalization due to the rising number of seniors and retirees in developed countries. Many healthcare experts agree that current enormous expense of Medicare results from the failing management of chronic illnesses and unnecessary long-term hospitalization (Information Technology Association of America, 2003).

The maintenance and improvement of patients’ health and lives are largely dependent on the information collected and managed in hospitals; therefore, effective use of information is essential for many healthcare centers. In modern healthcare settings, information communication technology such as wireless is expected to reduce errors, thus emphasizing the smart use of information (Hu et al., 2002).

Telehealth (previously telemedicine) is an IT-based innovation that supports, facilitates, and potentially improves the care and services of healthcare professionals to treat their patients (Jutra, 1959). The telemedicine technology is an effective way to supports patient care from a distance and distributed service collaboration of individual physicians from different healthcare organizations.

Prior studies indicate that wireless healthcare applications can provide significant advantages: including reduction in transcription errors, data collection at point-of-care, remote monitoring of patients, and connection with other systems such as patient care (Saussere, 2003; Simpson, 2003; Yacano, 2002). The wireless healthcare applications vary from pervasive health monitoring, intelligent emergency management systems, pervasive healthcare data access, to ubiquitous mobile telemedicine. These health monitoring devices can be wearable or handheld depending on the level of ease of use, including from healthcare wrist watch, GSM bluetooth watch phones, healthcare GPS watch phones, and so on. The main advantages of the above products are that they remotely monitor patients’ biometric measurements and transmit both routine vital signs and alerting signals when vital signs exceed a certain “individualized” threshold. For example, the research interest, intelligent RFID healthcare watches or mobile healthcare watches (MHW) provide functions such as emergency call, user location tracking, biometric measurements via Bluetooth, possible slip detection, and speed dial for family members when detecting abnormal temperature or blood pressure. Figure 1 illustrates how the mobile wireless healthcare technology works.

![Figure 1. The operating functions of mobile wireless healthcare technology](image)

In the application of wireless healthcare technology (WHT), TAM alone may not be sufficient to predict the acceptance of this technology because the healthcare context is novel and different. This study aims to make a contribution to WHT acceptance/adoption model by integrating the theory of
reasoned action (TRA), the technology acceptance model (TAM), and other factors including individual differences, technology characteristics, and social influences as previous studies have suggested (Hu et al., 1999; Lu et al., 2003).

2 THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

This study examined essential factors of the Mobile Healthcare Technology Acceptance Model (MHTAM). MHTAM is theoretical grounded in TRA and TAM in that it retains the constructs perceived ease of use, perceived usefulness, attitude, subjective norm, and behavioral intention. Moreover, other factors such as characteristics of technology (i.e., perceived ubiquity) and individual difference factors (i.e., perceived ubiquity and personal health knowledge and health need) are included as shown in Figure 2.

![Figure 2. Hypothetical research framework](image)

2.1 The theory of reasoned action (TRA) in e-healthcare

Technology acceptance is defined as an individual’s psychological state with regard to his or her voluntary or intended use of a particular technology, namely mobile wireless healthcare technology (MWHT) in the current study. The MWHT is an IT-based innovation to support and improve physicians’ performance in patient care, and thus can enhance healthcare organizations’ competitiveness. User technology acceptance is an essential challenge for organizations while considering or planning to provide telemedicine-enabled healthcare services (Hu et al., 1999). Correspondingly, TPB and TAM appear to be well-structured and parsimonious theories. Both are adequate to interpret the individual physicians’ technology acceptance decisions (Chau & Hu, 2002). Both TPB and TAM are originated from the theory of reasoned action (TRA), a well-established intention-based theory.

According to TRA, beliefs influence attitude, which in turn shapes intention that subsequently guides or dictates behavior. Attitudinal research suggests that attitudes will have a strong, direct, and positive effect on intentions (Fishbein & Ajzen, 1975). In addition, social influence such as friends, relatives, or even grandchildren affects the behavior of the elderly mobile phone user. In the current
study of mobile healthcare devices (i.e., MHW), we assume that family members and physicians play an important role as a referent group. Therefore, the following hypotheses were inferred:

Hypothesis 1: An elderly person’s AT towards MHW positively affects his/her BI towards MHW usage.

Hypothesis 2: An elderly person’s SN towards MHW positively affects his/her BI towards MHW usage.

2.2 The technology acceptance model (TAM) in e-healthcare

As mentioned, TAM is an appropriate model in explaining the acceptance in telemedicine technology (Chau & Hu, 1999). Besides, Lu et al. (2003) extended TAM to the study of mobile wireless Internet acceptance. Chau and Hu (1999) found that TAM appears to be a stronger theory than TPB in terms of explanatory power and path coefficients in the study of telemedicine. In a review article of healthcare, Holden and Karsh (2010) proposed that TAM is well adapted to the healthcare context even though some modifications is suggested, for instance, including additional variables. In attitudinal research, the relationship between AT and behavior intentions (BI) is significant and has been supported in literatures regarding to the adoption of technology including self-service (Dabholkar, 1996). The focal interest in the current study is mobile healthcare watch, a kind of mobile healthcare technology, which is a kind of mobile wireless and self-service healthcare device. In addition, because TAM has been validated as one of the dominant theories in IT field including e-health, we adopted it as the theoretical base to serve the aim of the study.

The TAM focuses on two main beliefs about the IT: perceived ease of use (PEOU) and perceived usefulness (PU). In TAM, intention is determined by attitude (AT) towards usage, which in turn, is influenced by PEOU and PU. According to the TAM, PU is hypothesized to be influenced by PEOU, because the easier a technology is to use, the more useful it will be. Thus, we have the following hypotheses.

Hypothesis 3: An elderly person’s PEOU towards MHW positively affects his/her PU towards MHW usage.

Hypothesis 4: An elderly person’s PEOU towards MHW positively affects his/her AT towards MHW usage.

Hypothesis 5: An elderly person’s PU towards MHW positively affects his/her AT towards MHW usage.

2.3 Perceived ubiquity

A significant body of literature has extended TAM by including additional constructs in three dimensions: characteristics of the individuals, characteristics of the technology, and characteristics of organizational context (Hu et al., 1999). In the study of mobile wireless healthcare technology, the most advantageous characteristics of technology are the ability that enables users to communicate and collaborate with others anytime and anywhere. That happens to be the concept of perceived ubiquity (PB), which represents a definitive form of spatial, temporal, and contextual mobility. In addition, Looney et al. (2004) claimed that the capability of communication from virtually anywhere at any time offers extraordinary levels of flexibility and convenience. Thus,

Hypothesis 6: An elderly person’s PB towards MHW positively affects his/her AT towards MHW usage.
2.4 Personal health factors (health knowledge, health needs)

In addition to technological factor, characteristics of the individual or individual differences are essential and included in the study of IT such as mobile wireless Internet acceptance (Lu et al., 2003). In this study, we refer an elderly person's healthcare knowledge as the awareness and knowledge about his/her health physical condition. Health need here is defined as the elderly person’s needs for acquiring medical advice from his/her healthcare professionals. Research in the process of improving e-health provides increasing value for health care services, and thus can meet ongoing patient needs. In the study of healthcare, personal factors such as elder persons’ healthcare knowledge could provide significant predictions towards their behavioral intention. If patients feel they have relatively little knowledge about their won health, they will intend to consult and accept resources from e-health sites (Wilson & Lankton, 2004; Helitzer et al., 2003). Furthermore, patients with certain health conditions such as chronic diseases (e.g., diabetes or severe injuries) will have greater need for the health care than other general patients. It is anticipated that patients with high need for health care will have stronger tendencies to accept e-health as a means to receive additional care. Thus, we inferred the following:

Hypothesis 7: An elderly person’s HK towards MHW positively affects his/her AT towards MHW usage.

Hypothesis 8: An elderly person’s HN towards MHW positively affects his/her AT towards MHW usage.

3 METHODOLOGY

3.1 Participants and procedure

To explore underlying factors for the mobile healthcare technology, 390 respondents above 60 years old were recruited from several health checkpoints in northern Taiwan to participate in this current study. Some trained instructors explained the research purpose for academic use and briefly presented the functions of mobile healthcare watches. Then questionnaires were distributed with or without the instructors’ help. As a result, 338 questionnaires were available for analysis, resulting in an effective response rate of 86.7%. Male and female made up 48% and 52% of the sample, respectively. Most of investigating subjects lived with their families (65.7%), others lived in long-term care facilities (21.9%), and the rest of them lived alone.

3.2 Measurement

In line with previous literature, measurement items in this paper were drawn and modified from the validated instruments to measure the constructs. All measures use 7-point Likert scales with anchors ranged from “strongly disagree” to “strongly agree”. A backward translation technique (with items translated from original English scale into Chinese, and back into English) was used to solve the discrepancies of versions.

Consistent with past research in technology acceptance, Perceived ease of use (PEOU) was drawn from Davis et al. (1989) and perceived usefulness (PU) was modified from (Wilson & Lankton, 2004). In addition, perceive ubiquity was modified from (Kim & Garrison, 2009). Subjective norm, attitude and behavioral intention toward using mobile healthcare technology were referred to the
theory of reasoned action (Fishbein & Ajzen, 1975; Ajzen, 1991). Two individual factors, health knowledge and health care need, were modified from (Wilson & Lankton, 2004).

3.3 Measurement assessment

To assess reliability and validity for the measures, a recommended two-step structural equation modeling (SEM) approach was facilitated (Anderson & Gerbing, 1988). First, the measurement model was evaluated by using confirmatory factor analysis (CFA) accompanying with LISREL 8.54. Results showed a satisfactory fit to the data with $\chi^2(247) = 666.51$ (p < 0.001) and other goodness of fit indices: NNFI = 0.98; CFI = 0.98; IFI = 0.98; GFI = 0.86; AGFI = 0.082; RMR = 0.051; RMSEA = 0.071; NFI = 0.97.

In addition, Indices of Cronbach’s alpha ($\alpha$) and composite reliability (CR) were used to determine how consistently individuals respond to the items within a scale. In this study, we found that $\alpha$ ranged from 0.83 to 0.96 and CR ranged from 0.82 to 0.96 for the all constructs, providing strong evidences for the existence of reliability. Furthermore, all the latent variables also demonstrated significant positive inter-correlations from 0.30 to 0.85.

3.4 Empirical results

With an adequate measurement model, structural equation modeling was then conducted to examine the hypothetical relationships among the above-mentioned constructs. Note that the goodness-of-fit of our proposed model is acceptable as well ($\chi^2(257) = 689.01$; NFI = 0.97; NNFI = 0.98; CFI = 0.98; IFI = 0.98; GFI = 0.86; AGFI = 0.82; RMR = 0.052; RMSEA = 0.071).

Overall, the hypothetical paths were all supported except one (the path from PU to AT). Specifically, we confirmed the first two hypotheses which examined the relationships in TRA (standardized coefficients were 0.26 and 0.64 from AT to BI and SN to BI, respectively).

Based on the extended TAM, hypotheses from 3 to 6 were proposed to identify potential technological factors which influence elderly people’s healthcare technology acceptance. The results indicated that: the effects of PEOU on PU ($\beta$ = 0.93, p < 0.001) and on AT ($\beta$ = 0.59, p < 0.001) were statistically significant; the significant linkage between PB and AT ($\beta$ = 0.38, p < 0.001) was confirmed as well. However, perceived usefulness failed to impact attitudes significantly.

Finally, health knowledge has shown its importance in explaining the elderly people’s attitude ($\beta$= 0.11, p < 0.05). Health need had significant but opposite direction towards elderly people’s attitude ($\beta$= -0.12, p < 0.05). In sum, seven out of eight hypotheses were supported. The present study also found that the proposed model accounted for 67% high of the variance explained in behavioral intention, and almost 90% of variance in attitudes toward mobile healthcare technology acceptance.

4 CONCLUSION

The present study strengthens our conclusions with a sound theoretical base and fills the gap in the adoption of Mobile Healthcare Technology. The empirical findings are supportive of the inclusion of perceived ubiquity and personal health knowledge into the TRA and TAM. The model presents an explication on how different determinants influence the elderly persons’ adoption of mobile healthcare devices such as mobile GPS watches or GPS wristwatches, thus providing researchers and practitioners with an in-depth understanding of the introduction of new technology devices for telehealth services.
References


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