International Journal of E-Services and Mobile Applications
Volume 14 • Issue 1

A Structural Equation Modelling of Governing Factors Influencing Patient Acceptance of Mobile Health in Saudi Arabia:
A Modified UTAUT Model

Tamim Alkhalifah, Department of Computer Science, College of Science and Arts in Ar Rass, Qassim University, Saudi Arabia*

ABSTRACT

There are obstacles that are delaying the implementation of mobile health (mHealth) in Saudi Arabia. For instance, mobile health cannot be effectively implemented if patients' behavioural intentions are not taken into account, as patients' attitudes and persistence are important for the successful introduction of any IT application. Indeed, the topic of mobile health acceptance, in the particular case of Saudi Arabia, has not been adequately investigated, despite the availability of some general research on the acceptance of technology. Therefore, the present study adopted the unified theory of acceptance and use of technology (UTAUT) model with the aim of identifying the determinants of mobile health application acceptance. The UTAUT model identified a selection of factors that influenced the uptake of mobile health services. Performance expectancy, effort expectancy, facilitating conditions, system quality, and trust in the ICT system were all positively influential. However, social factors did not appear to affect the behavioural intention to use mobile health.

KEYWORDS

Health Informatics, Ministry of Health, Mobile Health (mHealth), Patients, Saudi Arabia, Technology Acceptance, UTAUT

INTRODUCTION

Fast-paced mobile technology innovations have led to the emergence of several mobile technologies, such as mobile learning (Sattarov & Khaitova, 2020), mobile payment (Petry & Moormann, 2020), mobile health (Byrd IV, Kim, Yeh, Lee, & O'Leary, 2021). Mobile health technology can be used as a viable option to easily and effectively track patients' conditions. This, in turn, enables improved accessibility, affordability, and efficiency of healthcare provision. mHealth differs from conventional electronic health (e-health) technologies in that it is not dependent on computers and wired Internet connections. It exploits the benefits conferred by wireless cellular communication systems (i.e., mobility, portability, and extended battery capacity), while minimising the restrictions of time and

DOI: 10.4018/IJESMA.295963 *Corresponding Author

space on health service provision (Sezgin & Yıldırım, 2014). In this way, healthcare can be made significantly more accessible.

Additional advantages of mHealth services include cost, speed, and promotion of positive customs among patients, such as access to health services. As a new and significant approach of e-health, mHealth is not designed merely to mediate communication. It makes it easier for information and services associated with healthcare to be provided and managed through mobile devices (e.g., mobile phones, tablets, sensors, and monitors) and wireless networks.

For these reasons, many healthcare applications and services that benefit both patients and healthcare professionals have been developed based on mHealth technology. These include mobile telemedicine, patient monitoring, localised medical services, and broader health information accessibility. Owing to such information technology (IT) innovations, traditional healthcare systems have been revolutionised, with manual care being substituted with automatic monitoring and rapid intervention (Dwivedi, Shareef, Simintiras, Lal, & Weerakkody, 2016).

Although it is a subfield of e-health, mHealth is faster, timely, and mobile (Quiñonez, Walthouwer, Schulz, & de Vries, 2016). A general definition of mHealth is that it is the use of the latest wireless information and communication technologies (ICTs) to facilitate the delivery of healthcare services to patients via mobile devices like smartphones and tablets (Marcolino et al., 2018). Free et al. (2013) identified three categories of healthcare services that can be delivered through mHealth: (1) promotion services concerned with diagnosing and managing conditions; (2) prevention services focused on condition monitoring and intervention, as well as achieving better treatment compliance; and (3) procedural services focused on enhancing the efficiency of healthcare protocols like appointment attendance, test results, and guidance.

The topic of technology acceptance within developing countries has been extensively studied, with particular attention being paid to aspects related to ICTs, such as e-learning, e-health, e-commerce, and e-government. The need to explore the implications of the various concepts integrated in suggested theoretical models has been advocated by various researchers, such as Alshehri, Drew, Alhussain, and Alghamdi (2012). For example, according to Datta (2011), a limited number of explanations have been put forward to account for the variation in the degree to which technology has been accepted in developing countries despite the obvious significance that technology has in such areas.

Furthermore, considering the differences between developed and developing countries regarding the extent of adoption, comparative analysis and reassessment of current models and theoretical frameworks are required. mHealth applications are valuable as a means of health service provision both economically and medically; despite this, their implementation continues to be opposed by cultural, technological, social, organisational, and political factors, particularly in developing regions.

In line with the National Transformation Program 2020, a component of the Saudi Vision 2030 development plan, the Ministry of Health of Saudi Arabia has taken the initiative to improve healthcare provision through the introduction of technology (Al-Hanawi, Khan, & Al-Borie, 2019). This initiative has been successful, especially in areas that already rely on technology and digital transformation (Tomičić Furjan, Tomičić-Pupek, & Pihir, 2020). It is anticipated that e-health services will continue to be in demand given the growing proportion of Internet users in Saudi Arabia, which currently exceeds 24 million (Ministry of Communications and Information Technology, 2017). Moreover, the Saudi government has pledged ongoing backing for e-health projects geared toward expanding the extent of technology acceptance among all concerned groups (Alshahrani, Stewart, & MacLure, 2019). Under these circumstances, the determinants of mHealth acceptance within developing regions are receiving fresh attention owing to the latest healthcare developments.

As a technology designed specifically for the healthcare field, mHealth is yet to achieve maturity. Therefore, its adoption has not been extensively investigated, particularly in developing regions. The behaviour displayed by users toward adoption is a major topic of interest within the field of information systems (IS), which is underpinned by a diversity of influential factors, such as technological factors (e.g., quality of services and output), psychological factors (e.g., apprehension to technology, unwillingness to embrace change), and social factors (e.g., social ramifications, social standing). Venkatesh and Davis (2000) found that discrepancies in forecasting users' behaviour in relation to technology adoption were due to IT and psychological and social factors (over 40%). Current models of technology acceptance have also outlined a wide range of determinants of user behaviour.

Theories concerning technology acceptance focus primarily on factors that impact users' intention or use behaviour. According to Venkatesh, Morris, Davis, and Davis (2003), the unified theory of acceptance and use of technology (UTAUT) model was observed to explain 70% of user intention variation. It has since been commonly implemented for effectively explaining human behaviour in numerous fields. Other technology acceptance models, however, have only been able to model 17% and 53% of the user intention variations. Hoque and Sorwar (2017) examined the UTAUT model by focusing on mHealth adoption, noting that users' expectations concerning the original UTAUT constructs had significantly influenced the intention of adopting health technology.

The findings of technology acceptance studies have argued compellingly that system quality also exerts a favourable influence on novel technology adoption (DeLone & McLean, 2003). The correlation between intention to use a technology and the quality of the system is supported by numerous studies (Alkhalifah, 2018).

Trust is another significant determinant of mHealth acceptance (Zhao, Ni, & Zhou, 2018). This demonstrates that other vital factors, such as ease of use and usefulness, are not the only important factors for acceptance of new and novel technologies. This is especially relevant if developers can manipulate those technologies in ways that can harm users' interests, such as by improperly accessing and using their data.

In keeping with the review of the literature, the present article seeks to explore patients' acceptance of mHealth within the setting of a developing country, namely Saudi Arabia, to improve the understanding of unknown or unclear factors influencing the adoption of the technology. In particular, the article aims to answer the following research question: What key factors influence patients' acceptance of mHealth services in developing countries like Saudi Arabia?

First, this article presents a background of the study, including the conceptual framework underpinning the research hypotheses. The second section includes the research methodology, which explains the participants, data collection process, and formation of the study questionnaire. Third, the article discusses the measurement model results, validity analysis, and structural model results. Finally, the discussion section is presented, which is followed by study implications, limitations, future research, and conclusion.

BACKGROUND

The UTAUT model is among the models most referenced in user acceptance research in the past 10 years. This model, which has been assessed in a wide range of settings, has been refined through the addition of extra factors of influence (Patil, Tamilmani, Rana, & Raghavan, 2020). For example, system quality and trustworthiness were added to the model due to their significance in circumstances in which users require proof of application reliability (Sarker, Hughes, & Dwivedi, 2020).

Health Information and Communications Technology research has embraced the UTAUT model because it is widely applicable to investigations of technology acceptance. The usefulness of this model for examination of technology acceptance within the healthcare sector was first proposed by Hennington and Janz (2007), while the more recent work by Senft et al. (2019) argued that insight into e-health adoption by cancer patients of African American and Caucasian descent could be attained through the UTAUT model. Furthermore, the UTAUT model has been applied in empirical research related to the adoption of electronic medical record systems (Mukred, Yusof, Alotaibi, Asma'Mokhtar, & Fauzi, 2019).

To gain insight into the determinants of mHealth acceptance among patients in Saudi Arabia, a modified version of the UTAUT model (Venkatesh et al., 2003) is implemented in the present work.

Incorporating eight theoretical frameworks of individual acceptance, this model has been employed in healthcare settings since it was first developed. It has been confirmed suitable for shedding light on technology acceptance within a healthcare context. It must be noted, however, that most research has been in developed countries (Kenny & Connolly, 2017), while the specific situation of Saudi Arabia has not been explored.

Based on the exploration of earlier research in which the UTAUT model (see Figure 1) was applied in a healthcare setting, the present work chose four basic constructs to focus: (1) performance expectancy; (2) effort expectancy; (3) social influence; and (4) facilitating condition. These dimensions are the main factors influencing the behavioural intention of users. More specifically, user intention regarding technology adoption is most directly indicated by performance expectancy, effort expectancy, and social influence. In addition, the findings of the literature review prompted the inclusion of two additional factors in the UTAUT model, namely system quality and trust.

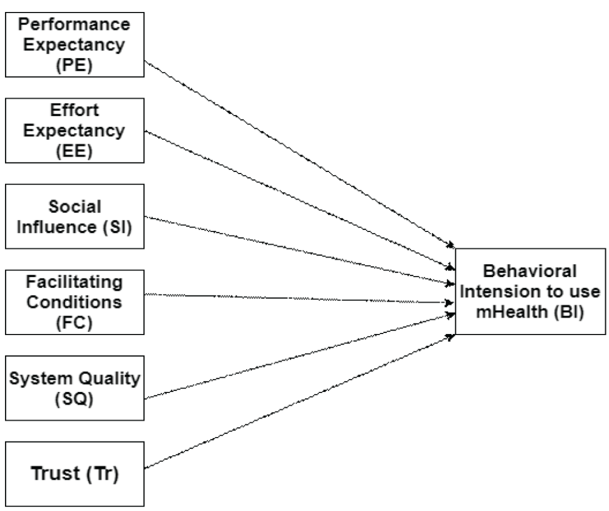
The following sections explain the hypotheses developed in this study.

Performance Expectancy

Individuals are more likely to adopt new ideas and technologies and modify their behaviour when they expect the change will be worthwhile in terms of their own performance (Salhieh, 2019). performance expectancy is also associated with other acceptance model constructs, such as outcome expectations (as per social cognitive theory), relative advantage (as per innovation diffusion theory), job-fit (as per model of computer utilization), extrinsic motivation (as per motivational model), and perceived usefulness (as per technology acceptance model and combined technology acceptance model and theory of planned behaviour). In the case of tablet use for mHealth applications, performance expectancy has been found to be the key determinant in user acceptance (Alam, Hoque, Hu, & Barua, 2020). In addition, it is the most common influencer of the degree of adoption (Davis, 1989). In the current research, performance expectancy was measured in terms of usefulness, ability to enhance productivity, and learning outcomes of using mHealth systems. performance expectancy is expected to positively impact users' intention to use mHealth. Consequently, the following hypothesis is suggested:

H1: Performance expectancy significantly affects patients' intention to use mHealth.

Figure 1. Research model



Effort Expectancy

According to Venkatesh et al. (2003), effort expectancy can be understood as the level of effort that system use requires. According to previous research, the was a strong correlation between effort expectancy and users' intension to use a health system. Several studies report that effort expectancy was a significant predictor to adopt mHealth monitoring systems, smartphone-based e-health services, clinical decision support systems, as well as mHealth (Garavand, Samadbeik, Nadri, Rahimi, & Asadi, 2019). Consequently, the following hypothesis is suggested:

H2: Effort expectancy significantly affects patients' intention to use mHealth.

Social Influence

Social influence was first presented as part of Ajzen's (1985) Theory of Reasoned Action model, wherein it was referred to as "normative beliefs." social influence refers to the way in which behaviour is perceived and shaped by peer or societal opinions of the behaviour (Venkatesh & Davis, 2000). social influence was also mentioned in the Combined Technology Acceptance Model and Theory of Planned Behaviour models, Technology Acceptance Model 2, and Planned Behaviour model, where it is referred to as the "subjective norm" (Venkatesh et al., 2003). As demonstrated by several researchers, SI has been significant in technology adoption (Jayaseelan, Koothoor, & Pichandy, 2020). Normative beliefs have been broken into peer influence and superior influence (Taylor & Todd, 1995). Both forms of normative belief were considered as part of social influence in the current study per the UTAUT model, wherein social influence was presented as a single construct. Consequently, the following hypothesis is suggested:

H3: Social influence significantly affects patients' intention to use mHealth.

Facilitating Conditions

According to Venkatesh et al. (2003), the facilitating conditions concept is regarded as an individual's conviction about the perception of organisational and technical infrastructures for supplementing the system. Several studies have found that behavioural intention and e-health technology adoption depend greatly on FCs (Al-Radaideh & Alazzam, 2020). Consequently, the following hypothesis is suggested:

H4: Facilitating conditions significantly affect patients' intention to use mHealth.

System Quality

System quality and information quality have been found to be the two core requirements for the adoption of Information Systems (Abidi & Khan, 2020; DeLone & McLean, 2003). In the current research, system quality refers to the clarity, accuracy, and reliability of the overall mHealth application and its services. System quality has been found to influence users' behavioural intention to adopt a technological system, as well as users' satisfaction with it (Alkhalifah, 2018; Amalia, 2019). It is widely accepted as an influencer of technology acceptance. Research suggests that service quality, user satisfaction, ease-of-use, security, information quality, and other dimensions should be incorporated into system quality (Aladwani & Palvia, 2002). Handayani, Meigasari, Pinem, Hidayanto, and Ayuningtyas (2018), in their study to determine the critical success factors for mHealth implementation, found that system quality was an important factor in successful mHealth deployment. Hossain (2016) found that platform quality (i.e., system quality) was important in the successful implementation of mHealth in Bangladesh. Consequently, the following hypothesis is suggested:

H5: System quality significantly affects patients' intention to use mHealth services.

Trust

As a dimension of a social and personal nature, trust has been explored in relation to various features of human behaviour, including personality and knowledge acquisition (Akhtar, Irfan, Kanwal, & Pitafi, 2019). Regarding mHealth, XIA et al. (2019) reported that patients' intention to adopt this technology depended on trust. Other studies also confirmed that technology acceptance and adoption in the healthcare sector hinge significantly on trust in medical services. Hence, people are more likely to use mHealth applications if they have a high level of trust (Deng, Hong, Ren, Zhang, & Xiang, 2018). This results in the hypothesis that a correlation exists between trust and mHealth use intention. Consequently, the following hypothesis is suggested:

H6: Trust significantly affects patients' intention to use mHealth services.

METHODOLOGY

The target population for this study was comprised of patients who had used or were using mHealth applications developed by the Saudi Ministry of Health. The purpose of the study was explained to participants in detail to ensure their understanding of the project. The structured questionnaire survey method was used to gather pertinent data.

The first part of the research instrument included general information on the study, completion of the questionnaire, and ethical aspects. The second part of the questionnaire sought demographic data. It also provided clarification about the concepts in the questionnaire. The questions were guided by the work of other researchers (Abu-Al-Aish & Love, 2013; Rahi, Mansour, Alghizzawi, & Alnaser, 2019). Part three's 23 questions related to different aspects of mHealth. These were sourced from earlier studies (Akhtar et al., 2019; Alkhalifah, 2018; Venkatesh et al., 2003; XIA et al., 2019); however, they were adapted to the setting and aims of the current study. The purpose of the questions in part three was to extract data about the various constructs that might encourage participants to accept mHealth. Each statement was scored by participants according to how important they thought it was in relation to mHealth. Table 1 shows the items in the study and the literature from which the items were derived.

Google Forms was used to develop an online questionnaire during the second semester (September) of the 2019 academic year. Data were reported from 320 patients who used mHealth applications developed by the Ministry of Health of Saudi Arabia. The questionnaire was distributed via several social media platforms. The duration of the survey was 10 to 15 minutes.

Analysis in IBM-AMOS employed structural equation modelling techniques. This software allowed for the confirmation or rejection of the research hypotheses. Urbano (2013) stated that structural equation modelling techniques have several advantages over the use of other multivariate techniques. These include reliability/measurement error, validity, and complex models (testing complex patterns of relationships).

RESULTS

Table 2 presents the estimated model fit values. The measurement model was constructed with more than 20 goodness-of-fit measures using the AMOS software. As seen in table 2, the goodness-of-fit indices achieved acceptable results. However, chi-square did not produce an acceptable result due to its sensitivity to the large size of the sample. Other fit indices were also examined. The normed chi-square (CMIN/DF) showed an acceptable fit for the estimated model of $2.872 < 5$. In addition, the root mean square error of approximation (RMSEA) showed a moderate level of acceptance. The

Table 1. Research instrument

Construct	Corresponding Items	Item Sources
Performance Expectancy	PE1: I would find the mHealth application useful in my job. PE2: The mHealth application enables me to accomplish tasks more quickly. PE3: The mHealth application increases my productivity.	(Eneizan, Mohammed, Alnoor, Alabboodi, & Enaizan, 2019; Garone et al., 2019)
Effort Expectancy	EE1: My interaction with the mHealth application would be clear and understandable. EE2: It would be easy for me to use the mHealth application. EE3: I would find the mHealth application easy to use.	
Social Influence	SI1: People who influence my behaviour think that I should use the mHealth application. SI2: People who are important to me think that I should use the mHealth application. SI3: Senior management of this hospital has motivated me to use the mHealth application.	
Facilitating Condition	FC1: I have the resources necessary to use the mHealth application. FC2: I have the knowledge necessary to use the mHealth application. FC3: The mHealth application is compatible with my other systems. FC4: A specific person (or group) is available to assist with difficulties experienced in the mHealth application.	(Rahi et al., 2019)
System Quality	SQ1: It is important for mHealth applications to be clear. SQ2: It is important for mHealth applications to be accurate. SQ3: It is important for mHealth applications to increase the quality of learning. SQ4: It is important for mHealth applications to be reliable.	(Amalia, 2019)
Trust	Tr1: I trust that mHealth systems are secure. Tr2: I believe mHealth systems are trustworthy. Tr3: I trust mHealth systems.	(Pejić Bach, Starešinić, Omazić, Aleksić, & Seljan, 2020; Zhang et al., 2019)
Behavioural Intention	BI1: I intend to use mHealth applications in the future. BI2: I will always try to use mHealth applications. BI3: I plan to continue to use the mHealth application.	(Alkhalifah, 2018)

Table 2. Measurement model results

Chi-sq.	P-VALUE	CMIN/DF	RMSEA	GFI	AGFI	CFI	PRATIO
251.854	0.00	2.872	0.033	0.925	0.903	0.922	0.836

goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and PRATIO were all acceptable.

Validity Analysis

Before applying the independent and dependent constructs to the structural model and testing the hypotheses, it was vital to check the validity of the constructs of the model. Construct validity indicates whether the variables used within a construct are related (to the same construct). Typically, two subdivisions, convergent and discriminant validity (Hair, Black, & Babin, 2010), are calculated. A few measures are necessary to calculate the discriminant and convergent legitimacy of the constructs. These are average variance extracted (AVE), maximum shared variance (MSV), and average shared variance (ASV). Hair et al. (2010) explained that convergent validity refers to the assertion that all items associated with a construct will have a common degree of variance. Poor correlation between the chosen variables is indicated by issues with convergent validity, meaning that the variables fail to offer a good level of insight into the latent factor associated with them. The composite reliability, maximum shared variance, average variance extracted, and average shared variance, as well as composite reliability, are presented in Table 3. As can be seen, the composite reliabilities for every factor exceeded the criterion of 0.70. Furthermore, all factors demonstrated discernment validity, which indicates that no constructs of a factor in the model had any effect on other constructs of other factors in the same model.

Table 4 shows that the square correlation between any two constructs was less than their respective AVE. After checking the validity and reliability, it was safe to proceed to the structural model.

Table 3. Validity analysis results

	Composite Reliability	Average Variance Extracted	Maximum Shared Variance	Average Shared Variance
Effort Expectancy	0.802	0.671	0.512	0.163
System Quality	0.835	0.622	0.501	0.134
Performance Expectancy	0.792	0.587	0.490	0.110
Facilitating Conditions	0.752	0.554	0.457	0.161
Social Influence	0.744	0.539	0.039	0.011
Trust	0.711	0.526	0.080	0.122
Behavioural Intention	0.822	0.511	0.500	0.233

Table 4. Factor correlation matrix with square root of the AVE on the diagonal for the exogenous and endogenous constructs

	System Quality	Performance Expectancy	Effort Expectancy	Facilitating Conditions	Trust	Social Influence	Behavioural Intention
System Quality	0.783						
Performance Expectancy	0.471	0.722					
Effort Expectancy	0.554	0.455	0.795				
Facilitating Conditions	0.721	0.585	0.449	0.762			
Trust	0.359	0.416	0.388	0.541	0.742		
Social Influence	0.034	0.066	0.085	0.047	0.128	0.777	
Behavioural Intention	0.365	0.258	0.523	0.398	0.477	0.064	0.718

Structural Model

After the successful development of the measurement model, the next step was to develop a structural model with all six factors. Hayduk (1987) explained that a structural model represents the associations that exist between different chosen variables. According to Byrne (2010), structural models are statistical methods that are designed with hypothesis testing in mind when assessing a structural theory relevant to a particular research topic or object. The process of assessing the hypotheses is designed to establish the extent to which they account for the dependent variables (Hair et al., 2010). In the present case, the independent variables identified by the model included performance expectancy, effort expectancy, social influence, facilitating conditions, and system quality; the dependent variable was Behavioural Intention.

The model of fit indices was examined when the structural model was evaluated and did not differ much from those associated with the measurement model. The standardised path coefficients and critical ratio (t-values) were also verified in the structural model to determine hypothesis validity. A critical ratio value higher than ± 1.96 or ± 2.56 reflected hypothesis significance at α level of 0.05 or 0.01, respectively (Gefen, Straub, & Boudreau, 2000).

Results of the Structural Model

The present study's structural model aimed to examine path relationships in the model's constructs. The bootstrap technique was implemented for evaluating the hypothesis.

Table 5 illustrates that the performance expectancy construct estimated the behavioural intention construct ($\beta = 0.163$, $p < 0.05$) positively, which supported H1. Further, effort expectancy predicted behavioural intention ($\beta = 0.236$, $p < 0.05$) positively, which supported H2. On the other hand, social influence failed to predict behavioural intention ($\beta = -0.071$ $p > 0.05$) significantly, thus rejecting H3. Facilitating conditions, however, predicted behavioural intention ($\beta = 0.511$ $p < 0.05$) positively, which supported H4. System quality predicted behavioural intention (β = 0. 0.367 $p < 0.05$) positively, which supported H5. Finally, trust positively predicted behavioural intention (β = 0. 0.278 $p < 0.05$), thus providing support for H6. According to the findings, facilitating conditions was the most influential factor in the studied model ($\beta = 0.511$). performance expectancy, on the other hand, was the lowest ($\beta = 0.163$).

Table 5. Results of research model based on SEM analysis

Hypothesis	Standardised path coefficient	Critical ratio (t-value)	P value	Empirical support
H1: performance expectancy→ behavioural Intention	0.163	2.030	0.042	Accepted
H2:effort expectancy→ behavioural Intention	0.236	3.254	0.035	Accepted
H3:social influence→ behavioural Intention	-0.071	-0.458	0.674	Rejected
H4:facilitating conditions→ behavioural Intention	0.511	6.422	*** (*P<=0.01*)	Accepted
H5:system quality→ behavioural Intention	0.367	3.887	*** (*P<=0.01*)	Accepted
H6:trust→ behavioural Intention	0.278	2.698	0.030	Accepted

DISCUSSION

In this study, a modified UTAUT model version was implemented for examining how Saudi patients accept mHealth. It also looked at patients' behavioural intention regarding the use of mHealth services. Through the study's empirical findings, it can be determined how UTAUT constructs like performance expectancy, system quality, effort expectancy, trust, and facilitating conditions impact mHealth implementation. In addition, it showed that SI has no effect on the acceptance of mHealth.

According to the analysis of results, performance expectancy positively impacts behavioural intention ($\beta = 0.163$, $p < 0.05$). Other empirical studies on mHealth also confirmed this finding (Duarte & Pinho, 2019). The results further suggested that a higher usefulness perception concerning mHealth among individuals results in higher behavioural intention for adopting mHealth. Hence, if mHealth's benefits are interactively explained to patients, it may result in increasing patients' performance expectancy and positive behavioural intent.

Effort expectancy demonstrated a positive and significant relationship with behavioural intention, which accords with other studies (Keikhosrokiani, Mustaffa, Zakaria, & Baharudin, 2019). Results show that people may have a positive attitude regarding mHealth applications if they feel they are easy to learn and use ($\beta = 0.236$, $p < 0.001$).

Patients seem more likely to use mHealth services when the services are easy to use; therefore, designers of health technology applications should ensure that the technology is simple, effective, and accompanied by quality service, procedures, and instructions. Furthermore, application designers must be conscious of the fact that apps for different types of mobile devices for use by different patients, including patients with special needs, should be intuitive and comparable across all platforms.

Per Venkatesh et al. (2003), social influence is vital in promoting the acceptance and use of technology. Numerous studies in developing countries have focused on how social influence affects the acceptance of technologies. Moreover, the UTAUT model was implemented by Alwahaishi and Snásel (2013) for identifying factors influencing mobile Internet's acceptance and use. They observed that social influence impacts the intention to use. In addition, Dwivedi et al. (2016) noted that social influence and behavioural intention of mHealth application use are positively related. (Ndayizigamiye, Kante, & Shingwenyana, 2020) also confirmed this by observing that behavioural intention of mHealth use was significantly impacted by social influence.

In the present research, however, social influence did not positively impact the behavioural intention to use mHealth ($\beta = -0.071$, $p > 0.05$). A similar finding was observed in the work of Breil, Kremer, Hennemann, and Apolinário-Hagen (2019). The evidence strongly suggests that the use of mHealth among patients is considered a personal and individual issue. The acceptance of mHealth in the Kingdom of Saudi Arabia depends on an individual's confidence, skill, experience, and self-esteem. Therefore, it can be concluded that in Saudi Arabia, where the use of mHealth is considered to be in its early stages, the use of mHealth among patients is not influenced by the behaviour of others.

The results indicated that the hypothesis regarding a correlation between facilitating conditions and mHealth acceptance had significance ($\beta = 0.511$, $p < 0.05$). This is consistent with the findings of earlier research about the importance of facilitating conditions for technology acceptance in healthcare, with the main condition resource availability (e.g., technical knowledge and computer familiarity) (Mbelwa, Kimaro, & Mussa, 2019). Similarly, in a study on female patients with high blood pressure, Rhoads et al. (2017) revealed that mHealth adoption by that group depended markedly on facilitating conditions. Likewise, facilitating conditions was established to directly affect mHealth adoption in a study in Cameroon (Bawack & Kamdjoug, 2018). Access to resources and technical support have, therefore, consistently been found to facilitate the adoption of technologies like mHealth (Hoque & Sorwar, 2017).

In addition, various studies noted that system quality is a significant factor that has a direct impact on overall intention to use e-applications (Amalia, 2019). The present study's results also showed that system quality positively affects behavioural intention of mHealth use ($\beta = 0.367$, $p < 0.05$), which was confirmed by (Akter, D'Ambra, & Ray, 2013).

The results of the present research indicate that patients benefit from better communication, shorter response times, greater privacy, and improved convenience provided by a high-quality system. Without a certain standard of system quality, mHealth system efficiency cannot be achieved because potential users will not perceive the system to be appealing. For this reason, it is important for the Ministry of Health to develop mHealth applications with two specific considerations. First, the system features should be easy to use, with an emphasis on navigation speed, response time, integration, flexibility, and interface design. Second, feedback and input from users, such as patients, must be considered to develop the most useful and successful experience.

The contribution of trust to influencing patients' intention to use mHealth is supported by robust statistical findings ($\beta = 0.278$, $p < 0.05$). trust has been observed to be a mediator in the correlation between worries about personal privacy in mHealth adoption, customisation concerns, and behavioural intention (Guo, Sun, Yan, & Wang, 2012). In other words, if patients hold perceptions of integrity, positivity, and capability in relation to mHealth, there is a greater likelihood that they will hold a favourable view about the technology and utilize its services. This highlights the sensitivity surrounding mHealth use, which requires patients to supply personal details. The findings of this study about trust are consistent with those of other studies exploring general Information System (Al Mansoori, Sarabdeen, & Tchantchane, 2018) or mHealth (Meng, Guo, Peng, Lai, & Zhao, 2019).

CONCLUSION

Summary

This study contributes to the body of knowledge surrounding mHealth by making a significant contribution in the field of digital health by measuring the intention to use mHealth by patients in Saudi Arabia. Acceptance was measured using an extension of the UTAUT model (Venkatesh et al., 2003).

Previous studies on mHealth acceptance predominately focused on developed countries. Research into technology adoption and acceptance exists in relation to developing countries. However, such studies have been conducted outside the health context, specifically in e-government (Jacob & Darmawan, 2019; Maharjan, 2019) and e-commerce (Hassen, Rahim, & Shah, 2019; Mohamad & Kassim, 2019). The few studies in the health context are generally focused on overall acceptance rather than individual patient acceptance (Ndayizigamiye & Maharaj, 2016). This study, therefore, is valuable in offering an mHealth acceptance model.

Additionally, the study was critical in the application of an extension to the UTAUT in the context of a developing nation (Saudi Arabia). The UTAUT theory was extended through the integration of several factors (i.e., system quality and trust), which was confirmed by structural equation modeling analysis. Therefore, the study makes an important theoretical contribution by refining our understanding of mHealth in developing countries, as well as by extending the UTAUT through the integration of factors from Internet research (trust) and IS (system quality).

Indeed, many fields have explored technology acceptance; however, research in the acceptance of mHealth in Saudi Arabia is relatively unexplored. More research is needed to expand the knowledge in this area.

Theoretical and Practical Implications

mHealth technology has developed at a fast pace owing to the phenomenal proliferation of smartphones and tablets. However, adoption and acceptance of this technology by patients are problematic for several reasons. According to the quantitative results in this study, patients must perceive mHealth as beneficial, high quality, and trustworthy in terms of performance to accept this technology. The mHealth interface should be intuitive and easy to use. Any functional difficulties that patients encounter in using the technology will lead to the formation of negative perceptions and rejection.

To promote trust, as well as minimise risks and ambiguities, mHealth must be stable and reliable. This can be achieved through an adequate system design (Schnall, Higgins, Brown, Carballo-Dieguez, & Bakken, 2015). The technology requires constant updating and its advantages to patient groups must be clear. At the same time, facilitating conditions (technical assistance, training) must be in place to make it easy for patients to use mHealth (Schomakers, Lidynia, & Ziefle, 2018). Although the Ministry of Health has many options for eliminating existing obstacles, any measures taken must be consistent and consider account users' feedback. Moreover, facilitation of mHealth integration with current systems of medical records and practice management would make the technology more advantageous. Adoption of e-health systems will remain limited if the problems of technology use are not addressed (Bally & Cesuroglu, 2020).

This study informs Saudi Arabian decision makers in the Ministry of Health about better ways to deploy mHealth technologies. The findings can help decision makers formulate and devise specific policies and strategies for the effective acceptance and adoption of mHealth technology by taking account the different factors and outcomes investigated in this study. According to Saudi Vision 2030 (National Transformation Program, 2016), over the next few years, the Saudi Arabian Ministry of Health will encourage innovation adoption and provide supported resources and efforts to enhance the health sector.

Limitations of the Research

When reviewing the results of this research, the following limitations must be considered. This study represents a particular period. Its cross-sectional design results do not demonstrate how views change or how technology may impact the results. Considering the likelihood that serious changes may have occurred over time due to the developing field, a longitudinal study may be appropriate for future studies. This would ensure a record of the changes for patients who have used Ministry of Health applications in Saudi Arabia. A longitudinal study should be kept in mind as motivators for the use of technology that are reported in the literature or other sources can become obsolete over time. This means that a thorough evaluation of the contexts from which statements are made would be needed during any longitudinal study. Saudi Arabia has a large population; therefore, the small sample size could limit the generalisation of this result. A larger sample may be recommended for more accurate depictions.

Future Research Directions

The Kingdom of Saudi Arabia is a wealthy, "developing" nation with a large population under the age of 30. It also has one of the highest penetrations of mobile devices in the world. Therefore, its use of mobile technologies for health is worth exploration. Recommendations for future research include: (i) investigate and test other factors in the UTAUT model, (ii) obtain and study a more effective outcome with the impact of moderating variables (i.e., age, gender, experience, and voluntariness of use) on the model constructs, and (iii) use a longitudinal study to investigate social influence on the use of mHealth to detect changes in social influence over time.

Besides, in this study, the social influence construct of the UTAUT model was defined as the influence by people on the patient toward using mHealth. However, the research period was restricted. Previous research has argued that social influence diminishes over time with the widespread use of a technology (Margaryan, Littlejohn, & Vojt, 2011). Therefore, more longitudinal and panel studies are needed to understand the impact of social influence on the uptake and performance of mHealth in Saudi Arabia over time.

ACKNOWLEDGMENT

The author gratefully acknowledges Qassim University, represented by the Deanship of Scientific Research, on the financial support for this research under the number (10078-alrasscac-as-2020-1-1 W) during the academic year 1442AH / 2020 AD.

REFERENCES

Abidi, S. H. D., & Khan, M. N. (2020). An analysis into UTAUT based research models for IT implementation. *Studies in Indian Place Names*, *40*(71), 2011–2027.

Abu-Al-Aish, A., & Love, S. (2013). Factors influencing students' acceptance of m-learning: An investigation in higher education. *The International Review of Research in Open and Distributed Learning*, *14*(5). Advance online publication. doi:10.19173/irrodl.v14i5.1631

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11–39). Springer. doi:10.1007/978-3-642-69746-3_2

Akhtar, S., Irfan, M., Kanwal, S., & Pitafi, A. H. (2019). Analysing UTAUT with trust toward mobile banking adoption in China and Pakistan: Extending with the effect of power distance and uncertainty avoidance. *International Journal of Financial Innovation in Banking*, *2*(3), 183–207. doi:10.1504/IJFIB.2019.102307

Akter, S., D'Ambra, J., & Ray, P. (2013). Development and validation of an instrument to measure user perceived service quality of mHealth. *Information & Management*, *50*(4), 181–195. doi:10.1016/j.im.2013.03.001

Al-Hanawi, M. K., Khan, S. A., & Al-Borie, H. M. (2019). Healthcare human resource development in Saudi Arabia: Emerging challenges and opportunities—a critical review. *Public Health Reviews*, *40*(1), 1–16. doi:10.1186/s40985-019-0112-4 PMID:30858991

Al Mansoori, K. A., Sarabdeen, J., & Tchantchane, A. L. (2018). Investigating Emirati citizens' adoption of e-government services in Abu Dhabi using modified UTAUT model. *Information Technology & People*, *31*(2), 455–481. doi:10.1108/ITP-12-2016-0290

Al-Radaideh, A. T., & Alazzam, M. (2020). Critical successful factors affecting adoption of e-health system in developing countries. *Test Engineering and Management*, *82*(1), 306–316.

Aladwani, A. M., & Palvia, P. C. (2002). Developing and validating an instrument for measuring user-perceived Web quality. *Information & Management*, *39*(6), 467–476. doi:10.1016/S0378-7206(01)00113-6

Alam, M. Z., Hoque, M. R., Hu, W., & Barua, Z. (2020). Factors influencing the adoption of mHealth services in a developing country: A patient-centric study. *International Journal of Information Management*, *50*, 128–143. doi:10.1016/j.ijinfomgt.2019.04.016

Alkhalifah, T. (2018). *An investigation of the acceptance of mobile learning by high school students in the K-12 context in the Kingdom of Saudi Arabia* [Doctor of Philosophy]. Flinders University.

Alshahrani, A., Stewart, D., & MacLure, K. (2019). A systematic review of the adoption and acceptance of eHealth in Saudi Arabia: Views of multiple stakeholders. *International Journal of Medical Informatics*, *128*, 7–17. doi:10.1016/j.ijmedinf.2019.05.007 PMID:31160014

Alshehri, M., Drew, S., Alhussain, T., & Alghamdi, R. (2012). *The effects of Website quality on adoption of e-government service: An empirical study applying UTAUT model using SEM.* arXiv preprint arXiv:1211.2410.

Alwahaishi, S., & Snásel, V. (2013). Acceptance and use of information and communications technology: A UTAUT and flow based theoretical model. *Journal of Technology Management & Innovation*, *8*(2), 61–73. doi:10.4067/S0718-27242013000200005

Amalia, F. (2019). *The use of modified UTAUT 2 Model to analyze the continuance intention of travel mobile application.* Paper presented at the 2019 7th International Conference on Information and Communication Technology (ICoICT).

Bally, E. L., & Cesuroglu, T. (2020). Toward integration of mHealth in primary care in the Netherlands: A qualitative analysis of stakeholder perspectives. *Frontiers in Public Health*, *7*, 407. doi:10.3389/fpubh.2019.00407 PMID:32010660

Bawack, R. E., & Kamdjoug, J. R. K. (2018). Adequacy of UTAUT in clinician adoption of health information systems in developing countries: The case of Cameroon. *International Journal of Medical Informatics*, *109*, 15–22. doi:10.1016/j.ijmedinf.2017.10.016 PMID:29195701

Breil, B., Kremer, L., Hennemann, S., & Apolinário-Hagen, J. (2019). Acceptance of mHealth apps for self-management among people with hypertension. *Studies in Health Technology and Informatics*, *267*, 282–288. PMID:31483283

Byrd, T. F. IV, Kim, J. S., Yeh, C., Lee, J., & O'Leary, K. J. (2021). Technology acceptance and critical mass: Development of a consolidated model to explain the actual use of mobile health care communication tools. *Journal of Biomedical Informatics*, *117*, 103749. doi:10.1016/j.jbi.2021.103749 PMID:33766780

Byrne, B. M. (2010). Structural equation modeling with AMOS: Basic concepts, applications, and programming (multivariate applications series). *New York. Taylor & Francis Group*, *396*(1), 7384.

Datta, P. (2011). A preliminary study of ecommerce adoption in developing countries. *Information Systems Journal*, *21*(1), 3–32. doi:10.1111/j.1365-2575.2009.00344.x

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, *13*(3), 319–340. doi:10.2307/249008

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9–30. doi:10.1080/07421222.2003.11045748

Deng, Z., Hong, Z., Ren, C., Zhang, W., & Xiang, F. (2018). What predicts patients' adoption intention toward mHealth services in China: Empirical study. *JMIR mHealth and uHealth*, *6*(8), e172. doi:10.2196/mhealth.9316 PMID:30158101

Duarte, P., & Pinho, J. C. (2019). A mixed methods UTAUT2-based approach to assess mobile health adoption. *Journal of Business Research*, *102*, 140–150. doi:10.1016/j.jbusres.2019.05.022

Dwivedi, Y. K., Shareef, M. A., Simintiras, A. C., Lal, B., & Weerakkody, V. (2016). A generalised adoption model for services: A cross-country comparison of mobile health (m-health). *Government Information Quarterly*, *33*(1), 174–187. doi:10.1016/j.giq.2015.06.003

Eneizan, B., Mohammed, A. G., Alnoor, A., Alabboodi, A. S., & Enaizan, O. (2019). Customer acceptance of mobile marketing in Jordan: An extended UTAUT2 model with trust and risk factors. *International Journal of Engineering Business Management*, *11*, 1847979019889484. doi:10.1177/1847979019889484

Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., Patel, V., & Haines, A. (2013). The effectiveness of mobile-health technologies to improve health care service delivery processes: A systematic review and meta-analysis. *PLoS Medicine*, *10*(1), e1001363. doi:10.1371/journal.pmed.1001363 PMID:23458994

Garavand, A., Samadbeik, M., Nadri, H., Rahimi, B., & Asadi, H. (2019). Effective factors in adoption of mobile health applications between medical sciences students using the UTAUT model. *Methods of Information in Medicine, 58*(4/5), 131-139.

Garone, A., Pynoo, B., Tondeur, J., Cocquyt, C., Vanslambrouck, S., Bruggeman, B., & Struyven, K. (2019). Clustering university teaching staff through UTAUT: Implications for the acceptance of a new learning management system. *British Journal of Educational Technology*, *50*(5), 2466–2483. doi:10.1111/bjet.12867

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, *4*(1), 7. doi:10.17705/1CAIS.00407

Guo, X., Sun, Y., Yan, Z., & Wang, N. (2012). *Privacy-personalization paradox in adoption of mobile health service: The mediating role of trust.* Paper presented at the PACIS.

Hair, J. F., Black, W. C., & Babin, B. J. (2010). *RE Anderson Multivariate data analysis: A global perspective*. Pearson Prentice Hall.

Handayani, P. W., Meigasari, D. A., Pinem, A. A., Hidayanto, A. N., & Ayuningtyas, D. (2018). Critical success factors for mobile health implementation in Indonesia. *Heliyon*, *4*(11), e00981. doi:10.1016/j.heliyon.2018.e00981 PMID:30519665

Hassen, H., Rahim, N. H. A., & Shah, A. (2019). Analysis of models for e-commerce adoption factors in developing countries. *International Journal on Perceptive and Cognitive Computing*, *5*(2), 72–80. doi:10.31436/ijpcc.v5i2.100

Hayduk, L. A. (1987). *Structural equation modeling with LISREL: Essentials and advances*. Jhu Press.

Hennington, A., & Janz, B. D. (2007). Information systems and healthcare XVI: Physician adoption of electronic medical records: applying the UTAUT model in a healthcare context. *Communications of the Association for Information Systems*, *19*(1), 5. doi:10.17705/1CAIS.01905

Hoque, R., & Sorwar, G. (2017). Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model. *International Journal of Medical Informatics*, *101*, 75–84. doi:10.1016/j.ijmedinf.2017.02.002 PMID:28347450

Hossain, M. A. (2016). Assessing m-Health success in Bangladesh. *Journal of Enterprise Information Management*, *29*(5), 774–796. doi:10.1108/JEIM-02-2014-0013

Jacob, D. W., & Darmawan, I. (2019). *Extending the UTAUT model to understand the citizens' acceptance and use of electronic government in developing country: A structural equation modeling approach.* Paper presented at the 2018 International Conference on Industrial Enterprise and System Engineering (ICoIESE 2018). doi:10.2991/icoiese-18.2019.17

Jayaseelan, R., Koothoor, P., & Pichandy, C. (2020). Technology acceptance by medical doctors in India: An analysis with UTAUT model. *System*, *7*, 31.

Keikhosrokiani, P., Mustaffa, N., Zakaria, N., & Baharudin, A. S. (2019). User behavioral intention toward using mobile healthcare system. In *Consumer-driven technologies in healthcare: Breakthroughs in research and practice* (pp. 429–444). IGI Global. doi:10.4018/978-1-5225-6198-9.ch022

Kenny, G., & Connolly, R. (2017). *Towards an inclusive world: Exploring m-health adoption across generations.* Retrieved from https://core.ac.uk/display/301372340

Maharjan, M. (2019). Citizens' Acceptance of e-Government Services in Nepal: Applying UTAUT Model. *Advanced Engineering and ICT–Convergence 2019 (ICAEIC-2019)*, 122.

Marcolino, M. S., Oliveira, J. A. Q., D'Agostino, M., Ribeiro, A. L., Alkmim, M. B. M., & Novillo-Ortiz, D. (2018). The impact of mHealth interventions: Systematic review of systematic reviews. *JMIR mHealth and uHealth*, *6*(1), e23. doi:10.2196/mhealth.8873 PMID:29343463

Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, *56*(2), 429–440. doi:10.1016/j.compedu.2010.09.004

Mbelwa, J. T., Kimaro, H. C., & Mussa, B. (2019). *Acceptability and use of mobile health applications in health information systems: a case of eIDSR and DHIS2 touch mobile applications in Tanzania.* Paper presented at the International Conference on Social Implications of Computers in Developing Countries. doi:10.1007/978-3-030-18400-1_48

Meng, F., Guo, X., Peng, Z., Lai, K.-H., & Zhao, X. (2019). Investigating the adoption of mobile health services by elderly users: Trust transfer model and survey study. *JMIR mHealth and uHealth*, *7*(1), e12269. doi:10.2196/12269 PMID:30622092

Ministry of Communications and Information Technology. (2017). *CITC: 44.5 Million Subscribers To Mobile Telecom Services.* Retrieved from https://www.mcit.gov.sa/en/media-center/news/89432

Mohamad, S. A., & Kassim, S. (2019). *Examining the relationship between UTAUT construct, technology awareness, financial cost and e-payment adoption among microfinance clients in Malaysia.* Paper presented at the 1st Aceh Global Conference (AGC 2018). doi:10.2991/agc-18.2019.56

Mukred, M., Yusof, Z. M., Alotaibi, F. M., Asma'Mokhtar, U., & Fauzi, F. (2019). The key factors in adopting an electronic records management system (ERMS) in the educational sector: A UTAUT-based framework. *IEEE Access: Practical Innovations, Open Solutions*, *7*, 35963–35980. doi:10.1109/ACCESS.2019.2904617

National Transformation Program. (2016). *National Transformation Program 2020*. Retrieved from http://vision2030.gov.sa/sites/default/files/NTP_En.pdf

Ndayizigamiye, P., Kante, M., & Shingwenyana, S. (2020). An adoption model of mHealth applications that promote physical activity. *Cogent Psychology*, *7*(1), 1764703. doi:10.1080/23311908.2020.1764703

Ndayizigamiye, P., & Maharaj, M. (2016). *Mobile health adoption in Burundi: A UTAUT perspective.* Paper presented at the 2016 IEEE Global Humanitarian Technology Conference (GHTC). doi:10.1109/GHTC.2016.7857342

Patil, P., Tamilmani, K., Rana, N. P., & Raghavan, V. (2020). Understanding consumer adoption of mobile payment in India: Extending Meta-UTAUT model with personal innovativeness, anxiety, trust, and grievance redressal. *International Journal of Information Management*, *54*, 102144. doi:10.1016/j.ijinfomgt.2020.102144

Pejić Bach, M., Starešinić, B., Omazić, M. A., Aleksić, A., & Seljan, S. (2020). m-Banking Quality and Bank Reputation. *Sustainability*, *12*(10), 4315. doi:10.3390/su12104315

Petry, L. F., & Moormann, J. (2020). Mobile Payment in the Connected Car: Developing Services Based on Process Thinking. *Business Systems Research: International Journal of the Society for Advancing Innovation and Research in Economy*, *11*(3), 63-77.

Quiñonez, S. G., Walthouwer, M. J. L., Schulz, D. N., & de Vries, H. (2016). mHealth or eHealth? Efficacy, use, and appreciation of a Web-based computer-tailored physical activity intervention for Dutch adults: A randomized controlled trial. *Journal of Medical Internet Research*, *18*(11), e278. doi:10.2196/jmir.6171 PMID:27829576

Rahi, S., Mansour, M. M. O., Alghizzawi, M., & Alnaser, F. M. (2019). Integration of UTAUT model in internet banking adoption context. *Journal of Research in Interactive Marketing*, *13*(3), 411–435. doi:10.1108/JRIM-02-2018-0032

Rhoads, S. J., Serrano, C. I., Lynch, C. E., Ounpraseuth, S. T., Gauss, C. H., Payakachat, N., Lowery, C. L., & Eswaran, H. (2017). Exploring implementation of m-health monitoring in postpartum women with hypertension. *Telemedicine Journal and e-Health*, *23*(10), 833–841. doi:10.1089/tmj.2016.0272 PMID:28475431

Salhieh, S. E. M. (2019). Modeling the rationality of customers' switching mobile services behavior. *International Journal of Engineering Business Management*, *11*, 1847979019865411. doi:10.1177/1847979019865411

Sarker, P., Hughes, D. L., & Dwivedi, Y. K. (2020). Extension of META-UTAUT for examining consumer adoption of social commerce: Towards a conceptual model. In *Advances in Digital Marketing and eCommerce* (pp. 122–129). Springer. doi:10.1007/978-3-030-47595-6_16

Schnall, R., Higgins, T., Brown, W., Carballo-Dieguez, A., & Bakken, S. (2015). Trust, perceived risk, perceived ease of use and perceived usefulness as factors related to mHealth technology use. *Studies in Health Technology and Informatics*, *216*, 467. PMID:26262094

Schomakers, E.-M., Lidynia, C., & Ziefle, M. (2018). *Exploring the acceptance of mHealth applications-Do acceptance patterns vary depending on context?* Paper presented at the International Conference on Applied Human Factors and Ergonomics.

Senft, N., Abrams, J., Katz, A., Barnes, C., Charbonneau, D. H., Beebe-Dimmer, J. L., & Thompson, H. S. et al. (2019). eHealth activity among African American and white cancer survivors: A new application of theory. *Health Communication*. PMID:32013612

Sezgin, E., & Yıldırım, S. Ö. (2014). A literature review on attitudes of health professionals towards health information systems: From e-health to m-health. *Procedia Technology*, *16*, 1317–1326. doi:10.1016/j.protcy.2014.10.148

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Tomičić Furjan, M., Tomičić-Pupek, K., & Pihir, I. (2020). Understanding Digital Transformation Initiatives: Case Studies Analysis. *Business Systems Research: International Journal of the Society for Advancing Innovation and Research in Economy*, *11*(1), 125-141.

Urbano, R. C. (2013). *Using secondary datasets to understand persons with developmental disabilities and their families*. Academic Press.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly*, *27*(3), 425–478. doi:10.2307/30036540

Xia, J.-J., Gao, M., Qiu, S., Sang, X.-X., Ma, X.-L., & Lee, C.-Y. (2019). Research on patient acceptance behavior of online medical app based on UTAUT improved model. *DEStech Transactions on Economics, Business and Management*.

Zhang, T., Tao, D., Qu, X., Zhang, X., Lin, R., & Zhang, W. (2019). The roles of initial trust and perceived risk in public's acceptance of automated vehicles. *Transportation Research Part C, Emerging Technologies*, *98*, 207–220. doi:10.1016/j.trc.2018.11.018

Zhao, Y., Ni, Q., & Zhou, R. (2018). What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age. *International Journal of Information Management*, *43*, 342–350. doi:10.1016/j.ijinfomgt.2017.08.006

Tamim Alkhalifah is currently working as an Assistant Professor in the Computer Department, College of Science and Arts in Ar Rass, Qassim University, Saudi Arabia. In 2009, he has been admitted to a full time CS master's program at Swansea university. In 2013, he joined Flinders University, Adelaide, Australia and obtained his PhD in Computer science in 2018. His primary research interests include e- technologies, mobile development, mobile learning, and gamification. He published several papers in the IT field.