Perspectives Of Patients' Behavior Towards Mobile Health (Mhealth) In Saudi Arabia: A Modified Model Of The UTAUT

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Abstract: The introduction of information and communication technology (ICT) has been studied for the last twenty years. In the context of Saudi Arabia, better healthcare accessibility and quality of service provision could be achieved through a novel IT application specifically designed for the health sector, namely, mobile health (mHealth). Mobile health uses wireless cellular communication systems to facilitate connections between patients and health services. Nevertheless, there are obstacles that are delaying the implementation of this application in Saudi Arabia. In this study, the importance of effort expectancy, performance expectancy, facilitating conditions, system quality, and social influence were highlighted. Also emphasised was the significance of trust and how it affects the intention of patients to use mHealth. Hence, the study presented a research model following the UTAUT model for better understanding the identified constructs concerning mHealth acceptance. It was observed the importance of the identified constructs as well as put forth certain relevant arguments that future studies must explore.

Index Terms: mobile health(mHealth), technology acceptance, health informatics, UTAUT, trust, Ministry of Health, Saudi Arabia.

1 INTRODUCTION

The information and communication technology (ICT) revolution has transformed global life, altering education, interpersonal communication, entertainment, commerce, travel and health services. The use of ICT has grown rapidly and is not limited by borders, thus significantly affecting how people learn, live, socialise, work, communicate, as well as transact their business. Communication technologies in medicine have seen a widespread transformation in the provision and efficiency of healthcare over the last couple of decades; and even highly localised services and interactions, such as health checks or personal counselling, have been transformed by internet technology, including local area networks (LANs), intranets, and wide area networks (WAN). Mobile health (mHealth) is one development in this technological transformation of healthcare. Broadly defined, mHealth is the provision of either medical or public health services using mobile devices. These include not just smartphones, but also less ubiquitous wireless networks and wireless devices, such as patient monitoring devices, personal digital assistants (PDAs), and sensors. A wide range of mHealth services and applications have emerged that both improve health delivery systems and the efficacy of interventions designed to improve health outcomes [1]. Lee and Han [2] have detailed the range of mHealth applications and services that have been successfully deployed to improve health outcomes in recent years. mHealth applications have been found especially valuable in allowing older people to live independently, by ensuring they are able to undertake the activities of their daily lives while being monitored by health care professionals, even at a distance [3].

At the same time, the ubiquity of today's smartphone and tablet technology has seen a boom in mHealth applications for otherwise fit and healthy younger people to constantly monitor and improve their health, fitness and wellbeing. The International Telecommunication Union reports that some five billion people have mobile phone access globally, with between 85% and 95% of the global population covered by mobile phone network technology, most of it offering mobile broadband [4]. Mobile device penetration has thus helped to drive the mHealth revolution [5]. For example, Lee, Cho [6] recent study has estimated that since 2016, the Google and Apple app stores have offered as many as 259,000 mHealth apps for download. As Hoque [7] has pointed out, mHealth applications offer a range of benefits, including reduced costs, better access, and more efficient and timely interaction between patients, nurses, and doctors, including for the reporting and monitoring of health concerns or chronic problems. Both convenience and confidentiality are two additional benefits when dealing with sensitive health concerns (Deng, Mo [8]. Importantly, as Fox and Connolly [9] have noted, health services applications provided through mobile broadband offer a means by which a population with limited access to personal computers or fixed- or home-broadband connections can nevertheless keep in touch with health service providers and health information, given the ubiquity of mobile phones, even in developing countries. Matricardi, Dramburg [10] have pointed out that key stakeholders, such as governments, healthcare providers, mobile operators, content makers, and device vendors work together so that they can provide mHealth services and applications across the world. Since the early 2000s, governments have seen the potential for mHealth projects in a range of public health domains, such as monitoring disease, offering and promoting health education, 'nudging' individual behavioural change and training medical personnel [11]. The adoption and use of the technology has been more pronounced in wealthier countries [12] due to their greater familiarity with the widespread use of a variety of technologies in both the government and private spheres. Nevertheless, since 2010 mHealth services have

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been increasingly rolled out from China and South Korea to the United States and European countries [8]. The authors further observed that European countries provide mHealth services more actively than Asian countries, including Japan and South Korea. Another region worth examining to determine the uptake of ICT in the health sector is the Middle East, in this case the Kingdom of Saudi Arabia (KSA). With a difficult geographical terrain and a low level of population density, the KSA has long faced the challenge of effective healthcare provision. The KSA's healthcare system is managed by the Ministry of Health (MoH), which regulates and supervises private providers, while also providing government-run clinics and hospitals. In terms of introducing mHealth, given that the KSA has a relatively high level of internet penetration, with some 91% of the population having internet access [13], the provision of personal health services online has significant potential. The MoH has made use of the Kingdom's National Transformation Program 2020 (NTP)—part of the government's Saudi Vision 2030 agenda—to design, prepare and implement new technologies. Thus far, there has been considerable progress in fields that make significant use of technology, including statistical applications, human resources, staff communications, as well as health system integration under central supervision. The MoH argues that the Saudi healthcare sector is now ready to expand their use of ICTs by introducing mHealth as part of its personal health service provision. However, as an emerging economy, the introduction and adoption of mobile health services faces significant challenges in take-up and implementation.

2 LITERATURE REVIEW

Our lives are increasingly dominated by information technology. The internet and World Wide Web, as well as mobile/smartphone technology are increasingly integral to the ways in which we work and play. It offers new opportunities to save time, reduce costs and improve service delivery and performance. Given the growing ubiquity of online activity, several theoretical approaches have been advanced to make sense of how humans take up technology. Intense interest in ICT acceptance behaviour began in the late 20th century with the introduction of the internet and still continues as the rate of software development and innovative applications for ICT rapidly increases. Theoretical frameworks available for use when examining the uptake of ICTs include:

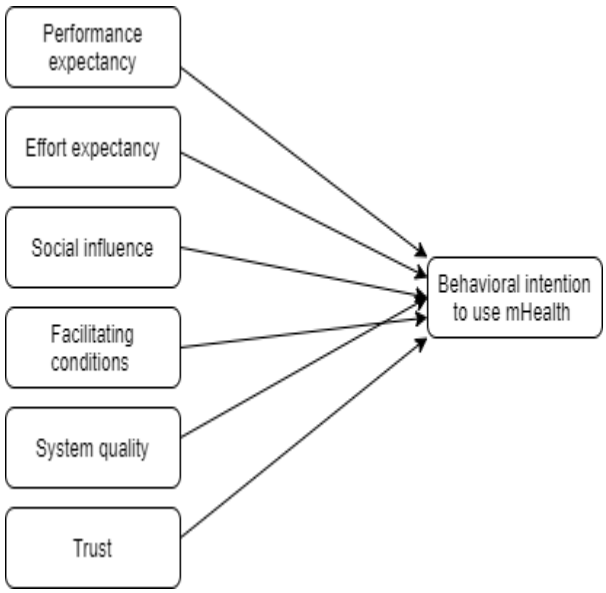
- theory of reasoned action [14]
- technology acceptance model [15]
- theory of planned behavior [16]
- diffusion of innovation [17]
- decomposed theory of planned behavior [18]
- technology acceptance model 2 [19]
- unified theory of acceptance and use of technology [20]
- technology acceptance model 3 [21].

Several authors have fused various models into broader theories covering topics as broad as the internet and online banking [22, 23], mobile shopping among UK consumers [24] and student acceptance of mobile learning in Saudi Arabia [25]. Acceptance / adoption theory models are increasingly being applied to mHealth studies. These studies apply a variety of acceptance theories, including the technology acceptance model (TAM), the theory of reasoned action (TRA), or the theory of planned behaviour (TPB). The researchers have generally adopted a mix of approaches to sampling, with some focusing on patients as the sample group, while others look at country-level data, and produce large-n, cross-country analyses. There are three key factors that characterise mHealth technology: mobility, portability, and ubiquity. Recent research has detailed the cost-effectiveness of mHealth applications in both identifying and monitoring health issues and in communicating heath habit changes [26]. The technology can be used to provide diverse services, such as health consultations, location-based services, and hospital registrations through mobile platforms. However, the number of empirical studies that examine the acceptance of mHealth among both patients and medical professionals is small. One study has analysed the connection between service quality and other outcomes in mHealth applications by developing a third-order reflective hierarchical service quality model [27]. Another drew on the TAM to analyse the adoption behaviour of hospitals in relation to using mHealth technology [28]. A study by Wu, Wang [29] determined that the perceived usefulness and ease of use of mHealth applications was connected to the degree of compatibility and self-efficacy for users; while Willison, Warkentin [30] observed that positive (motivation) as well as negative (perceived risks) factors influence how much doctors and patients accept and use mobile information computer technology. Patients' perspectives have seldom been studied, although one research study found perceived usefulness and enjoyment to be a significant feature in mHealth adoption [31]. A similar study identified several factors, including performance expectancy, effort expectancy have a similar predictive effect in relation to mHealth adoption [32]. More recently, research has highlighted the positive influence on mHealth adoption of several aspects of ICT usage, including its usefulness, convenience and monetary value [2]. Interestingly, the same study found that adoption intention is not affected at all by gender, age or income. Other studies have also emphasised the positive role of performance expectancy [33]. However, they found that subjective norms and effort expectancy did not influence IT adoption. Singh, Srivastava [34] have argued that several factors are critical to mHealth acceptance, such as perceived usefulness (PU), perceived ease of use (PEoU) and customer attitude (CA). DeLone & McLean (2003) have shown that the quality of an ICT system is highly influential when investigating the reasons for positive adoption behaviour. Good system quality provides greater user satisfaction, and later studies on technology acceptance models have continued to link the quality of the system with users' satisfaction and adoption of technology [25, 35]. According to a number of studies, trust is crucial for mHealth apps to be accepted [36, 37]. It is not enough to focus only on their usefulness and ease of use, particularly if the developers can exploit the technology and jeopardise the interests of users, such as app developers misappropriating the data gathered from app users. There are to date no major studies examining the factors driving mHealth acceptance and adoption in Saudi Arabia from the perspective of patients. This is despite the intention of the Saudi MoH to seek out and implement mHealth technology.

3 THEORETICAL FRAMEWORK AND DEVELOPMENT OF HYPOTHESES

In this study, an altered version of the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003) was implemented for gaining an understanding of the factors impacting mHealth's acceptance by patients in Saudi

Arabia. In the original UTAUT model, eight individual acceptance theories were merged to form one comprehensive model. Since its inception, numerous healthcare studies have used UTAUT and have demonstrated that the model can be used to explain how technology is accepted in healthcare. It should, however, be noted that the majority of these studies were carried out in developed countries (Dwivedi et al., 2011; Schaper et al., 2007; Han et al., 2004). As shown in Figure 1, the modified UTAUT model in this study presumes that there are six constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, system quality and trust) that determine behavioural intentions.



3.1 PERFORMANCE EXPECTANCY (PE)

Performance expectancy refers to the extent to which an ICT is perceived to be an aid to improved performance in the workplace (Venkatesh et al., 2003). It is also associated with other acceptance model constructs, such as outcome expectations (as per SCT), relative advantage (as per IDT), job-fit (as per MPCU), extrinsic motivation (as per MM) and perceived usefulness (as per TAM/TAM2 and C-TAMTPB). In terms of the types of devices for engaging with mHealth, it has been found that for tablet users performance expectancy is the key determinant in user acceptance [38] as well as the most common influencer of the degree of adoption (Davis, 1989). In the current research, performance expectancy was measured in terms of the perceived usefulness of the mHealth technology and its ability to enhance productivity, and it was predicted to influence the behavioural intention of users to accept mHealth.

Consequently, the following hypothesis is suggested:

H1: Performance expectancy significantly affects a patient's intention to use mHealth.

3.2 EFFORT EXPECTANCY (EE)

Effort expectancy is defined as 'the degree of ease associated with the use of the system' [20]. Effort expectancy significantly affects the intentions of patients to accept and use health information systems, including mobile health monitoring systems, clinical decision support systems and mobile health, as well as e-Health services through a smartphone.

Consequently, the following hypothesis is suggested:

H2: Effort expectation significantly affects a patient's intention to use mHealth.

3.3 SOCIAL INFLUENCE (SI)

Social influence was first presented as part of Ajzen [39] TRA model, in which it was referred to as 'normative beliefs'. Social influence refers to the way in which behaviour is shaped by peer or societal opinions of the behaviour or, in other words, the extent to which other people influence users' acceptance of a system (Venkatesh et al., 2003). Social influence was also mentioned in the C-TAM-TPB, TAM2, TPB and other models, where it is referred to as 'subjective norm' (Venkatesh et al., 2003). Social influence has been found to be a direct influencer of behavioural intention with regards to technology adoption, as demonstrated by several researchers [40, 41]. Normative beliefs have been broken down into two sub-forms: peer influence and superior influence [42]. Both of these forms of normative beliefs were taken into account as part of social influence in the current study, as per the UTAUT model, wherein social influence was first presented as a single construct.

Consequently, the following hypothesis is suggested:

H3: Social influence significantly affects a patient's intention to use mHealth.

3.4 Facilitating conditions (FC)

Facilitating condition is defined as 'the degree to which an individual believes that an organization and technical infrastructure exists to support the use of the system' (Venkatesh et. al., 2003, p.453). As shown by Chen, Li [43], FCs have a substantial impact on behavioural intention regarding which health information system use. In addition, Jewer [44] noted that FC directly affects behavioural intention, as well as technology use.

Consequently, the following hypothesis is suggested:

H4: Facilitating conditions significantly affect a patient's intention to use mHealth.

3.5 SYSTEM QUALITY (SQ)

System quality and information quality have been found to be the two core requirements for the adoption of an information system according to previous research (Delone & McLean, 2003). In the current research, system quality was taken to refer to how clear, accurate, and reliable the overall mHealth application and the services provided by the system are. System quality has been found to influence users' behavioural intention to adopt the IS, as well as the users' satisfaction with the IS (DeLone & McLean, 1992, 2003), and is widely accepted as an influencer of technology acceptance. [45] It has been suggested in other research that service quality, user satisfaction, ease-of-use, security, information quality and a number of other dimensions should be incorporated into the one concept of system quality [46]. Additionally, Schaupp, Fan [47] analysed survey data and found that users' satisfaction with websites was significantly determined by information and

system quality, whilst Lin and Lu [48] found that user acceptance and customer satisfaction are both highly driven by website quality (system quality).

Consequently, the following hypothesis is suggested:

H6: System quality significantly affects a patient's intention to use mHealth services.

3.6 TRUST (TU)

Trust is a personal and social factor that is examined in different dimensions, including knowledge-based trust and personality-based trust. Regarding acceptance, in Hernandez and Santos [49], the authors presumed that previous experiences affect the present trust level the most, which is called knowledge-based trust. Further, in Sim, Chia [50], the authors noted that trust directly and significantly impacts the intention of m-commerce users to use m-commerce technology. In Cohen, Bancilhon [51], the authors showed that trust greatly impacts the intention of a sample population to use e-prescribing technology. Thus, increased trust in a technology or in the persons responsible for the technology can result in increased intention to use mobile health services. It has been observed that numerous patients in developing countries have no trust in health services, particularly the ones provided by the government.

Consequently, the following hypothesis is suggested:

H6: Trust significantly affects a patient's intention to use mHealth services.

4 DISCUSSION

The present study examined various factors known to affect mHealth's acceptance. An analysis of the previously outlined constructs helped with designing the proposed research model that is largely founded on the UTAUT model (Venkatesh et. al., 2003) but incorporating two external constructs–trust (TU) and system quality (SQ). The proposed research model includes four main constructs–effort expectancy (EE), performance expectancy (PE), facilitating conditions (FC), and social influence (SI). The model estimates that PE, EE, SI, FC will significantly influence the intention of patients to use mHealth applications, along with system quality and trust. According to Carter, Weerakkody [52], trust has a strong relationship, either positive or negative, with service quality, system quality, and information quality, and this relationship should be examined. Various researchers (e.g., Al Katheeri [53]; Alam, Hoque [54]) have argued for the UTAUT model for determining users' intention to use mHealth, noting the UTAUT factors' significant impact. Thus, MOH officials must take into account the significance of the proposed model constructs and examine the way in which they can promote the acceptance of the mHealth system by patients. To test the mHealth system, different dimensions can be considered, such as usefulness, the influence of other people, ease of use, system reliability, and available resources. It is undeniable that trust is important and can be regarded as a necessity for patients to accept mHealth services.

5 CONCLUSION AND FUTURE WORK

As part of the KSA's Vision 2030 and the National Transformation Program 2020, the healthcare system of the Kingdom is to be reformed significantly. Central to the National Transformation Program 2020 is the application of technology across the Kingdom to increase the efficient use of existing resources, and use digital platforms to expand and enhance the delivery of healthcare services and the monitoring of Saudi citizen's health and wellbeing. In this study, the importance of effort expectancy, performance expectancy, facilitating conditions, system quality, and social influence were highlighted. Also emphasised was the significance of trust and how it affects the intention of patients to use mHealth. Hence, the study presented a research model following the UTAUT model for better understanding the identified constructs concerning mHealth acceptance. It was observed the importance of the identified constructs as well as put forth certain relevant arguments that future studies must explore.

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