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ADOPTION OF TELEHEALTH BY HEALTHCARE PROFESSIONALS:

AN OVERVIEW OF THEORETICAL MODELS AND THEIR APPLICATION

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Abstract

It has long been advocated that Information and Communication Technology (ICT) offers a huge potential to answer many of the challenges that the healthcare sector is facing. Therefore, information technology applications are abundantly present in healthcare sector. ICT applications promise efficient tools to collect, store, process and communicate health-related data and information. In that respect, it is believed that ICT could improve safety, quality, and costefficiency of healthcare services. For this reason, the integration of ICT into the health system constitutes a priority for many countries given regional disparities in the availability of health care services and in the distribution of health care human resources. However, telehealth adoption by healthcare professionals still represents a challenge. Indeed, the recognition of the utility of telemedicine by managers will not justify its adoption by physicians if they are reluctant to its use. In that sense, physicians' lack of acceptance of the technology represents one of the main reasons why telemedicine implementation projects have failed. This paper presents an overview of the theoretical models that have been applied to the study of ICT adoption in the specific sector of healthcare, presents a synthesis of actual knowledge on factors involved in ICT adoption among healthcare professionals, and identifies key elements to design strategies aimed at optimizing the use of telehealth in healthcare settings.

Keywords: theoretical models, telehealth, overview

1   INTRODUCTION

Over the past decades, adoption of information and communication technology (ICT) in the healthcare sector has been the focus of many studies. The rationale for studying ICT adoption is that many ICT projects have failed because of the lack of integration into practices and organizations (Ash & Bates, 2005; Lorenzi et al., 1997). Indeed, implementing new technologies is not sufficient to increase the performance of the potential users. To achieve this goal, the ICT must be accepted and used by them (Venkatesh et al, 2003). For this reason, technology acceptance has been a central theme in information system (IS) researches (Hu et al, 1999) and many studies were conducted in various implementation settings.

This paper has two goals: first, it presents an overview and a critique of some of the theoretical models that are most relevant to study ICT adoption. Second, it discusses some important findings from the literature on ICT adoption by healthcare professionals and proposes avenues for promoting an optimal use of these technologies. These findings are particularly relevant for the advancement of ICT integration in healthcare.

2   THEORETICAL MODELS OF ICT ADOPTION

Several theoretical models can be adapted and applied to the study of ICT adoption in healthcare. Most of them consist of frameworks developed in other scientific fields, such as social psychology. The theoretical models described below have been empirically applied to understand ICT adoption behaviours among healthcare professionals at the individual level.

The most significant models are the theory of reasoned action, the theory of planned behavior, the theory of interpersonal behavior, the diffusion of innovations theory, and the technology acceptance model.

2.1   Theories of Reasoned Action and Planned Behavior

These two models are very similar since the Theory of Planned Behavior (TPB) (Ajzen, 1985; 1991) constitutes an extension of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). Both models were developed in the field of social psychology in order to understand a variety of human behaviors. These models are often referred to as intention-behavior theory since they consider intention as the direct precursor of behavior.

The TRA (Fishbein & Ajzen, 1975) postulates that the realization of a given behavior (B) is predicted by the individual intention (I) to perform this behavior. In turn, the individual intention is formed by two antecedents: attitude towards the behavior (AACT) and subjective norm (SN). AACT represents the evaluation of the advantages and disadvantages associated with the performance of a given behavior. SN is the individual's perception that significant others will approve or disapprove the behavior in question, weighted by individual's motivation to comply.

However, some behaviors might not be totally under volitional control, which means that they require specific resources, skills, or opportunities for an individual in order to perform them. Therefore, the TPB (Ajzen, 1985; 1991) proposes to add the perception of behavioral control (PBC) – the person's evaluation of the barriers related to the realization of the behavior and his or her perceived capacity to overcome them – as a direct determinant of the behavior. Furthermore, the PBC can also act as an indirect determinant of the behavior by influencing intention.

2.2   Theory of Interpersonal Behavior

Another model that has been used to understand acceptance behaviours with respect to ICT is the Theory of Interpersonal Behaviour (TIB) (Triandis 1980). Essentially, the TIB is similar to the other

intention-behaviour models in that it also proposes a set of psychosocial factors that influence the realisation of behaviour. However, the TIB specifies that three direct determinants influence behaviour: intention, facilitating conditions, and habit. Intention refers to the individual's motivation regarding the performance of a given behaviour. Facilitating conditions represent perceived factors in the environment that can ease or impede the realisation of a given behaviour. Habit constitutes the level of routinisation of a given behaviour, i.e. the frequency of its occurrence.

According to the TIB, the behavioural intention is formed by attitudinal normative beliefs. Attitudinal beliefs are formed by an affective (affect) and a cognitive (perceived consequences) dimension. Affect represents an emotional state that the performance of a given behaviour evokes for an individual, whereas perceived consequences refer to the cognitive evaluation of the probable consequences of the behaviour. The TIB also incorporates two different normative dimensions: social and personal norms. Social norms are formed by normative and role beliefs. Normative beliefs consist of the internalisation by an individual of referent people or groups' opinion about the realisation of the behaviour, whereas role beliefs reflect the extent to which an individual thinks someone of his or her age, gender and social position should or should not behave. The personal normative construct of the TIB is formed by personal normative belief, the feeling of personal obligation regarding the performance of a given behaviour, and self-identity, the degree of congruence between the individual's perception of self and the characteristics he or she associates with the realisation of the behaviour.

2.3   Diffusion of Innovation Theory

One of the models that have received much attention for the study of ICT adoption in healthcare is the Diffusion of Innovation (DOI) (Rogers, 1995). This model suggests that there are three main sources influencing the adoption and diffusion of an innovation: perceptions of innovation characteristics; characteristics of the adopter; and contextual factors (Berwick, 2003). According to a review of numerous empirical studies (Rogers, 1995), perceptions of the characteristics of an innovation are the most critical factors for its diffusion. There are five perceived characteristics of innovation: 1) relative advantage is the degree to which the innovation is perceived as better compared to the status quo; 2) compability is the degree to which the innovation is perceived as being consistent with existing values and practices among potential adopters; 3) complexity is the degree of difficulty perceived regarding the use of the innovation; 4) triability represents the possibility for a potential adopter to experiment the innovation on a small scale; and 5) observability is the degree to which the results of the innovation are visible to potential adopters.

2.4   Technology Acceptance Model

The Technology Acceptance Model (Davis, 1989) was developed based upon the TRA specifically for understanding user acceptance of information technology. In its original version, the TAM is similar to the TRA, considering intention as the direct determinant of behavior, while attitude and social norms being the predictors of intention (Davis, 1989). The specificity of the TAM is that it decomposes the attitudinal construct found in previous models into two distinct factors: perceived ease of use (PEOU) and perceived usefulness (PU). However, the TAM has been simplified over time and the attitudinal and normative components have been dropped from the model, leaving PEOU and PU as the sole predictors of intention (Venkatesh et al., 2003). The TAM has been applied to understand healthcare professionals' acceptance of ICT (Hu et al., 1999; Croteau & Vieru, 2002).

The TAM has the particularity of being ICT-specific and it proposes a set of beliefs that can be measured among various groups of users (Davis, 1989). However, some authors have criticized the applicability of the TAM to the study of healthcare professionals' behaviors (Croteau & Vieru, 2002). Various efforts have been done to extend the TAM either by introducing variables from other theoretical models or by examining antecedents and moderators of perceived ease of use and perceived usefulness.

3 SYNTHESIS OF STUDIES ON ICT ADOPTION IN HEALTHCARE

A review of empirical studies that have applied theoretical frameworks to understand ICT adoption among healthcare professionals was conducted. A synthesis of the findings is presented in Table 1.

Authors	Theory used	Applications studied	Participants and setting
Hu et al. 1999 Chau and Hu 2001 Chau and Hu 2002	TAM TAM+TPB TAM+TPB	telemedicine	408 physicians in Hong Kong
Hu and Chau 1999	TPB	telemedicine	421 physicians in Hong Kong
Teles Araújo et al. 2000	TRA	teleconsultation	65 General Practitioners in Portugal
Harris et al. 2001	TAM	computer-based telemedicine	215 physicians, nurses and administrative personnel in USA
Gagnon et al. 2003	TIB	telehealth	519 physicians in Quebec, Canada
Helitzer et al. 2003	DIT	telehealth	31 clinicians and administrators in New Mexico, USA
Spaulding et al. 2005	DIT	telemedicine	186 physicians in Kansas, USA
Gaggioli et al. 2005	TAM	telemedicine	361 doctors in Italy
Park and Chen, 2007	TAM+DIT	smartphone	71 doctors 20 nurses 17 other specialities in the USA
Day et al, 2007	TAM	videophones	3 managers 10 nurses 4 social workers in the USA
Wu et al, 2007	TAM+IDT	Mobile Healthcare System (MHS)	123 physicians, nurses and medical technicians in Taiwan

Tabl 1.   *Synthesis of findings from theoretical studies of ICT adoption in healthcare*

The TAM was the model mostly used to predict telehealth adoption by healthcare professionals. Generally, TAM constructs explained a fair proportion of the variance in healthcare professionals' behaviors toward technologies (Kimberly et al, 2001; Gaggioli et al, 2005; Wu et al, 2007; Park & Chen, 2007).

In the TAM literature, the PU and the PEOU positively determine attitude toward using the technology. Moreover, the impact of PU on attitude is usually stronger than that of PEOU and the PU is also influenced by the perception of ease of use (Davis, 1989; Davis et al, 1989) .However, Day et al. (2007) have suggested that PEOU may have a stronger influence than PU among hospice staff. We should note that this research is qualitative and that these findings emerge from interviews with 17 participants from two rural hospice programs. Nevertheless, in all the other studies considered, the TAM relationships were confirmed through correlation analyses (Kimberly et al, 2001; Gaggioli et al, 2005; Park & Chen, 2007) or structural equation modeling (SEM) (Hu et al, 1999; Chau & Hu, 2001; 2002).

In some of the reviewed studies, the construct PEOU did not prove to be consistently related to attitude or PU (Hu et al, 1999; Chau & Hu, 2001; 2002). However, it is important to mention that in these studies the authors used the same sample (408 physicians in Hong Kong) which represent a serious limitation to compare findings since it diminishes the overall power of analyses.

While the TAM was able to predict the behavior of healthcare professionals, this model has limitations since the intention of medical staff may partially have been affected by characteristics of health care and the nature of their profession (Hu et al, 1999). Hence, many researchers have suggested that other variables should be included to obtain a comprehensive predictive model for the utilization of telemedicine (Kimberly et al, 2001; Day et al, 2007; Croteau & Vieru, 2002).

In some studies, the TPB was used as theoretical framework (Chau & Hu, 2001; 2002; Hu & Chau, 1999) , but in several of this studies, the TPB was combined with the TAM. The main findings are that the attitude and perceived behavioral control are crucial to physician acceptance of telemedicine, but subjective norm did not appear to have a significant impact. As Chau and Hu (2002) proposed, physicians are likely to develop independent evaluations and consequently may place less weight on others' opinions, thus limiting the importance of subjective norm.

Four studies of healthcare professionals' telehealth acceptance were completely or partially based on Rogers' DIT (Wu et al, 2007; Park & Chen, 2007; Spaulding et al, 2005; Helitzer et al, 2003). This theory seems to be helpful in terms of identifying determinants of telemedicine acceptance among the non-adopters (Spaulding et al, 2005; Helitzer et al, 2003). In all the studies based upon the DOI that were reviewed, relative advantage was the strongest predictor of ICT acceptance.

In other studies, only some characteristics of the innovation proposed by the DIT were studied in combination with the TAM. Wu et al. (2007) introduced the compatibility as a predecessor of PU and PEOU. Their results indicate that compatibility is the most important determinant of users' behavioural intention to use a mobile health care system. The constructs of observability and trialability were evaluated by Park and Chen (2007) as predecessors of attitude. Only observability was significantly and positively related to doctors' and nurses' adoption decision.

The TRA was used solely by Teles Araújo et al. (2000) to assess the adoption of neurotelemedicine. However, the model showed only a weak capacity to predict telemedicine acceptance ($R^2BI=26,9\%$). This result can be due to the limited size of the sample (53 general practitioners).

Gagnon and colleagues (2003) suggested that the TIB is an appropriate model to predict physicians' intention to use telemedicine, but refinements to this model are needed. In this research, the model explained the largest proportion of variance in technology acceptance among all included studies. However, multicollinearity was present between some of the theoretical constructs and only the normative factors and self-identity influenced technology acceptance (Gagnon et al, 2003).

4 DIRECTIONS FOR FUTURE RESEARCH ON ICT ADOPTION

This overview of theoretical frameworks applied to ICT adoption by healthcare professionals has highlighted some avenues to orient future advancements in this field of research. However, the purpose of this paper was not to provide a systematic review of studies on ICT adoption since it focused on a limited number of studies which provided examples of the application of the theoretical frameworks discussed. Thus, a logical next step would be to carry on a systematic review of the literature on the factors influencing healthcare professionals' adoption of ICT applications. This systematic review would synthesize actual knowledge on the factors that are the most influential for different professional groups and various ICT applications.

A second line of research that is proposed is the development of multidimensional models that combine concepts from individual-level behavioral theories with variables from group-level and organizational frameworks (Kukafka et al., 2003). Such models would provide knowledge to build multi-level interventions for an optimal integration of ICT into healthcare practices.

Theoretical developments are also important in order to improve our understanding of the factors affecting ICT adoption by healthcare professionals. Using meta-analysis techniques to compare theoretical models and develop comprehensive models that integrate the most influent concepts from existing theories would strengthen the development of effective interventions to promote an optimal integration of ICT in healthcare.

Finally, few studies have compared ICT adoption between various groups of healthcare professionals and between cultural groups. It would be interesting to conduct such comparisons to provide a cross-cultural validation of the theories and tools available and to explore factors that could explain variations in ICT adoption between countries and professional groups.

5 CONCLUSION

ICT adoption is a multidimensional and dynamic phenomenon that is transformed over time. Together with individual beliefs and motivations towards the adoption of ICT, it is also important to address factors that influence how ICT applications interact with current practices at the professional, organizational, and systemic levels. More empirical evidence is needed to understand user acceptance in the specific sector of health care. This paper provided an overview of some of the most prominent theoretical models used in the study of ICT adoption at the individual level and discussed some findings related to their application. A meta-analysis of quantitative theory-based studies of ICT adoption could provide a stronger basis to orient future research on ICT adoption by healthcare professionals and develop interventions based upon a combination of change strategies. In summary, the field of ICT adoption should move from using a single theory to study adoption at one point in time to assessing ICT adoption on a continuum based upon integrative theoretical frameworks.

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