ASAC 2001
London, Ontario

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TELEMEDICINE ADOPTION STUDIED FROM PHYSICIANS' PERSPECTIVE

This study addresses the factors that could affect the intention of physicians to adopt telemedicine technology. Based on theoretical foundations of technology adoption models, a reviewed model is proposed and tested via questionnaire with a sample of 127 physicians that were at the time of the survey, just about to use telemedicine technology. Results analyzed with PLS indicate that physicians' perceptions of usefulness and ease of use of telemedicine are positively related to their intention to adopt this technology, whereas the image they project by using it and the degree of their voluntariness to use it have no bearing on their intention to adopt telemedicine.

Introduction

The healthcare industry is now starting to grasp the impact that information technology can have on reshaping its activities. To help eradicate common problems such as difficult access, rising costs and poor quality of healthcare, telemedicine is on the road to becoming an integral part of medical practice worldwide.

There are several definitions of telemedicine. "Telemedicine is the practice of medicine without the usual physician-patient physical confrontation, but instead via an interactive audio-video communication system" (Bird, 1975, as in Bashshur, Sanders, Shannon, 1997, p. 19). Industry Canada defines telemedicine as "the use of communications and information technology to deliver health and healthcare services and information over large and small distances" (Picot, 1998, p.9). With the advent of Internet/Intranet technologies, telemedicine can be perceived as a set of communication modalities that allow for the transmission of medical data, video images and audio between physicians and other healthcare providers. These technologies apply to clinical areas such as radiology, dermatology, pathology, surgery, cardiology, home healthcare and to teaching through teleconferencing. Some of the benefits of telemedicine include the ability of bringing healthcare services to the patient, reducing the time it takes to make diagnosis and treatment decisions and improving the continuity of care.

In Canada, telemedicine could be the solution to medical woes namely access and costs. Telehealth technology has a major role to play in the plans endorsed by health ministers across the country to amalgamate and redistribute medical services in cities and local communities. For example, since 1996, at the Hospital for Sick Children in Toronto, over five hundred patient consultations have been conducted to sites in Northern Ontario, the rest of Canada as well as around the world (Picot, 1998). In Quebec a pediatric cardiology network links four University Centers with over thirty sites in the province. Nova Scotia has a telemedicine network connecting all forty-three hospitals for teleradiology, teledermatology and teleconferencing (Filler, 1999). In Montreal, at the McGill University Health Centre (MUHC) - which encompasses four major teaching hospitals on the island - an Intranet solution for teleradiology is being implemented in order to create a "film-free" environment.

Telemedicine can be a double-edged sword, as it can provide a mean for institutional survival or the path to professional failure, depending on how it is presented to the buying population and how it is implemented. This research is designed to provide academics and practitioners alike with a pragmatic explanation of key factors affecting the adoption of telemedicine. The general research question this paper examines is*: What are the key factors that influence physicians' adoption of telemedicine?* One of the reasons that telemedicine system implementations have failed in the past was the lack of physicians' adoption of the new technology, the poor quality of the technology and

premature funding termination (Bashshur *et al.*, 1997) With the emergence of province-wide telehealth networks it is crucial to address the physician technology adoption issue.

This paper puts forward a model of user adoption of information technology that is applicable to physicians. The proposed model combines a modified version of the Technology Acceptance Model (TAM) (Davis, 1989) with aspects of the Diffusion of Innovations Theory (DIT) (Rogers, 1995), in this way taking into account additional factors that might affect physicians' attitudes towards telemedicine. The study validates this model and addresses a pragmatic managerial need: avoiding the pitfalls of implementing telemedicine, stemming from millions of dollars invested into developing telemedicine programs by federal and provincial governments in recent years. The success of telemedicine requires an adopting organization to address both technological and managerial challenges.

Theoretical background

For the past decade, researchers have tried to create conceptual models that encompass the main factors that influence users to accept new technologies. Many times, academics have debated the issue of whether information technology (IT) is actually adopted by its intended users. This review emphasizes research that has tried to shed light on the determinants of user adoption, as this concept has been tackled theoretically and empirically in the academic literature on IT implementation. Studies that pertain to telemedicine technology adoption will also be addressed. User acceptance is a critical factor for IT adoption. User acceptance can be defined as: "the obvious willingness within a group to use IT for the tasks it is designed to support" (Dillon and Morris, 1996, p. 4). Reluctance of users to accept IT is a crucial hindrance to the success of the implementation of any new information system; user acceptance has been viewed as the pivotal factor in determining the success or failure of any IS project (Davis, Bagozzi and Warshaw, 1989).

Technology Acceptance Model (TAM) developed by Davis (1989) proposes a method of evaluating user acceptance by assessing users' beliefs, attitudes, intentions and "actual computer adoption behavior". Davis postulated that behavioral intention to use IT was predominantly correlated with usage. The main goal of TAM is to predict IT acceptance and shed light on design problems of new IS before users adopt the system (Dillon and Morris, 1996). TAM uses a set of two variables (perceived ease of use and perceived usefulness) employed in many computer technology acceptance contexts. This model was found to be much simpler and easier to use by most researchers and to be a more powerful model for establishing the variables influencing user acceptance of computer technology. TAM has proven to be successful in predicting and explaining usage across a variety of new technologies

Roger's Diffusion of Innovations Theory provides a solid foundation for developing conceptual models that assess the impact of new IT on users, over time. The innovation decision process leading to institutionalization of usage may be conceptualized as a sequence of steps where an individual goes from initial perception of an innovation, to the development of an attitude toward it, to a decision to adopt or reject it, to using it and finally reinforcing the adoption decision (Rogers 1995). Rogers defines adoption as "…the decision to make full use of an innovation as the best course of action available" (Rogers 1995, p.21).

In the last ten years, many researchers have tried to prove that TAM, enhanced with certain other constructs, is the model best suited to explore and explain user acceptance of new IT (Adams, Nelson and Todd, 1992; Igbaria, 1993; Compeau and Higgins, 1995; Szajna, 1996; Chang, 1998; Compeau, Higgins and Huff, 1999). Currently more and more academics realize that an all-encompassing model is hard to build. At the same time they recognize that every model they create has as a foundation, TAM. The emergence of this model represents the turning point in academics' and practitioners' endeavors to understand and predict user acceptance of new IT.

Only a few studies have been done to assess the impact of telemedicine on the actual or potential users of this particular technology. Succi and Walter (1999) proposed an extended Technology Acceptance Model to investigate physicians' acceptance of telemedicine. They argued

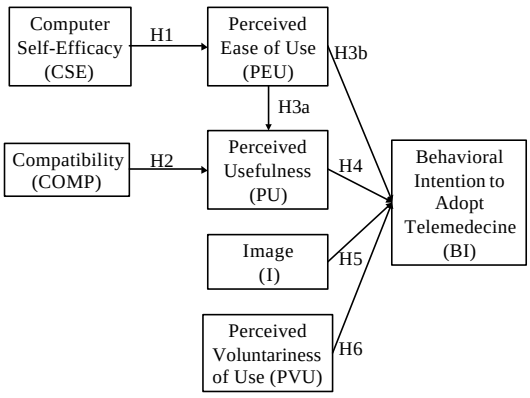
that, unlike middle managers or MBA students who had been used as the target population in most IT acceptance studies, physicians enjoy authority and prestige in their environment. Information systems, in general, improve many users' - including physicians' - job performance. However certain technologies, like telemedicine, could to a certain extent, codify expert knowledge owned only by professionals. Certain physicians may see this process as a threat to their expertise. From here stems the problem of physician reluctance to adopt telemedicine. The authors proposed a model that takes into account additional factors that could affect physicians' attitude toward telemedicine. They introduced a new factor, perceived usefulness towards professional status. Unfortunately the authors did not empirically test the model. Hu *et al.* (1999) used data obtained from physicians in selected hospitals in Hong Kong, to assess the explanatory force of technology acceptance model in the case of physician acceptance of telemedicine technology. The study's outcomes showed reasonable support for the utilization of this research model. The authors suggested that there is a need for adding other constructs to the model or integrating it with other IT acceptance models, in order to enhance its explanatory power in the healthcare milieu. These kinds of modified or integrated research models can provide a more thorough explanation of the understanding of IT acceptance by physicians.

Methodology

Research model

This study melds the existing user technology adoption literature, telemedicine research and practitioner goals. In this way a contribution to IT adoption research is expected by extending the validity and applicability of existing research models to healthcare providers. Also a better understanding of telemedicine technology adoption is anticipated because of the significant growth of IT investment in healthcare organizations across the globe, and especially in Canada. The proposed model, pictured in figure 1, attempts to answer the general research question: *What are the key factors that influence physicians' decision to adopt telemedicine technology?* The theoretical model for the study combines constructs taken from the Technology Acceptance Model (Davis, 1989) and constructs from the Diffusion of Innovations Theory (Rogers, 1995) in a complementary manner. The underlying foundation for our model is a simplified TAM. When end user perceptions are captured prior to adoption, the dependent variable should be the intention to adopt rather than the intention to use. According to TAM, studies need to be specific with regards to the target behavior of interest (Davis, 1989). This study's goal is to examine adoption; hence the dependent variable is the intention to adopt.

Figure 1 Research model



There are a few differences between our model and Davis' original model. The first difference is that the attitude construct has been removed in order to simplify the model (Davis *et al.*, 1989; Chau, 1996; Igbaria *et al*., 1997). While empirically testing his original model, Davis *et al.* (1989) found, in the outcomes of their studies, that the attitude-behavior relationship was non-significant. They therefore removed the attitude construct from their original model. The second

difference is that a link was added between perceived ease of use (PEOU) and behavior intention to adopt (BI). This was done because other empirical studies found a significant relationship between these two constructs (Moore and Benbasat, 1991; Chau, 1996). According to other researchers' suggestions (Chau, 1996; Jackson *et al.*, 1997; Agarwal and Prasad, 1999) BI was used as a dependent variable instead of actual use. This was done because TAM hypothesizes that behavior intention is the major determinant of usage behavior (Davis, 1989). This is the third difference. Another difference is the inclusion of the computer self-efficacy (CSE) construct in our model as an antecedent of perceived ease of use. Davis *et al*. (1989) suggested that the perception of self-efficacy could be an explanation for the effect of perceived ease of use on behavioral intention to adopt. In their study, Venkatresh and Davis (1996) empirically tested this notion by assessing the relationship between CSE and PEOU. The findings supported the authors' hypothesis that computer self-efficacy is a determinant of perceived ease of use.

Finally, three more constructs, namely compatibility, image and perceived voluntariness of use (PVU) were included in our model. These constructs originated from literature on the Diffusion of Innovations Theory. This theory, as shown in the literature review, provides a set of attributes that could affect an individual's opinion on the innovation, prior to adoption. In their study, Moore and Benbasat (1991) found that compatibility, image and PVU were among the other main characteristics that were identified as having a significant impact on the decision to adopt an IT innovation. Compatibility is seen as the degree to which adopting an innovation is consistent with the existing socio-cultural values and beliefs and prior and present experiences (Rogers, 1995). As postulated by Moore and Benbasat (1991) it is unlikely that individuals would view an innovation as useful if it is not compatible with their work style. The image construct encompasses the perceptions that adoption of the technology may enhance one's status in one's social system (Moore and Benbasat, 1991). This pertains to the physician's belief that his perceived professional status may be altered by the adoption of telemedicine technology. PVU was added to the model to assess whether or not the adoption of telemedicine is entirely voluntary. As shown in Moore and Benbasat's study this research examines the impact that PVU has on intention to adopt.

Hypotheses

In this research, telemedicine technology adoption is seen as a physician's psychological state with regard to his/her intention to adopt this particular technology. The target technology was telemedicine in general, rather than specific telehealth programs such as teleradiology, telesurgery etc. The reason behind this decision was that telemedicine is still in the adoption stage, which makes it difficult to assess user technology adoption based on specific telemedicine technologies. Nevertheless, the outcomes of this study will provide academics and practitioners alike insights relevant to technology adoption in general and telemedicine in particular. The following hypotheses will be tested in order to attain this paper's goal:

H1: Physicians' computer self-efficacy is positively linked to their perception of the ease of use of telemedicine.

H2: Physicians' compatibility is positively linked to their perception of the usefulness of telemedicine.

This first hypothesis follows from the outcomes of Venkatresh and Davis' (1996) study, which proved that computer self-efficacy accounted for thirty percent of the variance in perceived ease of use. The second hypothesis refers to the belief formation process is influenced by the user's socio-cultural values and work style. Compatibility is an important factor that affects a user's perception of IS usefulness (Moore and Benbasat, 1991; Karahana *et al.*, 1999)

H3a: Physicians' perception of the ease of use of telemedicine is positively linked to their perception of its usefulness.

H3b: Physicians' perception of the ease of use of telemedicine is positively linked to their behavioral intention to adopt it.

The two propositions are based on suggestions made by Davis *et al*. (1989) who argued that perceived ease of use has a direct impact on behavioral intention. Hypothesis H3a has been validated in other studies (Chau, 1996; Jackson *et al.*, 1997) and Hypothesis H3b was formulated taking into account that the easier a system is to use, the greater the perception that the technology being adopted will support the user's professional needs is (Jackson *et al*., 1997).

H4: Physicians' perception of the usefulness of telemedicine is positively linked to their behavioral intention to adopt it.

H5: Physicians' image is positively linked to their behavioral intention to adopt telemedicine.

H6: Physicians' perception of voluntariness of use of telemedicine is positively linked to their behavioral intention to adopt it.

A direct relationship between perceived usefulness and behavioral intention to adopt is established based on previous results obtained by Davis *et al.* (1989) and Adams *et al.* (1992). The last two hypotheses were formulated following recommendations from Moore and Benbasat (1991) who found that there is support for considering image as a separate factor that influences behavioral intention. They also argued that perceived voluntariness of use is an important attribute when consideration has to be given to whether the potential users are free to adopt or reject a new technology.

Variables

This model combines well-validated constructs from Technology Acceptance Model with elements from Diffusion Innovation Theory (Davis *et al*., 1989; Moore and Benbasat, 1991; Venkatresh and Davis, 1996; Hu *et al.*, 1999). Preliminary measurements of the model's variables were obtained from the above mentioned studies using a five point Likert scale with values ranging from 1 - *strongly disagree* to 5 - *strongly agree.* Most of the constructs' items were re-worded to fit telemedicine. Computer self-efficacy was operationalized using Compeau, Higgins and Huff's (1999) instrument, which was presented earlier in Compeau and Higgins (1995). The original instrument had ten items and used a Guttman scale; the authors empirically tested and validated it. The instrument was later re-used by Venkatresh and Davis (1996). They re-tested its reliability and found a Cronbach's alpha equal to 0.81. In the questionnaire, physicians were asked to indicate agreement or disagreement with the eight statements of the CSE construct. Perceived ease of use (5 items) and perceived usefulness (7 items) were adopted from Hu *et al*. (1999) who used them among 421 physicians from hospitals in Hong Kong. Behavior intention to adopt telemedicine construct, which was composed of 4 items, was based on Davis' original construct and modified to make it relevant to telemedicine. Image (2 items), compatibility (3 items) and perceived voluntariness of use (2 items) were based on Moore and Benbasat's (1991) instrument and adopted from Karahanna *et al*. (1999).

Data collection

The data for this study were gathered by means of a survey questionnaire administered to physicians in pre-selected specialties who practice medicine in healthcare institutions in the provinces of Québec and Nova Scotia. In the province of Québec, physicians working within the MUHC in Montréal were chose (which, at the time, was not yet part of the Québec Telehealth Network), as respondents. This institution was chosen because the MUHC is not only a healthcare provider, but also a teaching hospital and a world-renowned medical research institution. Here an Intranet solution for teleradiology and teleconferencing based on ATM technology is being implemented. All four MUHC sites will be able to hold teleconferences involving physicians and researchers alike. The choice of contacting 260 physicians from the MUHC, specialized in emergency medicine, surgery, orthopedic, oncology, respirology, urology and radiology, was based on the likelihood of their involvement with telemedicine programs in the near future since they will probably be among the

first to use telemedicine technology. Healthcare institutions in Nova Scotia were targeted because of the newly implemented telemedicine network that links 43 sites throughout the province. The questionnaire was sent to 140 physicians who had participated in at least one Continuing Medical Education (CME) session via teleconferencing.

The questionnaire was pre-tested by 10 physicians from five different specialties (general surgery, emergency medicine, oncology, orthopedic surgery and radiology). They were randomly chosen from the MUHC list and were eliminated from the final list. After a few adjustments, the final instrument was administered via mail, to physicians in Nova Scotia and Quebec (MUHC). The survey was accompanied by a cover letter stating the nature and purpose of the study. Participation was voluntary and confidentiality and anonymity were assured. The physicians were asked to respond within two weeks of receipt of the package. Of the 390 questionnaires distributed, 129 (87 from the MUHC and 42 from Nova Scotia) were completed and returned. Two from the MUHC were rejected because of too many unanswered questions, leaving 127 for the data analysis. This represents a 32.5 percent response rate. As a group, respondents averaged 16.5 years in practice in their specialty area (17.7 in NS and 16 in MUHC). Among the respondents the male-to-female ratio was approximately 7:1. There was not a significant difference regarding the intention to adopt telemedicine among physicians from the two data sources (MUHC and NS), but differences among physicians from the same source (especially from NS) categorized according to their job tenure were observed. No significant differences were found between early and late respondents regarding their answers to the questionnaire, suggesting that the threat of non-response bias would not be a factor.

Results

The research model was analyzed using Partial Least Squares (PLS), a second-generation multivariate technique that allows for the testing of the psychometric properties of the scales used to measure a variable, as well as the strength and direction of the relationships among variables (Cassel, Hackl and Westlund, 1999). PLS was developed to accommodate small size samples (contrary to LISREL) as long they are ten times larger than the number of items contained in the most substantial construct (Chin, Marcolin and Newsted, 1996). The data do not have to be normally distributed when using this technique. PLS is comprised of two sets of equations: the assessment of the measurement model, and the assessment of the structural model. The former implies the calculation of the item reliability, convergent validity and the discriminant validity. The latter entails determining the appropriate nature of the relationships (paths) between the measures and constructs. The estimated path coefficients indicate the sign and the power of the relationships while the item's weights and loadings indicate the strength of the measures (Hulland, 1999). The computer program used for this analysis was PLS Graph developed by Chin and Fee (1995).

Assessment of the measurement model

Item reliability shows whether the indicators measure this construct only. Only items with loading equal or greater than 0.50 were kept for inclusion in the scales (Hair, Anderson, Tatham and Black, 1992). The final number of items per construct is shown in table 1. Convergent validity assesses the degree to which items that should be related to a construct are in reality related. To do so, the rho coefficient was used and its value is determined by the respective loading of items The criterion established by Nunnally (1967) pertaining to the reliability of the construct is that any construct having a rho value equal or greater than 0.70 should be kept. This criterion is abided. The rho values are also presented in table 1. Discriminant validity reflects the degree to which each construct is unique. In order to assess the discriminant validity of the measures, two aspects have to be verified. First, the items associated with a construct correlate more highly with each other than with items associated with other constructs in the model. Second, the Average Variance Extracted (AVE) calculated for each measure is higher than all the variances shared between the measures (Fornell and Larker, 1981). Discriminant validity was not confirmed for the construct perceived usefulness. Its AVE was smaller than the variance shared with the construct compatibility (see table 1). Therefore an Exploratory Factor Analysis (EFA) was performed.

Table 1 Discriminant validity and construct reliability (CFA - initial version) [(1)]

Construct (# items)	PEOU Rho = 0.98	PU Rho = 0.90	CSE Rho= 0.70	COMP Rho = 0.96	BI Rho = 0.87	IMAGE Rho = 0.91	PVU Rho = 0.91
PEOU (4)	***0.67***						
PU (7)	0.39	***0.59***					
CSE (2)	0.19	0.20	***0.46***				
COMP (3)	0.29	**0.64**	0.12	***0.89***			
BI (4)	0.22	0.41	0.11	0.45	***0.84***		
IMAGE (2)	0.05	0.24	0.10	0.16	0.17	***0.83***	
PVU (2)	0.04	0.04	0.00	0.08	0.08	0.03	***0.63***

[(1)] *Diagonals represent the average variance extracted (AVE), while the other matrix entries represent the shared variance. The underlined value is the variance shared between two constructs higher than AVE.*

The EFA revealed a few interesting results. First, the construct compatibility disappeared and its related items added to those of the construct perceived usefulness. Second, the construct computer self-efficacy was split into two different constructs. According to Marakas, Yi and Johnson (1998), "self-efficacy is a composite of numerous factors, each of which serve to have a direct effect on the final individual judgment and on the relationship of that judgment to the actual performance" p.128. Their model's factors were compared with the two new factors obtained after the EFA and derived from the initial CSE construct. It turns out that the first one represents the situational support (SS) construct and the second one represents the user's perceived confidence (PC) construct. The former determines the users' perceptions regarding the appropriateness of the training approach and IS support, while the latter assesses the amount of perceived confidence and assurance built over time due to the efforts and persistence of users in completing a computer related task (Marakas et *al.*, 1998). Both constructs have been empirically proven to be facets of CSE (Bandura and Shunk, 1981). The two questions related to perceived confidence were conceived so that the more confidence the user has in his/her abilities to perform the computer related task, the higher he/she will score on the Likert scale. Taking into account the two major modifications, Hypothesis H1 will be assessed twice: once for the situational support construct and a second time for the perceived confidence construct. The new assessment of the measurements was proceeded and the discriminant validity was successfully verified this time (see table 2).

Table 2 Discriminant validity and construct reliability (CFA - revised version)

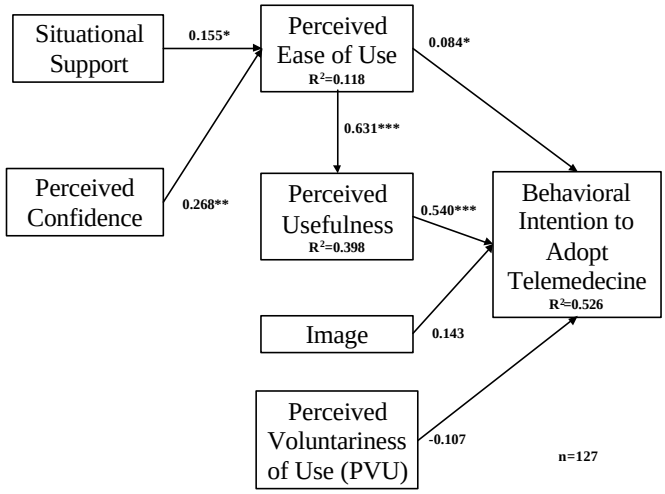
	PEOU r =0,89	PU r =0,88	IMAGE r =0,87	SS r =0,88	PVU r =0,90	BI r =0,87	PC r =0,88
PEOU	***0.675***						
PU	0.399	***0.689***					
IMAGE	0.099	0.345	***0.685***				
SS	0.053	0.068	0.070	***0.714***			
PVU	0.029	0.063	0.057	0.001	***0.829***		
BI	0.234	0.494	0.260	0.059	0.084	***0.641***	
PC	0.096	0.062	0.050	0.072	0.005	0.041	***0.801***

Assessment of the structural model

Results of the assessment of the structural model are indicated in Figure 2. Hypothesis 1 referred to the double relationship between situational support ($H1_a$) and perceived ease of use of telemedicine, which was supported ($path_a$=0.155; $p<0.05$), as well as between perceived confidence ($H1_b$) and perceived ease of use of telemedicine, which was also supported ($path_b$=0.268; $p<0.01$). Hypothesis 2 tested the relationship between compatibility and perceived ease of use. The exploratory factor analysis showed that the construct compatibility has been eliminated from the model; therefore the hypothesis is not supported. Hypothesis 3a referred to the relationship between perceived ease of use and perceived usefulness; which was supported (path=0.631, $p<0.001$). Hypothesis 3b, which referred to the relationship between perceived ease of use and behavioral

intention to adopt, was also supported (path=0.084, p<0.05). Hypothesis 4 tested the relationship between perceived usefulness and Behavioral Intention to Adopt. A positive and significant relationship was observed (path =0.540, p<0.001). Hypothesis 5 which referred to the relationship between image and behavioral intention to adopt was not supported. Hypothesis 6 tested for the existence of a positive impact of perceived voluntariness of use on behavioral intention to adopt was not supported as well.

Figure 2 Model path coefficients and significance



One-tail t-test *: p<0.05; **: p<0.01; ***: p<0.001

Discussion and limitations

In this study, TAM was modified to include additional constructs, namely image and perceived voluntariness of use, taken from the Innovations Diffusion Theory (Rogers, 1995), and computer self-efficacy, which has its roots in the Social Learning Theory (Bandura, 1977). A conceptual model was created that would better explain physician adoption of telemedicine technology. Perceived ease of use and perceived usefulness together accounted for 52.6 percent of the variance in intention to adopt.

Situational support is positively linked with perceived ease of use. This implies that even though there are some concerns, physicians believe that they have the ability to perform well their tasks if given the right resources regardless the complexity of telemedicine technology. Perceived confidence was also found to have a significant impact on perceived ease of use. This result can be explained by the fact that facing a novelty, physicians will relate their effort spent in prior experiences to their perception of telemedicine ease of use. They went through so many difficult tasks and learning experiences throughout their years of practice that they have built enough self-confidence to perceive telemedicine as a tool eventually easy to use. The association between perceived ease of use and behavioral intention to adopt telemedicine can be explained by the fact that physicians are professionals that, due to their general competence, intellectual and cognitive capacities, can adopt new technologies more quickly than the students used in most TAM studies. Perceived usefulness was found to be the most significant factor affecting behavioral intention to adopt, which is in agreement with what TAM postulates. This outcome suggests that physicians have the propensity to concentrate on the usefulness of telemedicine in their daily activities. Therefore, for telemedicine to be adopted, decision makers have to prove that this technology serves the needs of modern healthcare. Image and perceived voluntariness of use showed no significant impact on behavioral intention to adopt telemedicine. Contrary to the hypothesis, perceived voluntariness of use has a negative impact yet non significant on behavioral intention to adopt. This result may be explained by the fact that physicians, due to their heavy load of research and practice, have less time

to assess new technologies related to their work and they probably prefer that someone else do the legwork for them.

The goal of this research was to improve the understanding of the adoption of telemedicine technology among physicians. The verified model has important implications for academics as well as for IS practitioners. A number of important findings emerged from this study. Perceived usefulness of telemedicine has been proven to have a strong impact on physicians' behavioral intention to adopt it. Therefore more work needs to be done by IS practitioners to leverage the physicians' perception of telemedicine usefulness. Hospital decision makers will have to create more opportunities for physicians to voice their opinions on the usefulness of information technologies. This way, the healthcare professionals will have a more active role in the decision-making process when evaluating new technologies. These physicians need to be reassured that technology will never replaced their hands-on expertise. Image and perceived voluntariness of use had no impact on physicians' behavioral intention to adopt telemedicine, meaning that external pressure has noting to do on their decision to adopt or not this technology. As long as they perceived its usefulness for their work and they can perceive its easiness in usage with no major efforts, they will be inclined to adopt it. One interesting contribution of this study is the emergence of two new constructs after the exploratory factor analysis. These had been previously regarded as precedents of computer self-efficacy (Marakas *et al.*, 1998). The literature review found no evidence of any studies that considered these two constructs as precedents of perceived ease of use.

This research has some limitations. Responses to this study were voluntary, therefore prone to self-selection biases; only physicians who were interested in telemedicine technology likely filled in the questionnaire. More research needs to be done to further confirm the validity of the model presented in this study. Longitudinal studies that examine how beliefs of the same user evolve over time would also provide a more thorough test of how the determinants of behavioral intention to adopt telemedicine, namely perceived ease of use, perceived usefulness, perceived voluntariness of use and image change over time.

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