Predicting the Acceptance of Healthcare Information Technology in Morocco

Abstract

The Moroccan Ministry of Health recently implemented a new information system in public healthcare organizations so as to give better support to healthcare professionals in their daily activities, improve the efficiency of the healthcare system and the quality of healthcare delivered. However, these professionals have been reluctant to accept it. Lessons learned from this disappointing experience have raised the question: which model would be able to predict the acceptance of healthcare information technology by healthcare professionals in Morocco? This research adapted the Unified Theory of Acceptance and Use of Technology and used it to analyze a set of 252 data. The results revealed that the proposed model in this paper explained 31% of the variance in intention to use the healthcare information system and almost 10% in its actual use. This work can help stakeholders involved in healthcare information technology and healthcare information system projects.

Keywords: Health Information Technology; Health Information Systems; Healthcare professionals; Acceptance; Prediction model; Adapted UTAUT; Public organizations; Morocco; North Africa; Developing country.

1 Introduction

Information technology (IT) developments in the healthcare area provide health information technology (HIT) which is defined as IT that is used to produce health information systems (Telemedicine, Clinical Information Systems, Hospital Information Systems…). If it is used, it could contribute to high-quality, efficient care delivery (Wu, Chenc and Greenese, 2009) and to a reduction of organizational expenses (Scott, 2007). However, one of the main factors leading to the failure of information technology projects in this area is the reluctance of physicians, nurses and administrative staff to accept this technology (intention to use IT and actual use) (Kijsanayotin, Pannarunothai and Speedie, 2009). Consequently, no benefits can be expected by health organizations if these people do not accept the health information systems produced.

To predict information technology acceptance by physicians, nurses and administrative staff working in Moroccan public healthcare organizations, the authors considered a research model founded on a revised Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). They used this model in the healthcare context of a North African developing country. A set of data collected from ten healthcare centers and the regional hospital located in the city of Agadir, south of Morocco, was studied to identify and validate items and constructs explaining this acceptance. Indeed, since the advent of UTAUT, its resulting model was applied mainly in the context of business in western industrial developed countries (banking, accounting, entertainment and telecommunications services) (Venkatesh et al., 2003). Also, different research work that used this model, as it is or adapted, to address the issue of IT acceptance in healthcare context mainly concerns developed countries (Venkatesh et al., 2003; Chang et al., 2007; Schaper and Pervan, 2007; Kijsanayotin, Pannarunothai and Speedie, 2009).

To give better support to healthcare professionals in their daily activities, improve the health system efficiency and the quality of care delivered, and to go some way to responding to the growing needs of Moroccans with regard to healthcare, the 2020 strategic plan of the

health Moroccan ministry reviewed the existing health information system, in place since 2001. This system provides medical, administrative and financial information to management and permits the evaluation of promulgated care services. There have been several problems with its implementation that have affected its acceptance by different employees, especially physicians, nurses and administrative staff. The main difficulties were the lack of qualified staff capable of handling this system, the short implementation period, ineffective training and lack of support. In 2007, the ministry designated Hassan II regional hospital, located in Agadir city, as an experimental site to assess a new integrated health information system that performs certain appropriate processes such as patient management, billing, financial accounting, purchasing and logistics.

Despite this, physicians, nurses and administrative staff were still reluctant to accept the new system. Lessons learned from this second disappointing experience have raised the question: which model predicts the acceptance of healthcare information technology by physicians, nurses and administrative staff in Morocco?

In order to help stakeholders involved in healthcare information technology and healthcare information systems projects, this paper proposes a model predicting the acceptance of this technology by people in Morocco considered as developing country. The second section develops the theoretical background including basis theories, relevant models predicting IT acceptance, especially in healthcare context, and the research model. The third section describes the method, while the fourth shows the results including the measurement model and structural model. The fifth section discusses the proposed model's robustness in explaining healthcare IT acceptance in this country, and is followed by the conclusion.

2 Theoretical background

The research in information systems studies why and how individuals accept IT (Venkatesh et al., 2003). It refers to theories that deal with IT acceptance issue (Kukafka et al., 2003). According to Sally and Indrit(2007) "*Many competing theoretical models co-exist in the innovation acceptance and adoption literature..., most of these models attempt build theories to explain how and why innovations or technologies are adopted and predict the level of acceptance and adoption*". The following subsections review briefly these theories considered as the basis to build up a framework allowing IT acceptance prediction. Furthermore, Technology Acceptance Model (Davis, 1989) and its extensions are described prior depicting researches in the healthcare context.

2.1 Basis theories

The innovation diffusion theory is defined as the study which concerns innovation diffusion within a social group (Rogers, 1995). It can be applied to computing technology (Campeau, Higgins and Huff, 1999) and provides a basis for the development of conceptual IT acceptance models (Chau and Tam, 1997). While this theory focuses on the innovation itself, the theory of reasoned action suggested by Fishbein and Ajzen (1975) defines relationships between factors, namely beliefs, attitudes, intentions and behavior. Attitude is determined by relevant beliefs about the results of performing the behavior and evaluation of their desirability. The intention is influenced jointly by the individual's attitude and subjective norms. Moore and Benbasat (1991) have noted that this theory examines perceptions of IT acceptance by individuals. Moreover, the theory of planned behavior proposed by Ajzen (1991) states that behavior is determined by intention. The latter is predicted by attitude, subjective norms and perceived behavioral control that positively influence acceptance behavior. Furthermore, social cognitive theory suggested by Bandura (1986) explains how an individual acquires and maintains behaviors (Technology acceptance for example). It has two

principle objectives: (1) Understand and predict individual or group behavior (2) Identify methods to modify this behavior.

2.2 Relevant models predicting IT acceptance

A large number of models predicting the IT acceptance were drawn from the four theories cited above. Table 1 summarizes their factors and relevance and point out critical assessment.

Table 1 Theories used as conceptual framework to study IT acceptance.

Authors	Theory	Factors	Relevance	Critical assessment
Rogers (1995)	Innovation Diffusion Theory (IDT)	Relative advantage, Compatibility, Complexity, Trialability, Observability	Focuses on the technology itself	Studies neither acceptance behaviors nor individual reluctance
Fishbein and Ajzen (1975)	Theory of Reasoned Action (TRA)	Beliefs, Attitudes, Social norms, Intention and Behavior	States that an individual's actual behavior is predicted his intention to perform the behavior	Relationships between individual factors do not distinguish between the influences of attitude and subjective norm on intention
Ajzen (1991)	Theory of Planned Behavior (TPB)	Attitude, Subjective norms, and Perceived behavioral control	Intention is predicted by Attitude, Subjective norms and Perceived behavioral control that influence positively the acceptance behavior	Does not explain the move from beliefs to intention. No clear definition of perceived behavioral control (difficult to measure) Assumes that people are rational and make systematic decisions based on available information
Bandura (1986)	Social Cognitive Theory (SCT)	Outcome Expectations-Performance, Outcome Expectations-Personal, Self-efficacy, Affect, Anxiety	Understands and predicts individual and group behavior Explains how people acquire and maintain behaviors by providing basis for intervention strategies	Difficult to operationalize Multiple concepts difficult to implement in an intervention

The Technology Acceptance Model (TAM) represents the most powerful model to establish variables which influence this acceptance. It has proved to be the most successful in the prediction and explanation of acceptance of this technology (Adams, Nelson and Todd, 1992; Igbaria, Parasuraman and Baroudi, 1996; Chang, 1998). Davis (1989) defined two important constructs in this model, Perceived Usefulness and Perceived Ease of Use to predict behavioral intention and use behavior towards Information Technology. The actual use is determined by behavioral intention which is influenced by a basic individual factor namely attitude defined as positive or negative feelings towards IT. Behavioral intention is modeled as a function of attitude and usefulness and determines actual use.

Venkatesh and Davis (2000) extended the original TAM to TAM2 by including new social and cognitive constructs. They aimed to explain Perceived Usefulness and IT acceptance in terms of social influence processes (Subjective norm, Voluntariness, and

Image) and cognitive instrumental processes (Job relevance, Output quality, Result demonstrability and Perceived Ease of Use). They also wanted to understand how the effects of these constructs change over time with user experience. Their results showed that TAM2 explained up to 60% of the variance in Perceived Usefulness considered as a determinant of the intention of an individual to use IT.

Venkatesh et al. (2003) merged the above theories into four individual acceptance models, called TAM (Davis, 1989), Motivational Model (Davis, Bagozzi and Warshaw, 1992), Combined TAM and TPB (Taylor and Todd, 1995) and Model of PC Utilization (Thompson, Higgins and Howell, 1991), in order to integrate all of them into one unified model named UTAUT that includes four core constructs that determine intention and usage, namely, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Gender, Age, Experience, and Voluntariness were considered as moderators. The model identifies Performance Expectancy, Effort Expectancy, and Social Influence as determinants of behavioral intention, which explains 70% of the variance.

Furthermore, to develop an integrated model, the TAM3, Venkatesh and Bala (2008) used previous research (Venkatesh, 2000; Hu, Chau and Sheng, 2000) into Perceived Usefulness and Perceived Ease of Use determinants. Using longitudinal studies, the authors found that Perceived Usefulness is a significant predictor of Intention; moreover, Experience moderates the effects of Perceived Ease of Use and Subjective norm on Intention. They concluded that TAM3 explained between 40% and 53% of the variance in intention of IT acceptance.

2.3 IT acceptance in healthcare context

Comparing TAM and TPB, Chau and Hu (2000) found that they explained respectively 42% and 37% of the behavioral intention variance. Moreover, the integrated model proposed by these authors did not provide a significant additional explanatory power (R^2=0.43). To predict pediatrician's intention to accept Internet-based health applications (IBHA), Chismar and Wiley-Patton (2002) applied the extended Technology Acceptance Model (TAM2). They confirmed that only Perceived Usefulness had significant effects on this intention with 59% of the variance. Meanwhile, Perceived Ease of Use, social processes of Subjective Norm, IBHA Experience, Voluntariness and Image had no significant effect.

Croteau and Vieru (2002) proposed a model to predict factors affecting physicians' intention to adopt telemedicine. They referred to a modified version of the Technology Acceptance Model (Davis, 1989) and to the Innovation Diffusion Theory (Rogers, 1995). Their results showed that Perceived Usefulness significantly affects physicians' intention to adopt telemedicine and Voluntariness had a negative impact on this intention. However, Image had no impact on physician' intention. They concluded that the proposed model explained almost 60% of variance in Intention to adopt Telemedicine.

For Paré, Sicotte and Jacques (2006), Attitude, Psychological ownership and Overall Responsibility are considered the most important factors to predict physicians' usage of Clinical Information Systems with 55% of variance.

Tung, Chang and Chou (2008) examined the intention of nurses to accept e-logistics information systems in Taiwan. Their research model is based on Innovation Diffusion Theory, Technology Acceptance Model and two added new factors called Trust and Perceived Financial Cost. Results revealed that Perceived Usefulness, Perceived Ease of Use, Compatibility and Trust, all had strong positive effect on Behavioral Intention. Moreover, Perceived Financial Cost influenced this intention negatively. Authors concluded that the proposed model accounted for 70% of the variance.

Moreover, Chen et al. (2008) tried to understand factors influencing Public Health Nurses (PHNs) to accept Web-Based Learning Technology (WBL). Their results indicated the

absence of a significant relationship between attitude and intention to accept WBL, whereas, user characteristics, specifically computer competence, had significant indirect effects on this intention through Perceived Usefulness and Perceived Ease of Use. Also, only 7.8% of the variance in behavioral intention is accounted.

Wu et al. (2008) extended the Technology Acceptance Model by integrating a Trust construct to identify factors influencing acceptance of adverse event reporting systems by healthcare professionals. Their results indicated that Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and Trust were the significant predictors of this acceptance.

Aggelidis and Chatzoglou (2009) developed and tested a modified Technology Acceptance Model to examine factors affecting the intention of people who use Hospital Information Systems (HIS) in public health institutions. Their results showed that Attitude, Perceived Usefulness, Ease of Use, Social Influence, Facilitating Conditions and Self-Efficacy positively influenced personal intention to use HIS, whereas no significant influence is found between anxiety and this intention. Authors concluded that their modified model can explain 87% of the variance of behavioral intention.

Furthermore Yu and Li (2009) have applied TAM2 to study factors explaining healthcare information technology used by caregivers. Their results revealed that Perceived Usefulness, Perceived Ease of Use and computer skills had a strong positive impact on the intention of caregivers to accept this technology. However, Image, Voluntariness, Age and Work experience did not have any significant effects on this intention. The authors pointed out that the three significant factors accounted for 46% of the variance caregiver's behavioral intention.

Table 2 summarizes studies that applied the Technology Acceptance Model and its extensions in the healthcare context. It shows the most significant factors and the accounted variance of each model in explaining behavioral intention.

Table 2 Research works applying TAM and its extensions in healthcare context.

Authors	Technology acceptance models	IT application	Organization and/or professionals	Significant factors	R^2
Chau and Hu (2002)	TAM	Telemedicine	Physicians	Attitude, Perceived Usefulness, Perceived Ease of Use, Behavioral intention	TAM: 0.42 TPB: 0.47 Integrated model: 0.47
Chismar and Wiley-Patton (2002)	TAM2	Internet-based health applications	Pediatricians	Perceived Usefulness	0.59
Croteau and Vieru (2002)	TAM	Telemedicine	Physicians	Perceived Usefulness	0.60
Paré, Sicotte and Jacques (2006)	Extension of TAM	Clinical Information Systems	Physicians	Attitude, Psychological ownership and Overall Responsibility	0.55
Tung, Chang and Chou (2008)	TAM	E-logistics information system	Nurses in Taiwan	Perceived Usefulness, Perceived Ease of Use, Compatibility and Trust, Perceived Financial Cost	0.70
Chen *et al.* (2008)	TAM	Web-Based Learning Technology	Public Health Nurses	User characteristics and computer competence	0.078

Wu *et al.* (2008)	TAM with Trust	Event reporting systems	Healthcare professional	Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and Trust	Not revealed
Aggelidis and Chatzoglou (2009)	Modified TAM	Hospital Information System	Healthcare professional in public institutions	Attitude, Perceived Usefulness, Ease of Use, Social Influence, Facilitating Conditions and Self-Efficacy	0.87
Yu and Li (2009)	modified TAM2	Health IT applications	Healthcare personal	Perceived Usefulness, Perceived Ease of Use and computer skills	0.46

2.4 Research model: an adapted UTAUT

The literature review above describes the studies applying the TAM model and its extensions in the healthcare context. It shows factors relevant to predicting the acceptance of information technology in this context. However, we should note that several research projects have shown that TAM does not provide sufficient explanation of the variance because of the context and/or some important factors that were not captured (Venkatesh, Sykes and Zhang, 2011; Holden and Karsh, 2010; Raitoharju, 2005; Liang, Xue and Byrd, 2003).

Being one of the three salient extensions of TAM, UTAUT seems to be the most relevant model. Recently Venkatesh, Sykes and Zhang (2011) applied an adapted version to the context of Electronic medical record (EMR) systems to study the acceptance issue by physicians working for private hospitals. They showed that it predicted 44% of the variance in behavioral intention to use these systems, while the original UTAUT predicted 20% only. These authors found that only age has effects among physicians. Hennington and Janz (2007) applied the original UTAUT in order to explain to the healthcare industry why EMR technology has not been more widely accepted by physicians.

Kijsanayotin, Pannarunothai and Speedie (2009) applied a revised UTAUT to study factors influencing health information technology acceptance in Thailand's community health centers. They revealed that voluntariness has significant effects among responsible and administrative officers.

Schaper and Pervan (2007) proposed a model derived from UTAUT and examined IT acceptance and utilization by Australian occupational therapists. Results revealed that Effort Expectancy has an influence on occupational behavioral intention to accept and use IT. However, Performance Expectancy and Social Influence showed no effect on this intention.

Based on the UTAUT, Lubrin, Lawrence and Zmijewska (2005) explored factors influencing the acceptance of Wireless Sensor Networks, as a health monitoring technology, by elderly population. Results showed that Performance Expectancy and Effort Expectancy effects were significant for younger people rather than older ones. Moreover, they supported the stronger effects of Social Influence on younger women and those with minimal experience. Furthermore, Facilitating Conditions had non-significant effects on behavioral intention.

Because of its explanatory power and its robustness, the original UTAUT was retained as the theoretical basis for the research model (Figure 1). Its basic determinants were modified somewhat and an additional moderator called Participation in IT project was added to the four original moderators: Gender, Age, Experience and Voluntariness of Use. Precisely, in contrast to the findings of Venkatesh, Sykes and Zhang (2011) (only age had a significant moderating

effect), the authors hypothesize that all these moderators could have moderating effects separately or together in the Moroccan context.

Table 3 lists components and items used to estimate this research model. The four core constructs are theorized to determine the intention to use health IT that predicts the actual use. Performance Expectancy (PE) is defined as the degree to which an individual believes that using health IT will help him or her to attain gains in job performance. It was shown to be a strong predictor of intention to use IT (Kijsanayotin, Pannarunothai and Speedie, 2009). Effort Expectancy (EE) is defined as the degree of ease of use associated with health IT. Some previous studies showed that it has significant influence on intention to use IT, while others revealed the contrary (Kijsanayotin, Pannarunothai and Speedie, 2009). Social Influence (SI) is defined as the degree to which an individual perceives that important others believe he or she should use health IT. The effect of this construct on intention to use IT has been shown to be significant in several previous acceptance studies, but some research work has shown a non-significant influence, especially studies of professionals with high autonomy such as physicians (Kijsanayotin, Pannarunothai and Speedie, 2009). Facilitating Conditions (FC) is defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of health IT. Some studies found that it predicts the use of IT, but did not predict intention to use IT (Kijsanayotin, Pannarunothai and Speedie, 2009).

Table 3 Items in the questionnaire related to the research model constructs (N=252).

Variable	**Construct (LV) definition/ Item (MV) in questionnaire**
Performance Expectancy (PE) is the degree to which an individual believes that using IT will help him or her to attain gains in job performance.	
Attitude [a]	
Attitu_1	Using IT for management and patient care is a good idea
Attitu_2	Using IT for management and patient care is wise
Attitu_3	Using IT for management and patient care is pleasant
Job-fit [a]	
Comp_1	Using IT is compatible with the aspects of my work
Comp_2	Using IT is coherent with my preferred way of working
Comp_3	Using IT is coherent with my style of working
Perceived Usefulness [a]	
PU_1	Using IT would help me to accomplish my tasks quickly
PU_2	Using IT would increase my work efficacy
PU_3	Using IT would increase my productivity
PU_4	Using IT would make my work easier
PU_5	Using IT would be advantageous for the work
PU_6	Using IT would be useful for patient care
Effort Expectancy **(EE)** is the degree of ease associated with the use of IT.	
Self-Efficacy [a]	
Self_Eff_1	I can use IT in my work if I have used similar technologies
Self_Eff_2	I can use IT in my work if I can get user support
Self_Eff_3	I can use IT in my job if I have already seen how it is used
Self_Eff_4	I can use IT in my work if I have the user manuals
Anxiety [a]	
Anxi_1	Using IT annoys me in my work

Anxi_2	Using IT scares me
Complexity [a]	
Complex_1	Using IT in my work is difficult
Complex_2	Using IT exposes me to the loss of professional data
Perceived Ease Of Use [a]	
PEOU_1	Using IT could be easy for me
PEOU_2	My interaction with IT would be clear and understandable
PEOU_3	My interaction with IT requires more mental effort
PEOU_4	I would find IT easy to use

Social Influence **(SI)** is the degree to which an individual perceives that important others believe he or she should use IT.

Image [a]	
Ima_1	Using IT improves my image within the organization
Ima_2	Using IT improves my status
Ima_3	IT users have a high level of skill
Ima_4	IT is prestigious for its user
Management support [a]	
Man_Sup_1	Supervisors support and encourage me to use IT
Man_Sup_2	Supervisors provide me with resources to use IT
Man_Sup_3	Supervisors care about my satisfaction with IT
Man_Sup_4	Supervisors provide me with good access to IT
Influence of individual [a]	
So_Infl_1	Using IT depends on the users who influence my behaviour
So_Infl_2	Using IT depends on how the users are important to me
Importance to patient [b]	
Pat_Imp_IT	Using IT in my work is important to my patients

Facilitating Conditions **(FC)** the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the IT

Knowledge/Resource Compatibility/Assistance [a]	
Fa_Cdt_1	My knowledge allows me to use IT
Fa_Cdt_2	I have available resources to use IT
Fa_Cdt_3	IT must be compatible with those technologies that I use
Fa_Cdt_4	A person assists me when I face difficulties with IT
Behavioral intention **(BI)** [a]	
Inten_1	I intend to use IT if available
Inten_2	I intend to use IT to provide clinical services to patients
Inten_3	I intend to use IT to provide non-clinical services to patients
Inten_4	I intend to use IT frequently for work
Use Behavior **(UB)**	
Use [b]	Have you ever used IT in your practice
Use_freq [c]	How often do you use IT
Moderators	Have you participated in your organization's IT project
Participation in IT project [b]	
Gender [e]	
Age [f]	
Experience (Use_exp [d])	How long have you been using IT within your organization?

Voluntariness [b]	
Volont_1	I use IT voluntarily
Volont_2	Supervisors want me to use IT

LV : Latent variables

MV : Measurement variables

[a] Five-point scale: 1= Strongly disagree, 2= Disagree, 3= Agree somewhat, 4= Agree, 5= Strongly agree.
[b] 1= Yes, 2= No.
[c] 1= once a day, 2= 2-5 times a day, 3= More than 5 times a day.
[d] 1= Less than 6 months, 2= Less than 1 year, 3= For 2 years, 4= For 3 years, 5= For 5 years, 6= More than 5 years.
[e] 1= Man, 2= Woman.
[f] 1= Less than 25 years, 2= Between 25 and 40 years, 3= More than 40 years.

3 Method

3.1 Measures, pre-test and the final questionnaire

A questionnaire was developed from the research model and transcribed in French. Some validated items used in its predictors, i.e., Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions, and Behavioral Intention (BI) were adapted and measured using a Likert scale, ranging from 5 to 1 (5=Strongly agree, 4=Agree, 3=Agree somewhat, 2=Disagree, 1=Strongly disagree). It was reviewed and validated by two physicians, an inspector from the Health Ministry and two nurses.

In order to ensure that the items expressing the required information and wordings of the variables would be sufficiently understood by participants, whenever necessary the questionnaire was translated (Sperber, Devellis and Boehlecke, 1994; Muller, 1995) into Moroccan languages (Arabic) and dialect (Berber) because some nurses do not understand French. 150 questionnaires were distributed to medical specialists, general practitioners, nurses, midwives and students in their last year of medical studies. Of the 120 responses collected, only 80 included valuable corrections and comments. After correcting and adapting the questions to the Moroccan healthcare context, the final version of the questionnaire includes 63 questions. Apart from questions on personal innovation and interviewee identification, all the others are closed ones and it takes 15 minutes at the most to answer.

3.2 Participants and data collection

Data were collected from public healthcare organizations: ten healthcare centers and one regional hospital. In addition to essential curative health care, these centers promulgate prevention activities in maternal and child healthcare, medical advice, general medicine, pediatrics and gynecology. The total population concerned by this study was 145 and involved 37 physicians and 108 nurses. The regional hospital provides basic care and assures ophthalmology, dermatology and venereology, infectious diseases, ear, nose and throat care, psychiatry, pneumophtisiology, cardiology, gastroenterology, rehabilitation, endocrinology, rheuma-orthopedics, resuscitation and medical-surgery. The concerned population here was 469 individuals and involved 99 physicians, 332 nurses and 38 administrative staff.

Questionnaires were handed out to the director or head physician of each one of the ten centers, who dealt with their distribution to the concerned population. One week later, a first reminder was sent to get the feed-back from some respondents, and to provide explanations whenever necessary. All completed questionnaires were retained for analysis. Also, questionnaires were distributed to the fourteen directors of the hospital pavilions. They were

asked to hand them to the concerned population. Two weeks later, a reminder was sent to get feedback from respondents. Data collection began on the third week and lasted two weeks. This delay was due to many reasons such as people's workload and their unavailability for completion of the questionnaires; the resistance of some healthcare professionals to answering questions; and the low education level of some nurses making the French version of the questionnaire difficult to understand. Only 235 questionnaires were handed in. This limitation is mainly due to difficulties experienced accessing all the hospital pavilions, and to the shift work (two shifts, a day shift and a night shift). It consisted of 30 administrative staff, 50 physicians and 155 nurses representing almost 50% of the total concerned population.

4 Results

IBM SPSS Version 19.0 statistics package was used for the descriptive analysis, to calculate means, standard deviations (Table 4) and effect sizes. Partial Least Square path modeling (SmartPLS version 2.0.M3) software was used to examine the reliability and the measurement validity of theoretical constructs and to estimate the relationships between theses constructs. The method used by this robust software (Cassel, Hackl and Westlund 1999, 2000) analyzes and interprets data in two steps. The first one is the valuation of the measurement model by examining the reliability and validity of the composite of items measuring each construct, and the second one is the assessment of the structural model.

Table 4 Mean scores and standard deviations of each item in the questionnaire related to the research model constructs (N=252).

Variable	**Mean**	**SD**
Performance Expectancy (PE) is the degree to which an individual believes that using IT will help him or her to attain gains in job performance.		
Attitude [a]		
Attitu_1	4.54	0.800
Attitu_2	4.31	0.998
Attitu_3	3.96	1.217
Job-fit [a]		
Comp_1	4.02	1.115
Comp_2	3.76	1.130
Comp_3	3.58	1.236
Perceived Usefulness [a]		
PU_1	4.10	1.044
PU_2	4.19	0.903
PU_3	4.06	0.980
PU_4	4.05	1.003
PU_5	4.27	0.879
PU_6	3.88	1.109
Effort Expectancy **(EE)** is the degree of ease associated with the use of IT.		
Self-Efficacy [a]		
Self_Eff_1	3.48	1.429
Self_Eff_2	4.08	1.025
Self_Eff_3	3.72	1.301
Self_Eff_4	3.15	1.413

Anxiety [a]		
Anxi_1	2.43	0.969
Anxi_2	2.18	0.749
Complexity [a]		
Complex_1	3.01	1.167
Complex_2	2.60	0.876
Perceived Ease Of Use [a]		
PEOU_1	3.92	0.981
PEOU_2	3.75	1.012
PEOU_3	3.45	1.097
PEOU_4	3.89	0.971
Social Influence **(SI)** is the degree to which an individual perceives that important others believe he or she should use IT.		
Image [a]		
Ima_1	3.99	1.090
Ima_2	3.69	1.132
Ima_3	3.32	1.225
Ima_4	3.15	1.291
Management support		
Man_Sup_1	3.92	1.114
Man_Sup_2	3.34	1.238
Man_Sup_3	3.15	1.228
Man_Sup_4	3.18	1.251
Influence of individual [a]		
So_Infl_1	3.02	1.150
So_Infl_2	3.06	1.216
Importance to patient [b]		
Pat_Imp_IT	1.71	0.456
Facilitating Conditions **(FC)** the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the IT.		
Knowledge/Resource Compatibility/Assistance [a]		
Fa_Cdt_1	4.55	0.499
Fa_Cdt_2	4.43	0.496
Fa_Cdt_3	4.79	0.408
Fa_Cdt_4	4.70	0.460
Behavioral intention **(BI)** [a]		
Inten_1	4.32	0.811
Inten_2	3.90	1.125
Inten_3	3.79	1.124

Inten_4	4.13	0.896
***Use Behavior* (UB)**		
Use [b]	1.59	0.493
Use_freq [c]	2.77	1.123
Moderators		
Participation in IT project [b]	1.86	0.347
Gender [e]	1,49	0,501
Age [f]	2,41	0,615
Experience (Use_exp [d])	3,43	1,139
Voluntariness [b]		
Volont_1	1,35	0,476
Volont_2	1,15	0,355

[a] Five-point scale: 1= Strongly disagree, 2= Disagree, 3= Agree somewhat, 4= Agree, 5= Strongly agree.
[b] 1= Yes, 2= No.
[c] 1= 1 times a day, 2= 2-5 times a day, 3= More than 5 times a day.
[d] 1= Less than 6 months, 2= Less than 1 year, 3= Since 2 years, 4= Since 3 years, 5= Since 5 years, 6= More than 5 years.
[e] 1= Man, 2= Woman.
[f] = Less than 25 years, 2= Between 25 and 40 years, 3= More than 40 years.

4.1 Respondents' characteristics

For healthcare centers the response rate achieved was quite high (77%), with 111 replies. As shown in Table 5, the breakdown of these replies consisted of 30 physicians and 81 nurses. Most respondents were women, with almost 65% of the total respondents. More than half of respondents (54%) are under 40 years old. Also, of the 235 questionnaires distributed in the hospital, only 141 were completed representing a rate of 60%. 67% of the respondents were nurses, 15% were physicians and 18% were administrative staff. As opposed to the ten healthcare centers, most respondents were men with 68%. Also, 48% of those respondents are less than 40 years old.

Table 5 Summary of the respondents sample used for data analysis.

		Ten urban health public centers		**Regional hospital Hassan II**	
		Frequency	%	Frequency	%
Gender	Man	39	35	96	68
	Women	72	65	45	32
Age	Under 25 years	13	12	6	4
	Between 25 and 40	47	42	62	44
	Over 40 years	51	46	73	52
Healthcare professionals	Physicians	30	27	21	15
	Nurses	81	73	94	67
	Administrative staff	N/A	N/A	26	18
	Total	111	100	141	100

4.2 Measurement model estimation

Figure 2 shows the returned measurement model. The reliability of construct measurement was evaluated by examining the composite reliability and internal consistency reliability (Cronbach's alpha) as determined by PLS for each construct (Table 6). Apart from the facilitating conditions construct that showed 0.66, all the other constructs indicated composite reliability and Cronbach's alpha was greater than the acceptable level of 0.70 showing that the measurement errors were relatively small (Fornell and Larcker, 1981; Nunnally, 1978).

Convergent validity of a set of items with respect to their associated construct is measured by the factor loadings of the items on the model's constructs. A high loading of the item on its underlying construct and lower loadings on unrelated constructs indicates convergent validity. Barclay, Higgins, and Thompson (1995) recommended that an observed principle for convergent validity is to retain items with loadings of 0.70 or more. As presented in Table 7, factor loadings of all items on their respective associated constructs are superior than 0.70 while their loadings on unrelated constructs are inferior. The results proved very good convergent validity of the measurement model with respect to the model's constructs. Discriminant validity shows the level to which a specified construct is different from other constructs. In PLS path modeling analysis adequate discriminant validity is verified when a construct shares more variance with its measures than with other constructs in the model. A measure of variance shared between a construct and its measures is the Average Variance Extract (AVE) that should be greater than the variance shared between the construct and others constructs in the model (Falk and Miller, 1992).

Table 6 also shows the correlations between the constructs. The diagonal of the matrix contains the square roots of the AVEs which provide a metric comparable to a correlation (the square root of the variance shared between two variables). For satisfactory discriminant validity, the diagonal elements should be superior to the off diagonal elements in the corresponding rows and columns. Notice that in the case of Use Behavior the diagonal value is 1.0 indicating that there was only one measurement item associated with this construct. The results validated then acceptable discriminant validity for all constructs in the research model.

Table 6 Construct composite reliability (CR), internal consistency reliability (ICR), diagonal elements are the square root of the shared variance between the constructs and their measures (AVE); off-diagonal elements are correlations between construct s (N= 252).

	CR	**ICR**	**PE**	**EE**	**SI**	**FC**	**BI**	**UB**
PE	0,93	0,91	**0,83**					
EE	0,90	0,84	0,00	**0,87**				
SI	0,89	0,82	0,38	0,21	**0,86**			
FC	0,85	0,66	0,00	0,01	0,00	**0,86**		
BI	0,85	0,74	0,00	0,00	0,00	0,00	**0,81**	
UB	1,00	1,00	-0,01	-0,12	0,01	-0,29	-0,14	**1,00**

Construct identifiers: PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating Conditions, BI = Behavioral Intention, UB = Use Behavior.

Table 7 Loadings and cross-loadings of individual items (MVs) on their constructs (LVs) (N= 252).

	BI	EE	FC	PE	SI	UB
Fa_Cdt_1	0,24	-0,06	**0,82**	0,22	0,17	-0,21
Fa_Cdt_2	0,21	0,05	**0,90**	0,15	0,21	-0,28
Ima_2	0,23	0,10	0,18	0,30	**0,83**	0,01
Ima_3	0,22	0,16	0,22	0,31	**0,84**	-0,01
Ima_4	0,29	0,27	0,17	0,35	**0,91**	0,02
Inten_1	**0,82**	0,36	0,22	0,50	0,27	-0,07
Inten_3	**0,76**	0,23	0,19	0,32	0,22	-0,15
Inten_4	**0,85**	0,38	0,22	0,39	0,21	-0,14
PEOU_1	0,35	**0,88**	-0,06	0,36	0,07	-0,10
PEOU_2	0,41	**0,90**	0,07	0,38	0,26	-0,08
PEOU_4	0,31	**0,84**	-0,01	0,38	0,21	-0,15
PU_1	0,40	0,39	0,15	**0,77**	0,28	-0,02
PU_2	0,39	0,34	0,15	**0,89**	0,38	-0,01
PU_3	0,40	0,34	0,16	**0,87**	0,37	0,02
PU_4	0,44	0,41	0,18	**0,88**	0,30	0,03
PU_5	0,47	0,37	0,22	**0,82**	0,28	-0,08
PU_6	0,43	0,29	0,14	**0,75**	0,28	-0,01
Use	-0,14	-0,12	-0,29	-0,01	0,01	**1,00**

Construct identifiers: PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating Conditions, BI = Behavioral Intention, UB= Use Behavior.

4.3 Structural model assessment

The structural model (Figure 3) shows that all path coefficients were significant except the one between Behavioral Intention (BI) and Use Behavior (UB). These paths were in the suggested direction. Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) constructs predicted BI with an R^2 of 0.31, while Facilitating Conditions (FC) predicted UB with an R^2 of 0.09 only which is a little lower than the 0.10 recommended by Falk and Miller (1992). Despite this result, the authors consider that the structural model is satisfactory. Also, Chin and Newsted (1999) considered that effect sizes (f^2) of 0.02, 0.15 and 0.35 can be viewed as a measure for whether a predicting construct has a small, medium or large effect at the structural level. The analysis showed that with respect to Behavioral Intention, Performance Expectancy construct had the largest size (0.15) classified as medium outlining the strength of the relation between PE and BI, while effort expectancy had 0.06 classified as between small and medium, and social influence has 0.01 classified as small. For FC in respect to UB, effect size was 0.08 classified between small and medium. This points out that for predicting BI, the majority of the variance was accounted for by the combined effect of mainly two constructs PE and EE. Notice also that BI did not predict UB (β=1.1).

5 Discussion

This study examines the acceptance of health information technology by Moroccan healthcare professionals working in public organizations. Results show that Performance Expectancy is the most significant factor predicting the intention of Moroccan healthcare

professionals to accept IT (β=5.7). It means that these professionals give more importance to the utilitarian aspect of Information Technology, through the gains in work efficiency derived from its usage. They pointed out that using IT should be compatible with their values, work style and needs, and should enhance their job performance (productivity, patient care, and efficacy).

As for Effort Expectancy, it is the second most significant factor predicting IT acceptance in Moroccan healthcare context (β =3.8). It stresses the importance of ease of IT use. Moroccan healthcare professionals tend to accept IT when this technology is understandable and/or they are familiar with it. This is particularly true in the case of nurses because generally their lower educational background prevents them from using a new and/or complex technology.

Furthermore, the impact of Social Influence on Behavioral Intention of Moroccan healthcare professionals is smaller compared to PE and EE (β =2.0). Nurses are most concerned by this influence as they find that using IT could enhance their image within the organization.

Overall the results of the measurement model obtained reveal that measures of all constructs measuring values reliability and validity were psychometrically acceptable and retained for the structural. The latter indicated little less than a third (R^2 = 0.31) of the variance in intention to use this system and only almost one tenth (R^2 = 0.09) of the variance in use (actual system use).

Thus, given the fact that cultural factors that could impact the obtained results were not considered, the health information technology acceptance by Moroccan physicians, nurses and administrative staff was explained reasonably by the proposed research model that was adapted from UTAUT. It did not explain intention to use this health information technology well (R^2 values were between 0.31 and 0.34), even when moderators (Age, Gender, Experience, Voluntariness of use and Participation in IT project) were considered alone or combined. The highest value of the calculated R^2 was 0.34 while for example Performance Expectancy, Effort Expectancy and Social Influence constructs were moderated by Gender (GDR). For all the other cases the obtained values were 0.31, 0.32 or 0.33. Notice also that while Facilitating Conditions construct is moderated by Age (AGE), Experience (EXP) or Participation in IT project (PITP), alone or combined, the resulting R^2 for Use Behavior were respectively 0.09, 0.10, 0.17 and 0.18. Consequently, overall the moderators' effects were not significant except where facilitating conditions were moderated by PITP or by AGE and PITP combined, EXP and PITP combined, and by AGE, EXP and PITP all together.

Recently, Venkatesh, Sykes, and Zhang (2011) have applied the original UTAUT to healthcare context in order to predict physicians' intention to use electronic medical records. The findings revealed the significance of Age as moderating variable. Comparing to these results, the authors underline the moderate IT acceptance prediction in Moroccan healthcare context by the adapted UATUT model. However, this finding is satisfactory considering impacts of the items translation from English to French, Berber and Arabic languages, and other cultural factors that wouldn't considered in this study. Despite the introduction of Participation in IT project as a new moderator, variance showed a slight variation rising to 34% in Behavioral Intention. Since cultural factors were not captured, the authors considered these results satisfactory. Indeed, the proposed model predicted between 0.31 and 0.34 depending on the moderating factors, while in the study of Venkatesh, Sykes, and Zhang (2011) the original UTAUT predicted only 20% in developed countries' healthcare context and the adapted version predicted 44%.

6 Conclusion

In 2011, Venkatesh, Sykes, and Zhang recalled the relevance of UTAUT to prediction of information technology acceptance in the business context. They modified it in order to fit the context of electronic medical records in a developed country. The main purpose of this article

is to recommend the model predicting the acceptance of healthcare information systems by physicians, nurses and administrative staff working in Moroccan public healthcare organizations. Application of the adapted UTAUT model explained 31% of variance in Behavioral Intention and almost 10% in Use Behavior. This work contributes significantly to both, healthcare IT and UTAUT applied research to develop knowledge concerning developing countries such as Morocco. It can help health information technology producers and health information systems designers to produce acceptable systems in these countries.

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Figure 1 Research model: original UTAUT with an additional moderator.

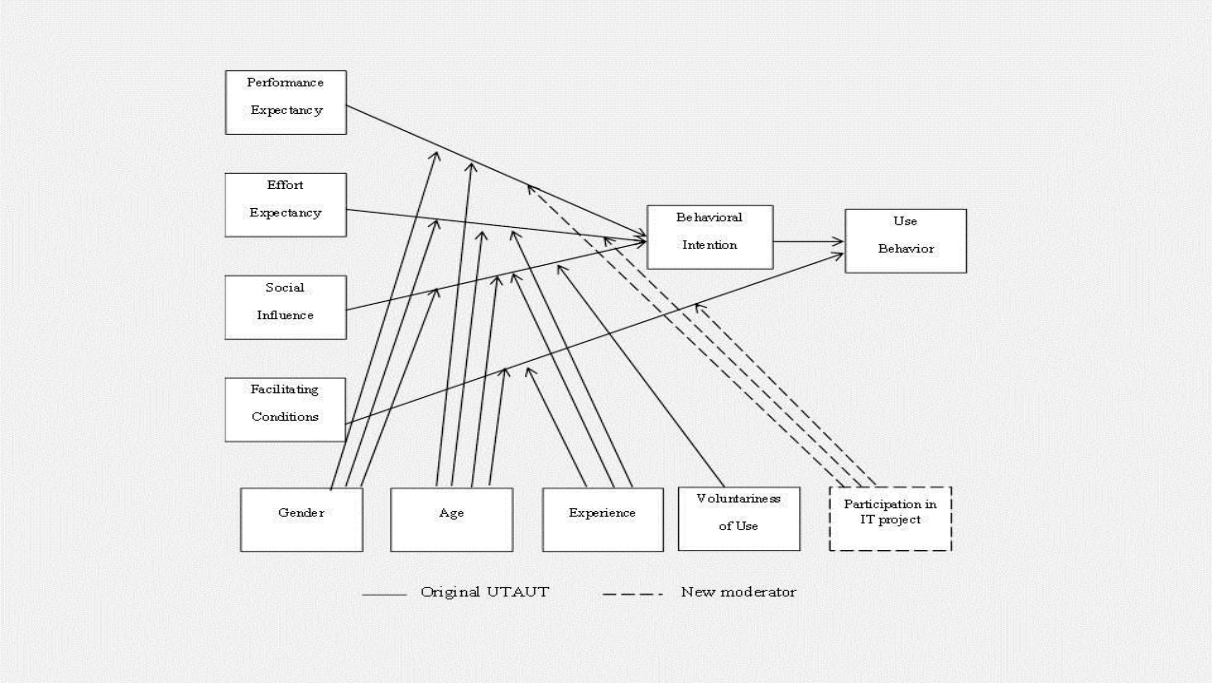

Figure 2 Measurement model.

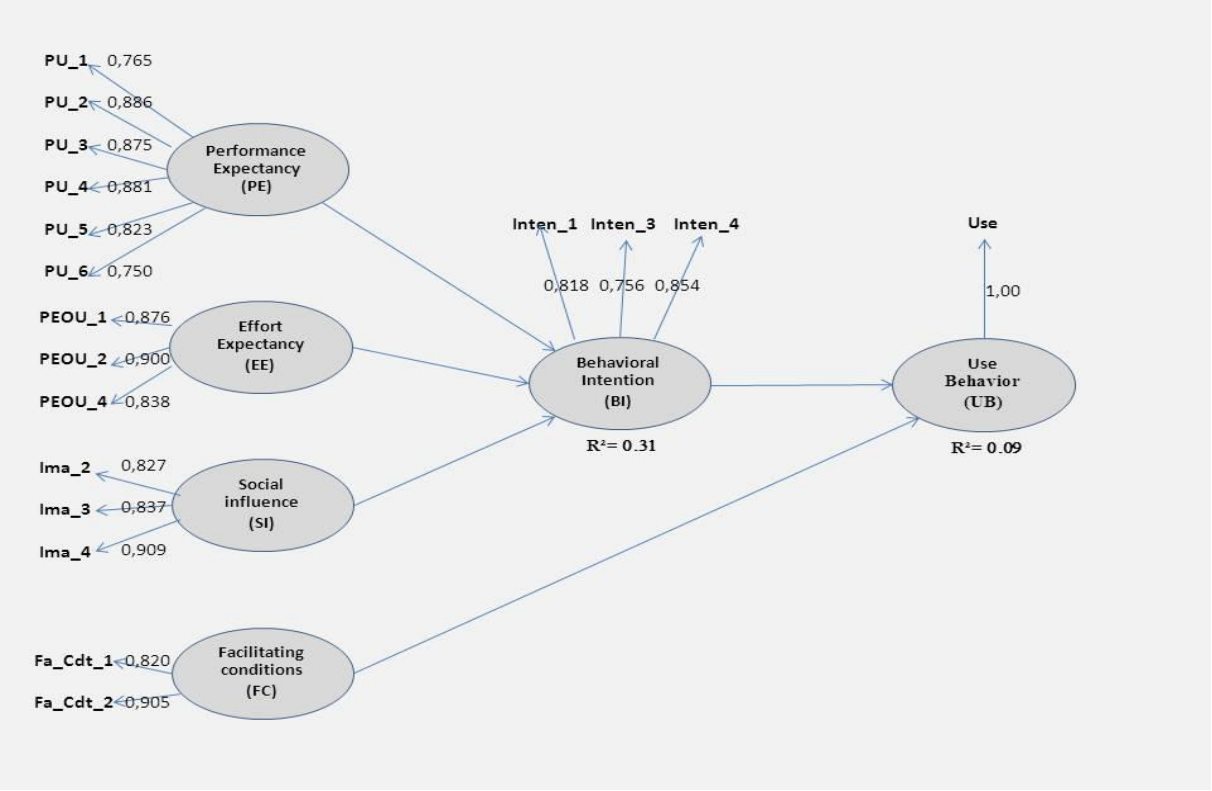

Figure 3 Structural models.