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An overview of patient acceptance of Health Information Technology in developing countries: a review and conceptual model

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Abstract:
The potential to improve the quality, efficiency, outcomes, patient safety and reduce cost of healthcare by Health Information Technology (HIT) has been established by researchers. But unfortunately HIT systems are not properly utilized or are not widely available. This problem is even more glaring in developing countries. This article presents a review of some available HIT systems in order to assess the level of their presence and the technology used in developing them. Works related to acceptance of HIT systems were also reviewed so as to study the gaps in this area and propose a solution in order to fill the gaps identified. The problems discovered from this review include lack of availability of these systems especially in developing countries, low rate of HIT systems acceptance and insufficient works on patient acceptance of HIT systems. Studying the factors that affect the acceptance of HIT systems by patients and considering the factors while developing the systems will play a significant role in getting over the aforementioned limitations. As Technology Acceptance Model (TAM) is one of the most popular models for studying users' perception and acceptance of Information System (IS)/Information Technology (IT), we proposed a conceptual model of HIT acceptance in developing countries based on TAM.

Keywords:
Health Information Technology; Technology Acceptance Model; User Acceptance; Electronic Health Record; Clinical Decision Support System.

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1. Introduction

The application of Information Technology (IT) in healthcare is a promising area that can be used to extend the delivery of healthcare to different people in different part of the world. This is very important as the world population is growing exponentially, and healthcare delivery is very poor in some countries. Unfortunately, in most of the countries, particularly in developing economies, people do not have access to healthcare facilities due to factors like shortage of healthcare professionals, inadequate hospitals or clinics, and high cost of medical consultation [1]. For instance, it is reported that the physician-patient ratio is 1:3500 in Nigeria, 1:45000 in Sierra Leone and 1:86000 in Liberia; this is really of great concern [2, 3]. Therefore, there is need for bringing other ways of improving the healthcare delivery in order to allow people especially in the rural area to have access to healthcare easily and timely. Meanwhile, healthcare delivery can be improved by using various Information Technology (IT) infrastructures; such application of IT in healthcare is termed as Health Information Technology (HIT).

HIT is a term that describes the management and exchange of health information between healthcare consumers and providers using both computers and mobile devices for decision making. HIT when implemented and used properly has the potential to improve healthcare quality, efficiency, effectiveness, reduce or prevent medical errors, reduce healthcare costs, provide up-to-date information to both providers and consumers, early detection of management of disease, and reduce storage cost. HIT can be implemented in the form of Electronic Health Record (EHR), Computerized Physician/Provider Order Entry (CPOE), Clinical Decision Support System (CDSS), or in some cases combination of two or more of the above.

EHR is a collection of health related information of patients such as demographics, medical and treatment history, laboratory result, etc., in an electronic form. The access to patients' record any time allows them to be monitored and know their status whenever required. Other terminologies related to EHR are EMR (Electronic Medical Record), EPR (Electronic Patient Record), PHR (Personal Health Record), which sometimes may be used interchangeably or as part of EHR. CPOE is a system that allows entry of medical instruction electronically to efficiently deliver care to patient. This has the benefit of reducing misinterpretation and transcription errors, reduce or eliminate order duplication, offer clinical decision support, and provide reminder service. Similarly, CDSS is a system that assists medical practitioners with decision making tasks like diagnosis, analysis of patient data, medication, prediction, reminder, etc. This improves the physician's performance and patient outcomes, increases efficiency, and reduces healthcare costs [4-6].

However, the acceptance of HIT systems specifically in developing countries is very low, so studying the perception of the intended users about the system before the development or implementation is a wise decision; as it is believed to positively affect the actualization of the real system [7-11]. There are theories that describe user behaviors and attitudes towards using a new technology, and these theories also show how this technology can be accepted and spread. The theories include Theory of Reasoned Action (TRA), Diffusion of Innovation (DOI), Unified Technology Acceptance and Use of Technology (UTAUT), Technology Acceptance Model (TAM), and the like.

This paper is structured into five sections. Section 1 introduced the concepts discussed in the article. The background of TAM is presented in section 2. Section 3 discusses previous literatures related to HIT systems and technology acceptance in healthcare. The proposed model with its theoretical background is presented in section 4. Finally, section 5 concludes the paper.

2. Background

Technology Acceptance Model (TAM) is among the popular theory for studying the perception and factors that contribute to the acceptance of a new technology. TAM is an extension of TRA which was developed in 1975 by Fishbein and Ajzen. TRA is a model for predicting human behavior [12]. TAM is considered as the most widely used theoretical framework for information system usage [13]. Chen et al. [14] described TAM as “one of the most influential research models in studies of the determinants of Information Systems and Information Technology

acceptance to predict intention to use and acceptance of Information Systems and Information Technology by individuals". TAM as developed by Davis in 1985 is designed for modeling user acceptance of Information Systems. The central idea behind it is to increase the use of IT by promoting its acceptance. The acceptance can only be promoted if the factors that influence it are known; this can be done by examining the perception of the users concerning the use of the technology [15, 16].

TAM focuses on factors that determine the users' behavioral intentions towards accepting a new technology. The model shows that certain factors influence the decision of users when they are presented with a new technology on how and why they will use it. The factors are: perceived usefulness and perceived ease of use. Perceived usefulness is defined by Davis [17] as "the degree to which a person believes that using a particular system would enhance his or her job performance"; while perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort". However, Davis hypothesized perceived usefulness and perceived ease of use as the major factors that determines user acceptance [17]. TAM also hypothesized that the intention to use the system is influenced by individual's attitude towards using the system. Attitude toward using is defined as "the degree of evaluative effect that an individual associates with using the target system in his or her job" [18]. Perceived usefulness is also hypothesized to affect behavioral intention directly as shown in figure 1; this is because users may intend to use a system just by thinking it may help them do their job better [17]. Also, as it is shown that perceived usefulness and perceived ease of use are affected by other external variables and determines users' attitude, perceived ease of use may have impact on perceived usefulness supported by a suggestion that "the easier it is to use the more useful it can be" [17, 19]. The attitude variable is usually omitted in some research because of the argument that it should not be a strong predictor of intention but rather has one of many factors that determine intention [20, 21].

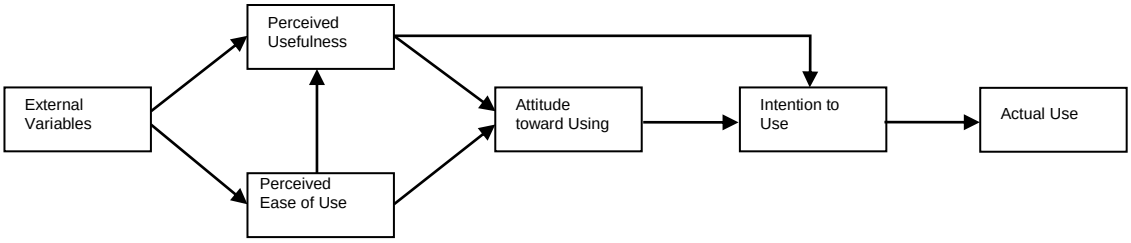

Fig. 1. TAM [15]

One of the earlier researches done on TAM includes *Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology* conducted by Davis [17]. The research developed and validated new scales for perceived usefulness and perceived ease of use, which were hypothesized to be fundamental determinants of user acceptance. Two studies involving 152 users and 4 application programs were conducted in which the definition of these variables were used to develop scale items that were pretested for content validity and then tested for reliability and construct validity. It was found based on both studies that usefulness had a significantly greater correlation with usage behavior than did ease of use. Additionally, regression analyses suggest that perceived ease of use may be causal antecedent to perceived usefulness, as opposed to a parallel and direct determinant of system use.

Since 1980's when it was developed, TAM has been further studied by its pioneer as well as other researchers for either testing its validity and reliability or extension and in some cases combined with other models. One significant improvement that is worth mentioning is development of TAM2 [19]. In TAM2 as depicted in figure 2, attitude variable that mediates some of the effects of perceived usefulness and perceived ease of use was removed. Despite the fact that a variable Subjective Norm was in TRA, but it was not included in TAM based on the explanation from Davis et al., that it is "one of the least understood variables" [15]. Following many criticism on TAM [22], antecedents of perceived usefulness was added including subjective norm.

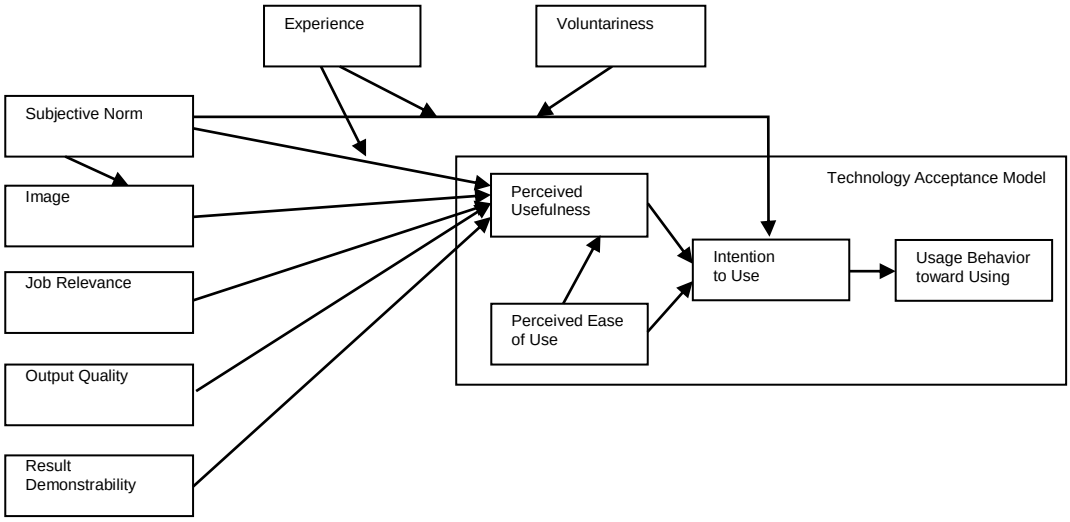

Fig. 2. TAM2 [19]

The perceived usefulness antecedents can be grouped into social influence variables and cognitive instrumental process variables [12],[23],[16, 19]. The variables are explained in table 1.

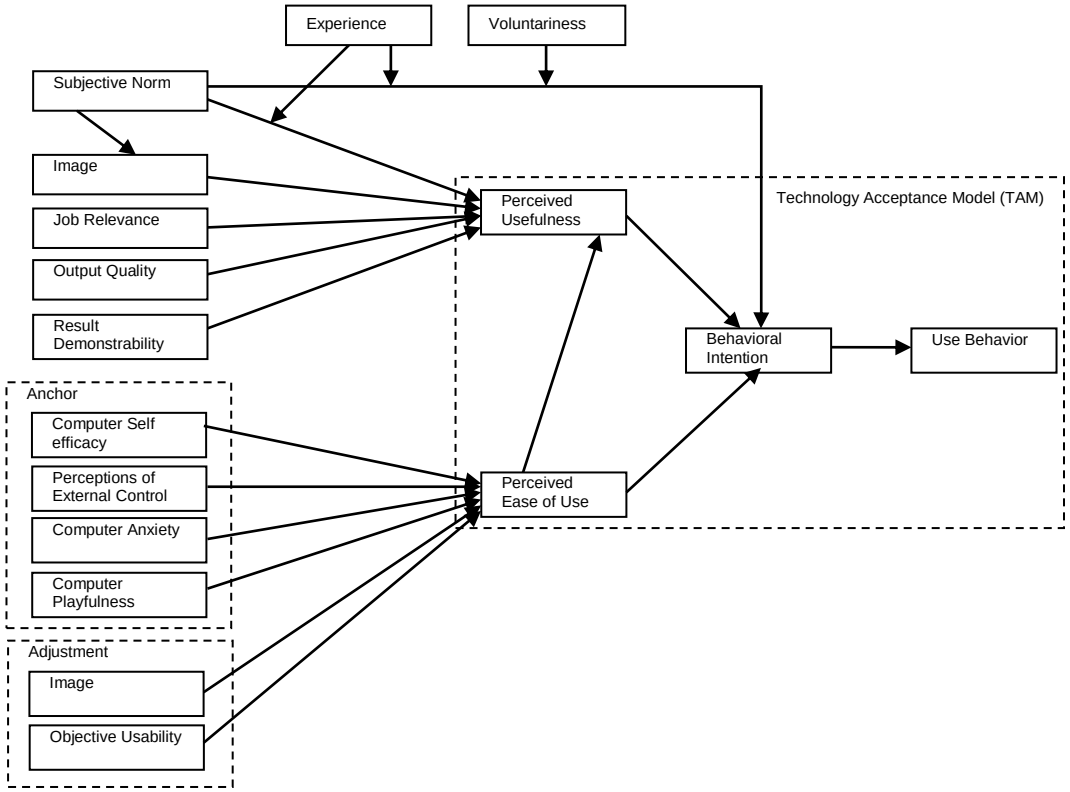

Fig. 3. TAM3 [24]

On the other hand, the leading researchers in TAM related studies developed TAM3 by considering interventions such as user participation, management support, training, etc., as a possible candidate that can influence the acceptance and use of IT through the determinants of perceived usefulness and perceived ease of use. The interventions are grouped into pre-implementation and post-implementation interventions. The pre-implementation intervention include design characteristics, user participation, management support and incentive alignment that lead to the realization of the system, while the post-implementation intervention include phases that come after putting the system into use these are: training; organizational support; and peer support [24].

Table 1. TAM constructs definition [25]

Constructs	**Definition**
Attitude	Individual's positive or negative feeling about performing the target behavior (e.g., using a system)
Behavioral intention	The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior
Computer anxiety	The degree of an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers
Computer playfulness	The degree of cognitive spontaneity in microcomputer interactions
Computer self-efficacy	The degree to which an individual beliefs that he or she has the ability to perform specific task/job using computer
Effort expectancy	The degree of ease associated with the use of the system
Facilitating conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system
Image	The degree to which use of an innovation is perceived to enhance one's status in one's social system
Job relevance	Individual's perception regarding the degree to which the target system is relevant to his or her job
Objective usability	A comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks
Output quality	The degree to which an individual believes that the system performs his or her job tasks well
Performance expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance
Perceived ease of use	See the definition of effort expectancy
Perceived enjoyment	The extent to which the activity of using a specific system is perceived to be enjoyable in it's own right, aside from any performance consequences resulting from system use
Perceived usefulness	See the definition of performance expectancy
Perception of external control	See the definition of facilitating conditions
Result demonstrability	Tangibility of the results of using the innovation
Social influence	The degree to which an individual perceives that important others believe he or she should use the new system
Subjective norm	Person's perception that most people who are important to him think he should or should not perform the behavior in question
Voluntariness	The extent to which potential adopters perceive the adoption decision to be non-mandatory

Other extensions of TAM include UTAUT which was an attempt to unify all the IT acceptance models by Venkatesh et al. [26]; an integration of technology readiness and technology acceptance model (TRAM) by Lin et al. [27]; a model that combine Task-Technology Fit (TTF) and TAM by Chang [28]; a model by Agarwal and Prasad [29] that combines DOI and TAM; etc. [14].

3. Literature review

3.1 Health Information Technology (HIT) for patient monitoring

Various HIT systems for patients monitoring are in existence, the monitoring can be within a clinical setting, or from outside usually from home (remote). Sensor network technology is used by most of these systems in order to collect physiological data of a patient suffering from different diseases like cardiovascular and other diseases. Generally, the common features of the above projects include using sensor technology, sending alert to caregiver or medical personnel. They also have distinctive features like CodeBlue has GPS integrated into the system for tracking the actual location of patients as well as doctors [30]. Other works with distinctive features include a system for managing home care activities in brain-injured children [31]; a system designed for people with cardiovascular disease [32]; a universal system for monitoring patients which do not specify disease [33-35].

Monitoring systems designed for managing patients suffering from a particular disease are many, some of which include those monitoring diabetic patients like a project presented on treatment of diabetic patients with foot ulcers. Larsen [36] designed his system in such a way that the patient and a nurse (home care nurse) will be at home while communicating with the expert at the hospital. This project was carried out at the Computer Science Department in University of Aarhus and Aarhus University Hospital. The Centre for Pervasive Healthcare is also associated with the project group. The patient will have a bandage wrap around the area affected with ulcer, the bandage has built-in sensors that continuously monitor biomedical data concerning the ulcer like: bacteria flora, skin temperature, moisture level, and blood pressure. Similarly, SiSPED 2.0 [37] is an extension of SiSPED ("a monitoring system for diabetic patients with the possibility of developing diabetic foot"), but in this case the monitoring is not remote, rather the system serves as a repository where patients' information is stored. Likewise, a two-tier pervasive healthcare architecture was presented [38]. The client (patient's PDA) and the server communicate via wireless network. Artificial Neural Network (ANN) model were implemented for diagnosing diabetes. The ANN model for diagnosing diabetes runs locally on the client's PDA.

There are also systems developed to monitor physiological data related to diabetes. These systems manage diabetic patients generally without considering any complication that might arise. For instance, Jog Falls [39], is a diabetes management system using sensor devices (for collecting physiological and activity data) that monitors patient's physical activities, food intake, sets some goals and monitor progress towards these goals. Related to this is a system called DI@L-Log, which is a project in collaboration between Ulster Hospital and researchers at the University of Ulster. Weight, blood sugar, and blood pressure are the elements that the patients will be measuring to monitor their status. The system allows the patients to use speech to input and record their measurement [40]. Similar works include a system of monitoring and management of Type 1 diabetic patient using mobile phone [41]; a diet management system that provides patient with information related to his/her diet record, exercise and medication [42]; and a web-based medical diagnosis and prediction model that uses neural network to predict patients' condition based on the previous similar cases [43].

3.2 Health Information Technology (HIT) Systems and Clinical Decision Support Systems

Making decision by healthcare professionals regarding their patients sometimes consumes extra time and resources than expected, hence the need for incorporating decision making component into HIT systems. This decision making capability help doctors and other medical experts to manage their patients with ease. This type of system is referred to as Clinical Decision Support Systems (CDSS). Some of the works related to CDSS include a CDSS which uses data mining techniques to build cooperative knowledge bases from domain experts' knowledge bases, clinical databases, and

most recent academic researchers. The data mining engine is connected to the EHR and clinical databases to continuously mine the very recent knowledge and adds it to local knowledge base, specialized knowledge bases from other institutions can also be consulted for relevant knowledge [44].

A model of a cost effective healthcare system for patients residing in remote areas of Pakistan was presented [45]. The complete architecture of the system consists of wearable medical sensor module, data gathering module, PDA, remote server with CDSS and EMR capability, and web enabled remote terminal for accessing services provided by web server. The remote server after processing the data then call CDSS for analysis of the data and finally the EMR will record the data against the patient's profile. After analyzing the data by the CDSS a feedback is sent to the doctor for approval, and then sent to the PDA after approval. The CDSS software analyses the patient's physiological data like ECG, blood pressure, temperature, etc. for possible sign of abnormality. The software can forecast the health status based on the received data and also can make decision based on the health situation. A combination of model-driven and knowledge driven decision support systems were used. The model-driven makes decision based on the statistical model of the patient's data, while the knowledge driven use facts, rules, procedures, etc. to make decision. For diagnosis, a cooperative system is employed in which the decision and action is first send to the consultant for confirmation before sending to the PDA. The EMR store the patient's data and serve as a source for data to CDSS.

Additionally, a DSS was presented that will help surgeons and hospital managers to schedule patients as well as allocate resources. Web service was used for integrating DSS with HIS; a third party integration agent called AIDA was used as a communication layer of the HIS. Enterprise oriented architecture was used to divide the software into four layers: data access; business logic; web service; and presentation layers. To synchronize DSS and HIS, an update service calls a web service in AIDA for a request to synchronize data warehouse with recent data in HIS. Then the update service requests the shared database to update the DSS database [46]. However, another work discuss about creating web-based DSS using Web services. The main components of their DSS are database, user interface, and DSS software system. Three layer design, Rich Internet Applications (RIA) and web services are the core elements that made up the web based DSS. The layers are data, business logic, and view [47].

3.3 Perception and Acceptance of HIT Systems

In spite of all the potential benefits of providing high quality care, reducing costs, and assuring patient safety, more than half of medical information systems are not in use. This is due to factors like extra time needed for entering patient record and reviewing the decisions provided by the system, interoperability, and user and staff resistance [8, 11]. Therefore, there are studies that identify factors that will facilitate the adoption and use of HIT system. One of such study described using cheaper and faster technology, offering incentive for CDSS deployment as some factors that can help to improve CDSS adoption [5]. Some of the works reviewed in this category are summarized in table 2.

A great deal of research has been conducted using TAM as a framework, and new models such as TAM2 and TAM3 were developed from it. TAM2 mainly focused on identifying determinants of perceived usefulness and moderating variables, since perceived usefulness is considered a strong determinant of intention [19]. TAM3, on the other, hand centered on interventions that can affect the acceptance and use of IT in an organization [24]. In addition, researchers apply TAM in healthcare settings with the objective of evaluating the behavior or intention of users regarding the use of new information system. These works include the application of TAM in examining physicians' decisions toward accepting telemedicine technology. In this work the data was analyzed from 421 respondents out of 1,728 distributed questionnaires sent to selected physicians from public tertiary hospitals in Hong Kong. They found perceived usefulness to be significant determinant of attitude and intention, while perceived ease of use was not [48]. A study was conducted with the aim of carrying out a comprehensive review of works on TAM related to health IT, in an effort to know the suitability of TAM as a theory for health IT acceptance and use, and also propose ways of improving its effectiveness by modifying it. Works reviewed include those that: quantitatively test relationships between TAM specified variables; use TAM as a theoretical framework; the end users of the health IT are healthcare professionals; and those that were published on or before July 2008; etc. This study shows that TAM predicts a substantial portion of the use or acceptance of health IT, but the theory can be modified for better prediction. The study proves TAM as a good theory that explains

healthcare providers' reaction to health IT. In addition, it shows a significant relationship between perceived usefulness and intention to use with actual use of health IT. Hence, promoting use and acceptance of health IT greatly depend on user perceiving it as useful [16].

In a study conducted to determine factors that affect the acceptance of integrated Personal Health Records (PHRs) for self-care management, a non-experimental descriptive cross-sectional survey was used to get response from 78 diabetic patients in Howard University Hospital. The result shows that users perceived the use of the PHR as easy, and they believed that PHR is useful for self-managing their care and diabetes. In addition, PHR adoption rate can be increased by promoting it by staff [49]. In another similar study, online diabetes self-management intervention participated by African American Type II diabetic patients of the Howard University Hospital (HUH) Diabetes Treatment Centre (DTC) was presented. Out of the 47 participants 26 were randomly assigned to treatment, while 21 were assigned to control conditions. The participants were surveyed at the beginning and end of the intervention. Home visit was organized as part of the practice for the intervention group, in which the participants will be trained by a nurse on accessing the web-enabled patient application. The patients will send their health data and accessed patient education materials through this application. The study showed a significant association between participation in the intervention and achieving glycaemic control; a significant positive relationship between the participation in the intervention and achieving a healthy BMI; and above all the treatment group testify that the intervention increased their diabetes knowledge and improve their adherence to better diabetes management practices [50].

UPMC HealthTrack is a PHR implemented in University of Pittsburgh Medical Centre (UPMC) for self-management of diabetes. The impact of the system was assessed by analyzing the patients' reaction to HealthTrack with five pre and five post implementation focus groups. The focus group participants felt that the system would enhance communication with the centre and they envisage the reminder system as beneficial. The participants also reported their bad feeling when test results were not released and messages were not answered [51]. An exploratory descriptive study using in-depth interviews and focus groups was conducted in an effort to learn how patients with inflammatory bowel disease value access to Internet-based patient records. University Health Network's tertiary centre in Toronto was the study area with 12 participating members. Four themes related to patient perceived usefulness were identified; these are sense of illness ownership, patient-driven communication, personalized support, and mutual trust between patients and their providers [52]. Another group of researchers conducted an online survey of 1,421 respondents of the Geisinger Health System, to valuate patients' values and perceptions regarding web-based access to their record. One-on-one interview with 10 clinicians and focus groups with 25 patients were also used to supplement the survey. The result of the study shows a positive patient's attitudes towards the use of Web messaging and online access to their EHR as dominant. Also patients described their medical information as complete and accurate when using the system. Some patients expressed their concern about the confidentiality and privacy of their information. On the other hand, clinicians prefer other types of communication like letters than electronic communication [53].

Three theoretical models of IT acceptance were studied to investigate the acceptance of e-health from patients that registered for e-health. An online questionnaire was used to test five hypothesized antecedents from subjects who registered for e-health in Midwestern United States. The five antecedents are: satisfaction with medical care; health-care knowledge; Internet dependence; information-seeking preference; and health-care need. The findings showed that all tested acceptance models predict patient's intention to use e-health very well [54]. Information and Communication Technology Acceptance Model (ICTAM) is a new model developed from TAM2 which is an extended version of TAM. The aim of the study is to predict and show consumer's health information and services usage behavior on the Internet. The independent variables that serve as antecedents of perceived usefulness were adopted from TAM2 into ICTAM with the exception of job relevance. The model is simply TAM with additional constructs as perceived playfulness from TAM2, compatibility, and Web site loyalty. The explanatory and predictive power of TAM and TAM2 were improved in ICTAM, with 52-66.1% of the variance in perceived usefulness and 47.6-74% in behavioral intention to use [55]. INTCare is a Pervasive Intelligent Decision Support System (PIDSS) developed to assist the Intensive Care Unit (ICU) professionals in making their decision. The system was evaluated by 14 users, who are nursing staff of the ICU of Centro Hospitalar do Porto. The instrument used was a questionnaire based on TAM3. This study revealed that the

users are comfortable with the system since the constructs Perceived Usefulness, Perceived Ease of Use, Behavioral Intention and Usage Behavior received higher positive response. But then they want the systems to perform faster [56].

TAM was used to observe people's readiness and attitude towards accepting self-service technology specifically self-diagnosis system, as a means to reduce cost and improve quality in healthcare setting. A total of 160 participants were chosen randomly from outside the capital of Norway. Among them 132 filled the paper version of the survey, and 28 completed the survey online. Trust was added to the model proposed as another factor that determines attitude and the variable usefulness is replaced by convenience. The result showed that expected usefulness is positively influenced by expected ease of use; there are also statistically significant and positive relationships between trust of service and expected usefulness and expected ease of use [57]. Another study from the perspective of end users was conducted to identify the health consumers' behavioral intention of using HIT. TAM was extended with additional variables from Health belief model, theory of planned behavior. The questionnaire was developed based on the proposed model with additional antecedent and mediating variables on top of the three theories. The participants were 728 members from three Internet health portals in Korea. Web based survey were used to collect the data using structured self-administered questionnaire. The study shows that perceived threat, perceived usefulness, and perceived ease of use significantly affect health consumers' attitude and behavioral intention. Also health status, health belief and concerns, subjective norm, HIT characteristics, and HIT self-efficacy had a strong indirect impact on attitude and behavioral intention through mediators of perceived threat, perceived usefulness, and perceived ease of use [58].

Gagnon studied the factors that could influence the healthcare professionals to use a telemonitoring system. A total of 234 questionnaires based on TAM were distributed among nurses and doctors of cardiology, pulmonary, and internal medicine department of Donostia University Hospital in Spain. The study used 93 responses out of the 234 administered questionnaires. The results of this study described TAM as a good predictive model of healthcare professionals' intention to use telemonitoring systems. The factor that greatly influences nurses' and physicians' intention to use this new technology is perception of facilitators [59]. Another work is presented to examine the factors that influence medical professional's behavioral patterns during the introduction of a new CDSS. The study uses 15 medical professionals as sample for the empirical study. The study found that social influence had no impact on the medical professionals' adoptions of the CDSS. TAM and UTAUT were used together with Decision-Making Trial and Evaluation Laboratory (DEMATEL) for finding the relationship between UTAUT variables. The variables are: performance expectancy, effort expectancy, social influence, attitude towards the use of CDSS, and behavior intention of using CDSS. DEMATEL analysis result showed that performance expectancy and effort expectancy have high impact on attitude; also the level of the impact is higher in attitude than behavior. The result also shows insignificant relationships on social influence to attitude and social influence to behavior towards the use of CDSS, and positive relationship between attitude and behavior towards the use of CDSS [60]. A cross-sectional study was carried out to measure beliefs and acceptance of HIT systems from 133 sample health professionals. Structured questionnaire was designed using modified TAM. Multiple linear regression analysis was used to evaluate the predictors of HIT usage intentions. The result revealed that perceived ease of use, relevance and subjective norms directly predicted usage intentions [61].

Another study was conducted to determine the physicians' attitude towards the use of CDSS, and find out if utilizing CDSS for long time has a positive effect on the intention to adopt them in the future. A TAM based questionnaire was administered to 8 volunteered pediatricians who used a CDSS (e-GuidesMed) for a period of 3 months. The findings show that the attitude towards using the CDSS is good, the participants perceive possible difficulty to integrate e-GuidesMed into their daily routine, and also the facilitators variable shows highest correlation with the intention to use the CDSS [62]. Dentist professionals were examined to explore their willingness and acceptance of CDSS; questionnaires were distributed for the cross-sectional study in the dental department of Riyadh Military Hospital. The response rate was 30% from the 100 distributed questionnaires. The hypothesis that was tested is to find if there is correlation between the factors in the UTAUT model and the intention to use the system and further the user behavior. The result of the study shows that performance expectancy had no significant correlation with behavior intention in contrast to other studies that report strong effect of performance expectancy on behavior intention. Also social influence shows no significant correlation while effort expectancy shows significant positive correlation [63].

There are studies that evaluate the people's readiness to accept e-Healthcare. These include a work by Oio et al. [64] that identifies need-change readiness, engagement readiness, structural readiness, and acceptance and use readiness as factors that affect e-Healthcare readiness in developing countries. Need Change Readiness is described as "a combination of real need, usually based on conditions caused by isolation and a felt of expressed dissatisfaction with current situations, so strong that members of the community in question were willing to aggressively adopt new practices to create desire change". Engagement Readiness is defined as "a process in which community members are actively engaged in the idea of e-Healthcare, weighing its perceived advantages and disadvantages, to provide insight into the factors that potentially encourage or impede further readiness for e-Healthcare adoption". Structural Readiness is "the extent to which there exists efficient structures to support successful implementation of e-Healthcare". Acceptance and Use Readiness is "the intention to accept and use e-Healthcare technology". The model consists of four constructs as defined above; which was pilot tested in Uthungulu Health District of Kwazulu/Natal province of South Africa with healthcare practitioners, the public managers and patients. The questionnaire used was based on the four constructs with 94 items. The questionnaire was later complemented with interviews. The valid responses obtained were 323 from the 500 administered questionnaires. The findings identified acceptance and use readiness as the most important attribute followed by structural, engagement and finally need-change. The healthcare practitioners show their agreement to the readiness of e-healthcare while the public and patient fairly agreed.

Another similar study investigates if physician's perceived professional autonomy, involvement in the decision to implement CDSS and the belief that CDSS will improve job performance increase the intention to adopt CDSS. A survey was conducted in seven public and five private hospitals in Kuala Lumpur, Malaysia from different specialties. A total of 450 physicians were randomly selected and given questionnaire out of which 335 were returned and 309 were used. The hypotheses were tested using SEM and the result shows that Physicians' perceived threat to professional autonomy lowers the intention to use CDSS; Physicians involvement in the planning, design and implementation increases their intention to use CDSS; Physicians belief that the new CDSS will improve his/her job performance increases their intention to use CDSS [9]. In addition, a study was conducted using Unified Technology Acceptance and Use of Technology (UTAUT) theory to examine the factors influencing HIT services. A structured questionnaire was used to collect data from 400 employees (physicians, nurse, hospital staff members) in Thailand. The model was tested using SEM and the result shows that performance expectancy, effort expectancy, and facilitating conditions are the factors that have significant effect. Also they were found to have significant impact on behavioral intention. They suggested based on their findings that healthcare staffs' behavioral intention and facilitating conditions need to be improved by healthcare organizational management in order to increase the adoption and use of HIT by the staff [65].

In another study lack of telemedicine policy, knowledge and skills, and resistance to change by members of staff in the hospital were identified as factors that affect the adoption, implementation, and sustainability of telemedicine in Uganda. Two hospitals were selected (1 private, 1 public) out of the three well known hospitals in Uganda that use telemedicine. In each hospital 75 stakeholders (Information Systems managers, ICT technicians, administrators and doctors) were selected using purposive sampling for the study. In addition 5 participants (1 nurse, 1 doctor, 1 IT technician, 1 administrator and 1 patient) were interviewed from each hospital. The questionnaires distributed were 160, out of which 146 were analyzed. Apart from the factors identified, the respondents suggest some solutions to the challenges like training, computer hardware and software, security for client data and improved confidentiality, telemedicine policy and laws, sensitization of clients, sensitization for staff to embrace changes in technology, reduced cost of telecommunication services, need public-private partnership, government support and government hospitals should provide telemedicine for free [66].

Physicians are said to work and make decision independently, without sharing their knowledge with medical assistants and other clerical assistants. This may be as a result of them perceiving sharing their knowledge as a threat to their profession. In this regards, Esmaeilzadeh et al. [67] proposed an extended TAM (perceived usefulness and perceived ease of use) with three additional constructs: attitude toward knowledge sharing, perceived threat to professional autonomy, and involvement in decision making. This model will explain how healthcare professionals' intention will be influenced by attitude toward knowledge sharing. Perceived Threat to Professional Autonomy is defined as "the degree

to which a person believes that using a particular system would decrease his or her control over the conditions, processes, procedures, or content of his or her work" [9, 68].

Table 2. Summary of HIT acceptance literature

Authors, Year	Country	Technology/ Platform	Subjects	Sample/ used	Variables	Key Findings
Buenestado et al. [62], 2013	Spain	CDSS	Physicians	8	TAM Variables	The physicians attitude towards CCGP-based CDSS is good, PU, ATT, OEU, COM, FAC are highly correlated with IU, and SN and HAB are not correlated
Phichitchaisopa et al. [65], 2013	Thailand	HIT users	Physicians, nurses, healthcare staff working in hospital	800/437, 400 usable	UTAUT variables	Performance expectancy had the strongest effect on behavioral intention of all the main determinants
Portela et al. [56], 2013	Portugal	PIDSS	ICU Nurses	13/14	TAM3 (PEOU, PU, BI, UB)	Positive responses for PEOU, PU, BI, UB constructs. The speed of the system need to be improved
Gagnon et al.[59], 2012	Spain	Telemedicine	Healthcare professionals	234/ 93	TAM with compatibility, habits, facilitators, SN	Perception of facilitators greatly influences nurses' and physicians' intention to use this new technology
Ketikidis et al. [61], 2012	Macedonia	Intended HIT users	Health professionals	200/169, 133 usable	TAM 2 variables	Only PEOU not PU significantly predicted HIT usage intention, TAM 2 more suitable for healthcare than TAM
Sambasivan et al. [9], 2012	Malaysia	CDSS	Physicians	450/335, 309 usable	UTAUT variables except FC & SN	Perceived threat lowers the intention to use, involvement increases intention to use, and the belief also increases the intention to use
Kim et al. [58], 2012	South Korea	Online Health Portal users	Users of particular online health portals	728	Variables from HBM, TAM, and TPB	Perceived threat, usefulness, and ease of use significantly affected health consumers attitude and behavioral intention
Morton [49], 2011	USA	PHR	Diabetic patients	78 (48 users, 30 non-users)	PU, PEOU, BI	Both users and non-users intend to use the PHR, perceive the PHR is/could become easy to use, and believe the PHR is useful for self-managing their care and diabetes
Alghaith et al. [63], 2010	Saudi Arabia	CDSS	Dentists	100/30	UTAUT variables	Effort expectancy is the only factor that had a significant correlation with the behavior intention
Winkelman et al. [52], 2005	Canada	Online EMR (iChart)	Patients with inflammatory bowel disease	In-depth interview & focus group	–	Useful IT promotes and supports illness The ability of a patient to act on his/her own behalf to directly influence his/her illness Trajectory

Table 2. Summary of HIT acceptance literature (cont.)

Authors, Year	Country	Technology/ Platform	Subjects	Sample/ used	Variables	Key Findings
Hassol et al. [53], 2004	USA	EHR	Patients and clinicians	4282/ 1421. Interview 10 clinicians, focus group with 25 patients	ease of use, and information completeness, accuracy, and usability	Positive patient's attitudes towards the use of Web messaging and online access to their EHR. Also patients described their medical information as complete and accurate when using the system
Hu et al. [48], 1999	Hong Kong	Telemedicine	Physicians	1728/ 421	TAM variables	PU as significant determinant of attitude and intention while PEOU not
Tsai [69], 2014	Taiwan	Telehealth	Telehealth users	365/370	PEOU, PU, SSE, SP, IT, and ST	SSE significantly affect PEOU; SP, IT, and ST significantly positive effect on PEOU and PU
Isabalija et al. [66], 2011	Uganda	Telemedicine	Users (patients and non-patients)	146/160	-	Telemedicine policy, knowledge and skills, and resistance to change by staff affect telemedicine
Oio et al. [64], 2008	South Africa	e-healthcare	Practitioners, managers, and patients	323/500	Need-change, engagement, structural, and acceptance and use readiness	Acceptance and use readiness as the most important attribute followed by structural, engagement and finally need-change. Healthcare practitioners show their agreement to the readiness while public and patient fairly agreed

There are few works that extend TAM by integrating it with other behavioral theories like Social Capital Theory (SCT), among them is a study which present a model that integrate Social Capital Theory and Social Cognitive Theory with TAM [69]. The model is for analyzing relationships among social capital factors (social trust, institutional trust and social participation), technological factors (TAM, PEOU and PU), and social cognitive factor (system self-efficacy) in telehealth. The model was validated using 365 responses out of 370 recruited subjects from rural community in Nantou County, Central Taiwan. The respondents used telehealth for at least one month from Chu Shang Show Chwan Hospital in Jhushang township. The findings show that elderly residents generally reported positive perception toward the telehealth system. It was also revealed that the social capital factors show significantly positive effect on the technological factors which influenced usage intention. Likewise, the system self-efficacy was confirmed as the salient antecedents of perceived ease of use. Suggestions on how to improve social capital factors like social trust, institutional trust were also given. The model's excellent fit indicates its appropriateness for evaluating and predicting the behavioral intention toward adopting telehealth.

4. Proposed Model of HIT Acceptance

The high number of citations for Davis' (TAM) work is an indication that numerous researches were conducted on the subject. According to Google scholar [70] TAM early work by the founder Davis [71] is cited by 2498 articles, and another highly cited TAM related article also by Davis is cited by 20462 articles. Out of these works some focused on examining and validating the constructs and variables while others focused on extending the model by introducing new variables or constructs [72]. Therefore, the model proposed in this study is an extension of TAM, with additional constructs perceived output quality adopted from TAM2, perceived cost-effectiveness, and trust as depicted in Fig 4. The purpose of this study is to examine the factors that influence acceptance of one HIT system by diabetic patients in developing countries. Based on our review and preliminary study [73] quality improvement, cost reduction, and trust were identified as three important factors that can affect the acceptance of HIT. Even though TAM has variables that

can determine the users' acceptance of IT, but the variables are not adequate to better explain users' behavior towards accepting HIT for improving quality and reducing cost of diabetes care. Hence additional variables were added as suggested by Moon [74] that additional factors should be added to the TAM depending on the context of the study.

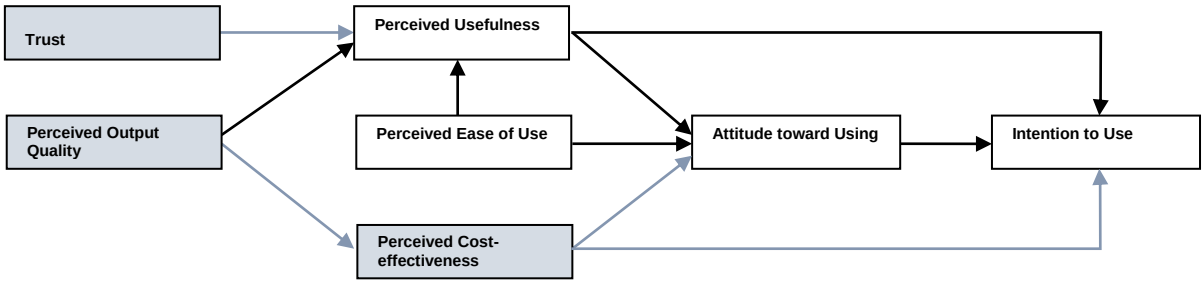

Fig. 4. Proposed model

Davis et al. proposed output quality as the perceptions of people on how well the system performs its tasks [16, 19, 75]. In our context perceived output quality can be referred to as the perception of people on how well the system provides healthcare services to patients. In Davis et al. [75], the relationship between perceived output quality and perceived usefulness was shown. This relationship with additional relationship between perceived output quality and perceived cost effectiveness will be examined in our proposed model [58, 76]. Literatures related to cost analysis, and factors that determine the cost of healthcare were reviewed in order to define how cost-effectiveness will be measured. In our study we identify medication, transportation, loss of time, loss of productivity as the factors that determine the cost of healthcare [77-80]. This is also assumed to directly influence perceived usefulness and perceived cost-effectiveness. Perceived cost-effectiveness was added to measure the perception of the users regarding the cost-effectiveness of the system [81]. Therefore, perceived cost-effectiveness can be defined as the perception of an individual on using a system and achieving the required result at a lower cost compared to its alternative [82]. This is hypothesized to directly affect intention and attitude toward using the proposed system. Trust has been used by many researchers especially in the area of e-commerce; it can be defined as "the extent to which one is willing to ascribe good intentions to, and have confidence in, the words and actions of other people (or systems)" [83]. Health information needs to be controlled and protected carefully because of its sensitivity. This information is confidential in most cases and has to do with the life of those involved. For any system that handles such information to be welcomed by users it has to be trustworthy. Trust was incorporated into the proposed framework as antecedents of perceived usefulness, in contrast to other studies that hypothesized it to directly influence behavioral intention [83-85].

Therefore we combine TAM variables, perceived output quality fromTAM2 and two additional constructs, *perceived cost-effectiveness* and *trust*, to form the new model. The new relationships postulated are *trust influences perceived usefulness, perceived output quality influences perceived cost-effectiveness, perceived cost-effectiveness influences attitude toward using*, and *perceived cost-effectiveness influences intention to use the system*.

Trust to perceived usefulness: we envisage that when the system is perceived as trustworthy and the patients have confidence in the system then they will consider it as useful.

Perceived output quality to perceived cost-effectiveness: when the quality of the system is high, it is expected that the cost will reduce, in other words the system will be cost-effective. For instance, when the hospitalization rate is reduced, the cost related to the care will also be reduced.

Perceived cost-effectiveness to attitude toward using: if the users believe that the system reduces cost of their care, their attitude toward using it will be positive.

Perceived cost-effectiveness to intention to use: the intention of the patients to use the system will be high if they realize that using it will reduce the cost related to their care.

5. Conclusion

Although healthcare delivery can be improved using HIT, a small number of HIT systems are implemented and used in developing countries. Moreover, there is lack of studies on the patients' perception and acceptance of HIT systems, most especially in developing countries as found in this article. When the factors that lead to low adoption of HIT are known, they can be tackled before implementation which will enhance the rate of user adoption. Therefore, we proposed an extended TAM for assessing factors that contribute to HIT acceptance by patients in developing countries. We chose to extend TAM since it is considered the most influential IT adoption model by many IT/IS researchers, and it can be applied to different context. The additional variables in the proposed model were added in order to better explain the perception and acceptance of HIT systems by patients. This is a contribution to the existing theories of IT adoption, since the study describes patients' perception toward acceptance of HIT system.

In the future, this model should be validated in a real clinical setting. The validation process may start with conducting an exploratory study and later develop an instrument that will be used to collect data from patients in developing countries. Once the model is validated it can be evaluated and compare with existing technology acceptance models. The model can be enhanced further by identifying and incorporating other relevant variables.

References

[1] P. Boucher, "Electronic Medical Record systems in developing countries," World Health Organization, ed., 2007.

[2] C. del Rio, A. K. Mehta, G. M. Lyon, and J. Guarner, "Ebola Hemorrhagic Fever in 2014: the tale of an evolving epidemic," *Annals of internal medicine,* vol. 161, no. 10, pp. 746-748, 2014.

[3] T. N. Elumelu, A. A. Adenipekun, L. O. Eriba, and B. I. Akinlade, "Knowledge of cancer pain management among nurses in a Nigerian tertiary health institution," *Journal of Nursing Education and Practice,* vol. 4, no. 4, pp. 74, 2014.

[4] A. X. Garg, N. J. Adhikari, H. McDonald, and et al., "Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: A systematic review," *JAMA,* vol. 293, no. 10, pp. 1223-1238, 2005.

[5] E. S. Berner, "Clinical decision support systems: state of the art," *AHRQ Publication,* no. 09-0069, 2009.

[6] F. Sullivan, "Clinical Support Decision Systems: The Time has come.," n.d.

[7] N. Hikmet, "State of Content: Healthcare Executive's Role in Information Technology Adoption," *Journal of Service Science and Management,* vol. 05, no. 02, pp. 124-131, 2012.

[8] E. Kilsdonk, L. Peute, S. Knijnenburg, and M. Jaspers, "Factors Known to Influence Acceptance of Clinical Decision Support Systems," *Studies in health technology and informatics,* vol. 169, pp. 150-154, 2010.

[9] M. Sambasivan, P. Esmaeilzadeh, N. Kumar, and H. Nezakati, "Intention to adopt clinical decision support systems in a developing country: effect of Physician's perceived professional autonomy, involvement and belief: a cross-sectional study," *BMC medical informatics and decision making,* vol. 12, no. 1, pp. 142, 2012.

[10] S. Standing, and C. Standing, "Mobile technology and healthcare: the adoption issues and systemic problems," *International journal of electronic healthcare,* vol. 4, no. 3, pp. 221-235, 2008.

[11] K. Zheng, "Clinical Decision Support Systems," *Management, Types and Standards,* vol. 36, pp. 501-509, 2012.

[12] M. Fishbein, and I. Ajzen, *Belief, attitude, intention, and behavior: an introduction to theory and research*: Addison-Wesley Pub. Co., 1975.

[13] M. Koufaris, "Applying the technology acceptance model and flow theory to online consumer behavior," *Information systems research,* vol. 13, no. 2, pp. 205-223, 2002.

[14] S.-C. Chen, S.-H. Li, and C.-Y. Li, "Recent related research in technology acceptance model: A literature review," *Australian Journal of Business and Management Research,* vol. 1, no. 9, pp. 124-127, 2011.

[15] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: a comparison of two theoretical models," *Management science,* vol. 35, no. 8, pp. 982-1003, 1989.

[16] R. J. Holden, and B. T. Karsh, "The technology acceptance model: its past and its future in health care," *J Biomed Inform,* vol. 43, no. 1, pp. 159-72, Feb, 2010.

[17] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS quarterly,* pp. 319-340, 1989.

[18] F. D. Davis, "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts," *International journal of man-machine studies,* vol. 38, no. 3, pp. 475-487, 1993.

[19] V. Venkatesh, and F. D. Davis, "A theoretical extension of the technology acceptance model: four longitudinal field studies," *Management science,* vol. 46, no. 2, pp. 186-204, 2000.

[20] T. Irani, "Prior Experience, Perceived Usefulness and the Web: Factors Influencing Agricultural Audiences' Adoption of Internet Communication Tools," *Journal of Applied Communications,* vol. 84, no. 2, pp. 49-63, 2000.

[21] M.-L. Jung, "From Health to E-health: Understanding Citizens' Acceptance of Online Health care," PhD. dissertation, Business Administration and Social Sciences, Lulea University of Technology, Lulea, Sweden, 2008.

[22] L.-d. Chen, M. L. Gillenson, and D. L. Sherrell, "Enticing online consumers: an extended technology acceptance perspective," *Information & management,* vol. 39, no. 8, pp. 705-719, 2002.

[23] G. C. Moore, and I. Benbasat, "Development of an instrument to measure the perceptions of adopting an information technology innovation," *Information systems research,* vol. 2, no. 3, pp. 192-222, 1991.

[24] V. Venkatesh, and H. Bala, "Technology acceptance model 3 and a research agenda on interventions," *Decision sciences,* vol. 39, no. 2, pp. 273-315, 2008.

[25] V. Venkatesh. (2013, November 22). *Construct Definitions* [Online]. Available: http://www.vvenkatesh.com/it/organizations/Theoretical_Models.asp#Con=structdefs.

[26] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS quarterly,* pp. 425-478, 2003.

[27] C. H. Lin, H. Y. Shih, and P. J. Sher, "Integrating technology readiness into technology acceptance: The TRAM model," *Psychology & Marketing,* vol. 24, no. 7, pp. 641-657, 2007.

[28] H. H. Chang, "Intelligent agent's technology characteristics applied to online auctions' task: A combined model of TTF and TAM," *Technovation,* vol. 28, no. 9, pp. 564-577, 2008.

[29] R. Agarwal, and J. Prasad, "The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies," *Decision sciences,* vol. 28, no. 3, pp. 557-582, 1997.

[30] M. Welsh. (2012, June 29) *CodeBlue: A Wireless Sensor Network for Medical Care and Disaster Response* [Online]. Available: http://www.eecs.harvard.edu/mdw/proj/codeblue

[31] A. Tura, M. Badanai, D. Longo, and L. Quareni, "A medical wearable device with wireless bluetooth-based data transmission," *Measurement Science Review,* vol. 3, no. 2, pp. 1-4, 2003.

[32] P. Kulkarni, and Y. Ozturk, "mPHASiS: Mobile patient healthcare and sensor information system," *Journal of Network and Computer Applications*, vol. 34, no. 1, pp. 402-417, 2011.

[33] D. Konstantas, V. Jones, and R. Herzog, "Mobihealth-innovative 2.5/3G mobile services and applications for health care," 2002.

[34] K. Van Laerhoven, B. P. Lo, J. W. Ng, S. Thiemjarus, R. King, S. Kwan, H.-W. Gellersen, M. Sloman, O. Wells, and P. Needham, "Medical healthcare monitoring with wearable and implantable sensors," In *Proc. of the 3rd International Workshop on Ubiquitous Computing for Pervasive Healthcare Applications*, Nottingham, England, 2004.

[35] W. Wu, J. Cao, Y. Zheng, and Y.-P. Zheng, "WAITER: A Wearable Personal Healthcare and Emergency Aid System," in *Sixth Annual IEEE International Conference on Pervasive Computing and Communications*, Hong Kong, 2008, pp. 680-685.

[36] S. B. Larsen, "Pervasive Home Care-Technological support for treatment of diabetic foot ulcers at home," PhD. Dissertation, Computer Science, University of Aarhus, Aarhus C, Denmark, 2006.

[37] K. Santos, L. Feistauer, M. Carvalho, L. Silva, and K. Rezende, "SiSPED 2.0: an extension of a system to monitor diabetic patients," in *Proceedings of the 6th Euro American Conference on Telematics and Information Systems*, pp. 11-18.

[38] O. Karan, C. Bayraktar, H. Gümüşkaya, and B. Karlık, "Diagnosing diabetes using neural networks on small mobile devices," *Expert Systems with Applications,* vol. 39, no. 1, pp. 54-60, 2012.

[39] L. Nachman, A. Baxi, S. Bhattacharya, V. Darera, P. Deshpande, N. Kodalapura, V. Mageshkumar, S. Rath, J. Shahabdeen, and R. Acharya, "Jog falls: a pervasive healthcare platform for diabetes management," *Pervasive Computing*, pp. 94-111: Springer, 2010.

[40] R. Harper, P. Nicholl, M. McTear, J. Wallace, L.-A. Black, and P. Kearney, "Automated Phone Capture of Diabetes Patients Readings with Consultant Monitoring via the Web," in *15th Annual IEEE International Conference and Workshop on the Engineering of Computer Based Systems*, 2008, pp. 219-226.

[41] M. Skevofilakas, S. G. Mougiakakou, K. Zarkogianni, E. Aslanoglou, S. A. Pavlopoulos, A. Vazeou, *et al.*, "A communication and information technology infrastructure for real time monitoring and management of type 1 diabetes patients," in *Engineering in Medicine and Biology Society, 2007. EMBS 2007. 29th Annual International Conference of the IEEE*, 2007, pp. 3685-3688.

[42] D.-W. Lai and Y.-P. Li, "Examining the Technology Acceptance Model of the Computer Assistance Orthopedic surgery system," in *Service Systems and Service Management (ICSSSM), 2010 7th International Conference on*, 2010, pp. 1-6.

[43] U. M. Ashwinkumar and K. R. Anandakumar, "A Web-Based Patient Support System Using Artificial Intelligence to Improve Health Monitoring and Quality of Life," pp. 101-105, 2012.

[44] S. H. El-Sappagh and S. El-Masri, "A Proposal of Clinical Decision Support system Architecture for Distributed Electronic Health Records," *world-comp. org*.

[45] M. Z. Khalid, A. Akbar, A. K. Tanwani, A. Tariq, and M. Farooq, "Using telemedicine as an enabler for antenatal care in Pakistan," in *2nd International Conference E-Medisys: E-Medical Systems, Sfax*, 2008.

[46] C. Gomes, F. Sperandio, J. Borges, B. Almada-Lobo, and A. Brito, "A Decision Support System for Surgery Theatre Scheduling Problems," in *ENTERprise Information Systems*, ed: Springer, 2011, pp. 213-222.

[47] Y. Boreisha and O. Myronovych, "Web-based decision support systems as knowledge repositories for knowledge management systems," *UbiCC Journal*, vol. 3, 2008.

[48] P. J. Hu, P. Y. Chau, O. R. L. Sheng, and K. Y. Tam, "Examining the technology acceptance model using physician acceptance of telemedicine technology," *Journal of management information systems*, pp. 91-112, 1999.

[49] A. A. Morton, "Examining Acceptance of an Integrated Personal Health Record (PHR)," PhD. dissertation, University of Maryland, Baltimore, USA, 2011.

[50] E. L. Carter, G. Nunlee-Bland, and C. Callender, "A patient-centric, provider-assisted diabetes telehealth self-management intervention for urban minorities," *Perspectives in Health Information Management/AHIMA, American Health Information Management Association*, vol. 8, 2011.

[51] R. Hess, C. L. Bryce, S. Paone, G. Fischer, K. M. McTigue, E. Olshansky, *et al.*, "Exploring challenges and potentials of personal health records in diabetes self-management: implementation and initial assessment," *Telemedicine and e-Health*, vol. 13, pp. 509-518, 2007.

[52] W. J. Winkelman, K. J. Leonard, and P. G. Rossos, "Patient-perceived usefulness of online electronic medical records: employing grounded theory in the development of information and communication technologies for use by patients living with chronic illness," *J Am Med Inform Assoc*, vol. 12, pp. 306-14, May-Jun 2005.

[53] A. Hassol, J. M. Walker, D. Kidder, K. Rokita, D. Young, S. Pierdon, *et al.*, "Patient experiences and attitudes about access to a patient electronic health care record and linked web messaging," *J Am Med Inform Assoc*, vol. 11, pp. 505-13, Nov-Dec 2004.

[54] E. V. Wilson and N. K. Lankton, "Modeling patients' acceptance of provider-delivered e-health," *Journal of the American Medical Informatics Association*, vol. 11, pp. 241-248, 2004.

[55] J.-Y. An, "Correlates and Predictors of Consumers' Health Information and Services Usage Behavior on the Internet: A Structural Equation Modeling Approach," PhD. dissertation, School of Education, New York University, New York, USA, 2005.

[56] F. Portela, M. F. Santos, Á. Silva, F. Rua, A. Abelha, and J. Machado, "Adoption of Pervasive Intelligent Information Systems in Intensive Medicine," *Procedia Technology*, vol. 9, pp. 1022-1032, 2013.

[57] E. J. Lanseng and T. W. Andreassen, "Electronic healthcare: a study of people's readiness and attitude toward performing self-diagnosis," *International Journal of Service Industry Management*, vol. 18, pp. 394-417, 2007.

[58] J. Kim and H. A. Park, "Development of a health information technology acceptance model using consumers' health behavior intention," *J Med Internet Res*, vol. 14, p. e133, 2012.

[59] M. P. Gagnon, E. Orruno, J. Asua, A. B. Abdeljelil, and J. Emparanza, "Using a modified technology acceptance model to evaluate healthcare professionals' adoption of a new telemonitoring system," *Telemed J E Health*, vol. 18, pp. 54-9, Jan-Feb 2012.

[60] D. Jeng, "Analysis of Adoption Factors for Clinical Decision Support Systems by Decision-Making Trials and Laboratory Evaluations," *Analysis*, vol. 1, pp. 56-66, 2010.

[61] P. Ketikidis, T. Dimitrovski, L. Lazuras, and P. A. Bath, "Acceptance of health information technology in health professionals: An application of the revised technology acceptance model," *Health informatics journal*, vol. 18, pp. 124-134, 2012.

[62] D. Buenestado, J. Elorz, E. G. Pérez-Yarza, A. Iruetaguena, U. Segundo, R. Barrena, *et al.*, "Evaluating Acceptance and User Experience of a Guideline-based Clinical Decision Support System Execution Platform," *Journal of Medical Systems*, vol. 37, 2013.

[63] L. S. Alghaith, B., "The Acceptance of Clinical Decision Support Systems among Saudi Dentists," in *Saudi E-Health 2010 Conference*, Saudi Arabia, 2010.

[64] S. Oio, O. Olugbara, G. Ditsa, M. Adigun, and S. Xulu, "Formal model for e-healthcare readiness assessment in developing country context," in *Innovations in Information Technology, 2007. IIT'07. 4th International Conference on*, 2007, pp. 41-45.

[65] N. Phichitchaisopa and T. Naenna, "Factors Affecting the Adoption of Healthcare Information Technology," *Excli Journal*, vol. 12, pp. 413-436, 2013.

[66] S. R. Isabalija, K. G. Mayoka, A. S. Rwashana, and V. W. Mbarika, "Factors affecting adoption, implementation and sustainability of telemedicine information systems in Uganda," *Journal of Health Informatics in Developing Countries*, vol. 5, 2011.

[67] P. Esmaeilzadeh, M. Sambasivan, N. Kumar, and H. Nezakhati, "Adoption of technology applications in healthcare: the influence of attitude toward knowledge sharing on technology acceptance in a hospital," in *U-and E-Service, Science and Technology*, ed: Springer, 2011, pp. 17-30.

[68] Z. Walter and M. S. Lopez, "Physician acceptance of information technologies: Role of perceived threat to professional autonomy," *Decision Support Systems*, vol. 46, pp. 206-215, 2008.

[69] C.-H. Tsai, "Integrating Social Capital Theory, Social Cognitive Theory, and the Technology Acceptance Model to Explore a Behavioral Model of Telehealth Systems," *International journal of environmental research and public health*, vol. 11, pp. 4905-4925, 2014.

[70] Google Scholar. (2014, September 01). *Fred D Davis*. [Online] Available: http://scholar.google.com/scholar?q=fred+d+davis&btnG=&hl=en&as_sdt=0%2C5

[71] F. D. Davis, "A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results," PhD. dissertation, Management, Massachusetts Institute of Technology, USA, 1985.

[72] S. Y. Yousafzai, G. R. Foxall, and J. G. Pallister, "Technology acceptance: a meta-analysis of the TAM: Part 1," *Journal of Modelling in Management*, vol. 2, pp. 251-280, 2007.

[73] A. R. Ahlan and B. I. Ahmad, "User Acceptance of Health Information Technology (HIT) in Developing Countries: A Conceptual Model," *Procedia Technology*, vol. 16, pp. 1287-1296, 2014.

[74] J.-W. Moon and Y.-G. Kim, "Extending the TAM for a World-Wide-Web context," *Information & Management*, vol. 38, pp. 217-230, 2001.

[75] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "Extrinsic and intrinsic motivation to use computers in the workplace," *Journal of applied social psychology*, vol. 22, pp. 1111-1132, 1992.

[76] K. Zheng, R. Padman, M. P. Johnson, and H. S. Diamond, "Evaluation of healthcare IT applications: the user acceptance perspective," in *Advanced Computational Intelligence Paradigms in Healthcare-2*, ed: Springer, 2007, pp. 49-78.

[77] R. M. Coffey, T. L. Matthews, and K. McDermott, *Diabetes care quality improvement: a resource guide for state action*: Agency for Healthcare Research and Quality, 2004.

[78] P. Cosgrove, M. Engelgau, and I. Islam, "Cost-effective approaches to diabetes care and prevention," *Diabetes voice*, vol. 47, pp. 13-17, 2002.

[79] C. S. Goodman, "Introduction to health technology assessment," *The Lewin Group. virginia, USA*, 2004.

[80] L. A. Khowaja, A. K. Khuwaja, and P. Cosgrove, "Cost of diabetes care in out-patient clinics of Karachi, Pakistan," *BMC Health Services Research*, vol. 7, p. 189, 2007.

[81] R. G. Boone, "Factors impacting innovation acceptance in a product development organization: Utilizing technology acceptance model," PhD. dissertation, Capella University, Minneapolis, USA, 2011.

[82] World Bank (2013, September 15). *Sourcebook for Evaluating Global and Regional Partnership Programs Sourcebook for Evaluating Global and Regional Partnership Programs Indicative Principles and Standards Indicative Principles and Standards*. Washington: Independent Evaluation Group–World Bank, [Online]. Available: http://www.mfcr.cz/assets/cs/media/OECD_Dokumentace-Pr-005_2007_Prirucka-pro-hodnoceni-globalnich-a-regionalnich-partnerskych-programu-Indikativni-zasady-a-standardy.pdf

[83] J.-H. Wu, W.-S. Shen, L.-M. Lin, R. A. Greenes, and D. W. Bates, "Testing the technology acceptance model for evaluating healthcare professionals' intention to use an adverse event reporting system," *International Journal for Quality in Health Care*, vol. 20, pp. 123-129, 2008.

[84] D. Gefen, E. Karahanna, and D. W. Straub, "Trust and TAM in online shopping: an integrated model," *MIS quarterly*, vol. 27, pp. 51-90, 2003.

[85] S. Terrizzi, S. Sherer, C. Meyerhoefer, M. Scheinberg, and D. Levick, "Extending the technology acceptance model in healthcare: Identifying the role of trust and shared information," in *AMCIS 2012*, *Proceedings*, Seattle, USA, 2012.

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