Acceptance of Electronic Health Record System among Nurses: The Effect of Technology Readiness

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Abstract: It is expected that the implementation of Electronic Health Record (EHRs) systems should be noted amongst others as one of the most exclusive strategies needed to improve the quality of care provided by nurses. Nonetheless, the under-utilization of the capabilities of the EHRs by the nurses have become of concern due to their technology-related personality in relation to accepting to use EHRs. For decades now, researchers and attendant empirical underpinnings have been concerned about people's behaviours relating to adopting innovative IT and how those innovations are diffused. The critical nature of the above submission is noted. Conventionally, factors such as usefulness and ease of use have been used to examine technology adoption vis-a-vis the need to predict accepting technologies by individuals. Nevertheless, charting the above line-of-thought is noted to be plausibly problematic in that the determining factors of people's perception on ease of use and usefulness in accepting a technology may not be properly understood and clarified. Consequently, further empirical endeavours aimed at suggesting improved interventions relating to people's acceptance and eventual use of a technology is suggested and/or called for. Hence, this study further lengthens the unified theory of acceptance and use of technology (UTAUT2) so as to understand how technology acceptance and use in the health care setting with the incorporation of the TRI theory into UTAUT: optimism innovativeness, discomfort and insecurity.

Key words: UTAUT, TRI intention to use, HIS, EHRs, nurses, optimism

INTRODUCTION

It is noted that there are countless benefits accruable from the use of new technologies in healthcare practice. Characteristically, some of these benefits are, reduced operational costs, decrease medical errors improved management of sicknesses, effective healthcare services delivery and value-added management operations (Goldzweig *et al.*, 2009; Herricck *et al.*, 2010; Buntin *et al.*, 2011). Succinctly put, the technologies employed in the healthcare system are jointly referred to as Healthcare Information Systems (HIS) and are thus noted to be computerized systems specially fashioned to perform a myriad of clinical, managerial, finance-related and communication functions in healthcare establishments. Meanwhile, implementing new technologies in top-tier healthcare facilities (primarily hospitals) has become unavoidable in view of the benefits accruable therefrom. More so, it is worthy to note that many countries on their part have also tried to intensify efforts in digitizing their healthcare facilites (Chang *et al.*, 2006). By implication of the introduction of the HIS, healthcare personnel are thus

exposed to new work experiences which they previously did not possess. However, taking into cognizance the need for the newly introduced technologies to succeed, the attendant challenges that emanate from the introduction should be matched with effectual responses. The essence of this is to ensure that the healthcare personnel acceptance of such systems is guaranteed (Cresswell and Sheikh, 2013; McGinn *et al.*, 2011).

The EHR is assumed to be the bedrock on which related health information tools (e.g., emergency information, telemedicine, test system, DSS, electronic prescription and digital imagery) rest and which could possibly increase healthcare professional's acceptance decisions. This could, to a large extent ensure a safer and more result-oriented healthcare system, even as extant literature review also supports numerous benefits of EHR for patients. Specifically highlighted benefits are superior care for patients based on availability care records to their responsible health care provider in order to ensure improved coordination of care so provided (Herian *et al.*, 2014) and improved efficiency of primary care practice (Guilbert *et al.*, 2012). The EHR support endowed people

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with the ability to dynamically get involved in making decisions on their health and on the best line of preventive care they should be provided with through primary care practices (Hypponen *et al.*, 2014). Additionally, the EHR is a system that supports exchange of knowledge and ease of decision-making between and among professionals in the healthcare system, especially those attached to hospitals with the provision of important, current and well-timed information.

In the healthcare setting, technology-related user acceptance and adoption behaviour has been investigated. For example, Electronics Medical Records (EMR) (Dunnebeil *et al.*, 2010; Talaei-Khoei *et al.*, 2013), Picture Archiving and Communication System (PACS) (Duyck *et al.*, 2010), tele-rehabilitation technologies (Cranen *et al.*, 2012) and telemedicine programs (Chang and Hsu, 2012; Whitten *et al.*, 2010), rehabilitation by occupational and Physical Therapists (PTs) (Liu *et al.*, 2015). Therefore, this study is aimed at extending the UTAUT Model by integrating TRI to investigate factors that affect acceptance behaviour of nurses in the Jordanian public health sector on the use of the EHRs.

Our position is predicated upon the fact that in our opinion and to the best of our knowledge, only a few studies have investigated issues related to the acceptance of EHRs among nurses in Jordan. Hence, there is still vagueness as to the extent to which nurses are adopting and accepting EHRs. It would therefore be worthwhile to develop theoretical frameworks that is capable of examining the acceptance of EHRs among nurses.

Theoretical background

The UTAUT Model: In the social sciences and associated fields of study, some theories have been employed to investigate behavioural intention with respect to the use of technology and in explaining how and why people adopt technologies. For example, the theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1977), the Technology Acceptance Model (TAM-TAM2) (Davis, 1989), the Theory of Planned Behaviour (TPB) (Ajzen, 1991) the Innovation Diffusion Theory (IDT) (Moore and Benbasat, 1991), the Combined TAM and TPB Model (C-TAM TPB) (Taylor and Todd, 1995), Social Cognitive Theory (SCT) (Compeau and Higgins, 1995), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003) and the Motivational Model (MM) (Dunnebeil *et al.*, 2010).

Specifically, the UTAUT has its foundations from the TRA and TPB (Ajzen and Fishbein, 1980; Ajzen, 1991; Armitage and Christian, 2003) in addition to previous technology acceptance models (Venkatesh *et al.*, 2003). Characteristically, the UTAUT comprises of four

situational or contextual factors. They are performance expectancy, effort expectancy, social influence and facilitating conditions. Performance expectancy entails how users of a technological system believe that use of the system will enable them perform. Effort expectancy is explained as how easy it is to use a system. On the other hand, social influence is noted to be the extent other prominent persons are of the opinion that users ought to use a particular system. These constructs are however hypothesized in the UTAUT to be able to determine the use of a system via its effect on behavioural intentions (Venkatesh *et al.*, 2003). Facilitating conditions denote user's perception of organizational and technical support for the system. However, this construct is theorized in the UTAUT to directly determine technology use (Venkatesh *et al.*, 2003) and intention to use (Venkatesh *et al.*, 2012). Furthermore, demographic factors such as age and gender are proposed to be able to act as moderators in the association between the situational constructs and technology acceptance and use. The UTAUT is does not contemplate the direct effect of individual differences on technology use, a gap that the TRI can fill in view of its critical it eliciting individual's reaction to the use of technology. In addition, the TRA which forms the foundation for technology acceptance models, clearly integrates individual differences as a exogenous variable that is capable of influencing people's perceptions. This position is in response to a myriad of empirical underpinnings that suggested the inclusion of all sorts of individual differences in examining technology use (Zmud, 1979; Nelson, 1990; Harrison and Rainer, 1992; Neufeld *et al.*, 2007; Pramatari and Theotokis, 2009). However, that posited that 'although, mounting evidence suggests individual differences influence IT use, more integrative research is needed to better understand the nomological net among individual differences that relate to IT acceptance and use'.

The internal differences of individuals (i.e., personality traits) amongst other antecedents are mostly examined (Bhattacherjee and Hikmet, 2007; Walczuch *et al.*, 2007). However, it would be risky to ignore the personality traits of persons, especially on models relating to technology adoption as the adoption models may be poorly stated which in consequence may lead to negatively influencing how people adopt a technology. Of all the distinct personality traits, it is submitted that the Technology Readiness Index (TRI) is actually theorized as a trait which is further noted as comparatively established descriptor of infididuals (Parasuraman, 2000). This study further seeks to investigate the association between nurse's technology readiness, perceptions of EHR and intention to use EHR

by considering individual differences with specific focus on individual's technology readiness as a construct (Parasuraman, 2000) with the UTAUT (Venkatesh *et al.*, 2012). This is expected to add to the body of knowledge of the innovative adoption research.

In addition to originally validating the UTAUT (Venkatesh *et al.*, 2003), its main hypotheses have been tested by quite a good number of scholars and an extension of the model has also been done. Characteristically done are, examining it in novel settings, presenting new constructs that predicts behavioural intentions and technology usage or investigating factors that influence the UTAUT constructs in its entirety (Venkatesh *et al.*, 2012). On the whole the studies all support the UTAUT (Brown *et al.*, 2010; Chan *et al.*, 2010; Fillion *et al.*, 2012). Nevertheless, certain UTAUT factors are noted to have been accorded constant prominence in relation to others and the incorporation of extra determining factors into the main UTAUT seems to be responsible to raising the variance explained in behavioural intentions and actual use.

TRI: Technology readiness index Technology Readiness (TR) denotes "people's proclivity to accept and use new technologies which should aid them to achieve goals in their places of work and at their homes life" (Parasuraman, 2000). The TRI can also be considered as a complete state of mind emanating from both mental catalysts and inhibitors that mutually define a person's inclination to use new technologies (Kleijnen *et al.*, 2004). Taking a cue from the above positions, Parasuraman (2000) proposed the TRI can be used across a broad-spectrum of consumer populations. Characteristically, it comprises 36 items of four dimensions namely, optimism or "a positive view of technology and a belief that it offers people improved control, efficiency and flexibility in their lives"; innovativeness or "a inclination to be a nearly adopter of technology and opinion leader"; discomfort or "a perception of inability to control the technology and a sense of being astounded by it"; insecurity or "suspect of technology and doubt about its capability to work". Of the four dimensions, it is noted that optimism and innovativeness enables technology readiness while discomfort and insecurity inhibits technology readiness (Parasuraman, 2000). It is further submitted that optimistic and innovative people as against people who are discomforted and insecure are more susceptible to accepting new technology and eventually use the technology (Parasuraman, 2000).

Evidently, positions from previous research classifies the TRI into two broad-based categories (Kuo *et al.*, 2013). While the first category measures the subject's technology readiness scores by using the TRI as a leverage, the second category utilizes the TRI in relation to another theory to examine the acceptance of new technologies by individuals. Not with standing that the ability of the TRI in predicting the acceptance of new technology has been noted by a myriad of studies, findings from the studies suggest that the TRI has not been empirically validated within the context of the healthcare sector which is noted to be more complex in relation to other sectors (Goldschmidt, 2005). Additionally, findings from studies based on other studies may not be appropriate within the context of the healthcare sector. Supporting the above positions, an argument put forward by Van Riel *et al.* (2006) is of the view that further empirical endeavours are needed aimed at investigating the ability of TR in determining how people accept technology. Insofar as the TRI is acclaimed to be most recent integrative measure of technology readiness (Yi *et al.*, 2003), a comprehensive investigation on how it determines the behavioural intention of nurses using EHRs is theoretically worth while.

Framework of the study and hypothesis development: In the study, the UTAUT and TRI is integrated primarily based on the following three reasons: firstly, it is possible to use the UTAUT and TRI in explaining people's perception about technology acceptance (Parasuraman, 2000; Venkatesh *et al.*, 2012). Secondly, while differentiating the characteristics of the two models, the UTAUT is noted to use system-specific opinions to clarify technology acceptance while the focus of TRI is through the general inclination of individuals (Yi *et al.*, 2003). Thirdly, the relationship between individual differences (i.e., psychological traits) and technology acceptance was mediated by the cognitive dimensions of perceived usefulness and perceived ease of use similarly to performance expectancy and effort expectancy in the UTAUT (Agarwal and Prasad, 1999). Consequently, it is theoretically suitable to merge the UTAUT with TRI to examine nurse's acceptance of EHRs in a single Model of empirical investigation.

Further, the healthcare industry is noted to be quite different from other industries in terms of its socio-technical characteristics (Chiasson and Davidson, 2004). Therefore, it is critical to conduct empirical investigations aimed at further understanding the aforementioned relationships and specifically via. the proposed framework of this study as illustrated in Fig. 1. Characteristically, the proposed framework is made up of the basic concept of the UTAUT which is used to denote nurse's intention to use EHRs and as affected by their effort expectancy and performance expectancy of EHRs.
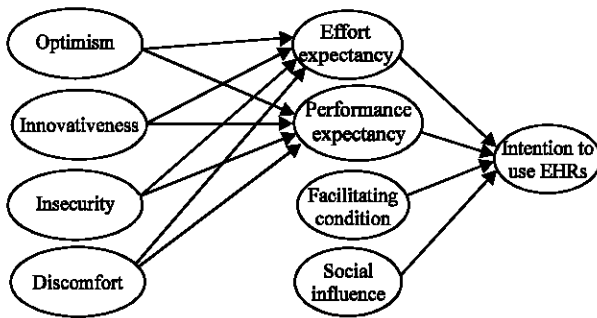
Fig. 1: Research framework

Additionally, the TRI has four indicators (optimism innovativeness, discomfort and insecurity) which are the exogenous variables capable of influencing the nurse's effort expectancy and performance expectancy toward EHRs.

Notwithstanding that the associations between the constructs of this study has been examined in a myriad of healthcare-related empirical efforts, they actually used different subjects, technologies, research methodologies, etc. which might have plausibly skewed the results obtained therefrom. We therefore argue that additional in-depth studies are needed to widen the knowledge-base and better understanding of technology acceptance with specific focus on the healthcare setting. Also, it is noted that EHRs improve healthcare quality and that since nurses are more in number and are at the frontline of the healthcare service delivery it is therefore critical to examine how they accept EHRs vis-a-vis the impact it will have on the healthcare industry. More so, with the integration of constructs of personality traits, having a grander understanding of factors that influence performance expectancy and effort expectancy is greatly encouraged and cannot be over-emphasised.

Performance Expectancy (PE): PE is defined as "the degree to which an individual believes that using the system will help to attain gain in job performance" (Venkatesh *et al.*, 2003). They further argued that PE is effective in the examination of all stages of acceptance in settings that are both mandatory and voluntary. Some empirical submissions also found that PE positively affected intention behaviour (Duyck *et al.*, 2008; Wills *et al.*, 2008; Aggelidis and Chatzoglou, 2009; Hennington *et al.*, 2009; Kijsanayotin *et al.*, 2009; Holtz and Krein, 2011; Jeng and Tzeng, 2011). Therefore, we hypothesize that:

- H_1: Jordanian nurse's intention to use EHRs will be positively influenced by performance expectancy

Effort expectancy: In the UTAUT Model, the effort expectancy construct is made up of two factors of perceived ease of use and complexity. It is hence, submitted that healthcare professionals who are of the perception that it is easy to use IT have in turn shown the tendency to be ready to use such IT systems in their jobs (Aggelidis and Chatzoglou, 2009; Kijsanayotin *et al.*, 2009). However, findings from related studies posited that effort expectancy di not usefully predict healthcare professional's intentions (Duyck *et al.*, 2008; Steele *et al.*, 2009). We therefore hypothesize that:

- H_2: Jordanian nurse's intention to use EHRs will be positively influenced by effort expectancy

Social influence: Social influence is defined as "the degree to which one perceives that important others believe one should use the system" (Venkatesh *et al.*, 2003). This construct is made up of three sub-constructs of subjective norm, social factors and image. Social influence denotes that people's intention are framed based on the perceptions and opinions of people in their environment. In the context of the healthcare setting it is posited that social influence positively determined behavioural intention (Aggelidis and Chatzoglou, 2009), while other factors did not. We therefore hypothesize that:

- H_3: Jordanian nurse's intention to use EHRs is positively determined by social influence

Facilitating condition: Facilitating conditions denote user's perceptions of the resources and support that are available to perform a behaviour (Brown and Venkatesh, 2005; Venkatesh *et al.*, 2003). Based on the UTAUT it is hypothesized that facilitating conditions directly influence technology use. This is based on the notion that in a work context, facilitating conditions can serve as the substitute for actual behavioural control which then can directly influence behaviour (Ajzen, 1991). In addition, facilitating conditions may act like perceived behavioural control in the Theory of Planned Behaviour (TPB) and influence both intention and behaviour (Ajzen 1991). Characteristically, a user who has access to a favourable set of facilitating conditions is more likely to have a higher intention to use a technology. Also, a consumer with a lower level of facilitating conditions will have lower intention to use system. It has been submitted from prior studies that facilitating conditions can determine behavioural intention (Venkatesh *et al.*, 2012; Aggelidis and Chatzoglou, 2009). We therefor hypothesize that:

- H_4: Jordanian nurse's intention to use EHRs will be positively influenced by facilitating condition

Effect of optimism on EE and PE: Optimism is an all-purpose construct that clasps the specific feelings of people and an indication that technology is a good thing (Tsikriktsis, 2004). Evidently, it is noted by a technology optimist that new technology is more beneficial in that it increases flexibility, control and efficiency in the lives of the users (Parasuraman, 2000). They are noted to use more optimistic approaches which are commonly more useful in realizing the expected results (Walczuch *et al.*, 2007). Obviously, optimistic persons do not always concern themselves on plausible negative events, hence freely accept to use technology. Thus, optimists believe that technologies are more useful and easy to use as they are less concerned with the negative outcomes of technology. We therefore propose the following hypotheses in line with previous lines of thoughts:

- H_{5a}: nurse's EE of EHRs is positively influenced by optimism
- H_{5b}: nurse's PE of EHRs is positively influenced by optimism

Effect of innovativeness on EE and PE: Innovativeness denotes the predisposition of persons in being a pioneer and thought leader technology (Parasuraman, 2000). It is thus considered a critical determining factor of cognitive absorption which by implication determines PEOU and PU-similar to EE and PE (Agarwal and Karahanna, 2000). This shows that persons with high technology innovativeness are more susceptible to accepting and to a large extent enjoy how it feels to use a new technology (Yi *et al.*, 2003). In another position, Agarwal and Prasad (1999) are of the view that self-innovativeness is essential in examining the acceptance of innovative technology. Additionally, persons with high tendency of innovativeness generally possess positive impression of the usefulness of a new technology (Walczuch *et al.*, 2007). Based on the above submissions, we propose the following hypotheses:

- H_{6a}: nurse's EE of EHRs is positively influenced by innovativeness
- H_{7b}: nurse's PE of EHRs is positively influenced by innovativeness

Effect of insecurity on EE and PE: In this study, insecurity denotes some doubt of technology and uncertainty about the optimal functionality of such technology (Parasuraman, 2000). Persons with high tendency of insecurity often times lack confidence, especially in terms of how secure such technologies are hence making them weary and in need of the assurance of safety of use (Parasuraman and Colby, 2001). Put in another way people who feel insecure about new technologies always feel the use of such technologies are risky. In prior research it has been posited that risk perceptions influence PU and PEOU (similarly to PE and EE) (Lu *et al.*, 2005; Siegrist, 2000). Therefore it is only when people believe that it will be greatly rewarding from the use of the new technology that they will in fact be disposed to taking the risk of using such technology (Tsikriktsis, 2004). We therefore hypothesize that:

- H_{7a}: nurse's EE of EHRs is negatively influenced by insecurity
- H_{7b}: nurse's PE of EHRs is negatively influenced by insecurity

Effect of discomfort on EE and PE: Discomfort denotes the perception of people that they are deficient of control over technology and the sentiment that they are being astounded by the technology (Parasuraman, 2000). When people notice a discomfort with a technology they are usually under the presumption that the technology is controlling them and that the use of technologies is not for common people (Parasuraman, 2000). In other words, the discomfort is capable of making people apprehensive with respect to the use of technology. Interestingly. Discomfort is comparable to the construct of computer anxiety which is confirmed to have a negative effect on PEOU (EE) (Hackbarth *et al.*, 2003) and PU (PE) (Igbaria *et al.*, 1994). The following hypotheses are therefore proposed:

- H_{8a}: nurse's EE of EHRs is negatively influenced by discomfort
- H_{8b}: nurse's PE of EHRs is negatively influenced by discomfort

Constructs and measures of the variables in the model: The measures used for this study were adapted from the empirical efforts of Venkatesh *et al.* (2003) and Parasuraman (2000). The items were assess with the 7-point Likert scale from "strongly disagree" to "strongly agree" on which respondents indicated an appropriate response accordingly. Hence, in light of the position that this study is a work-in-progress, the study will evaluate the proposed hypotheses using the structural equation modelling in order to understand the causal associations between the variables as proposed in the conceptual model.

CONCLUSION

Adopting Electronic Health Record (EHRs) systems is projected to be one of the best strategies for improving the quality of care provided by nurses. Unfortunately, the under-utilization of the EHRs has become of concern to researchers and industry practitioners, since, the acceptance and actual usage of the EHRs depend majorly on the technological personality of the nurses. Research on adoption behaviour of innovative IT and the diffusion of innovations has gained so much prominence in view of the attention in that direction (Van Riel *et al.*, 2006; Davis *et al.*, 1989). As an age-long convention, research on technology adoption has primarily focused on constructs such as usefulness and ease of use to predict individual's acceptance of technologies (Davis, 1989). Unfortunately, such standpoint and/or strategy hinders the understanding and explanation of the determinants of ease of use and usefulness perceptions in line with how people accept technology (Venkatesh and Davis, 1996). Therefore, further empirical endeavours are needed to address issues relating to proposing better interventions that are capable of improving people's acceptance and use of a technology. Consequently, this study extends the unified theory of acceptance and use of technology (UTAUT2) to examine acceptance and use of technology in the healthcare setting and thus incorporates the TRI theory into UTAUT.

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