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Exploring physicians' behavioural intention toward the adoption of electronic health records: an empirical study from Jordan

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Abstract: The response of health professionals to the use of health information technology (HIT) can partly explain the success or failure of any HIT adoption and/or its application. The present study applies a modified version of the revised technology acceptance model (TAM) to examine EHR acceptance and utilisation by physicians in Jordan. The paper presents the theoretical basis behind the development of a research model which was employed to empirically validate the model using substantial quantitative data. The theoretical significance of this work is evidenced by utilising a rigorously constructed research model to extend technology acceptance research into the health sector.

Keywords: technology acceptance model; TAM; healthcare; electronic health records; EHRs; technology adoption; health information technologies; HITs; Jordan.

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1 Introduction

The healthcare industry is a hot spot of research owing to the growing importance of healthcare to people and governments and the rapid increase of its costs (Fichman et al., 2011). As the volume of medical information continuously increases, health organisations face additional demands to improve their services, especially in light of the emergence of advanced technologies (Hung et al., 2009). Healthcare professionals face many challenges every day and the decisions of 'knowing what the right thing is', 'what the right way is' and 'when the right time is' continue to be the biggest challenges (Eisenberg, 1997). The recent developments of advanced technologies and the appearance of new waves of medical treatment and practices have resulted in increasing public expectations of healthcare services.

The primary mission of any healthcare institution is to deliver safe and high quality care to its patients (Browning and Torain, 2011). In order to achieve the desired objective, healthcare providers need to acquire comprehensive and accurate information about the health status of patients. Furthermore, timely access to high quality health information is a fundamental requirement towards providing comprehensive care. However, a number of problems and challenges face health information systems (HIS) due to the dramatic increase in patient numbers and medical information.

The healthcare environment is an intensive information industry which basically depends on patients' health information that is gathered whenever patients visit healthcare institutions (Omary et al., 2010). The diversification and expansion of healthcare services has generated a significant amount of information utilising different formats which require a high level of management. The healthcare sector has many users with different needs in terms of how information is used, represented and stored (Grimson et al., 2000). It is considered one of the most transaction-intensive environments that includes all encounters between patients and providers, providers and insurance, provider and other providers. The nature of any healthcare environment is complex in its requirements and expectations (Wager et al., 2005). As a consequence, traditional HIS face increasing demands to improve the quality of their healthcare services outcomes, especially in light of the complex nature and rapid growth of the healthcare environment (Omary et al., 2010).

In fact, healthcare institutions operate within dynamic environments that require them to update their capabilities to deal with the different aspects of patients' health status (Mann et al., 2007). In light of the rapid expansion of the healthcare environment, paper-based records are not sufficient to cope with the complexity of the healthcare environments and its continuous growth. Obtaining a sustained and reliable improvement in healthcare with such methods is extremely difficult (Wager et al., 2005). Indeed, healthcare specifically depends on the availability of patient's information records that allows healthcare professionals to make better medical decisions. Therefore, the use of the electronic health records (EHR) is dynamically growing (Luo, 2006).

An urgent need to achieve data integrity whilst cutting costs, forces many healthcare organisations across the world to shift towards the adoption of health information technologies (HITs) particularly EHRs (Sullivan, 2010; Luo, 2006). In the literature, EHRs generally refer to the computerisation of health information into electronic records. However, the current study adopted the definition offered by the National Electronic Health Records Taskforce (2000, p.21), whereby EHRs are defined as:

> "An electronic longitudinal collection of personal health information, usually based on the individual, entered or accepted by healthcare providers, which can be distributed over a number of sites or aggregated at a particular source."

EHRs are considered to be the core application of modern HITs, where data can be easily obtained and manageably transferred (Allan and Eglebright, 2000). EHRs have the ability to create a complete health record of patients that support all care activities across all medical stages. The EHRs are more than a mere collection of health information; they are also a source of evaluation and decision-making that supports both patient care and healthcare management. Additionally, EHRs also have the capability to offer additional facilities since they may be extended to include additional facilities such as billing, payments and quality assessment.

2 EHR acceptance

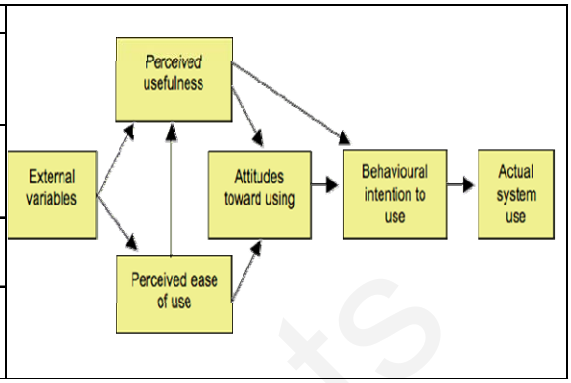
Understanding user's acceptance or rejection of information technology is considered one of the most challenging issues in information system research (Venkatesh et al., 2003). Successful implementation of an information system depends heavily on the amount of attention paid to human issues which have a dramatic impact on the process (Burke et al., 2001). One of the biggest human issues is resistance to change. Klaus and Blanton (2010, p.3) in their research recognised that the main obstacle towards implementing successful IT projects within organisations is employees' resistance to change, which is defined as "the behavioural expression of a user's opposition to an information system during the implementation". Many organisations suffer from individual users who do not recognise the important benefits offered by new technologies. Adams et al. (2004) insist that users' resistance is a substantial issue that should be addressed early on. Individuals responsible for information systems' implementation should be aware that users' resistance results in system failure.

EHR acceptance by healthcare professionals is an important step to ensure that the expected benefits will be achieved (Ludwick et al., 2010). Particularly, EHR acceptance by physicians is considered one of the most challenging issues. Physicians are often considered the frontline user-group of EHRs and there are several factors that contribute to a physician's resistance to use HITs (Meinert, 2005). Consequently, understanding the factors influencing EHR acceptance is one of the fundamental aspects in ensuring its best benefits are achieved during integration with the existing health systems. Many scholars have used theoretical models to investigate the factors driving physicians' acceptance of EHR systems (Moores, 2012; Melas et al., 2011). Among studies that used a theoretical model most were based on the technology acceptance model (TAM). TAM proposes that users' behavioural intention (BEI) predicts their actual use of a system (Chang et al., 2011). It also suggests two major beliefs that determine users' behavioural intention towards using a new system, particularly perceived ease of use (PEOU) and perceived

usefulness (PU) (Davis, 1989). Furthermore, TAM assumes that external variables indirectly impact technology acceptance by influencing PU and PEU (Chismar and Wiley-Patton, 2003).

Figure 1 The technology acceptance model (see online version for colours)

Construct	Detention
Perceived Usefulness (PU)	*"The degree to which a person believes that using a particular system would enhance his or her job performance".*
Perceived Ease of Use (PEOU)	*"The degree to which a person believes that using a particular system would enhance his or her job performance".*
Behavioural Intentions (BEI)	*"a measure of the strength of one's intention to perform a specified behaviour".*
Attitude (A)	*"an individual's positive or negative feelings (evaluative affect) about performing the target behaviour"*



Source: Adopted from Davis et al. (1989)

The current study considers TAM as the most appropriate model for exploring the acceptance of EHR systems in Jordanian hospitals. The selection of TAM was based on three reasons. Firstly, TAM has been developed specifically to predict and explain the acceptance of IS and is acknowledged as being a robust model suited to the examination of the acceptance of various IS applications (Chen et al., 2011). Secondly, TAM contains very useful and effective elements that serve the objective of this research. According to Khasawneh and Ibrahim (2008) the predictive power of TAM lies in determining the relationship between two important sets of constructs – a technical concept (PU and PEOU) and a psychological concept (intentions and attitudes). Thirdly, TAM has the ability to be restructured according to the technology that will be investigated. Thus, TAM through the external variable construct, gives researchers the opportunity to add more potential factors that could affect the acceptance of a particular technology. Accordingly, the literature of technology acceptance and usage highly recommends TAM as one of the most influential models in terms of investigating technology acceptance. Indeed, TAM has captured wide attention from researchers within the IS arena over past decades (Chen et al., 2011; Holden and Karsh, 2010).

Physicians are different from other users in terms of technology acceptance (Ward, 2013). When compared to end users in ordinary business settings physicians are different in their technology acceptance decision-making. Accordingly, scholars have added more constructs to TAM in order to investigate the different aspects influencing the physicians' behavioural intention to use EHR (Gagnon et al., 2013; Moores, 2012; Melas et al., 2011; Llie et al., 2009). Most significant factors influencing physicians' behavioural intention to use EHR were PU, PEOU, facilitating conditions, information quality, attitude and accessibility. Additionally, Walter and Lopez (2008) have pointed out the role of perceived threat (PTH) to physicians' autonomy as a main predictor of PU. However, Esmaeilzadeh and Sambaivan (2013) suggest that physicians' autonomy directly affects their behavioural intention. Holden (2010) in his qualitative study highlights the impact of social influence (SI) on the physician's decision to use EHR as the results suggest that the social factors may encourage or discourage the use of EHR. Morton and Wiedenbeck

(2010) also investigated the impact of EHR use on the physician/patient relationship; the results indicated that the use of EHR had a negative impact on physician/patient relationship and in turn a negative impact on the physicians' PU and PEOU. Moreover, Yarbrough and Smith (2007) found TAM an effective tool in investigating physicians' behavioural intention to use EHRs. However the results indicated that the perceptions of ease of use are not highly significant, whereas time efficiency and organisational culture are important for successful integration of EHRs into the physicians' workflow.

Overall, the different TAMs and theories in the literature have similar concepts, but with different emphases (Ward, 2013). Additionally, the complexity of such models has increased over recent years and their predictive power is not proven in the healthcare context. Despite such limitations these models offer insights which could be used to improve the possibilities of HIT being adopted by the potential end-users. Prior studies have demonstrated support to use TAM as a theoretical model of EHR acceptance by physicians. However, TAM remains limited in its predictive power and thus further technology acceptance research should attempt to incorporate other theories (Venkatesh et al., 2011).

3 Aim and objectives

The primary aim of the current research is to contribute to the existing body of knowledge of the EHR adoption by identifying the primary factors that facilitate and prevent EHR acceptance by physicians in the developing countries such as the Hashemite Kingdom of Jordan. Specifically, the current study is based on the original TAM to evaluate a relevant framework that best describes the factors that significantly influence physicians' behavioural intention toward the use of EHR in Jordan. Jordan is considered as one of the renowned centres in medical tourism. It has gained a wide reputation due to its experienced healthcare managers, specialised physicians and highly equipped hospitals and medical centres (NJMS, 2008). However, the Ministry of Information and Communication Technology in Jordan points out the Jordanian health sector is realising the importance of ICT adoption in its operations and trying to increase the number of patients from outside the kingdom.

In order to sustain its position as a leading country in the region as a medical destination, the government of Jordan is committed to making radical changes in the country's health systems. More importantly, in 2009 the kingdom has launched the first national e-health system which has dubbed 'Hakeem' (Ghazal, 2009). The purpose of this project was to use EHR and establish a unified database to include the medical history of patients around the kingdom. The project took place within a limited number of public hospitals and according to the project plan, the system will expanded to include all public hospitals in Jordan by 2017.

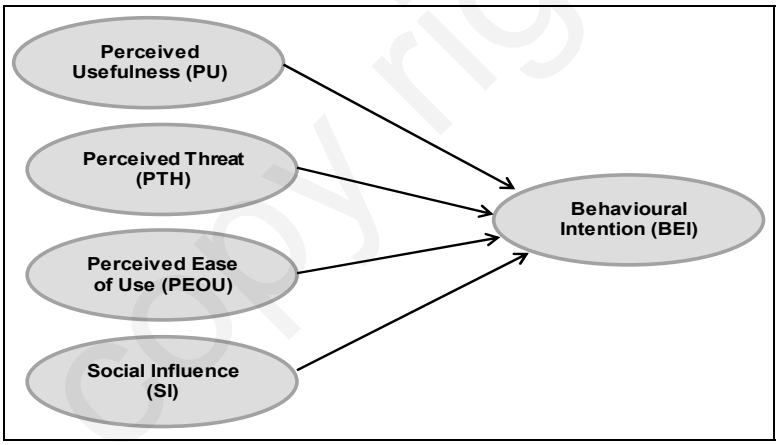
Since the Jordanian public health organisations depend heavily on paper-based HIS, this study examines the vital issue of 'IT usage' that potentially impacts on the adoption of EHRs systems. Taylor and Todd (1995, p.145) state "understanding the determinants of information technology usage should help to ensure effective deployment of IT resources in an organisation. Such usage is a necessary condition for ensuring productivity payoffs from IT investments". In Jordan, few empirical studies on ICT adoption in healthcare institutions exist. To date there is no formal research on the status of HITs adoption in Jordan, particularly EHR adoption. Thus, research studies are needed

to ascertain the readiness of Jordanian healthcare institutions to engage with electronic services. This study aims to address this gap. The health ministry in Jordan reports that many healthcare organisations in the public sector will adopt EHRs in the near future. We posit that our research findings will provide useful information about the factors influencing technology acceptance by physicians that will assist the public health organisations to assess their readiness to be involved in EHR. Moreover, our findings will identify those factors related to the failure of adoption which in turn will avoid potential financial losses. Finally, the findings will be important to all Jordanian health sectors since the outcomes of this study will not be confined to the public health sector, but also can be beneficial to the private sectors as well.

4 Conceptual framework

The proposed model is based on the original TAM developed by Davis (1989). This research study measured physicians' EHR acceptance by their BEI to use the EHR. As the research model in Figure 2 indicates, it retains PU and PEOU as the fundamental determinants of EHR system's acceptance. Furthermore, the model suggests two additional salient beliefs namely: PTH and SI.

Figure 2 The research model



4.1 Behavioural intention (BEI)

Collectively, the intention-behaviour relationship is well-established in the technology acceptance literature (Venkatesh et al., 2003; Davis et al., 1989). Ajzen and Fishbein (1975, p.288) define behavioural intentions as "a measure of the strength of one's intention to perform a specified behaviour". TAM suggests that behavioural intention is the main predictor of system usage. The results of prior research have confirmed a significant correlation between behavioural intention and usage behaviour (Taylor and Todd, 1995; Venkatesh and Morris, 2000). Behavioural intention has an important role in predicting usage behaviour; the strong relationship between behavioural intention and actual usage is clearly demonstrated in TAM, the extended technology acceptance model

(TAM2), theory of planned behaviour (TPB), the unified theory of acceptance and use of technology (UTAUT), theory of reasoned action (TRA) and decomposed theory of planned behaviour (DTPB) models. Regarding the healthcare context, the relationship between behavioural intention and usage has been found to be conclusive when applied to healthcare settings (Schaper and Pervan, 2007).

4.2 Perceived ease of use (PEOU)

PEOU refers to the extent to which users think that they can save or minimise the physical and mental efforts required to perform their job by using a specific technology (Davis et al., 1989). PEOU is theorised as a direct determinant of PU in various models such as combined TAM and TPB (C-TAM-TPB), TAM and TAM2. Harle et al. (2014) point out the more a system is easier to use, the more users will find it useful. Furthermore, Venkatesh and Davis (2000) argue increasing the level of ease of use directly influences behavioural intentions and also leads higher performance and thus the PEOU construct has direct influence on PU. Therefore, several studies support these views as PEOU directly influences behavioural intentions (Lau and Woods, 2009; Chang and Tung, 2008) and indirectly impacts behavioural intention through PU (Lee et al., 2011).

The PEOU construct has proven its importance on decision-making regarding the acceptance of EHRs, where the negative perception of ease of use of EHRs can be a major barrier to EHR adoption (Granlien and Hertzum, 2012). Physicians work within complex, dynamic and busy environments, thus they need an easy tool to use in order to facilitate their job and avoid additional workload. Additionally, PEOU was found to have a positive impact on attitude, physicians' behavioural intention and PU of EHRs (Venkatesh et al., 2011; Phichitchaisopa and Naenna, 2013; Archer and Cocosila, 2011).

4.3 Perceived usefulness (PU)

According to Davis et al. (1989), PU refers to the extent to which users think that they can improve and enhance their job performance by using a specific technology. According to Nysveen et al. (2005), a system that does not help its users to enhance their jobs performance is not likely to be perceived as useful. Individuals are very keen to use a technology when they understand and perceive its usefulness and potential benefits (Yeow et al., 2008). Therefore, technology acceptance literature emphasises PU as the strongest predictor of technology acceptance (Ma and Liu, 2004).

TAM suggests that PU has an important role in technology acceptance and it significantly influences the behavioural intention and actual usage of new systems. Godoe and Johansen (2012) argue that users are willing to adopt a new technology based on their functions, rather than on how easily it performs functions and that users are willing to adopt a difficult system if it offers useful functions. Accordingly, many researchers have theorised PU as a direct determinant of behavioural intention towards use (Venkatesh and Davis, 2000; Venkatesh, 2008).

In terms of HIT adoption, PU refers to the extent that HITs bring about perceived gains and enhancements in job performance (Holden and Karsh, 2010). As mentioned above, compared to other end users in ordinary business settings physicians are different in terms of their acceptance of technology. Physicians are pragmatic, they rely on the usefulness of the technology rather than its ease of use (Schaper and Pervan, 2007; Ward,

2013). Prior research points out that physicians' PU of EHRs directly influences their behavioural intentions to use EHRs usage (Esmaeilzadeh and Sambaivan, 2013; Hamid and Cline, 2013). Thus, confirming that the positive perception of usefulness of EHRs can be major facilitator to EHRs adoption (Granlien and Hertzum, 2012; Lin et al., 2012).

4.4 Perceived threat (PTH)

Kaplan (1987) maintains that the introduction of new technologies into organisations will undoubtedly impact the existing workflow and as such is considered as change introduction. Management usually reacts to the potential rejection of a technology by improving the technology functions, users' training or interface designs (Lin et al., 2012). Such actions can payoff in lessening user resistance but do not remove it. Similarly, most of HIT designs focus on the technology considerations (Bhattacherjee and Hikmet, 2007), such as new functions, enhanced speed, improved system access and response times rather than concentrating on end-users consideration. Change introduction is a personal issue as it has several mental and psychological impacts on individuals. Resistance can be dimensioned by understanding the users' negative perceptions of HIT and also how these perceptions and the antecedents are linked to changes in the outcomes and processes of their workflow. Therefore, in order to understand the different perceptions and reactions of HIT introduction, it is essential to consider the individual factors that generate the resistance or adoption behaviour (Lin et al., 2012). Accordingly, the current research focuses on the instinctive feature of change to capture the determinants of threat perceptions. According to Lin et al. (2012, p.1968), "resistance comes from an individual's perception of change as a threat, such as the work style, habit and content. The unknown nature of change also causes an individual's sense of job insecurity, followed by the fear of losing control of the job and job opportunity".

Although physicians realise the current trend is moving toward EHRs and they understand that the change is certain to occur, they still resist the adoption of EHRs (Lin et al., 2012). According to Mishra et al. (2012), physicians consider themselves the frontline of care delivery as other healthcare staff, such as nurses and pharmacists, follow their instructions. However, the changes following the introduction of EHRs can generate substantial transitions and identity reconstruction. Consequently, such changes can threaten the healthcare staff identities that the physicians founded and created.

Generally, humans fear change and have reservations about its importance (Boonstra and Broekhuis, 2010). Healthcare professionals may perceive different facets of threat when they consider the adoption to EHR systems (Archer and Cocosila, 2011). The introduction of EHRs to the healthcare environment results in a fundamental change for physicians who have their own and long-established work style. If the new system is inconsistent with physicians existing work routines or increases their workload, the introduction of such change may result in negative reactions such as fear and anger (Lin et al., 2012). These emotions act as barriers to adoption or to making changes. Healthcare professionals, particularly physicians, have concerns about whether the use of EHRs will result in additional malpractice threats rather than minimising them (Barr, 2012). Furthermore, the PTHs to the security and privacy of patients' data are considered major issues that limit the wider development of EHRs (Sahama et al., 2013). Physicians also have some concerns about potential loss of control of patients' information due to the fact that data may be shared, assessed and used by others.

Many studies strongly suggest the necessity of considering PTH as a predictor of the behavioural intention to use EHRs (Ford et al., 2009; Mishra et al., 2012). Particularly, Bhattacherjee and Hikmet (2007) propose that physicians' resistance to technology is positively correlated to their threat perception from HIT adoption. Additionally, Yarbrough and Smith (2007) conducted a study to investigate physicians' behavioural intention to use the EHRs. They examined obstacles such as inhibitors to technology acceptance into a modified technology acceptance framework. The results indicated the physicians' intentions to use EHRs were equally impacted by inhibitors (such as threat) and enablers (such as PU). Furthermore, it has been suggested that the physicians' negative perception of HIT adoption is negatively associated to their perceptions of usefulness and behavioural intentions (Bhattacherjee and Hikmet, 2008). Additionally, Walter and Lopez (2008) have pointed out the role of PTH to physicians' autonomy as a main predictor of PU and behavioural intent. Therefore, it is expected that PTH negatively influences the physicians' perception of usefulness and their intention towards the use of EHR systems (Archer and Cocosila, 2011; Lin et al., 2012).

4.5 Social influence (SI)

SIs refer to the social factors and their reflections on technology acceptance. Venkatesh et al. (2003, p.451) define SI as "the degree to which an individual perceives that important others believe he or she should use the new system". SI has a great impact on humans' behaviours and their decisions (Taylor and Todd, 1995). Although several technology acceptance studies have investigated the impact that SI has on the decision to accept technology the results are inconsistent. For example, Ajzen and Fishbein (1975) the founder of TRA, acknowledged the uncertainty of the theoretical status of SI, where it was found to be the least understood factor of TRA. Furthermore, Davis et al. (1989) found the association between SI and other variables is weak. According to Davis et al. (1989, p.999) SI may have no influence on behavioural intention, particularly when the use of a system is voluntary. Nonetheless, they admitted the need for further research to "investigate conditions and mechanisms governing the impact of social influences on usage behaviour". Moreover, Venkatesh and Davis (2000) point out that SI significantly influences intention in mandatory situations, where such an influence had weakened over time. On the other hand, several studies of HIT acceptance found SI to have significant effect on behavioural intention and usefulness (Steininger et al., 2014; Phichitchaisopa and Naenna, 2013).

According to Taylor and Todd (1995), SI is decomposed into two main types of influences that affect a technology adoption – peer influence and superior influence. User peers may oppose the use of a technology because they think it requires significant change in their work processes, whereas superiors encourage the use of the technology because they expect certain advantages for their organisations such as productivity payoffs. Prior research related to the HIT adoption suggests that SI may positively influence the decision-making to adopt such technologies (Wu et al., 2008), or negatively affect the decision-making process (Aggelidis and Chatzoglou, 2009).

Boonstra and Broekhuis (2010) believe that SI within the work environment has a negative influence on physicians' perception of EHRs. Particularly, the SI of management negatively impacts the adoption of EHRs if the management is not committed to the changes. Additionally, Holden (2010) in his qualitative study highlights the impact of SI on physicians' decision to use EHR as the results suggest that the social

factors may encourage or discourage the use of EHR. In light of these divergent views and since this study was conducted in a mandatory setting, it is expected that social factors will have a positive influence on the acceptance of EHRs.

5 Sample and data collection

The population of the current research is physicians who are using EHRs in the Jordanian public health sector. The sample frame (N = 396) of this study is obtained from the Ministry of Health in Jordan in order to gain an updated, accurate and complete list of the physicians who are using EHRs. These physicians were working at three hospitals and three medical centres which had EHRs in place at the time of conducting the study. Particularly, these institutions had the WorldVistA EHR system. The WorldVistA EHRs consists of a set of integrated applications that relate to all aspects of a patient's treatment and appointments, including patient registration, clinical order entry, progress note templates and result reporting. It is mandatory for any person within these institutions involved in treating patients to make use of one or more of these applications.

A probability sampling (convenience sampling technique) was used to select cases (physicians) from the sample frame. Overall, 333 paper-based questionnaires were sent to the physicians. Of the 333 physicians who received the questionnaire, 227 physicians responded. Five of the returned questionnaires were reported as incomplete, thus they were eliminated from the analysis. Consequently, 222 questionnaires were valid for analysis giving a response rate of 66.6%. According to the general sample size guidelines offered by Krejcie and Morgan (1970) based on the population of this study the minimum sample size for generalisation would be 196 cases. Thus, the obtained sample size of this study is sufficient to generalise the findings to the entire population.

Accordingly, data for this study were collected through the use of a paper-based questionnaire distributed to physicians. The questionnaire was used to measure the five constructs in the research model. The items (measures) used were adopted from well-established sources and measured on a four-point Likert scale ranged from strongly agree (1) to strongly disagree (4). With the exception of the behavioural intention construct, all constructs were measured by four items. The items of the PTH construct were adopted from Lin et al. (2012). The items of PEOU and PU were adopted from Morton and Wiedenbeck (2010). The items of SI were adopted from Venkatesh et al. (2003). Finally, the behavioural intention construct was measured by three items adopted from Moores (2012). Additionally, the respondents were asked to provide information about their gender, age, computer experience, number of years in clinical practice and how many patients they see per week.

6 The physicians' profile

The respondents' characteristics are displayed in Table 1. The results show that among the 222 respondents, 66.2% of respondents were males and 33.8% were females. It was found that 39.6% of the respondents were between the ages of 30 and 39 years old and only 1.4% of the respondents reported themselves over 60 years. Furthermore 85.6% of respondents had more than 44 patients per week. In regards of computer experience, 55% of the participants in the survey were identified as intermediate users, 18.5% beginners

and only 7.2% were experts. Finally, 20.3% of the respondents had less than 5 years in the medical practice, 39.2% had 5 to 10 years and 16.7% had more than 15 years.

Table 1 Characteristics of the respondents (N = 222)

	Mean	*Mode*	*Median*	*Std. deviation*	*Frequency*			*Percentage (%)*
Gender	1.34	1	1	0.474	(1)	Male	147	66.2
					(2)	Female	75	33.8
						Total	N = 222	100%
Age	2.58	2	2	0.947	(1)	< 30 years	25	11.3
					(2)	30–39	88	39.6
					(3)	40–49	68	30.6
					(4)	50–59	38	17.1
					(5)	> 60	3	1.4
						Total	N = 222	100%
Medical experience	2.37	2	2	0.988	(1)	< 5 years	45	20
					(2)	5–10	87	39
					(3)	11–15	53	24
					(4)	> 15	37	17
						Total	N = 222	100%
Computer experience	2.06	2	2	0.804	(1)	Beginner	41	18.5
					(2)	Intermediate	122	55
					(3)	Advanced	43	19.4
					(4)	Expert	16	7.1
						Total	N = 222	100%
Work load	1.14	1	1	0.352	(1)	> 44	190	85.6
					(2)	< 44	32	14.4
						Total	N = 222	100%

Note: () = Likert scale

7 Constructs validity and reliability

SPSS22 and SmartPLS statistical software packages were used to assist the analysis of the data gathered. Despite the relative complexity of SmartPLS, exploratory models can be developed where the core goal is predictive rather than confirmatory analysis (Chin et al., 2008). SmartPLS is sufficiently robust to be able to deal with multicollinearity between latent constructs and between observed variables (Lenhner and Haas, 2010). Furthermore, the use of SmartPLS is consistence with studies that aim to explain the variance of the endogenous constructs (Hair et al., 2013).

In order to increase the rigour and quality of the results, the current study evaluated the validity and reliability of the five constructs in the research model. The concept reliability refers to the internal consistency of scale or construct, whereby it describes the level to which a set of items measure the same construct (Tavakol and Dennick, 2011).

Thus, the current research examined the reliability of both the individual items and the constructs. Cronbach's alpha and composite reliability were used to assess the constructs' reliability, whereas the individual item reliability was evaluated by the standard loading of each item to its underlying construct (Hulland, 1999). The minimum acceptable coefficient value of Cronbach's alpha for exploratory studies is 0.6 and the composite reliability should be ≥ 0.7 (Hair et al., 2013). The loading values of each item that relates to a construct theoretically should be at least equal to or higher than the value of 0.707 as the squared loading (R^2) should be equal to or exceed 0.5 (Farrell and Rudd, 2009; Vinzi et al., 2010).

Utilising SmartPLS software the loadings of all items were obtained by building the outer model and thereafter running the PLS algorithm. As Table 2 indicates, the Cronbach's alpha coefficient values for all constructs were acceptable and above 0.7, indicating a high internal consistency. The composite reliability scores were all above the acceptable level of 0.7 indicating that the measurement's errors were relatively small (Hair et al., 2013). Finally, the loadings of all items were above 0.707 and the squared loadings were above 0.5 indicating that all items in the questionnaire were highly correlated with their underlying constructs.

Table 2 The reliability evaluation for scale variables

Construct		*Items*	*Item*	R^2	*M*	*Cronbach*	*CR*
Behavioural intention (BI)	1	I intend to continue using EHRs.	0.93	.87	1.44	0.80	0.95
	2	I intend to continue using EHRs for more of my job responsibilities.	0.92	.85			
	3	I intend to continue using more new features of EHRs.	0.93	0.87			
Perceived ease of use (PEOU)	1	Learning to operate EHRs is easy for me.	0.81	0.66	1.69	0.86	0.90
	2	My interaction with EHRs is clear and understandable.	0.88	0.77			
	3	I find it easy to get the EHRs to do what I want it to do.	0.85	0.72			
	4	Overall, I think that EHRs are easy to use.	0.83	0.68			
Perceived usefulness (PU)	1	Using EHRs in my job enables me to accomplish tasks more quickly.	0.86	0.73	1.51	0.90	0.93
	2	Using EHRs enhances my effectiveness on the job.	0.90	0.81			
	3	Using EHRs improves my job performance and productivity.	0.89	0.79			
	4	Using EHRs increases the quantity of my output for the same amount of effort.	0.87	0.75			

Notes: All items measured on four-point Likert scale:
1 = strongly agree, 2 = agree, 3 = disagree , 4 = strongly disagree,
M = construct mean,
R^2 = squared loading,
CR =composite reliability

Table 2 The reliability evaluation for scale variables (continued)

Construct		*Items*	*Item*	R^2	*M*	*Cronbach*	*CR*
Social influence (SI)	1	People who influence my behaviour think that I should use EHRs.	0.79	0.62	1.81	0.92	0.87
	2	Peers think that I should use EHRs.	0.81	0.66			
	3	Management of my organisation thinks that I should use EHRs.	0.78	0.61			
	4	Generally, the organisation supported the use of EHRs.	0.77	0.59			
Perceived threat (PTH)	1	I fear that I may lose control over the way I work because I am using EHRs.	0.85	0.72	3.18	0.89	0.92
	2	I fear that I may lose my credibility with my patients because I am using EHRs.	0.88	0.77			
	3	I fear that the use of EHRs may result in legal or ethical problems.	0.89	0.79			
	4	I fear that I may lose my personal and professional privacy as a doctor.	0.86	0.73			

Notes: All items measured on four-point Likert scale:
1 = strongly agree, 2 = agree, 3 = disagree , 4 = strongly disagree,
M = construct mean,
R^2 = squared loading,
CR =composite reliability

The validity of an instrument refers to the extent to which the instrument truly measures what it is designed to measure (Bryman and Hardy, 2004). In order to claim that the measures used in the current research questionnaire were valid, the convergent and discriminant validity should be assessed (Hair et al., 2013). Discriminant validity aims to assess the extent to which items (measures) of a construct and items of theoretically different constructs are distinct (Koufteros et al., 2001). Convergent validity assesses whether the items used to measure a construct are converging and clustering to form a single construct; convergent validity evaluates whether the measurement items are related to the constructs (Lu et al., 2007). In this study, convergent validity was examined by the average variance extracted (AVE) (Kwong and Wong, 2013). The AVE is the summary measure of convergence among a set of items as it reflects the average of variation explained among those items (Gefen et al., 2000). An AVE's value of 0.5 or higher indicates a good convergence (Hair et al., 2006). As can be shown in Table 3, all constructs have AVE above the recommended cut-off value 0.5. Therefore, it can be concluded that all items used in the current research questionnaire are converging on their underlying constructs and thus all constructs have convergent validity.

Table 3 Discriminant analysis results

Construct	*BEI*	*PEU*	*PTH*	*PU*	*SI*
BEI	***0.86**				
PEU	0.5837	**0.71**			
	**(0.3407)				
PTH	0.5943	–0.3949	**0.76**		
	(0.3531)	(0.1559)			
PU	0.6188	0.6125	–0.5218	**0.78**	
	(0.3829)	(0.3751)	(0.2722)		
SI	0.5133	0.2003	–0.2551	0.2714	**0.62**
	(0.2634)	(0.0401)	(0.065)	(0.0736)	

Notes: *AVE values in bold,
**Squared correlation

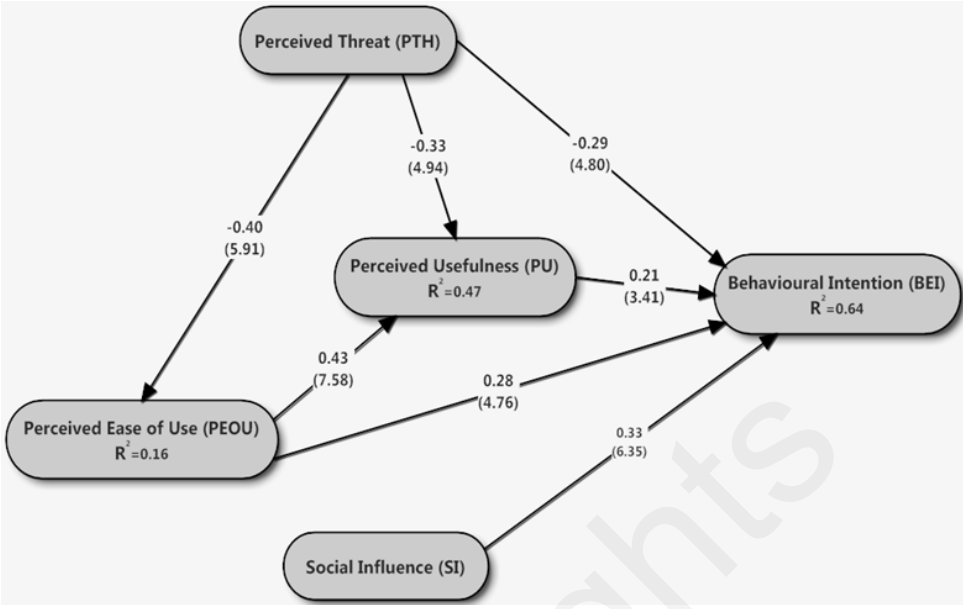
The discriminant validity was evaluated by comparing the AVE for each construct with the construct's squared correlations. Hair et al. (2006, p.778) point out "the variance extracted estimates should be greater than the squared correlation estimate". Table 3 shows that the AVE values (in bold) for each construct in the current research is substantially higher than the squared correlation with all other constructs, thus the constructs in this study demonstrate adequate discriminant validity.

8 Structural model results

After confirming the measurement model, the structural equation model was examined by using the SmartPLS software. The structural model was used to build the inner model to identify the predictive power of the research model and to assess the significance of relationships. Figure 3 summarises the results of the structural model analysis. The four independent variables explain 64% of the variance in the physicians' behavioural intention (BEI) towards the use of EHRs, indicating that the research model offered adequate explanatory power. Furthermore, the results suggest that both PTH and PEOU explain 47% of the variance in PU and also PTH explain 16% of the variance in PEOU.

Additionally, Figure 3 presents the significant relationships among the constructs revealed by the analysis. The results indicate that all the relationships are significant at 1% level ($p < 0.01$). The four independent constructs have a direct effect on BEI. The results suggest that SI, PEOU and PU act as facilitators to use EHRs. Compared to other PEOU and PU, SI is the strongest direct effect on BEI ($\beta = 0.33$). SI is the most significant factor that positively impacts the physicians' behavioural intention to use EHRs. Physicians' perception of ease of use (PEOU) also has positive influence on their intentions ($\beta = 0.28$), indicating that PEOU is associating with positive intentions to use EHRs. Similarly, PU is positively influencing the physicians' intentions ($\beta = 0.21$). On the other hand, physicians' perception of threat is the only inhibitor to use EHRs as it is negatively impacts on BEI ($\beta = –0.29$). The result indicates that PTH among physicians has a negative impact on their behavioural intention to use EHRs.

Figure 3 Path diagram of the research model



Notes: R^2 = the determination coefficient,
*(T-statistics)

8.1 Mediation effect

Furthermore, in order to prove that the indirect effects of the independent variables on BEI through the mediator constructs are significant, the Sobel (1982) test was conducted.

Table 4 The mediation effect

Mediator	*Path*	*T-statistic*	*P-value*
PEOU	PTH → PEOU → PU	–4.64	$P < 0.01$
	PTH → PEOU → BEI	–3.37	$P < 0.01$
PU	PEOU → PU → BEI	3.01	$P < 0.01$
	PTH → PU → BEI	–2.76	$P < 0.01$

As shown in Table 4, the results of the Sobel test suggest that all indirect effects are significant. PTH has an indirect and negative impact on BEI through PU and PEOU. Additionally, PTH has an indirect negative effect on PU through PEOU. PEOU also indirectly influences the BEI through PU. Overall, all direct, indirect and total effects are significant at 1% level (see Table 5).

Table 5 Effects of independants on dependant variable in the research model

Independent	*Dependent*	*Standardised direct effect*	*P value*	*Standardised indirect effect*	*P value*	*Standardised total effect*	*P value*
Perceived threat (PTH)	BEI	–0.29	P < 0.01	–0.22	P < 0.01	–0.51	P < 0.01
	PU	–0.33	P < 0.01	–0.19	P < 0.01	–0.52	P < 0.01
	PEOU	–0.4	P < 0.01	N.A	N.A	–0.4	P < 0.01
Perceived usefulness	BEI	0.21	P < 0.01	N.A	N.A	0.21	P < 0.01
Perceived ease of use (PEOU)	BEI	0.28	P < 0.01	0.1	P < 0.01	0.38	P < 0.01
	PU	0.43	P < 0.01	N.A	N.A	0.43	P < 0.01
Social influence (SI)	BEI	0.33	P < 0.01	N.A	N.A	0.33	P < 0.01

8.2 Moderating effect

Moderation effects refer to the situation when a moderator variable change or influence the strengths or the direction of the direct effect (relationship) between the independent and dependent variables (Vinzi et al., 2010). The moderating effects are also called interaction effects where the causes of such effects are called moderators. Accordingly, the results in Table 6 confirm the moderating effect of PTH on the different relationships in the research model. The increase of threat perception among physicians leads to a negative impact on their behavioural intention by lessening their perceptions of usefulness and ease of use. Importantly, the results imply that the increase of PTH results in decreasing the impact of PEOU and PU to BEI from 0.27 and 0.14 to –0.02 and –0.1 respectively. Additionally, PTH is negatively influencing the physicians' PU by lessening their perception of ease of use as the moderating effect of PTH leads to a decrease in the impact of PEOU on PU from 0.47 to 0.32.

Table 6 Moderation effect

Dependent variable	*R^2 without moderator*	*R^2 with moderator*	*Predictor * moderator*	*Path coefficient*	*P-value*	*T-statistics*
PU	0.47	0.49	(PEOU*PTH) → PU	–0.15	$P < 0.05$	2.04
BEI	0.64	0.67	(PU*PTH) → BEI	–0.24	$P < 0.01$	4.1
	0.64	0.68	(PEOU*PTH) → BEI	–0.27	$P < 0.01$	6.2

9 Discussion

The aim of this study was to identify the main factors influencing the physicians' behavioural intention to use EHRs. The results determine that physicians' decision to adopt EHRs depends on the following factors: SI, PTH, PEOU and PU. Consistent with the research of Phichitchaisopa and Naenna (2013) and Steininger et al. (2014), the results of this study demonstrate that SI has a significant positive impact on the physicians' behavioural intention, specifically the SI of the management and peers. This may refer to the compulsory usage and the considerable commitments of top management to support their use of EHRs.

Furthermore, this study also explains that PU and PEOU are major factors in the physicians' decision to use EHRs. In a healthcare environment, the physicians' primary goal is to provide patients with proper treatment and care. The aim of using HIT (e.g., EHRs) is to serve this ultimate goal by supporting physicians and other medical staff in the different medical processes. Therefore, the physicians' PEOU and PU are important beliefsthat directly impact the physicians' job. In agreement with Esmaeilzadeh and Sambasivan (2013), Hamid and Cline (2013) and Gagnon et al. (2013), the results demonstrate the significant positive role of the instrumental benefits in influencing the behavioural intention to use EHRs in a developing country like Jordan. If physicians perceive that the use of EHRs can improve their job performance they become more willing to use the systems in their work environment.

Similarly, the results suggest that the physicians' perception of ease of use significantly influences their decision to use EHRs. In this study, the physicians' perception positively influences theirusefulness perception (β =0.43) and behavioural

intention to use EHRs (β = 0.28). This concurs with the research into the adoption of EHRs, particularly the work of Archer and Cocosila (2011), Phichitchaisopa and Naenna (2013) and Hung et al. (2013). If physicians find EHRs easy to use they become more motivated to utilising the system in their daily work activities. Additionally, the physicians' perceptions of ease of use amplify their perceptions of usefulness and in turn their intention towards using the system. It has been argued that physicians focus on the usefulness of the technology rather than the ease of using it (Chismar and Wiley-Patton, 2003). However, the results of this study contradict such an assumption. This may be due to the early stage of the EHRs adoption as the physicians are more concerned about the system's ease of use. Thus, this study signifies the importance of useful and easy features to enhance the physicians' motivation to use EHRs.

In line with prior research the physicians' PTH was a barrier to EHRs (Walter and Lopez, 2008). The results indicate that the extent to which physicians are threatened by EHRs affects their intention to use the system. The introduction of EHRs to the medical practices results in a radical change for physicians who have their own long-established work style particularly in terms of control over work processes and the relationship with their patients. If physicians perceive the guidelines and instructions of EHRs are against their independent practice and affect the physician-patient relationship, they feel threatened by EHRs and thus they become less likely to use the system.

10 Conclusions

Healthcare professionals' acceptance to use EHRs is considered as a key challenge in the healthcare industry to gain strategic values of the new technology. In this study, the use of TAM notably proved its capabilities in predicting the physicians' behavioural intention to use EHRs in Jordan. The research model suggests that the physicians' acceptance of EHRs can be increased if efforts to improve the EHRs are directed by how the EHRs system is perceived by the physicians. The current study proposed a comprehensive model to explain physicians' acceptance and resistance. The relationships specified in the research model of this study were all significant with the direct and indirect effects of PU, PEOU, PTH and SI explaining 64% of the variance in the physicians' behavioural intention (BEI) towards the use of EHRs. Beside the technological considerations, physicians' concerns were also addressed. The results of this study stress that the technological characteristics of EHRs acted as significant facilitators to use EHRs.

10.1 Theoretical and practical contributions

The main theoretical contribution of this study is that it extends the TAM model by adding PTH as a salient belief that explains physicians' behavioural intention toward EHRs. Previous research of HIT adoption has focused on the technological and organisational considerations and overlooked individual considerations such as the perceptions of threat. More specifically, EHRs adoption research has been focused on the organisational changes associated with the use of EHRs, such as an organisation's policies and strategies regarding resistance to change. Additionally, the literature of EHRs acceptance paid more attention to users' resistance by looking at the barriers of EHRs usage, such as whether the EHR is beneficial or problematic. Accordingly, we believe that the over reliance on PEOU and PU as the main salient beliefs to predict the

physicians' adoption of the different HITs, particularly EHRs, created a gap between the current understanding of EHRs acceptance and potential adoption strategies. Thus, we put forward an extended EHRs acceptance model aimed at generating a better understanding of EHRs adoption by physicians that serves to address the threat involved.

Our findings also make several practical contributions. To improve the overall acceptance of EHRs by physicians in Jordan, this study suggests several actions. Management and developers should consider the physician's perception of usefulness and ease of use during the design and the implementation of EHRs in order to enhance their acceptance. Additionally, top management and EHRs' developers should pay special attention to the potential inhibitors of usage caused by PTH. PTH not only influences the physicians' behavioural intention, but it also negatively influences their ease of use and usefulness perceptions. Understanding the causes of PTH allows mangers and developers to specify the real problems and physicians' reactions to EHRs. The measurement scale developed in this research to measure physicians' PTH can be an effective tool to address and assess the physicians' behaviours and potential causes of resistance. Consequently, the barriers to physicians' acceptance can be determined earlier before the rejection of EHRs.

10.2 Research limitations

The current study has several limitations. The first limitation is the selection of constructs, which was based on previous research. There are many constructs that may be act as inhibitors, moderators, mediators and enablers of EHRs that were not included in this research and thus such factors can be subjected for future research. Moreover, there are additional antecedents of behavioural intention, PEOU, PU and PTH that are worthy of further investigation. Although the sample of this study was homogeneous from the medical practice point of view, the study did not include the other medical staff such as nurses, administration and laboratory staff. The current study did not differentiate between the physicians' specialties and the level of EHRs experience. Particularly, EHRs experience can be measured by complexity of tasks performed with the system and the frequency of use. Physicians in some specialties might use only the basic functions of the EHRs, such as tracking the medical records, which results in less impact on work productivity and quality. On the contrary, physicians with different specialties might use more complex functionalities of EHRs, suitable to support their tasks, but such complex functionalities may results in several types of user problems.

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