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Healthcare Information Technology Adoption and Protection Motivation: A Study of Computerized Physician Order Entry Systems

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ABSTRACT

In this study, considering medical errors causing significant patient safety risk as the major threat perceived by health care providers, we adopt the protection motivation theory (PMT) from health psychology and investigate factors affecting the decision of health care providers to adopt CPOE systems. This research examines the effect of two major PMT variables on the CPOE adoption such as threat appraisal variables (i.e. perceived severity and vulnerability of threat, rewards) and cognitive appraisal variables (i.e. response efficacy, self-efficacy, and response cost). In addition, this study extends the original PMT model by incorporating the internal organizational and environmental factors associated with CPOE systems adoption and examine their effects on its actual adoption. They are organizational size, IT resources, top management support, industry and government regulations, and competitive pressures. A semistructured interview with senior executives at five regional healthcare providers was conducted and a national questionnaire-based field survey with senior healthcare executives will be followed for this research. The potential theoretical and practical implications are discussed.

Keywords

Healthcare Information Systems, Computerized Physician Order Entry Systems, Protection Motivation Theory, IT Adoption

INTRODUCTION

The use of information technology (IT) intended to improve service quality and patient safety of healthcare providers recently has received a great deal of attention in the medical field. A computerized physician order entry (CPOE) system is a clinical IT application designed specifically for use by physicians to write patient orders electronically rather than on paper (Metzger and Turisco 2001). The system is intended to increase patient safety by reducing error in the order process which can be measured as a reduction in the number of medical errors or as a reduction in the number of adverse events. However, only 9.6 percent of U.S. hospitals (and probably even fewer European hospitals) have complete access to a CPOE system (Durieux 2005). It is of great interest that there is such a large gap between healthcare providers that believe CPOE systems is effective in improving safety and those that have actually chosen to begin using it. There has been no rigorous research conducted to investigate the facilitators and inhibitors affecting healthcare providers' decision to adopt CPOE systems.

In this study, considering medical errors causing significant patient safety risk as the major threat (danger or concern) perceived by health care providers, we adopt the protection motivation theory (PMT) (Rogers 1975; Rogers 1983) from health psychology and investigate factors affecting the decision of health care providers to adopt CPOE systems. This research examines the effect of two major PMT variables on the CPOE adoption such as threat appraisal variables (i.e. perceived severity and vulnerability of threat, rewards) and cognitive appraisal variables (i.e. response efficacy, self-efficacy, and response cost).

Instead of adopting the original PMT, this study further extends it in two aspects. First, by incorporating situation-specific factors that can capture a significant proportion of the variances in protective motivation or actions. In particular, we examine whether the internal organizational and environmental factors associated with CPOE systems adoption significantly contribute to its actual adoption including organizational size, IT resources, top management support, industry and government regulations, and competitive pressures. Second, we test the PMT for addressing organizational protective actions. The original PMT was applied to explain or predict individual's protective behaviors, but researchers including Rogers requested to extend its theoretical boundary to predict organizational decision makings.

PROTECTION MOTIVATION THEORY

Protection Motivation Theory (Rogers 1975; Rogers 1983) has been a viable theoretical framework in health and social psychology, providing an important social cognitive account of diverse protective behavior. The basic postulate of this theory is that protection motivation arises from the cognitive appraisal of a threatening event as serious and likely to occur, together with the belief that a recommended coping response can effectively prevent the event from its occurrence (Milne et al. 2000). The former, threat appraisal, is associated with the maladaptive response which is affected by perceptions regarding to the severity of and vulnerability to the expected threat. The likelihood of an adaptive response is increased when perceptions of severity and vulnerability are high, while it is reduced when any rewards associated with continuing the maladaptive response are expected (McMath and Prentice-Dunn 2005). The rewards consist of intrinsic rewards (e.g., physical and psychological pleasure) and extrinsic rewards (e.g., social approval). For example, if a person perceives that smoking is effective to reduce a mental stress (intrinsic rewards) or is acceptable by his/her referents (extrinsic rewards), he/she does not have strong motivation not to continue smoking (Pechmann et al. 2003). The latter, coping appraisal, is associated with proposed adaptive recommendations. The coping appraisal process evaluates one's ability to cope with and avert the threatening behavior. It is related to the individual's assessment of the effectiveness of the proposed adaptive behavior to avert the threat (i.e., response efficacy) and the perceived ability to conduct the advocated behavior (i.e., self-efficacy). The likelihood of enacting the adaptive behavior is increased when high levels of the efficacy variables are predicted. Meanwhile, the likelihood is decreased when high response costs associated with selecting the adaptive behavior are perceived. Examples of perceived costs are inconvenience, expense, unpleasantness, difficulty, complexity, side effects, disruption of daily life, and overcoming habit strength. In sum, the combination of the threat appraisal and coping appraisal processes activates a person's protective motivation, resulting in the applicable adaptive responses (Flynn et al. 1995).

While considering constructs of our model, we extend the level of analysis from the individual level of the original PMT model to organizational level. First, system theorists (e.g., Miller, 1978) have noted that all social entities (individual, group, or organization) have similar properties and predilections. In particular, Staw (1991) explained that organizational behavior can be explained with psychological theories since many "macro actions" on the organizational level can be interpreted as "micro behavior" on the individual level. In addition, there have been studies of applying same theories at both individual level and organization level including innovation diffusion theory, change theory, and self-efficacy theory. Further, in management and IS literature, there have been supports and cases of using top executives as informants for analysis at the organizational level (e.g. Chau and Tam, 1997).

RESEARCH HYPOTHESES

Assuming that the decision making of healthcare providers to adopt CPOE systems is strongly influenced by threat appraisal and coping appraisal, this study proposes a theoretical model by adopting protection motivation theory and develops hypotheses. The major assumptions of our theoretical model are that (1) the intention to adoption CPOE systems is a positive linear function of four factors: (a) the severity of threat, (b) the vulnerability of the threat, (c) the response efficacy, and (d) the self-efficacy; and (2) the intention is a negative linear function of two factors: (a) the rewards associated with the maladaptive response and (b) the response costs. Detailed discussions of the constructs and hypotheses associated with this model are presented below.

Intention to Adopt CPOE systems

Severity of the Threat

Severity refers to "the degree of physical harm, psychological harm, social threats, economic harm, dangers to others rather than oneself, and even threats to other species" (Rogers and Prentice-Dunn 1997, p. 115). It is expected that the more seriously a person perceives the magnitude of the consequences resulting from continuing maladaptive actions, the more he/she adopts recommended adaptive actions. In this context, the sources of threat perceived by health care providers regarding CPOE systems adoption include considerable numbers of medical errors, administrative errors (e.g., wrong dosage), low-quality patient services, potential lawsuit from patients affected by medical errors, resulted in damage of organizational image, low-level customer satisfaction, and negative evaluation from the Joint Commission about accreditation. We predict that healthcare providers will have strong intention to adopt a CPOE system when they perceive high severity of threat described above. Thus we hypothesize that:

H1: Perceived severity of the risks positively influences healthcare providers' intention to adopt CPOE systems¹.

¹ Protection motivation theory posits that protection motivation is elicited as a function of the threat and coping appraisals processes and the motivation is best measured by behavioral intentions (Rogers 1983).

Vulnerability of the Threat

Vulnerability refers to “the conditional probability that the threatening event will occur provided that no adaptive behavior is performed or there is no modification of an existing behavioral disposition” (Rogers and Prentice-Dunn 1997, p.115). The perceptions of vulnerability are associated with an individual’s assessment of his/her probability of being exposed to the unfavorable threat (Woon et al. 2005). Thereby, the likelihood of adopt advocated adaptive behavior is increased when a person perceives high vulnerability (McMath and Prentice-Dunn 2005). Along the same vein, this study posits that healthcare providers seriously consider the adoption of CPOE systems when they perceive that their physicians and medical staffs high likely commit medical and administrative errors which will result in poor patient services, damaged images, poor outside evaluation, and potential lawsuits. Therefore, we hypothesize that:

H2: Perceived vulnerability positively influences healthcare providers’ intention to adopt CPOE systems.

Rewards from Maladaptive Responses

The reward of not adopting the recommended coping responses is the variable newly added into the revised protection motivation theory (Rogers 1983) as part of the threat-appraisal process. The higher the rewards of not adopting the recommended action, the less likely the individuals are to adopt it (Milne et al. 2000). Rewards consist of intrinsic and extrinsic rewards. Intrinsic reward is associated with physical and psychological pleasure (‘pleasure, relaxing, and helpful’) and extrinsic reward is associated with peer approval and support. This study focuses on extrinsic rewards², particularly about the approval (i.e., silence) and support of referents (i.e., physicians, nurses, pharmacists, patients, the Joint Commission, and other healthcare organizations) to continue manual order practices. We expect that healthcare providers are less likely motivated to adopt CPOE systems if they find the approval and support from referents to continue current manual order practices. Therefore, we hypothesize that:

H3: Rewards of non-adopting CPOE systems negatively influences healthcare providers’ intention to adopt CPOE systems.

Response Efficacy

Response efficacy refers to the belief that the adaptive response will work and taking the recommended protective action is effective to avert a undesirable threat (Rogers and Prentice-Dunn 1997). Given the information of the counteractive measure for coping with the threats, people assess of the effectiveness of the advocated adaptive behavior. The higher the individual perceives a response efficacy, the greater likelihood of enacting the adaptive behavior is predicted. CPOE systems have been reported to significantly reduce medical errors by providing physicians with up-to-date patient medical records and with warnings and recommendations based on newest medical research findings. Therefore, we predict that healthcare providers perceiving more response efficacy, believing CPOE systems is an effective solution to resolve their concerns associated with medical errors and patient safety, will more inclined to adopt it.

H4: Response efficacy positively influences healthcare providers’ intention to adopt CPOE systems.

Self-Efficacy

Self-efficacy referring to the belief that one is or is not capable of performing a coping behavior (Rogers and Prentice-Dunn 1997) has been found to have a robust effect on intentions of protective actions (Milne et al. 2000). If people have high confidence in their ability to conduct a recommended action, they feel the action is not a difficult thing to do, and thus they are more likely to adopt the action (Bandura 1977; Schwarzer 1992). In this study, we posit when healthcare providers perceive that the physicians, pharmacists, nurses, and other medical staffs can easily learn and use CPOE systems and that the IT group and vendors are easily accessible to get technical supports for CPOE systems, they will have stronger intention to adopt CPOE systems. Therefore, we hypothesize that:

H5: Self-efficacy positively influences healthcare providers’ intention to adopt CPOE systems.

Response Cost

Response cost refers to any costs (e.g., monetary, time, effort, inconvenience, unpleasantness, difficulty, complexity, side effects) associated with taking the adaptive coping response (Rogers 1983; Rogers and Prentice-Dunn 1997). Individuals will hesitate to adopt the recommended response if they have to put a considerable amount of time, effort, and money, feel awkward to conduct it, or encounter resistance from important others to perform it (Milne et al. 2000). CPOE systems adoption may lead to various costs such as administrative costs such as vendor selection, customization, training, changing business process (e.g. redesigning impatient care processes), considerable amount of initial investment, operational costs, and

² We did not consider intrinsic reward since it was not overly identified during our literature review and interviews with senior healthcare executives about CPOE systems adoption.

potential resistance from medical staffs. The more healthcare providers perceive response cost, the less likely they will adopt CPOE systems. Therefore we hypothesize that:

H6: Response cost of adopting CPOE systems negatively influences healthcare providers' intention to adopt CPOE systems.

Adoption of CPOE systems

The protection motivation theory has been applied and empirically validated its usefulness in a variety of behavioral context. Researchers have supported elaboration of a theoretical model by identifying important proximal determinants (Ajzen 1991; Taylor and Todd 1995). For example, Ajzen (1991) indicated that “the theory is, in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behavior after the theory’s current variables have been taken into account” (p. 199). In particular, the value of utilizing situation-specific control variables has been widely recognized by researchers, stating that “by focusing on situation specific belief, the model becomes more managerially relevant, pointing to specific factors that may influence the behavior” (Taylor and Todd 1995, p.151). Therefore, in addition to adopting the original protection motivation theory, this study extends its theoretical boundary by incorporating several situation-specific variables such as organizational size, IT resources, top management support, industry and government regulations, and competitive pressures and examining their influences on actual adoption. These factors have been found to significantly contribute to addressing organizational IT adoption (Chau and Tam 1997). The relationships between self-efficacy, response cost, and actual adoption also are newly investigated.

Organizational Size

There has been research which investigates the impact of organizational size on technology adoption. In the context of healthcare providers and hospitals, researchers (Kimberly and Evanisko 1981) have found that hospital size (measured in beds, total assets, total employees, and full-time equivalent employees) is positively related to adoption of technological innovations. Wang et al. (2005) found that larger hospitals (with a broader range of services and larger bed size) adopted IT systems more frequently than their counterparts. Burke et al. (2002) also suggested that larger hospitals might have more slacks and resources for IT adoption. In the same vein, we expect that the larger a healthcare provider is, the more likely it can afford and support CPOE systems, resulting in adopting CPOE systems.

H7: Healthcare providers with large organizational size are more likely to adopt CPOE systems.

IT Resources³

One of the common purposes of adopting a new technology is to gain a competitive advantage. There is a body of knowledge in the IS literature that attempts to explain how IT helps gain a competitive advantage using the resource-based view of the firm (Barney 1991). According to this view, competing firms vary in the resources they possess, and heterogeneity and immobility of those resources are the sources of competitive advantages. Studies have found positive effects of the availability of resources on IT adoption (Iacovou et al. 1995; Venkatesh 2000). We predict that healthcare providers with more IT resources such as IT budgets, skilled IT professionals, and up-to-date computing environment are more likely to adopt the system.

H8: Healthcare providers with sufficient IT resources are more likely to adopt CPOE systems.

Top Management Support

The final decision to adopt a new technology is typically made by top management no matter how much resources an organization possesses. There are a considerable number of studies that underscore the role of top management support as one of the deciding factors for the success of any IT endeavor (Eder and Igbaria 2001; Rai and Bajwa 1997). In the healthcare environment, for example, Poon et al. (2004) suggested that strong leadership is critical to CPOE adoption. Sengstack and Gugerty (2004) stressed not only the initial but also continuous administrative support at the executive level is a necessary prerequisite for CPOE adoption. Given that all the important decisions of healthcare providers are made by their top managers, the similar crucial influence of top management support on the CPOE systems adoption are expected. Therefore, we hypothesize that:

H9: Healthcare providers with strong top management support are more likely to adopt CPOE systems.

³ In this study, we separated the construct “IT resources” from “organizational size”, despite the expected correlation between them. During our interviews with healthcare executives we found examples of large organizations with a small amount of IT resources and relatively small organizations with a large amount of IT resources. We also identified that previous studies have distinctively considered IT resources as a unique construct in IT adoption context. Through empirical investigation, we can demonstrate the relationship between organizational size and IT resources, and their effect on adopting CPOE systems.

External Regulation (Endorsement)

Regulatory compliance has dramatic impact on the adoption and design of information systems (e.g., Sarbanes-Oxley Act (SOX), Health Insurance Portability and Accountability Act (HIPAA) of 1996). For healthcare technology, several states (e.g., California, New York, and Florida) in the United States enforced the regulations to mandate hospitals to adopt technology for reducing medical errors and improving patient safety systems (Cutler et al. 2005; Doolan and Bates 2002). In specific to CPOE systems, there has also been debate on whether national regulatory mandate of CPOE systems should be applied or not (Overhage et al. 2002). In industry, advocator and supporter groups for health care safety, quality, and customer value such as Leapfrog Group, publish reports recommending the adoption of healthcare systems such as CPOE systems. Given the regulation presents, requires, or recommends the adoption of healthcare technologies, healthcare providers perceived pressure regarding to adopting these technologies. For example, Prince (2002) also suggested that market force, including pressure from IOM and members of the Leapfrog Group, Coalition for Affordable Quality Healthcare, MedUnite, and MedBiquitous Consortium, will strongly encourage hospitals' investment in IT such as CPOE systems and electronic medical records (EMR). Therefore, we predict that the presence of the industry (or government) regulation will influence the adoption of CPOE systems.

H10: Healthcare providers subject to industry regulations or government mandates are more likely to adopt CPOE systems.

Competitive Pressure

It is reasonable to assume that healthcare providers would like to adopt technology as early as they can in order to gain competitive advantage or stay competitive. Forman (2005) found that external industry and regional pressure have a positive and statistically effect on Internet applications adoption. Burke et al. (2002) found that a positive association between competition and hospitals' IT adoption. They suggested that the adoption of IT may provide incentives for competitive advantage for hospitals in highly competitive market. Kimberly and Evanisko (1981) also found that hospitals with high adoption of technological innovations are the ones that faced competition. In practice, a high-level executive of a large regional medical center indicated that "we were behind (concerning competition) on technology so that we contracted a big bulk of healthcare IT solutions including CPOE⁴." Therefore, we predict that:

H11: Healthcare providers that intend to adopt CPOE systems and with strong competitive pressure are more likely to actually adopt CPOE systems.

Perceived Behavioral Control

The significant direct effect of perceived behavioral control, the ease or difficulty of performing the behavior, on actual behavior or behavioral change, has been well acknowledged by previous studies (Ajzen 1991; Armitage and Conner 1999). To the extent that perceived behavioral control is present, it contributes to the prediction of the behavior in question. Perceived behavioral control is determined by the individual's beliefs about the presence of factors that may facilitate or impede performance of the behavior. Specifically, it has been found that the perceived cost related to the behavior (response cost) as a strong inhibitor of actual behavior, and the belief of one's ability to complete the behavior successfully (self-efficacy) as a strong facilitator of actual behavior (Bandura 1977). Along the same line, we posit that healthcare providers may hesitate to adopt the CPOE systems when they found significant costs associated with the adoption, including administrative costs, large initial investment, operational costs, and potential resistance from medical staffs. Therefore, we hypothesize that:

H12: Response Cost of adopting CPOE systems negatively influences the actual CPOE systems adoption.

Meanwhile, healthcare providers are more inclined to adopt IT systems when they are confident that their medical staffs have enough skills to learn and use the systems and their IS group can provide satisfactory technical assistance. As with previous research findings of a significant direct effect of self-efficacy on diverse behaviors, such as IS adoption (Venkatesh 2000), we hypothesize that:

H13: Self-efficacy positively influences the actual CPOE systems adoption.

Adoption Intention

Just as previous studies have determined that adoption intention predicts actual adoption (Sheppard et al. 1988), this study predicts that the intention to adopt CPOE system positively influences actual adoption. Therefore, we hypothesize that:

H14: Healthcare providers' adoption intention of CPOE systems is positively related to their actual adoption.

⁴ The citation is created based on an interview with a senior executive of a large regional medical center in the Midwestern area.

In summary, Figure 1 shows the proposed CPOE systems adoption model.

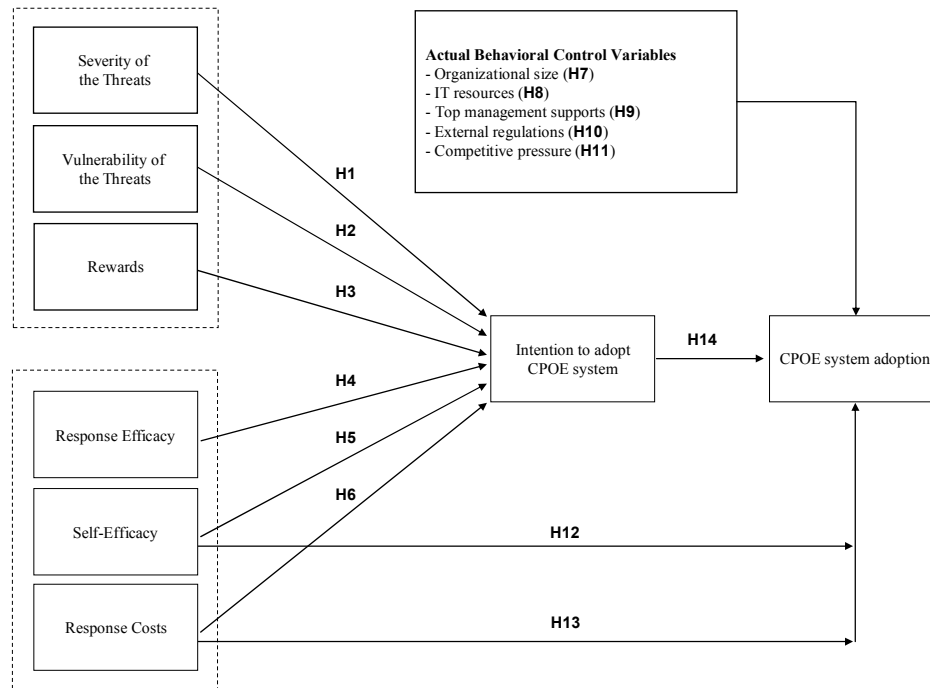


Figure 1. CPOE systems Adoption Model

RESEARCH METHODOLOGY

This study employs mixed methodology to investigate the relationship between antecedents of the CPOE system adoption of healthcare providers and their implementation speed. The mixed methodology has been known to significantly enhance the internal validity of research. For example, Kaplan and Duchon [14] argued that “collecting different kinds of data by different methods from different sources provides a wider range of coverage that may result in a fuller picture of the unit under study . . . Moreover, using multiple methods increases the robustness of results because findings can be strengthened through triangulation the cross-validation achieved when different kinds and sources of data converge and are found congruent.” Both interviews and a questionnaire survey were selected for this study.

We first conducted a semistructured interview with ten senior executives at five regional healthcare providers in the Midwest area. Three were in the process of implementing CPOE while their adoption stages were different; and two others were not in the process but intend to adopt CPOE. The interviews lasted from 60 minutes to 90 minutes. All of the interviews were tape-recorded and transcribed. Brief summary of interview data is shown in Table 1.

Although more thorough analysis will be followed, the initial results of interview data analysis showed that significant influences of most of the factors we hypothesize to affect healthcare providers’ CPOE adoption were confirmed.

To validate these findings, we will gather quantitative data by conducting a national questionnaire survey with 300 members of the Healthcare Information and Management Systems Society (HIMSS). HIMSS is the healthcare industry’s membership organization exclusively focused on providing leadership for the optimal use of healthcare IT and management systems for the betterment of healthcare. There are currently 47 local chapters across the nation and thousands of CIOs, CEOs, and CNOs as members. Subjects will be recruited through regional and national HIMSS meetings. Both online and paper-based questionnaires will be developed for providing convenience for participants to response. Their participation will be compensated with small gifts.

Instrument items of the constructs in our model were developed by following a scientific instrument development procedure (Straub 1989). The items shown in the Table 2 were developed based on Rogers’ conceptualization and on instruments from follow-up studies (Woon et al. 2005) and on the findings of direct interviews. A pre-test and a pilot test will be carried out to develop and validate the instrument items. Data will be analyzed using partial least squares (PLS).

Criteria	Summary
Protection Motivation	<p>Main reasons for adopting CPOE include:</p> <ul style="list-style-type: none"> • Concerned about and improve patient safety (Perceived Threats) • CPOE adoption can help reduce medical error, provide better medical outcome and service quality, and increase standardization of care (and system) to increase efficiency (of operation and medical care) (Response Efficacy) • CPOE adoption does help competition and image since customers (patients) are more cost-sensitive (Response Efficacy). • Having “champions” on the users’ side is important. All hospitals will have CMIO, CMO, and/or CNO to promote and advocate CPOE acceptance among users (Self-Efficacy) • Internal cost (soft money) such as physician time is a large investment other than the system cost. (Response Cost) • An existing IT infrastructure and foundation should be in place first. Other relevant medical IT systems (e.g., EMR, barcode system) that are already in place will be very helpful as well (Response Cost). • Adequate equipment and hardware (e.g., wireless devices, mobile stations) need to be in place in order for users to take advantage of CPOE (Response Cost).
Organizational Factors	<ul style="list-style-type: none"> • Strong and continuous top management support is crucial. It is believed that CPOE adoption should be an organizational initiative not just a technological initiative (Top Management Support). • CPOE adoption does help competition and image since customers (patients) are more cost-sensitive. Customer-driven concept also leads hospitals to focusing on outcome and data driven paradigm. (Competition) • CPOE and other IT systems are a result of internal initiative in most cases. Only late adopters of these systems are mainly influenced by regulation or competition (External Regulation).
Others	<ul style="list-style-type: none"> • There should be a gradual and incremental implementation of CPOE. • A “single vendor” solution is adopted by most hospitals on CPOE systems and other medical systems to avoid potential integration issues. • Involvement of users at the selection and design phase of CPOE adoption is helpful. One hospital’s CPOE system is a users’ pick and other hospitals get physicians’ inputs at design time. • User acceptance (not resistance) is very important. Mechanism and incentive such as partnership with physicians (constant communication), flexible (multiple formats) training, migrating IT people in different functional areas can help. • Control of the work. <ul style="list-style-type: none"> ○ Adopting CPOE will definitely change physicians’ workflow and work processes. Therefore, stick (power) and carrot (incentive) need to be used to help their acceptance. • Justification of spending. <ul style="list-style-type: none"> ○ ROI or making a business case might not be the sole justification. There are many objectives of CPOE adoption such as patient safety improvement, medical error reduction, service quality enhancement, efficiency of operation increase ○ However, outcome and performance measurement force accountability on physicians and CIO alike while adopting CPOE systems.
Table 1. Interview Summary	

Perceived Vulnerability	<ul style="list-style-type: none"> Physicians and medical staffs in my hospital could be subjected to enter medication or other orders incorrectly Physicians and medical staffs in my hospital could be vulnerable to make errors in medication or other orders. 	Cox et al. (2004)
Perceived Severity	<ul style="list-style-type: none"> Grouping specific types of orders together with other orders by mistake can cause a serious problem for our patients Ordering medication without considering new information regarding patient characteristics or status can be in significant danger for our patients. Ordering medications with wrong dosage can cause a serious problem for our patients 	Milne et al. (2002) Woon et al. (2005)
Response Efficacy	<ul style="list-style-type: none"> Adopting the CPOE system on my hospital will prevent physicians and medical staffs from ordering wrong medication. Implementing the CPOE system on my hospital is an effective way of reducing order entry errors Enabling the CPOE system on my hospital will prevent physicians and medical staffs from ordering medications without having updated customer status information Adopting the CPOE system on my hospital will quickly reduce the error rates related to medication order entry 	Woon et al. (2005)
Self-efficacy	<ul style="list-style-type: none"> It would be easy for physicians and medical staffs in my hospital to use the CPOE system by themselves. Physicians and medical staffs in my hospital could use even though there was no one around to tell them what to do as they go. Physicians and medical staffs in my hospital could complete their medication orders using the CPOE if someone else had helped them get started. 	Compeau and Higgins (1995)
Response Cost	<ul style="list-style-type: none"> It will take significant amount of time for physicians and medical staffs in my hospital to be familiar with the CPOE system. There are too many overheads associated with adopting the CPOE for physicians and medical staffs in my hospital. Learning how to use the CPOE system would require considerable effort for physicians and medical staffs in my hospital. 	Tanner et al., (1991)
Rewards	<ul style="list-style-type: none"> Most people, advocators or supporters, or healthcare community whose opinions my hospital value do not adopt the CPOE system. Most people, advocators or supporters, or healthcare community whose opinions are important to my hospital do not value much the adoption of the CPOE system. 	Pechmann et al. (2003)
Adoption Intention	<ul style="list-style-type: none"> Assuming it had access to the CPOE system, my hospital intends to adopt it. Given that it had informed about the CPOE system, my hospital predicts that it would adopt it. 	Venkatesh et al. (2003)
Actual Adoption	Adoption (y/n) Level of Use in the past year	
Organizational Size	Number of beds Total assets Number of patients	Kimberly et al. 1981 Wang et al. (2005)
IT Resources	IT budgets Number of full-time employees in IT department Percentage of IT budget to total operating budget	Kambil et al. (2000) Chen 2003
Top Management Support	<ul style="list-style-type: none"> I have initial strong support from the board of directors and organizational executives for the adoption of the CPOE system. I have continual strong support from the board of directors and organizational executives for the adoption of the CPOE system. 	Poon et al. (2004) Sengstack, Gugerty (2004)
Regulation	<ul style="list-style-type: none"> There are local or state mandates on hospitals to improve patient safety. Even though there is no local or state mandate on hospitals to improve patient safety, I am aware of other states have such mandate and expect similar mandate from the region in the future. My organization and I are aware of the endorsement of CPOE systems for improving patient safety from industry advocator or government agency such as IOM, Joint Commission, Leapfrog Group. 	Prince (2002) Poon et al. (2004)
Competitive Pressure	<ul style="list-style-type: none"> I am aware that my local and regional competitors have adopted or in the process of adopting CPOE systems. I feel that IT and CPOE in specific can help my organization to compete in the healthcare market. 	Burke et al. (2002) Kimberly, Evanisko (1981)

Table 2. Instrument Items

EXPECTED CONTRIBUTIONS

This study can provide several theoretical and practical implications for researchers as well as practitioners. From a theoretical perspective, this study is expected to demonstrate that protection motivation theory successfully explain healthcare providers' CPOE systems adoption. By validating its usefulness, the theory can be applied in future research as an alternative model explaining healthcare technology adoption where threats act as a crucial motivator. In addition, this study extends the theoretical boundary of the original PMT by identifying and including several predictors specific to the context of healthcare and investigates whether the extended model has a higher explanatory power than the original PMT model. The model comparison contributes to theoretical advancement of the protection motivation theory. This study would provide further insights into the phenomenon of healthcare IT adoption, in particular, in the context in which threats are involved, and thereby would make significant contribution to the technology acceptance literature in general.

For practitioners, this study provides useful insights for managers of healthcare providers, policy makers, and advocator and supporter groups to develop a strategic guideline on how to motivate healthcare providers to adopt CPOE systems. This study also provides CPOE system providers with valuable suggestions for designing the system and developing a promotion plan.

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