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EXPLORING DIFFUSION OF COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE) SYSTEMS FOR IMPROVING PHYSICIANS' ROUTINE OPERATIONS IN HOSPITALS: AN EMPIRICAL SURVEY

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ABSTRACT

In our study, the adoption and implications of computerized physician order entry (CPOE) were investigated to answer the central research question, "What factors facilitate health care organizations receptivity to adopting and implementing CPOE?" After a pilot study a survey instrument was developed from constructs of perceived benefit, complexity, satisfaction with existing system and technical knowledge. The survey was distributed to technology leaders (800) in the health care industry and responses (136) were analyzed. We found that perceived benefits, complexity, organizational size, market uncertainty and technology knowledge all contributed to receptivity to CPOE in health care organizations. The results also indicated when the organization was dissatisfied with the existing system, its motivation for adopting CPOE increased as well.

Keywords: technology adoption, computerized physician order entry (CPOE), healthcare IS

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 [27, 3, 14, 1, 2]. Computerized physician order entry (CPOE) systems are electronic prescribing systems that intercept errors when they most commonly occur at the time medications are ordered. With CPOE, physicians enter orders into a computer rather than on paper [26]. Orders are integrated with patient information, including laboratory and prescription data. The order is then automatically checked for potential errors or problems. Although CPOE has shown great promise and potential in the health care industry and despite the fact that both federal and state governments have been pushing its implementation [14, 36], widespread adoption and implementation of CPOE technology has not yet occurred in health care [14, 1, 36, 20, 11]. Furthermore, the health care industry has

traditionally been a slow adopter when it comes to new technology [27, 14, 21, 36]. As a result, less than 10 percent of U.S. hospitals (and probably even fewer European hospitals) have complete access to a CPOE system [11, 2]. Ford et al. [14, p.542] further argue that "CPOE systems do not appear likely to achieve the widespread use hoped for by policymakers and patient safety advocates." Considering the importance of CPOE systems and the unique characteristics of the health care industry, the challenges/barriers for health care organizations to adopt CPOE systems cannot be overlooked [27, 14, 42].

Extant research has recognized the importance of exploring CPOE adoption issues in healthcare organizations [27, 3, 14, 1, 36, 8]. Ford et al. [14] apply the classic technology diffusion model (TDM) to predict the CPOE adoption patterns and they predict a slow growth of CPOE adoption in U.S. healthcare industry. Using mixed empirical methods, Ash et al. [3] investigate the unintended consequences (UCs) in CPOE adoption and they argue that a viable way to deal with UCs of CPOE is to focus on critical success factors (CSFs) for implementing CPOE. Mixed results of CPOE implementation are also reported in the study of Metzger et al. [27]. Other studies explore CPOE adoption and implementation from organizational structure perspectives [13, 8]. Findings of the study by Ford and Short [13] indicate that hospitals with different organizational structures render different CPOE adoption rates. Cutler et al. [8] examine the relationship between hospital ownership and teaching status and CPOE adoption. Results of their study show that government and teaching hospitals have the significant higher rates of CPOE adoption than those of other hospital types. There is also study [36] that focuses on human factors of the CPOE adoption process. She claims that the principles of human factors (e.g., task analysis, interface design and human-computer interaction) can be utilized to enhance the CPOE adoption and implementation performance. In spite of prior research that has explored CPOE adoption and implementation from various aspects, much fruitful theoretical work remains to be conducted.

In spite of extensive prior studies, there is a lack of systematic investigating of the factors influencing health care organizations' adoption of CPOE applications, which is crucial for both practitioners and researchers in terms of generating deeper understanding of the CPOE adoption [1, 20]. Ash et al. [2] propose a comprehensive framework for CPOE adoption research based on their qualitative research and moreover, they call for future quantitative empirical studies to validate their proposed framework.

This research fills this void by studying adoption and implications of CPOE systems in a health care organization using a holistic approach. The central research question is: "What technological, organizational, and environmental factors facilitate health care organizations receptivity to adopting and implementing CPOE systems?" To answer this question, we employ a holistic framework to understand the intentions and actions of key players in organizations, the process by which CPOE systems are adopted and implemented, the technological, organizational, and environmental contexts within which the adoption occurs, and the impact of CPOE systems on organizations [13, 2, 36, 29].

The paper proceeds as follows. First, we establish theoretical background. We then develop our hypotheses. After developing our hypotheses, we describe our survey methodology, our sample (N=136), and our regression analyses. We then discuss the results and implications.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

IT Adoption

Researchers have proposed several models explaining why various factors impact firms to adopt new technologies. Many of these models address different aspects of organizational factors. Premkumar *et al.* [33] identified three groups of elements that may be associated with the extent of adoption of EDI technology. The first group contains innovative characteristics of the IT technology [5, 33]. The second group termed organizational characteristics includes elements such as company size, the support of top management for the adoption of the new technologies, and the existence of champions leading the process of change required for the new technology to be introduced [21, 5, 33]. The third group is comprised of a series of environmental characteristics [27, 1, 5, 33]. Combined these three groups are referred to as the TOE (Technology- Organization-Environment) model [21, 5, 33].

Technological Context

The technological context considers the available technologies important to the firm, both internal and external, that might be useful in improving organizational productivity [25]. The technological context relates to the technologies available to an organization and has two dimensions (*i.e.,* technology characteristics and organization technology). The main focus is on how the characteristics of the technology can influence the adoption process [41], and if the existing

organization technology infrastructure is adequate to the new technology adoption [32]. Since not all innovations are relevant to an organization, the degree of relevance depends on the relative advantage and the ability to adopt [32, 33, 34]. Innovation can bring different types of changes to the existing technology, for instance, incremental changes that provide additional features to the existing product or process, or discontinuous changes that involve the development of significant new products or process. The degree of compatibility between the innovation's characteristics and the current practices of the organization will also impact the technology adoption [32, 33]. It is evident that an innovation of inducing discontinuous changes may impose large knowledge barriers outstripping their potential benefits [5] and negatively impacting the adoption, and Ramamurthy et al. [34] similarly found that when the new technology is suitable for the organizational existing technical scope, sustainable benefits can be obtained by new technology adoption.

Organizational Context

Bruque-Cámara et al. [4] identified organizational factors such as IT-complementary intangible assets, firm size, experience in the use of basic technologies, and corporation culture for facilitating the IT adoption. Most recently, Ramamurthy et al. [34] investigated key determinants of data warehouse adoption, and suggested organizational commitment; absorptive capacity, organizational size, existing technology structure, and technical scope as well as the relative advantage and complexity of the technology itself are the organizational factors that affect data warehouse adoption.

A review of the prior research shows that firm capability has not sufficiently addressed technology adoption processes directly [6, 12]. By describing the capabilities that underlie organizational innovation processes, it sheds light on the types of capabilities that are likely to support effective technology adoption processes. Damanpour [9] and Premkumar & Ramamurthy [32] also examined the influence of organizational characteristics on innovation adoption decision. They suggest that organizational structure, organizational culture and technical knowledge resources are among the factors associated with organizational innovation. Rogers [35] also pointed out that organization size, which is used in many innovation studies as a surrogate measure for organization structure or resources, has a positive influence on adoption behavior.

Environment Context

Competitive pressure has been widely recognized and empirically supported in IS adoption literature as one of the major factors in the environment context of the TOE model [21, 5]. Competitive pressure refers to the degree of pressure that the company feels from competitors within the industry [31]. Adoption of a new innovation might help a firm to gain and sustain competitive advantages over its competitors [21, 31]. Similarly, it has been explained that innovations allow firms to achieve an edge in competitive environments [5]. It is also found in health care research that competitive pressure plays a major role in IT adoption [24, 16]. We echo this earlier work and suggest that IT innovations are often adopted in situations of market uncertainty because IT is seen as one way that organizations can become more agile and better-positioned to respond to emerging competitive threats [39].

In our study, we will test the impact of characteristics of the CPOE such as relative advantage [32, 33] and the complexity of the new technology on CPOE adoption [27, 1, 33]. We will also test the impact of current technology infrastructure and the organizational technology scope on CPOE systems adoption [13, 8], and finally we will test the impact of environment factor on CPOE adoption [1].

Conceptual Framework

This paper's conceptual model depicts the positive effects of technological context, organizational context, and environment context on CPOE systems adoption (see Figure 1). We extend the work of Chau and Tam [5] to CPOE adoption in the health care industry. Figure 1 also presents a bivariate view of the three constructs. The bivariate view indicates that the constructs in our model (technology characteristics, organization technology, and, environment) can be split into several different dimensions. The models described in Figure 1 will be tested as we investigate our hypotheses.

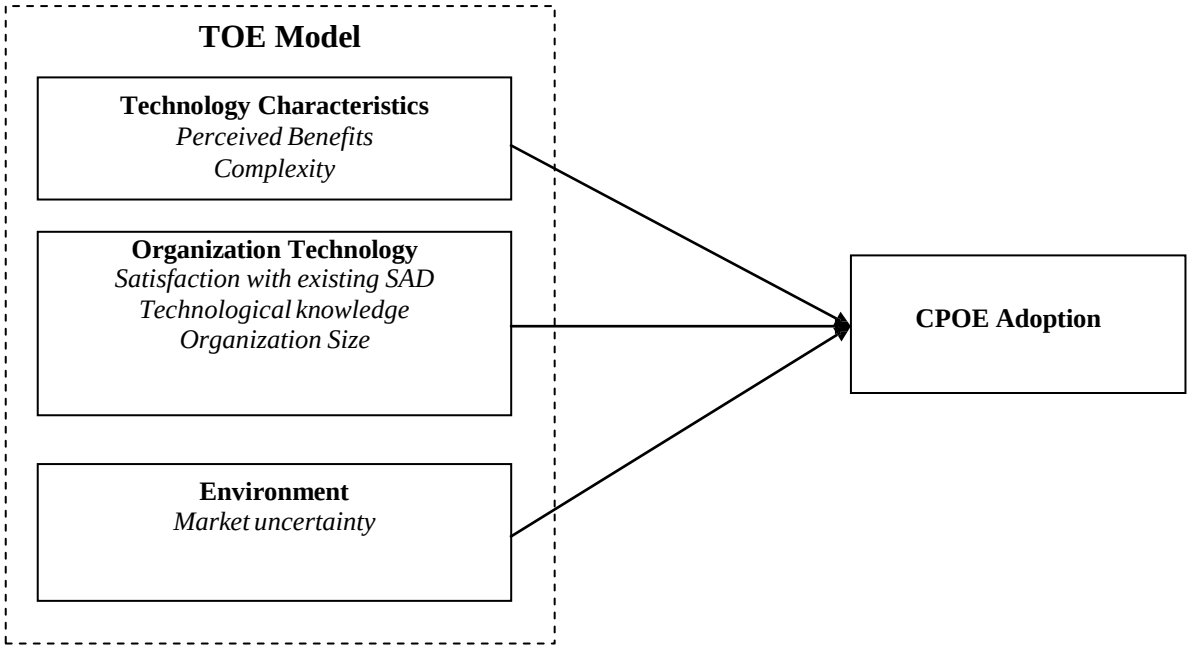

Figure 1: Research Model

Research Hypotheses

Technology Characteristics

Based on the innovation diffusion theory, Tan and Pian [39] developed a research framework to identify factors in Internet banking adoption. The results of the study revealed that perceived benefits (relative advantage) and complexity are major factors influencing the intention to adopt Internet banking services and their findings were supported by Thong [40]. Perceived benefits are also similar to the term "relative advantage" that has been included and supported in other adoption studies [19, 40]. The complexity dimension was supported by Chau and Tam [5] and Copper & Zmud [7]. An innovation possesses a perceived benefits when it is superior on one or more dimensions to the product it replaces [35].

Perceived benefits of CPOE include accurate, current information that helps physicians keep up with new drugs as they are introduced into the market, drug-specific information that eliminates confusion among drug names that sound alike, improved communication between physicians and pharmacists, and reduced healthcare costs due to improved efficiencies [27, 3, 14, 1, 8]. Given these stated potential benefits, we hypothesize that:

Hypothesis 1a: Higher levels of perceived benefits of CPOE systems are positively associated with adoption of CPOE in hospitals.

Systems have become increasingly complex, and as a result development methods have become more complex as well. The CPOE has been criticized for the often cited and sometimes overwhelming complexity it presents to its users, and those seeking to learn to use it. Sengstack and Gugerty [38] argue that the largest reason for the slow implementation of CPOE systems is the complexity of the entire task. This assertion is also echoed by studies by Aarts et al. [1] and Metzger et al. [27]. According to Copper & Zmud [7], complexity of IT will have a negative effect on IT adoption. Therefore, we hypothesize:

Hypothesis 1b: Higher level of complexity of CPOE systems is negatively associated with adoption of CPOE in hospitals.

Organizational Technology

Organizational Technology comprises two dimensions: technological knowledge of CPOE and satisfaction with existing technology. The technological knowledge of an organization is part of organizational technology context that promotes (or inhibits) adoption [44]. Technological knowledge can extends to non-IT professionals, a group that has been shown to be more likely to support and accept new technologies

when they have a relatively high level of IT knowledge about technological innovations [43]. Consistent with earlier research, technological knowledge is thus an integrative construct that includes both physical as well as human resources [43]. Aarts et al. [1] contend that CPOE is a highly collaborative process and requires a high-level of domain knowledge in its implementation. As such, hospitals with a high degree of technological knowledge are better- prepared to use CPOE in their organization. For these reasons, we hypothesize:

Hypothesis 2a: Higher levels of technological knowledge are positively associated with adoption of CPOE in hospitals.

The level of satisfaction with existing systems also plays an important role in the adoption process. Some physicians claim that their handwriting was perfect and illegibility was not an issue [38], while other physicians find it time consuming and even demeaning to enter orders themselves [36]. Earlier research has indicated that *satisfaction* with existing technology was a factor that decreased the likelihood of adoption [5]. As such we hypothesize:

Hypothesis 2b: Higher levels of satisfaction with existing systems are negatively associated with adoption of CPOE systems in hospitals.

There has been research which investigates the impact of organizational size on technology adoption. In the context of healthcare providers and hospitals, researchers [22] 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. Burke et al. (2002) also suggested that larger hospitals might have more slack in their resources for IT adoption. We expect that the larger a healthcare provider the more likely it can afford and support CPOE systems, resulting in adopting CPOE systems.

Hypothesis 2c: Hospitals with large size are more likely to adopt CPOE systems.

Environment

The relationship between IT innovations and competition, or market uncertainty, has been explored in several previous IT adoption studies, with virtually all finding support for this relationship [5, 40, 43, 44]. We echo this earlier work and suggest that IT innovations are often adopted in situations of market uncertainty because IT is seen as one way that organizations can become more agile and better- positioned to respond to emerging competitive threats. Similarly, it has been explained that innovations allow firms to achieve an edge in competitive environments [21, 31]. In the healthcare domain, previous studies suggest that regulations, policies, mandates and incentives on CPOE from both federal and state governments (e.g., President Bush's 2004 Executive Order and California State Health and Safety Code, Section 1339.63) have a huge impact on CPOE adoption and implementation [14, 1]. Recently passed American Recovery and Reinvestment Act of 2009 and Health Care Reform Bill will certainly leave a lasting imprint on healthcare in general and consequently on CPOE adoption and implementation.

Based on this we hypothesize:

Hypothesis 3: Higher levels of market uncertainty are positively associated with the adoption of CPOE systems in hospitals.

RESEARCH METHODOLOGY

Variables and Measurement

This study uses a two-part research design in order to increase the reliability and validity of the data collected. Part one involves constructing a questionnaire. This process began with reviewing and analyzing previous literature, and then moved to developing the theoretical framework. These steps have been reported in sections 2 and 3 of this paper. The next step involved defining the constructs in the research model.

Our research model includes 3 constructs: technology characteristics, organization technology, and environment. The technology characteristics construct consists of two dimensions, perceived benefits and complexity. Our items were adopted from foregoing research from IT adoption [5, 23]. The organization technology construct also has two dimensions: satisfaction with existing order entry system and technological knowledge. We adapted these measures from prior studies [5]. The items for market uncertainty are similarly adapted from prior research [5]. All opinion responses in our research study were adapted from previous studies and measured on a seven-point Likert Scale. A total of 21 items measure the constructs in our proposed CPOE adoption model (see Table 1).

Table 1: Items for variables

Please indicate the degree to which you agree or disagree with the following statements. (Please circle the appropriate number from 1 to 7. Here 1 signifies "Strongly Disagree" and 7 signifies "Strongly Agree")	
Benefits of CPOE	
Ben1 – CPOE reduces your operations overhead cost.	1 2 3 4 5 6 7
Ben2 – CPOE reduces your operations error rates.	1 2 3 4 5 6 7
Ben3 – CPOE improves your patient service.	1 2 3 4 5 6 7
Ben4 – CPOE enhances your hospital image.	1 2 3 4 5 6 7
CPOE complexity	
Com1 – System Analysis and Design	1 2 3 4 5 6 7
Com2 – System Integration	1 2 3 4 5 6 7
Com3 – Data Management	1 2 3 4 5 6 7
Satisfaction with existing physician ordering systems	
Sat1 – Does your existing physician ordering systems serve the needs of your hospital?	1 2 3 4 5 6 7
Sat2 – Are you satisfied with the performance of your existing physician ordering systems?	1 2 3 4 5 6 7
Company size	
Csz1 – Number of employees (natural log transformed in data analyses).	1 2 3 4 5 6 7
Csz2 – Number of beds (natural log transformed in data analyses).	1 2 3 4 5 6 7
Market uncertainty	
Env1 – The competition among hospitals is intense.	1 2 3 4 5 6 7
Env2 – The frequency of cost-increase in healthcare is high.	1 2 3 4 5 6 7
Env3 – The demand for service of your patients is high.	1 2 3 4 5 6 7
Env4 – The degree of loyalty of your patients is low.	1 2 3 4 5 6 7
Env5 – The government regulation in healthcare is strong.	1 2 3 4 5 6 7

After assembling a preliminary version of our instrument based on prior literature, we then conducted interviews with key employees of hospitals such as the CIO, CTO, and the Director of IT. After conducting these steps, a series of questions addressing the key variables of the study were developed. A pilot study was conducted by distributing the preliminary questionnaire to administrators of several hospitals in a Midwestern city. Administrators were asked to examine the degree to which the preliminary questionnaire captured the measured constructs and how easy or difficult the preliminary questionnaire was to complete. Based on feedback received in this pilot study, minor adjustments were made in the instrument before conducting the survey.

Sample

The unit of analysis in this study is the hospital, and as such, the subjects for this study are the IT decision makers within the organization such as the CIO, CTO, and the Director of IT. An initial sample of firms for inclusion in this study was randomly selected from the 2007 North American Industry Classification System NAICS (621111). A total of 800 questionnaires were distributed in a single mailing. From that mailing, 136 were returned. Of the 158 responses, 136 were usable resulting in an actual response rate of 17%. The 22 unusable responses did not contain sufficient data for

further analysis. This response rate is not unusual when the unit of analysis is the firm and the questionnaire involves extensive organizational level questions [18].

Reliability

Cronbach's alphas were calculated for all constructs and dimensions in the conceptual model [15]. Cronbach's alpha is based on the correlations among the indicators that comprise a measure, with higher correlations among the indicators associated with high alpha coefficients [30]. Cronbach's alpha is the most widely used method of reliability assessment in operations management research [10].

Validity

We examined construct validity using a two-step procedure. First, we conducted exploratory factor analyses (EFA) for all the constructs. Factor solutions were consistent with prior studies [5, 23]. Second, to assess the convergent and discriminant validity of the constructs, we separated the constructs into two groups and conducted confirmatory factor analyses [15]. We allowed the latent constructs to be correlated while constraining the measurement items and their error items to be uncorrelated. This study employs CFA to test the unidimensionality of the constructs because CFA is deemed to be a better technique for assessing unidimensionality than EFA.

FINDINGS

Table 2 presents the demographic information for our sample.

The Cronbach's alpha values for all constructs and dimensions in this study (see table 3) exceed the suggested alpha value of 0.70 rule generally considered as 'adequate' for assessing reliability in empirical research [28]. Thus, it is assumed that the scale items used in this research can be considered reliable. Table 3 also shows the CFA values of the constructs indicating they are all valid.

Table 2: Demographic Information

	Number of Respondents	**Percentage of Respondents**
Hospital Tax Status		
For-profit	48	35%
Non-profit	88	65%
Geographic Location		
Rural	38	28%
Urban	98	72%
Size (# of Beds)		
Less than 300	88	65%
300-500	40	29%
More than 500	8	6%
Respondent's Job Position		
CIO	74	54%
CTO	46	34%
IT Director	16	12%
Avg. number of yrs. in position	3.2 years	

Table 3: Reliability, Factor Loadings and Convergent Validity

Construct (reliability)	**Indicator**	**Loadings*** **	**Convergent Validity (t-statistics)**
Benefits of UML (0.80)	Ben1	0.78	9.03
	Ben2	0.81	10.58
	Ben3	0.76	8.51
	Ben4	0.82	11.89
UML complexity (0.81)	Com1	0.80	10.07
	Com2	0.78	9.12
	Com3	0.81	10.67
IT Knowledge (0.77)	Kno1	0.78	9.15
	Kno2	0.74	8.07
	Kno3	0.76	8.59
Satisfaction with Existing SAD tool (0.83)	Sat1	0.82	11.51
	Sat2	0.84	12.74
Company size (0.77)	Csz1	0.76	8.24
	Csz2	0.77	8.83
Environment (0.80)	Env1	0.77	8.91
	Env2	0.74	7.72
	Env3	0.75	8.08
	Env4	0.78	9.31
	Env5	0.82	11.59
	Env6	0.80	10.83
Adopt (na)	Ado1	(na)	(na)

*p < 0.10; ** <0.05; *** p < 0.01

By using binary logistic regression, we were able to see the correlations (B and Odd Ratio) among all the variables (table 4). Logistic regression analysis also allowed us to assess the effects of variables on CPOE systems adoption.

The Cox & Snell R-Square and Nagelkerke's R-square are 0.34 and 0.48 respectively; thus, the proposed predictors have satisfactory explanatory power.

Hypothesis 1a suggests that a firm's higher level of perceived benefits of CPOE systems has a positive effect on the firm's adoption of CPOE. Table 4 shows perceived benefits of CPOE has significant influence on adoption (B = .38 and Odd Ratio = 1.46, $p < .01$), thus supporting hypothesis 1a.

Hypothesis 2a demonstrates that higher levels of technological knowledge are positively associated with adoption of CPOE in hospitals. Hypothesis 2c states that hospital size has a significant effect on IT adoption, while hypothesis 3 suggests market uncertainty also has a positive effect on CPOE adoption. By the same token, hypotheses 2a (B = .35 and Odd Ratio = 1.42, $p < .01$), 2c (B = .20, Odd Ratio = 1.22, $p < .10$), and 3 (B = .37 and Odd Ratio = 1.45, $p < .01$) are all supported respectively.

Hypothesis 1b suggests that CPOE systems complexity has an adverse impact on CPOE adoption, while hypothesis 2b suggests that satisfaction with the existing physician ordering system might also diminish the willingness of adoption of CPOE systems. According to table 4, CPOE complexity and satisfaction of the existing physician order systems are both negatively related to CPOE systems adoption (i.e., B = -.25 and Odd Ratio = 0.77, $p < .05$ and B = -.26 and Odd Ratio = 0.78, $p < .05$ respectively) in support of hypotheses 1b and 2b.

Table 4 – Logistic Regression Model

	Coefficient (B/Odds Ratio)	**95% C.I. for Odds Ratio**		**Support for Model**
		Lower	Upper	
Variables in the Model				
Technology Characteristics				
Benefits of UML	(0.38/1.46)***	1.03	1.87	H1a: Yes
UML Complexity	(-0.25/0.78)**	.36	1.12	H1b: Yes
Organization Technology				
Technological Knowledge	(0.35/1.42)***	.96	1.71	H2a: Yes
Satisfaction with Existing System	(-0.26/0.77)**	.34	1.08	H2b: Yes
Company size	(0.20/1.22)*	.79	1.45	H2c: Yes
Environment				
Market Uncertainty	(0.37/1.45)***	1.01	1.79	H3: Yes
Likelihood Ratio χ^2 Statistic	75.49			
Degrees of Freedom	11			
Cox & Snell R-Square	0.34			
Nagelkerke's R-square	0.48			
+p < 0.1, *p < 0.05, **p<0.01 ***p<0.001				

DISCUSSION

To best achieve the advantages especially in medication error reduction in health care organizations several important steps can increase the receptivity of adopting and implementing CPOE.

First, the variable perceived benefits discussed in this research shows a positive result concluding that the more benefits seen to be gained from adopting CPOE, the more willingness the hospital would have to adopt CPOE. It is in line with the notion that perception of benefits serves as a major motivation for adopting and implementing CPOE [2]. According to Saathoff [36], leadership plays a key role in CPOE implementation process. To promote a shared CPOE vision [2], leadership can greatly enhance receptivity to CPOE through clear and convincing explanations as to the benefits of CPOE. Both specific examples of medication errors and resulting consequences and statistics can be used to make a compelling case that CPOE can play a powerful role in eliminating errors and improving health care.

Technological innovation (i.e., CPOE adoption) is often considered a complex assignment and bewildering to the adopting organization [27, 1]. The findings in this research that complexity has an adverse effect on CPOE adoption are similar with the results generated from past literature [5, 23]. The case for reducing complexity is an appealing aspect of CPOE especially if the health care organization is large in size which in and of itself contributes to complexity. Illustration of complexity reduction can be achieved through different alternatives. One approach is to use video to illustrate "before" procedures and improved procedures "after" CPOE implementation. For example, consider a video that documents how easily an error can be made with the current system and prevented with the new one. A second approach is to use testimonials from other organizations. Convincing cases can be made by both approaches to motivate staff to embrace the enhanced process possible through CPOE. In the event that staff is dissatisfied with the existing system our research indicates receptivity to CPOE is increased. To strengthen that aspect of receptivity the "before" illustration should

vividly point out deficiencies as to why that status quo is inferior to the "after" or future CPOE process and environment.

Technical knowledge plays a key role in IT adoption [3, 1, 2]. If that expertise currently exists within the organization receptivity of CPOE should be enhanced. If knowledge is lacking adding that skill set – perhaps from organizations that have already achieved positive results with CPOE – could play a meaningful role in facilitating adoption. Moreover, both Aarts et al. [1] and Ash et al. [2] call for training and technical support in the CPOE implementation process.

Market uncertainty and competition in health care has become an increasing challenge as pressure from insurance companies and government intervene to fix and reduce costs as well as further regulate health care. For instance, the Health Insurance Portability and Accountability Act (HIPAA) set a variety of security norms, standards, and restrictions on the deployment of healthcare information technology (HIT). Therefore, when hospitals adopt and implement CPOE, they must be particularly careful to consider medical policies and the regulations of security restrictions [1, 20]. In light of mandate and incentives provided by both federal and state government, hospitals need to take initiatives to adopt and implement CPOE [14, 1] as CPOE is a win/win situation in that it can reduce costs at the same time it reduces errors [20]. Articulating this message benefits leadership's efforts to facilitate successful CPOE adoption.

The results of this study also show that larger hospitals are more inclined to adopt and implement CPOE because of their richer resources and higher capabilities (Burke et al., 2002). In line with this inference, we further argue that the larger hospital should also explore the invisible advantages and potential of CPOE more.

Practitioner Implications

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. Fortunately, there are others successes and mistakes to learn from in promoting CPOE implementation. Leadership will achieve best results by providing clear communication via specific examples and statistics on how CPOE will benefit both patients and hospital employees. This can be accomplished with testimonials and success stories from other organizations that have already benefited from CPOE implementation.

Future Research and Limitations

Two limitations of this research of the study are worth noting. First, in this study, we endeavor to employ hospital size as the proxy for organizational structure and analyze its impact on CPOE adoption, but there are also other organizational structure variables can be applied in CPOE adoption and implementation, i.e., hospital ownership and teaching status [8]; strategic group [13]. Future studies need to address the issue of creating and validating a multi-dimensional organizational structure construct in IT adoption research.

The second limitation is that all the measuring instruments used in this research were based on manager's perceptions. While this is a time-honored and valid operational process for measuring various constructs (Buchko, 1994), all questionnaire surveys are limited by the truthfulness of the respondents. The validation and reliability analyses undertaken in this study provided some level of assurance of the instrument ability to capture useful measures. It is interesting if we will be able to test our model using achieved data.

CONCLUSION

In conclusion the question raised in our research is "What factors facilitate health care organizations receptivity to adopting and implementing CPOE systems?" The answer our research finds is that CPOE systems are best received when the benefits are perceived, expertise is appropriate, complexity can be reduced while increasing satisfaction, and the health care organization is large and is coping with market uncertainty. Awareness, assessment and communication of these factors within health care organizations can better facilitate receptivity for adoption and implementation.

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