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ABSTRACT

Despite the importance of sustained and continued use of healthcare information systems to reap their benefits of cost reductions and quality improvements, research on continuance use of these systems is limited. In this paper, we study physicians' continuance to use a pain management clinical decision support system by developing a theoretical model that integrates Delone and McLean IS success model with physicians' professional identity constructs, an integration that addresses the gap of separating information systems constructs from physicians' idiosyncrasies constructs in extant literature. We conduct our study through a mixed methods longitudinal design that addresses our research questions. This study enhances our understanding of factors influencing physicians' continuance behavior and extends current literature on healthcare information systems use

Keywords

Clinical Decision Support Systems, Continuance, , Delone and McLean IS success model, Physicians' professional identity

INTRODUCTION

The use of e-health systems has been associated with improvements in quality of care (Kummervold et al. 2008) and reduction in healthcare costs (Blumenthal 2009). However, to realize these benefits, prolonged and sustained use of e-health systems is necessary. Yet, extant research has focused on pre-implementation and acceptance phases of e-health system use (e.g., Pynoo et al. 2013) and the research on sustained use of e-health systems has been scarce despite its importance and despite the numerous calls by researchers (Archer et al. 2011b).

Another apparent gap in current e-health systems use is the existence of two distinct research streams; one viewing e-health systems as business information systems and uses traditional IS models such as technology acceptance model (TAM) (Davis 1989) to study clinicians use of e-health systems, and the other stream focusing on the role of healthcare users idiosyncrasies such as autonomy on clinicians' behavior and attitude towards e-health systems (Doolin 2004). Despite the importance of these two streams, their separation fails to provide us with a complete picture of the factors that influence the use of e-health systems.

In this study, we integrate both streams of research into a theoretical model to study physicians' intention to continue using a CDSS system.

LITERATURE SURVEY

Aspects of physicians' professionalism include their autonomy and their focus on patients' best interests (Roland et al. 2011). These aspects are enhanced through the long medical education as well as ongoing communications among physician community members (Freidson 1994).

In this study, we utilize identity theories to study the effect of physician professionalism on their use of CDSS. Identity theory (Stryker 1987) and social identity theory (Abrams et al. 1990) are two complimentary theories (Stets et al. 2000) that define the individual and social meaning of one's identity. According to the identity theory, identity is how one perceive oneself as different from others (Stryker et al. 2000) while social identity theory studies one's identity as part of a group or collective (Abrams et al. 1990). An important process in both theories is self-categorization, but while identity theory propose that one categorizes oneself by one's role in society (e.g. a physician); social identity theory describes self-categorization as associating oneself with a specific group. The outcome of self-categorization is associating meanings and expectations based on the role or the group membership of the individual (Stets et al. 2000).

For physicians, they view their role in society as taking care of patients. They value their autonomy and decision making independence as a core part of their role. Physicians regard these values as a symbol of their professionalism and commitment to patients beyond their "employment contract" (Tallis 2006).

DELONE-MCLEAN (D&M) IS SUCCESS MODEL

The D&M model (DeLone et al. 1992) was proposed to define the different dimensions of IS success. One of the strengths of the D&M model is its parsimony and its explanation of both process and causal relationships among the constructs (Petter et al. 2008). Although the D&M model was originally developed to measure system success, it has also been extended to predict use behavior (e.g., Seddon 1997) especially since the model explains the causal relationships between use and other dimensions of IS success. Moreover, D&M model is an excellent choice for studying continuance behavior since it links past and future system use in a process model while providing insights into the role of information and system attributes on use.
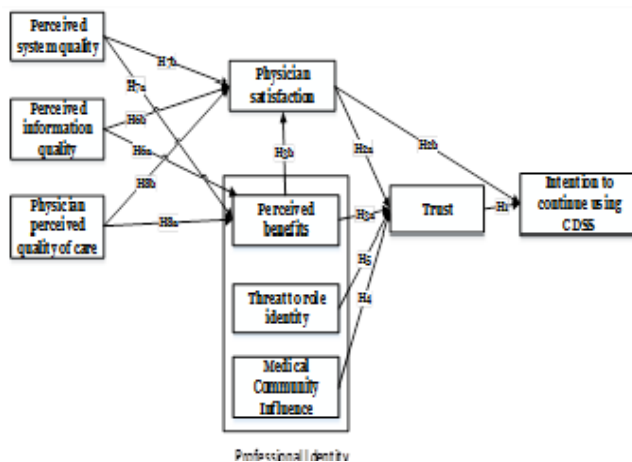
RESEARCH MODEL

Figure 1. Research Model

Trust in CDSS

We define trust as the physicians' willingness to depend on the CDSS (Gefen 2000). When physicians are making a decision to continue using the system, part of their decision making process is to compare the benefits of using the system such as improved efficiency with the risks associated with this use such as loss of autonomy. Trust reduces the complexity of this decision (Gefen et al. 2003) and provides physicians with a basis to continue using the system *(H1)*. This use of trust agrees with prior IS research which found trust to play an important role in encouraging system continuing use (Gefen et al. 2003). CDSS research also argues that physicians can lose their "trust" in CDSS systems and hence stop using it (Magnus et al. 2002).

Satisfaction with PMDSS

In our research, satisfaction refers to physicians' positive attitudes towards using the CDSS based on their cognitive and emotional appraisal of its performance (Wixom et al. 2005). Satisfaction is created as a result of positive experience with the system(Delone 2003). On the other hand, trust in a party is created based on past positive

interactions with this party (Gefen et al. 2003). Therefore, when physicians are satisfied with the system, they are likely to perceive their overall interactions with the system as positive and hence enhance their trust in this system *(H2a)*. Moreover, satisfaction has often been associated with use intention(Bhattacherjee 2001). D&M model also proposes that satisfaction is positively related to system use which has been validated in several studies(Petter et al. 2008) *(H2b)*.

Perceived benefits

Perceived benefits refer to the current improvements incurred by physicians in terms of efficiency and patient care because of the use of the CDSS. We also consider perceived benefits to be a result of physicians' role identity classification process. This agrees with the sense making theory which proposes that the benefits perceived by users depend on how they perceive the system as related to their role (Jensen et al. 2009) and with previous research on identity theory (Mishra et al 2012). When physicians experience the benefits of the system, they will regard their interactions with the system as positive and hence will improve their trust that the system will continue to be beneficial and to work in their favor (Gefen et al. 2008) *(H3a)* Similarly, when physicians experiment the benefits of the system in line with their roles as care-takers, they are likely to be satisfied with using the system in pain management *(H3b)*.

Perceived influence of medical society

Social identity theory proposes that when one identifies oneself with a group, one's perceptions are influenced by this identification (Chreim et al. 2007). For physicians, this influence is more salient given how physicians perceive their belonging to the medical community as fundamental in their profession (Freidson 1994). The role of medical community in forming physicians' beliefs about the system is emphasized in the institutional theory which poses that widely accepted institutional beliefs or "institutionalized myths" influence individuals' beliefs and that individuals adhere to institution normative influence (Jensen et al. 2009; Meyer et al. 1977)

In this study, we argue that physicians highly value each other's opinions and experiences because of their common education and life-long training (Hilton et al. 2005; Tallis 2006) and identify themselves as members of the medical community. Therefore, when the CDSS is widely accepted and used by medical society members, this is likely to boost physicians' beliefs in the capability and benevolence of the system and share the widely accepted "institutional myth" and hence will positively influence their trust in the system *(H4)*.

Perceived threat to role identity

Previous research in healthcare found that physicians my resist change or the use of a healthcare system because this system represents a threat to how they conduct their

tasks. This agrees with identity theory which poses that when physicians identify themselves as care-takers, they form their expectations of using the system based on this classification and may label the system as "identity-challenging" (Tripsas 2009) if using the system threatens their role identities. Sense making theory also confirms this view by posing that users expectations and beliefs of IS systems may differ based on their identities (Weick et al. 2005). Although this threat to identity may be perceived in early usage stages, it materializes and intensifies with system usage. Previous research in healthcare confirms this argument (e.g., Bhattacherjee et al. 2007).

In this study, we propose that when physicians perceive the system as threatening to their role identity as care-takers, they perceive the CDSS as identity-challenging or identity-threatening and hence their beliefs in the benevolence of the system will decrease negatively influencing their trust in the system (Mishra et al. 2012)*(H5)*.

Perceived information quality

Perceived information quality is the usefulness and desirability of the information produced by the system (Wixom et al. 2005). In the context of CDSS, perceived information quality reflects the accuracy and timeliness of the clinical guidelines and alerts provided by the system.

D&M model proposes a positive relationship between information quality and system benefits and satisfaction(Petter et al. 2008). In CDSS context, information quality is directly related to CDSS perceived benefits because the system can only be useful if the information it produces reflects disease management guidelines accurately. In other words, information quality is a perquisite of any system benefits *(H6a)*. Similarly, information is the main outcome of using a CDSS, and hence, physicians' satisfaction with using the system is likely to be dependent on their perception of the quality of information they get from this system *(H6b)*.

Perceived system quality

Perceived CDSS system quality refers to the physicians' subjective evaluation of the quality of the system which may include reliability, flexibility, and familiarity with the system(DeLone et al. 1992).

Similar to information quality, D&M model proposes a relationship between system quality and system benefits and satisfaction. For CDSS systems, when physicians perceive the system as of high quality, they are likely to be satisfied by using it *(H7b)* and more likely to perceive system outcomes as useful *(H7a)*.

Physician's perceived quality of care

We define physician's perceived quality of care as the physician subjective evaluation of the improvement in

patients' quality of care as a result of using the CDSS system.

This construct is equivalent to the service quality construct in the modified D&M model (Delone 2003) where the service provided by the system directly influences patients' conditions. We propose that when physicians become aware of improvements in their relationship with their patients and the quality of care experienced by those patients, they are likely to perceive system use outcomes as more valuable *(H8a)* and they become more satisfied with using the system *(H8b)*.

METHODOLOGY

In this study, we study the continuous use of McMaster Pain Assistant (MPA). MPA is a CDSS integrated with Oscar EMR system (Daglish et al. 2009) that aims at providing physicians and other clinicians with the information they need to manage patients with pain.

We employ a mixed method design by introducing a survey after 6, 12 months of system usage followed by the formation of focus groups(Kaplan et al. 1988; Venkatesh et al. 2013). Using longitudinal design helps us to examine how different constructs influence use through time . Previous IS studies (e.g., Venkatesh et al. 2003) suggested that the influence of different constructs such as ease of use on system use changes with time therefore, we attempt to study such changes in this research.

To achieve content validity, instrument scales for different constructs are adopted from existing validated IS scales. However, because of the context difference between those scales and pain management CDSS, these scales were adapted to our context following (Boudreau et al. 2001) and validated by examining construct validity and reliability.

Research questions will be answered by validating the model in figure 1 using partial least squares (PLS) since it suits the exploratory nature of our study (Gefen et al. 2000).

IMPLICATIONS & FUTURE WORK

The model introduced in this study has several implications. First, this model integrates two disparate e-health system usage research streams into a comprehensive model to study physicians' intention to continue using e-health systems, a behavior rarely studied in extant literature. Second, this model also proposes the use of D&M success model as an adequate model for IS continuance. Third, this model emphasizes the role of trust in influencing physicians' decision to continue using a system. Finally, this study will help in evaluating CDSS and in linking physicians' behavior with system and information attributes.

While the antecedents of information quality and system quality are well established in literature, these antecedents are general and are not directly related to how physicians

perceive these constructs. Therefore, future work should include CDSS related antecedents of system and information quality such as agreement with CDSS recommendations and the ability to customize the system to specific patients. Future work also includes extending this study to other CDSS to enhance the generalizability of the results.

Limitations of this study include its focus on studying physicians' intention to continue using McMaster pain assistant CDSS. Therefore, this study cannot be generalized to other CDSS systems. The population studied is limited to family physicians in Ontario, Canada and hence the results of this study cannot be generalized to other regions or other medical specialties.

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