Knowledge-Based Clinical Decision Support Systems Continuance: An Integration of Physicians' Identity and System Attributes

Research-in-Progress

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Abstract

Despite the importance of sustained use of healthcare information systems, research on the continuous use of these systems is scanty, especially for clinical decision support systems. Moreover, there is an apparent gap between information systems and healthcare research approaches in studying use. We address these gaps by creating a comprehensive model based on the composite attitude-behavior model that integrates system related constructs with physicians' professional identity constructs to explain and model physicians' continuous use of a pain management clinical decision support system theoretically. Using a mixed methods longitudinal study design, we investigate factors influencing continuous use of automated clinical guidelines. The potential contributions of this study include enhancing our understanding of factors influencing physicians' continuance behavior, and providing guidance on developing effective automated knowledge-based clinical decision support.

Keywords: Clinical Decision Support Systems, attitude-behavior model, continuous use, professional identity

Introduction

Examining factors influencing the continuous use of information systems (IS) is critical as continuous use is key to reaping IS intended benefits (Bhattacherjee 2001). Use of health IS (HIS) is no exception (Bloom 2002). Unfortunately, many organizations fail to benefit from IS use because, after their initial acceptance, employees stopped using them (Devaraj et al. 2003). Past studies showed that users can abandon a HIS after its adoption(Archer et al. 2011a). Indeed, physicians, who highly value their professional idiosyncrasies such as autonomy and relationship with patients (Tallis 2006) are likely to abandon a system despite its usefulness if they perceive the HIS to threaten their professionalism (Doolin 2004). Given the runaway cost of, and the need for ongoing quality improvement (Kummervold et al. 2008) in, healthcare services, HIS discontinuance will negatively impact the quality and efficiency goals of the health organization, which in turn are prime goals of the current healthcare systems.

Despite the importance of HIS use continuance, research in this area has been scarce. Increasingly, there has been calls to study continuance in a HIS context (Archer et al. 2011b). To date, research in HIS use (and HIS continuance use), is characterized by having two different streams. The first stream views e-health systems as business IS and uses traditional IS models such as Technology Acceptance Model (TAM) when investigating e-health systems use by clinicians (Hu et al. 1999). This research stream neglects the unique characteristics of the healthcare environment and its users. The other stream focuses on the role of healthcare users' idiosyncrasies such as autonomy and control over care processes on clinicians' behavior and attitude towards e-health systems (Doolin 2004; Jensen et al. 2006). These idiosyncrasies are highly valued by clinicians as an essential component of their professionalism(Roland et al. 2011) and represent a core part of their identity (Freidson 1994).

Despite the significance of these two streams, their separation fails to provide us with a complete picture of the factors that influence the use as well as continuing use of HIS. To address the research gaps, we study physician continuance use of the McMaster Pain Assistant (MPA)[1], a knowledge-based clinical decision support system (KB-CDSS) that integrates evidence-based guidelines with patient information to guide clinicians in managing patients with pain. As a knowledge-based system, MPA not only provides suggestions and alarms to clinicians based on patient information, but also attempts to encourage physicians to use pain management guidelines to improve their pain management skills. Hence, MPA may be viewed as a CDSS, aside from a knowledge management system that aids in translating evidence-based knowledge into practice (Alavi et al. 2001; Ko et al. 2011). For this study, Eagly et al. (1993) composite model is used as a framework to integrate context specific constructs (physicians' professionalism) with the Delone-McLean IS success (DM) model (Delone 2003; DeLone et al. 1992) to examine MPA continuance use. And answer the following research questions:

(RQ1) What factors influence physicians' intention to continue using the MPA, a KB-CDSS system?

(RQ2) How do physicians' use patterns and beliefs change with time? Or, what are MPA use dynamics?

Background

The Dual Nature of HIS

As discussed above, HIS can be viewed as having a dual nature. They can be viewed as business information systems that aim at improving users' efficiency. This view is adopted by IS researchers and is evident through the use of IS models that were originally developed for business IS such as TAM and by employing IS constructs such as usefulness and ease of use (e.g., Chismar et al. 2003; Hu et al. 1999). Although IS constructs were able to explain a significant percentage of variance in HIS use (Holden et al. 2010), another significant percentage of variance in HIS was left unexplained. This unexplained variance was attributed to the lack of context in the used models causing researchers (e.g., Benbasat et al. 2007; Holden et al. 2010) to call for using basic behavior theories such as theory of planned behavior (TPB) (Ajzen 2011) and for employing contextual constructs in in HIS research.

But where would we get these contextual constructs? The answer is in the second view of HIS adopted by healthcare community which studies HIS as an intervention or change that aims at improving healthcare providers work. This view is evident in the use of healthcare methodologies (e.g. randomized controlled trials), focus on practicality more than theory (Kaplan 2001; Kaplan et al. 2004), and employing the same constructs used to study other forms of change in healthcare such as attitude, threat to care workflow, and medical community influence (Haux 2006). However, because healthcare research focuses on practicality more than theory, it is difficult to incorporate healthcare contextual constructs in IS models.

This dual nature of HIS is not unique to these systems. It exists in other contexts such as electronic commerce (e-commerce) websites which are viewed as IS and at the same time as sellers or stores (Gefen 2000). By understanding this dual nature of e-commerce, researchers were able to consider contextual constructs such as trust and create comprehensive models for using e-commerce. We propose that understanding the dual nature of HIS and integrating the two views of HIS is essential in building a comprehensive model that better predicts and explains HIS use.

[1] The following video provides more details on the system: https://www.youtube.com/watch?v=y3MGkpG9jl8

Physicians' Professional Identity:

Owing to their professionalism and dedication to patients (Real et al. 2009), physicians earned the trust and respect of patients. Key aspects of physicians' professionalism include their autonomy (Blumenthal 2009), and their focus on the patients' best interests(Roland et al. 2011), which arise generally through the long medical education and ongoing exchanges among physician community members(Freidson 1994). In the proposed study, we explore the effect of physician professionalism on their engagement with CDSS via identity theories.

Identity (ID) theory and social identity (SID) theory are theoretically complimentary (Stets et al. 2000). Stryker(Stryker 1987) defines identity as how one perceives oneself as different from others. SID theory(Abrams et al. 1990) projects a social meaning to one's ID by studying one's ID as part of a group. In both theories, a key process is self-categorization. Whereas ID theory proposes that one categorizes oneself by one's role in society (e.g. a physician, a professor, and so on), SID theory describes self-categorization as associating oneself with a specific group (or collective). In essence, self-categorization associates meanings based on the role or the group membership of the individual (Stets et al. 2000).

In society, physicians are expected to care for their patients or make decisions in their patients' best interest (Roland et al. 2011; Tallis 2006). As such, physicians value their autonomy and decision making independence. In IS, resistance to new HIS has been linked to negative impacts on physician-patient communications (Mishra et al. 2012) or threats to the physician autonomy. As physicians identify themselves to be members of the medical profession or community (Shaw 2014), they see this belonging as a way to establishing their autonomy and independence (Friedson 1970). Hence, we define professional identity (PID) as the physicians' role identity and medical community membership identity. We argue that physicians' PID forge their expectations from the CDSS and influence their decision to continue using the system (Stets et al. 2000; Tallis 2006).

IS Continuance and Attitude

Attitude toward a behavior is the tendency to evaluate the behavior as favorable or unfavorable (Ajzen 2005). Attitude has been extensively studied in psychology as a main factor influencing behavior resulting in the creation of several attitude-based theories that explain behavior such as theory of reasoned action (TRA) (Fishbein et al. 1975) and TPB (Ajzen 2011). While these theories are the basis of most IS adoption models such as TAM (Davis 1989), the attitude construct was dropped from these models as insignificant in predicting behavior in the presence of other constructs such as usefulness and ease of use (Venkatesh et al. 2003). However, as researchers noted (Benbasat et al. 2007), these business oriented IS models may not work in all contexts and therefore, basic theories need to be used instead. On the other hand, healthcare researchers consider attitude an important factor in determining physicians' adoption of guidelines or HIS. This is evident in influential models created to explain physicians' adoption of guidelines (Pathman et al. 1996) and in attitude being the main predictor of HIS and guidelines use in healthcare studies (e.g., Cabana et al. 1999; Howes et al. 2012; James et al. 1997; Solà et al. 2014).

While TPB and TRA have been widely accepted in attitude and IS research, they have been criticized for focusing on cognitive beliefs and ignoring affect, identity and prior behavior (Maio et al. 2009). To incorporate identity constructs discussed above, we consider the Eagly et al. (1993) composite attitude-behavior model (CAB) which is considered one of the most influential attitude models (Maio et al. 2009) and which contains both normative and identity outcomes as predictors of attitude. This model also considers previous behavior as a predictor of future behavior making it suitable to study continuous use.

IS Continuance & DM Model:

While the CAB model provides a framework to study continuous, it does not consider external beliefs that influence the model constructs. These beliefs are context specific and need to be considered based on the studied system (Ajzen 2005). While identity theories can provide external beliefs influencing identity and normative outcomes, we still need to include system related beliefs that influence utilitarian outcomes and attitude toward the system. We followed (Pavlou et al. 2006) and identified those beliefs based on a review of healthcare and IS literature as system quality (Escobar-Rodríguez et al. 2012; Salinas et al. 2011), information quality (Dillon et al. 2010; Graham et al. 2005), and perceived quality of care

improvement (Brooks et al. 2006). These factors were confirmed by interviews with family physicians and healthcare researchers.

To include these identified system related beliefs in our model, we employ DM model that has been widely used in IS literature to explain the relationship between system quality, information quality, and system use (Petter et al. 2009). Our conceptualization, as given in **Figure 1**, is that as users start using the system with an initial set of beliefs (e.g., usefulness and ease of use), and with further use, users will reevaluate their beliefs based on their perceptions of the system attributes, that is, system and information quality. These perceptions influence users' satisfaction with the system (attitude toward system) and their beliefs about future system use (utilitarian outcome), which in turn modifies their attitude toward using the system. Hence, users decide whether to continue with the system. Therefore, DM model not only explains the relationship between external beliefs, it also relates those beliefs to system use.

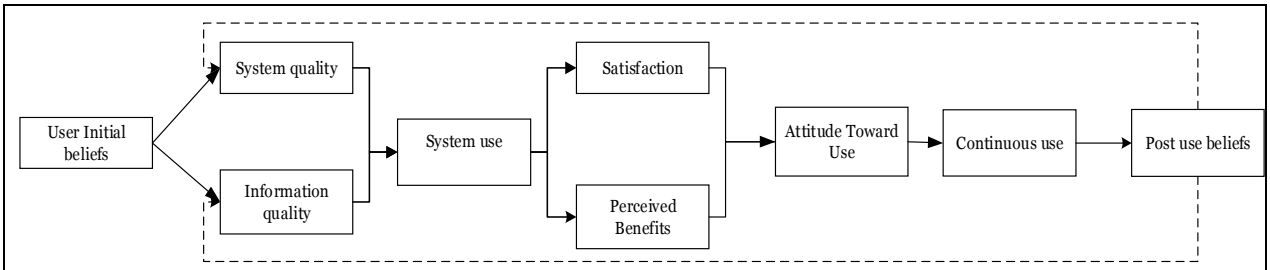

Figure 1. Relationship between pre-use, post-use, and use beliefs and perceptions

Research Model and Hypotheses

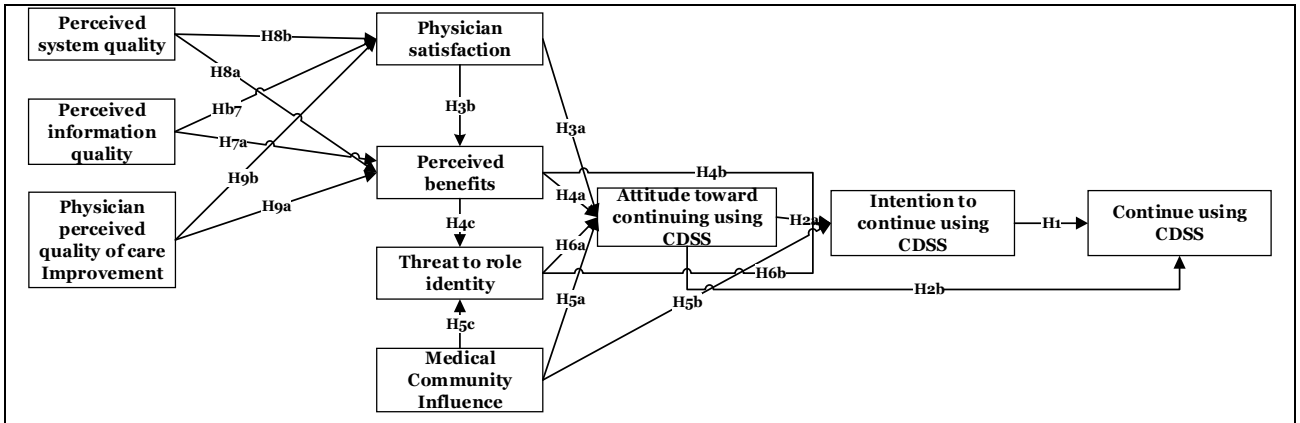

Figure 2. Research Model

Figure 2 shows the theoretical model we use to investigate MPA continuance use. The model integrates our IS-related and ID-related constructs into a comprehensive framework. But we did not include "habit" as a direct antecedent of attitude for the following reasons: (1) Habit, if seen as an automatic behavior that requires little or no self-instruction (De Guinea et al. 2009), requires a stable context (Limayem et al. 2007). Such a stable context is rare in HIS use as physicians regard each patient to be unique, and in deciding whether it is suitable to use a HIS with their patients, they also engage cognitive efforts. Physician behavior is then not automatic and their behavior is mostly performed under "unstable" conditions. (2) Although past behavior has been proposed to influence attitude, researchers(Burton-Jones

et al. 2006) have called for different conceptualization of system use, for example, Ajzen (2005) cautioned against using past behavior to explain future behavior as it may only reflect the stability of the factors affecting the behavior. (3) In psychological studies (e.g., Haddock et al. 1994) as well as IS research (e.g., Limayem et al. 2007), attitude is found to be related with satisfaction and the quality of previous behavior more than the frequency of behavior.

Intention to Continue Using CDSS:

Intention captures the motivational factors to do a behavior. The intention-behavior relation has been well established in attitude models, including TPB, TAM, and the CAB model, all of which have intention as a predictor of behavior. Empirical research confirms a strong intention-behavior relation (Ajzen 2005). Thus, *Intention to continue using the CDSS is positively related to continuing to use the system (H1).*

Attitude towards Continuing CDSS Use:

Attitude towards using CDSS may be rated (un)favorable (Ajzen 2005; Maio et al. 2009) depending on how the tendency behavior of continuing CDSS use is to be evaluated. The attitude-intention relation is well established. TPB proposes that individuals intention towards performing a behavior is influenced by their attitude towards this behavior (Ajzen 2005). Empirically, this same relationship has been confirmed in past IS studies (e.g., Pavlou et al. 2006). Thus, *Physicians' attitude toward continuing to use CDSS positively influences their intention to continue using the system (H2a).* Also, the CAB model proposes a direct attitude-behavior relationship. Thus, we propose that *the stronger the attitude towards using the system, the more physicians will continue using the system* (H2b).

Satisfaction with CDSS:

Next, satisfaction refers to physicians' positive attitudes towards CDSS use based on their cognitive and emotional appraisal of its performance (Wixom et al. 2005). Satisfaction represents the attitude toward target factor in **Figure 2** model (Delone 2003), also representing the quality of previous interactions with the system. It can represent previous system use. Accordingly, we propose that *when physicians are satisfied with the system, this attitude toward the system will be transferred to their interactions with the system and hence physicians will have a positive attitude toward continuing system use* (Zhang 2013)*(H3a)*. Also, *satisfied physicians are likely to have a more positive view of system outcomes (Petter et al. 2008), relating it positively to perceived benefits* (DeLone et al. 1992) *(H3b).*

Perceived Benefits (PB):

PB refer to the improvements in terms of efficiency and patient care derived by physicians from the use of the CDSS. PB are also a result of physicians' role identity classification process. This agrees with the sense making theory which proposes that the PB by users depend on how they perceive the system as related to their role (Jensen et al. 2009). Thus, when physicians experience PB of the system, they will evaluate their interactions with the system as positive and will then have a positive attitude toward continuing system use (Venkatesh et al. 2003)*(H4a)*. Although the CBA model adapted in this study does not propose a direct relationship between PB (utilitarian outcome) and intention, the positive relationship between PB and intention to use the system has been proposed in several IS use models, including TAM (Davis 1989). Moreover, this relationship can be seen if we consider PB as a component of self-identity outcomes. Hence, we propose that *physicians' PB from using the CDSS positively influence their intention to continue using the system (H4b).*

Perceived Influence of Medical Society:

SID theory proposes that when one identifies oneself with a group, one's perceptions are influenced by this identification (Abrams et al. 1990; Chreim et al. 2007). For physicians who identify themselves as members of the medical community, this influence is more salient given how physicians perceive such a membership as fundamental in their profession and how they associate to such a community more than with their employer (Freidson 1994). As such, we argue that physicians highly value each other's opinions and experiences due to their common education and life-long training (Hilton et al. 2005; Tallis 2006). If

a CDSS is widely accepted by the medical society, this is likely to boost physicians' positive evaluation of using the system, and hence will positively influence their attitude toward the system. *Thus, the perceived influence of medical society positively affects physicians' attitude toward continuing CDSS use (H5a).* Moreover, as *physicians perceive that the medical community favors their use of the system, it will directly enhance their intention to continue using the system* (Eagly et al. 1993; Venkatesh et al. 2003) *(H5b).*

Perceived Threat to Role Identity (RI):

Previous research in healthcare found that physicians my resist change or the use of a HIS because this system represents a threat to how they conduct their tasks, for example, through loss of control or loss of autonomy. This agrees with ID 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. Here, we argue that when physicians perceive the system as threatening to their RI as care-givers, they perceive the CDSS as identity-challenging (identity-threatening) and hence they will negatively evaluate their use of the system. Thus, *Perceived threat to physicians' RI negatively influences physicians' attitude toward continuing CDSS use (H6a).* Moreover, as *physicians consider the negative consequences of the system use on their ID, they are likely to be less motivated to continue using the system and hence their intention to continue using the system will be negatively affected (H6b).*

Perceived Information Quality (PIQ):

PIQ is the usefulness and desirability of the information produced by the system such as, accuracy, and currency of the information (Wixom et al. 2005). In the CDSS context, PIQ reflects the accuracy and timeliness of the clinical guidelines and alerts provided by the system as well as the meaningfulness of the information format. DM model proposes a positive relationship between *information quality* and *system benefits* and *satisfaction*(Petter et al. 2008). In a CDSS context, PIQ is directly related to CDSS PB because the system can only be useful if the information it produces reflects disease management guidelines accurately. Hence, *PIQ positively influences physicians' PB (H7a).* Also, information is the main outcome of a CDSS use. Thus, physicians' satisfaction with using the system is likely to be dependent on their perception of the quality of information they get from the system. Hence, *PIQ positively influences physicians' satisfaction from using the CDSS (H7b).*

Perceived System Quality (SQ):

Perceived CDSS SQ 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 PIQ, DM model proposes a relationship between *system quality* and *system benefits* and *satisfaction*. For CDSS, when physicians perceive the system to be of high quality, they are likely to be satisfied using it and more likely to perceive system outcomes as useful. Hence, *Perceived SQ positively influences physicians' satisfaction from using the CDSS (H8b) as well as PB from using the system (H8a).*

Physician's Perceived Quality Improvement:

We define physician's perceived quality of care as the physician subjective evaluation of the improvement in patients' quality of care due to using the CDSS. This construct is similar to the SQ construct in the modified DM 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 use outcomes as more valuable(H9a) and they become more satisfied with use (H9b).*

Methodology

Research Design:

To address RQ1 and RQ2 we study the continuous use of the MPA, the McMaster Pain Assistant, and explore how MPA influences the implementation of pain management guidelines in practice.

For RQ1, a mixed method design (survey and focus groups) is employed. Mixed methods combines the strengths of quantitative-qualitative research designs to provide triangulation of research findings, thereby yielding an understanding of the relationships between study constructs as well as the "why" behind these constructs and the context where relationships among constructs hold (Kaplan et al. 1988; Venkatesh et al. 2013). Our mixed-methods study will employ a novel model to explain why physicians continue using a CDSS.

To address RQ2, We will measure the actual behavior of physicians (system use) longitudinally. Burton-Jones et al. (2006) proposed individual system use as a construct that involves a user, a system, and a task. They suggest a 2-step approach to conceptualize use that includes selecting the elements of use and the measures that reflect these elements. This relates closely to our continuance model in which the same 2-step method is adopted. We are mainly interested in how physicians use the CDSS; therefore, we will study the frequency of system use and its breadth (ie., number of modules used). To further enhance the richness of measuring usage, we will employ qualitative methods (focus groups) to assess how physicians use the different systems functions to achieve their goal (managing patients with pain). Altogether, we incorporate the system, task, and users to build a comprehensive measurement of system use. Previous IS research (e.g., Venkatesh et al. 2003) suggests that the influence of different constructs such as ease of use and subjective norm on system use changes with time. In this sense, our longitudinal study is designed to explore and investigate whether the influence of constructs such as threat, and medical community influence on physicians' continuous use of CDSS systems change with time.

Altogether, our study comprises: (1) a survey to be presented to a sample of physicians after six and twelve months of using the system; (2) Following the 12-month survey, we will employ focus groups to assess the quantitative results and to examine the context of system use.

Measurement Instrument & Validation:

To achieve content validity, instrument scales for different constructs are adopted from existing validated IS scales. Even so, due to contextual differences between existing scales and pain management CDSS, we adapt these scales to our context following (Boudreau et al. 2001). We pretested with a panel of 6 physicians and health researchers to examine the questionnaire item by item to assess the content validity and the appropriateness of instrument items in a CDSS context. Modifications to the instrument scales also resulted from a follow-up pilot involving 18 physicians and residents. Both reflective (e.g. attitude) and formative (e.g. information quality and system quality) scales are employed with different validation approaches used to evaluate different scales. For reflective constructs, construct validity (convergent and discriminate validity) and reliability will be examined whereas for formative constructs, we use Q-sorting (Petter et al. 2007) to ensure content validity and principal component analysis for construct validity (Chin 1995).

Data Analysis and Sample Size:

Our **Figure 2** model will be validated using structural equation modeling (SEM) techniques, specifically partial least squares (PLS) as it suits the exploratory nature of our study (Gefen et al. 2000), and is recommended when formative constructs are used (Petter et al. 2007), as it provides highest accuracy (Fornell et al. 1994). Assuming a medium effect, and with 0.8 as the statistical power, the minimum sample size needed to validate the model is 85 (Cohen 2013), a figure more than ten times the number of paths leading to a dependent variable (attitude in our case) recommended when using PLS analysis (Gefen et al. 2000). Still, we aim to get about 120 physicians to accommodate invalid and incomplete surveys. A post-hoc analysis will be conducted to examine possible additional relationships (eg., a direct relationship between ease-of-use and intention, or between PB and intention using saturated model analysis (Chin et al. 2003).

Conclusion

This study has novel theory, method and practice contributions. **In theory**, we bridge two disparate e-health system usage research streams to achieve a comprehensive CDSS continuous use model, a gap found in the extant literature. To the best of our knowledge, this is a first attempt to integrate DM with CBA model to conceptualize IS continuance use, a first attempt to integrate ID characteristics with IS constructs into a comprehensive frame of reference on CDSS continuous use. **In method**, a longitudinal study to assess systems dynamics and analyzing system use pattern is a novel contribution in healthcare IS. Combining quantitative-qualitative approaches in assessing physicians' attitude and HIS use is also a unique contribution. **In practice**, this study will help us understand factors influencing physicians' decision to continue using KB-CDSS, and hence control these factors to enhance the use of these systems. Moreover, this study will help in evaluating CDSS and in linking physicians' behavior with system and information attributes.

While using HIS is important to achieve its goals, the role of HIS use in enhancing knowledge translation (KT), the application of knowledge into practice, is even of greater importance since it transfers the value of system use to a practical context. Therefore, future work will include extending the model presented in this study to include knowledge translation as a consequence of continuous use. We intend to implement KT using interviews and survey to understand when and why physicians would translate knowledge obtained from the system into practice. This model can also be extended by including facilitating conditions such as training as a part of the model.

References

Abrams, D. E., and Hogg, M. A. 1990. *Social identity theory: Constructive and critical advances*, (Springer-Verlag Publishing).

Ajzen, I. 2005. *Attitudes, personality, and behavior*, (McGraw-Hill International).

Ajzen, I. 2011. "The theory of planned behaviour: reactions and reflections," *Psychology & health* (26:9), pp 1113-1127.

Alavi, M., and Leidner, D. E. 2001. "Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues," *MIS quarterly*), pp 107-136.

Archer, N., and Cocosila, M. 2011a. "A comparison of physician pre-adoption and adoption views on electronic health records in Canadian medical practices," *Journal of medical Internet research* (13:3).

Archer, N., Fevrier-Thomas, U., Lokker, C., McKibbon, K. A., and Straus, S. 2011b. "Personal health records: a scoping review," *Journal of the American Medical Informatics Association* (18:4), pp 515-522.

Benbasat, I., and Barki, H. 2007. "Quo vadis TAM?," *Journal of the association for information systems* (8:4), p 7.

Bhattacherjee, A. 2001. "Understanding information systems continuance: an expectation-confirmation model," *MIS quarterly* (25:3), pp 351-370.

Bloom, B. S. 2002. "Crossing the quality chasm: a new health system for the 21st century," *JAMA: The Journal of the American Medical Association* (287:5), pp 646-647.

Blumenthal, D. 2009. "Stimulating the adoption of health information technology," *New England Journal of Medicine* (360:15), pp 1477-1479.

Boudreau, M.-C., Gefen, D., and Straub, D. W. 2001. "Validation in information systems research: A state-of-the-art assessment," *Mis Quarterly*), pp 1-16.

Brooks, R. G., and Menachemi, N. 2006. "Physicians' use of email with patients: factors influencing electronic communication and adherence to best practices," *Journal of Medical Internet Research* (8:1).

Burton-Jones, A., and Straub Jr, D. W. 2006. "Reconceptualizing system usage: An approach and empirical test," *Information systems research* (17:3), pp 228-246.

Cabana, M. D., Rand, C. S., Powe, N. R., Wu, A. W., Wilson, M. H., Abboud, P.-A. C., and Rubin, H. R. 1999. "Why don't physicians follow clinical practice guidelines?: A framework for improvement," *Jama* (282:15), pp 1458-1465.

Chin, W. W. 1995. "Partial least squares is to LISREL as principal components analysis is to common factor analysis," *Technology Studies* (2:2), pp 315-319.

Chin, W. W., Marcolin, B. L., and Newsted, P. R. 2003. "A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study," *Information systems research* (14:2), pp 189-217.

Chismar, W. G., and Wiley-Patton, S. Year. "Does the extended technology acceptance model apply to physicians," System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on, IEEE2003, p. 8 pp.

Chreim, S., Williams, B. B., and Hinings, C. B. 2007. "Interlevel influences on the reconstruction of professional role identity," *Academy of Management Journal* (50:6), pp 1515-1539.

Cohen, J. 2013. *Statistical power analysis for the behavioral sciences*, (Academic press.

Davis, F. D. 1989. "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS quarterly*), pp 319-340.

De Guinea, A. O., and Markus, M. L. 2009. "Why break the habit of a lifetime? Rethinking the roles of intention, habit, and emotion in continuing information technology use," *Mis Quarterly*), pp 433-444.

Delone, W. H. 2003. "The DeLone and McLean model of information systems success: a ten-year update," *Journal of management information systems* (19:4), pp 9-30.

DeLone, W. H., and McLean, E. R. 1992. "Information systems success: The quest for the dependent variable," *Information systems research* (3:1), pp 60-95.

Devaraj, S., and Kohli, R. 2003. "Performance impacts of information technology: is actual usage the missing link?," *Management science* (49:3), pp 273-289.

Dillon, T. W., and Lending, D. 2010. "Will they adopt? Effects of privacy and accuracy," *Journal of Computer Information Systems* (50:4), p 20.

Doolin, B. 2004. "Power and resistance in the implementation of a medical management information system," *Information Systems Journal* (14:4), pp 343-362.

Eagly, A. H., and Chaiken, S. 1993. *The psychology of attitudes*, (Harcourt Brace Jovanovich College Publishers.

Escobar-Rodríguez, T., Monge-Lozano, P., and Romero-Alonso, M. M. 2012. "Acceptance of e-prescriptions and automated medication-management systems in hospitals: An extension of the Technology Acceptance Model," *Journal of Information Systems* (26:1), pp 77-96.

Fishbein, M., and Ajzen, I. 1975. *Belief, attitude, intention and behavior: An introduction to theory and research*, (

Fornell, C., and Cha, J. 1994. "Partial least squares," *Advanced methods of marketing research* (407), pp 52-78.

Freidson, E. 1994. *Professionalism reborn: Theory, prophecy, and policy*, (University of Chicago Press.

Friedson, E. 1970. "Profession of medicine," *New York: Dodd, Mead* (81).

Gefen, D. 2000. "E-commerce: the role of familiarity and trust," *Omega* (28:6), pp 725-737.

Gefen, D., Straub, D. W., and Boudreau, M.-C. Year. "Structural equation modeling and regression: Guidelines for research practice," Communications of the Association for Information Systems, Citeseer2000.

Graham, I. D., and Harrison, M. B. 2005. "Evaluation and adaptation of clinical practice guidelines," *Evidence Based Nursing* (8:3), pp 68-72.

Haddock, G., Zanna, M. P., and Esses, V. M. 1994. "The (limited) role of trait-laden stereotypes in predicting attitudes toward Native peoples," *British Journal of Social Psychology* (33:1), pp 83-106.

Haux, R. 2006. "Health information systems–past, present, future," *International journal of medical informatics* (75:3), pp 268-281.

Hilton, S. R., and Slotnick, H. B. 2005. "Proto-professionalism: how professionalisation occurs across the continuum of medical education," *Medical education* (39:1), pp 58-65.

Holden, R. J., and Karsh, B.-T. 2010. "The technology acceptance model: its past and its future in health care," *Journal of biomedical informatics* (43:1), pp 159-172.

Howes, O. D., Vergunst, F., Gee, S., McGuire, P., Kapur, S., and Taylor, D. 2012. "Adherence to treatment guidelines in clinical practice: study of antipsychotic treatment prior to clozapine initiation," *The British Journal of Psychiatry* (201:6), pp 481-485.

Hu, P. J., Chau, P. Y., Sheng, O. R. L., and Tam, K. Y. 1999. "Examining the technology acceptance model using physician acceptance of telemedicine technology," *Journal of management information systems*), pp 91-112.

James, P. A., Cowan, T. M., Graham, R. P., and Majeroni, B. A. 1997. "Family physicians' attitudes about and use of clinical practice guidelines," *The Journal of family practice* (45:4), pp 341-347.
Jensen, T. B., and Aanestad, M. 2006. "How healthcare professionals "make sense" of an electronic patient record adoption," *Information Systems Management* (24:1), pp 29-42.
Jensen, T. B., Kjærgaard, A., and Svejvig, P. 2009. "Using institutional theory with sensemaking theory: a case study of information system implementation in healthcare," *Journal of Information Technology* (24:4), pp 343-353.
Kaplan, B. 2001. "Evaluating informatics applications—some alternative approaches: theory, social interactionism, and call for methodological pluralism," *International journal of medical informatics* (64:1), pp 39-56.
Kaplan, B., and Duchon, D. 1988. "Combining qualitative and quantitative methods in information systems research: a case study," *MIS quarterly*), pp 571-586.
Kaplan, B., and Shaw, N. 2004. "Future directions in evaluation research: people, organizational, and social issues," *Methods of Information in Medicine-Methodik der Information in der Medizin* (43:3), pp 215-231.
Ko, D.-G., and Dennis, A. R. 2011. "Profiting from knowledge management: The impact of time and experience," *Information Systems Research* (22:1), pp 134-152.
Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H.-U., Rasmussen, J., Santana, S., Staniszewski, A., and Wangberg, S. C. 2008. "eHealth trends in Europe 2005-2007: a population-based survey," *Journal of medical Internet research* (10:4).
Limayem, M., Hirt, S. G., and Cheung, C. M. 2007. "How habit limits the predictive power of intention: The case of information systems continuance," *Mis Quarterly*), pp 705-737.
Maio, G., and Haddock, G. 2009. *The psychology of attitudes and attitude change*, (Sage.
Mishra, A. N., Anderson, C., Angst, C. M., and Agarwal, R. 2012. "Electronic health records assimilation and physician identity evolution: An identity theory perspective," *Information Systems Research* (23:3-part-1), pp 738-760.
Pathman, D. E., Konrad, T. R., Freed, G. L., Freeman, V. A., and Koch, G. G. 1996. "The awareness-to-adherence model of the steps to clinical guideline compliance: the case of pediatric vaccine recommendations," *Medical care* (34:9), pp 873-889.
Pavlou, P. A., and Fygenson, M. 2006. "Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior," *MIS quarterly*), pp 115-143.
Petter, S., DeLone, W., and McLean, E. 2008. "Measuring information systems success: models, dimensions, measures, and interrelationships," *European journal of information systems* (17:3), pp 236-263.
Petter, S., and McLean, E. R. 2009. "A meta-analytic assessment of the DeLone and McLean IS success model: An examination of IS success at the individual level," *Information & Management* (46:3), pp 159-166.
Petter, S., Straub, D., and Rai, A. 2007. "Specifying formative constructs in information systems research," *Mis Quarterly*), pp 623-656.
Real, K., Bramson, R., and Poole, M. S. 2009. "The symbolic and material nature of physician identity: Implications for physician–patient communication," *Health communication* (24:7), pp 575-587.
Roland, M., Rao, S. R., Sibbald, B., Hann, M., Harrison, S., Walter, A., Guthrie, B., Desroches, C., Ferris, T. G., and Campbell, E. G. 2011. "Professional values and reported behaviours of doctors in the USA and UK: quantitative survey," *BMJ quality & safety*), p bmjqs. 2010.048173.
Salinas, G. D., Williamson, J. C., Kalhan, R., Thomashow, B., Scheckermann, J. L., Walsh, J., Abdolrasulnia, M., and Foster, J. A. 2011. "Barriers to adherence to chronic obstructive pulmonary disease guidelines by primary care physicians," *International journal of chronic obstructive pulmonary disease* (6), p 171.
Shaw, N. 2014. "The role of the professional association: A grounded theory study of Electronic Medical Records usage in Ontario, Canada," *International Journal of Information Management* (34:2), pp 200-209.
Solà, I., Carrasco, J. M., del Campo, P. D., Gracia, J., Orrego, C., Martínez, F., Kotzeva, A., Guillamón, I., Calderón, E., and de Gaminde, I. 2014. "Attitudes and perceptions about clinical guidelines: A qualitative study with Spanish physicians," *PloS one* (9:2), p e86065.
Stets, J. E., and Burke, P. J. 2000. "Identity theory and social identity theory," *Social psychology quarterly*), pp 224-237.
Stryker, S. 1987. "Identity theory: developments and extensions,").

Tallis, R. C. 2006. "Doctors in society: medical professionalism in a changing world," *Clinical Medicine* (6:1), pp 7-12.

Tripsas, M. 2009. "Technology, identity, and inertia through the lens of "The Digital Photography Company"," *Organization Science* (20:2), pp 441-460.

Venkatesh, V., Brown, S. A., and Bala, H. 2013. "Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems," *Mis Quarterly* (37:1), pp 21-54.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. "User acceptance of information technology: Toward a unified view," *MIS quarterly*), pp 425-478.

Wixom, B. H., and Todd, P. A. 2005. "A theoretical integration of user satisfaction and technology acceptance," *Information systems research* (16:1), pp 85-102.

Zhang, P. 2013. "The affective response model: a theoretical framework of affective concepts and their relationships in the ICT context," *MIS Quarterly* (37:1), pp 247-274.