Physician acceptance of information technologies: Role of perceived threat to professional autonomy

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A B S T R A C T

Physician acceptance of clinical information technology (IT) is important for its successful implementation. We propose that perceived threat to professional autonomy is a salient outcome belief affecting physician acceptance of an IT. In addition, level of knowledge codification of an IT is an important technological context affecting physician acceptance. Data from a sample of U.S. physicians were collected to test the hypotheses using partial least squares analysis. Results show that perceived threat to professional autonomy has a significant, negative direct influence on perceived usefulness of an IT and on intention to use that IT. Level of knowledge codification is also an important variable. The effect of perceived threat to professional autonomy is larger for clinical decision support systems than for electronic medical records systems. Awareness of these results would help managers better manage IT implementation in health care settings.

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1. Introduction

As the cost of health care continues to spiral up, the health care industry increasingly is looking to information technology (IT) as “the biggest levers…to re-make health care for the 21st century” [21]. Because investment in health care IT cannot reap benefits unless clinical information systems are used properly, physician adoption has long been considered “the holy grail” of these systems [44]. However, physicians’ adoption of clinical information systems is known to be slow [44]. An understanding of physician acceptance of these systems is sorely needed.

User acceptance of IT has long been recognized by researchers as a major factor in its successful adoption [15–17,35,36,39]. The more accepting of a new IT the users are, the more willing they are to make changes in their long-standing practice patterns and to both adopt and integrate a new IT into their day-to-day work activities. To predict and explain user acceptance of a new IT and to ultimately understand users’ usage behavior, researchers have developed various IT adoption models [15–17,35,39,42]. The aforementioned models are general models for any users. They are not specifically targeted at the physicians.

Empirically, all those models have received considerable support from studies using undergraduate students, MBA students, and so called knowledge workers from various industries [3,25,35,52,60]. IT acceptance of physicians in the context of telemedicine has been studied by Hu and colleagues in a series of papers [10,11,32,33,58]. Their results suggest that physicians differ from other types of IT users investigated in the literature with respect to IT acceptance. Such differences originate from their specialized training, autonomous practices, and professional work arrangements. Research by Paul and McDaniel [50] provide additional support that physicians respond to IT differently from other users. In their study of telemedicine adoption, they found that physicians were more likely to consider trust as an essential condition in telemedicine adoption than they did usefulness or ease of use considerations [50].

Because physician users may differ from other types of users in terms of IT adoption, we examine whether and how factors relevant to physicians’ priorities influence their acceptance of a new IT in different technological context.
We identify professional autonomy as a central physician characteristic that may be affected by an IT and propose that perceived threat of an IT to professional autonomy is a salient outcome belief that directly affects physicians’ intention to use that IT. We further identify that codification of knowledge by IT is the source of perceived threat to professional autonomy and investigate physician acceptance of IT in two technological contexts that differ in the level of knowledge codification: electronic medical records and clinical decision support systems.

2. Theories of intention and IT acceptance

IT acceptance models (e.g., [4,31]) have been developed based on existing behavioral intention models in social sciences including theory of reasoned action [6,20], theory of planned behavior [5], and diffusion of innovation models [54]. Derived from social psychology literature, theory of reasoned action is a well-known model that has proven successful in predicting and explaining behavioral intentions across a wide variety of domains when users have complete volitional control. Its extension, theory of planned behavior, accounts for behaviors beyond an individual’s complete volitional control [5]. Despite their success, many have argued that they do not specify the beliefs that are operative for a particular behavioral intention such as IT usage [17,45]. To explain behavioral intention to use IT, researchers using theory of reasoned action or theory of planned behavior must first identify the beliefs that are salient for IT users concerning IT usage.

The most influential IT adoption model is Technology Acceptance Model (TAM) developed by Davis [15,16]. This widely accepted, parsimonious model highlights two key factors that explain and determine user intention to use a new IT: perceived ease of use and perceived usefulness. Davis defined perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort” and perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance” [15]. The model initially included an attitude construct, which was later excluded [3,60,65].

Many extensions of TAM exist [64]. A unified model was proposed in 2003 that incorporated perceived usefulness, perceived ease of use, social influence, and facilitating conditions, as well as a few moderating variables [66]. This and other models provide a rich body of literature to study IT adoption behavior.

The models discussed above are general models for any users. They are not specifically targeted at the physicians. IT acceptance of physicians in the context of telemedicine has been studied by Hu and colleagues in a series of papers [10,11,32,58]. Results suggest that physicians may differ from other types of IT users investigated in the literature with respect to IT acceptance. They tend to be more pragmatic, concentrating more on perceived usefulness than on ease of use [10,11]. They are more likely to consider trust as an essential condition in technology adoption than they do usefulness or ease of use considerations [50]. They are reluctant to support an IT that interferes with their traditional work routines [7]. Chau and Hu have attributed this difference to physicians’ “specialized training, autonomous practices, and professional work arrangements” [10]. However, few IT acceptance studies have examined whether and how such differences influence physician acceptance of IT. In this paper, we examine professional autonomy, one of the central characteristics of the medical profession [2], and introduce a new construct, Perceived Threat to Professional Autonomy, that we argue affects intention to use an IT. Next, we develop this construct and present hypotheses about how this construct influences IT acceptance decisions.

3. Theories of professionals and professional autonomy

The definition of a profession in the sociology literature, though general in nature, has mostly been developed using the medical profession as a model. According to this literature, professionals are commonly defined as members of “occupations with special power and prestige...[based on] special competence in esoteric bodies of knowledge linked to central needs and values of the social system” [41]. By this literature, accountants, financial analysts, lawyers, university professors, and physicians are all considered professionals [57]. By achieving the status of being members of a profession, professionals are granted professional autonomy [1,23,24]. Professional autonomy is generally defined as professionals’ having control over the conditions, processes, procedures, or content of their work according to their own collective and, ultimately, individual judgment in the application of their profession’s body of knowledge and expertise [43,48,53].

With professional autonomy, professionals are trusted to not only work conscientiously without supervision but also to self-regulate, that is, to undertake the proper regulatory action on those rare occasions when an individual does not perform his work competently or ethically [23,24]. Because professional autonomy is granted to professionals on the belief that individuals outside the profession do not possess the professional knowledge needed to evaluate the practices of the professionals [23,24], professionals proclaim that they are in the best position to operate, control, and regulate their own practices.

With self-regulation, professionals are evaluated primarily through a peer review process, in which professionals evaluate one another. Peer review evaluations for professionals are subjective in nature, primarily because objective measurements defining professionals’ performance are difficult to establish. Where objective measures are established, many have argued that they do not properly reflect how professionals have performed due to the complexity and unstructured nature of their work [56]. For example, objective measures such as output measures (e.g., revenues generated or number of papers published) are considered insufficient for evaluating professionals because they seldom pinpoint individual contributions [67]. As a result, professionals claim that they should be evaluated by their peers based on subjective interpretations of objective measures. Peer review is one of the main indicators of professional autonomy because being reviewed by individuals outside the profession would invalidate the claim of exclusive possession of esoteric knowledge — the basis of professional autonomy.

From professional autonomy, many privileges result. First, professional workers achieve greater access to or more
control of critical resources than non-professionals. This is because, as the sole possessors of specialized expertise and knowledge in the field, professionals can argue that they cannot perform their work adequately unless they are given the appropriate resources (e.g., equipment, staff) to conduct their work properly [24]. Second, professional workers have control over the tasks performed by non-professionals and paraprofessionals that assist rather than replace their work activities [24]. This control is acquired because, as holders of an esoteric body of knowledge with professional autonomy over their work domain, professionals can argue that they cannot perform their work adequately unless they have such control. The privilege of control over nonprofessionals and paraprofessionals is particularly valuable in those organizations where hierarchies exist among multiple occupational groups. A hospital, for example, is an organization where medical knowledge is divided among many occupational groups in health care with physicians being at the top of the hierarchy. For the rest of the paper, because our interests rest mainly on physicians’ acceptance of IT, we will focus our discussions on the medical profession.

3.1. Resistance to perceived threat to professional autonomy

Because privileges associated with professional autonomy directly link to social value systems, status, and economic outcome, physicians are likely to support elements that foster their autonomy and resist those that may threaten their professional autonomy. There is ample empirical evidence with regard to clinical practice guidelines that support this argument. For example, surveys of physicians’ attitudes about and preferences regarding clinical practice guidelines consistently found that a substantial percentage of physicians were concerned over the loss of autonomy [8, 30]. The practice of performance indicators in UK clinical care has also been demonstrated to be perceived by general practitioners to reduce their clinical autonomy [19]. In addition, a case study of Canadian physicians found that physicians vigorously defended their professional ideology, free-enterprise ideology, and economic self-interest [26]. Another study found that most general practitioners welcomed clinical guidelines as a means of improving care, but they resisted them when they perceived that the guidelines encroached on their professional autonomy [18]. Similarly, other studies documented resistance to particular medical provisions [27, 59] or organizational changes [29] on the basis that such changes might adversely affect professional autonomy. A survey of physicians found that 68% agreed or strongly agreed that clinical freedom was essential to the practice of medicine and physicians should fight against any constraints upon it [14].

3.2. IT and perceived threat to professional autonomy

Because IT (such as clinical decision support systems) may, to certain degree, codify expert knowledge possessed by physicians and the problem-solving process previously known only to physicians, physicians may perceive it as threatening to their professional autonomy. This is because the process of knowledge codification inevitably results in more knowledge distributed among subordinate paraprofessionals [51], making it difficult for physicians to claim exclusive possession of a special competence in esoteric bodies of medical knowledge [29]. Codification of knowledge may also result in objective measures that are intended to reflect physicians’ performance and permit laypersons and subordinate paraprofessionals greater access to the abstract knowledge possessed by physicians as well as greater understanding of physicians’ practices. This greater access, in turn, may invalidate physicians’ claim for sole possession of esoteric medical knowledge and basis for peer review, thereby weakening their professional autonomy and, consequently, their control of resources and the work of subordinate groups. Similar arguments about the relationship between outside access of previously exclusively possessed body of specialized knowledge and reduction in professional autonomy have been made and well articulated in the literature (e.g., [40]). The claim of exclusive possession of specialized knowledge gives an occupation professional autonomy [40]. Further, access to specialized knowledge by persons outside a profession erodes the profession’s autonomy [40]. These arguments in the literature directly lay support for our argument that degree of codification of knowledge by information technology is positively related to perceived threat to professional autonomy.

A case study examining the relationship between IT and professional autonomy indeed found that when IT codified procedures and knowledge, it was perceived as threatening to professional autonomy and was perceived to reduce professional autonomy [46]. The case study examined physician reactions after the adoption of information systems. In this case study, the information system being implemented had many rules and recommendations built into it, much like a decision support system. According to Mclaughlin and Webster [46], the system greatly threatened knowledge claims and occupational boundaries. They found through qualitative interviews that because of the rules and recommendations built into the system, it was perceived by lab officers’ and medics’ as encroaching on their professional autonomy. Some respondents indicated that they believed that the system reduced their professional autonomy and others reported that they brought about changes to how the system interacted with them. Drawing from conceptual arguments and case studies, we argue that professionals may react with resistance when they believe that an IT may threaten their professional autonomy. As such, we propose that Perceived Threat to Professional Autonomy is an important construct to study in the context of IT acceptance, that is, perceived threat to professional autonomy is a salient belief affecting physicians’ intention to use an IT.

3.3. Perceived threat to professional autonomy as a new construct

Past studies have extended TAM and considered other factors specific to professionals when examining physician adoption. These studies have examined the possible influence of subjective norms, perceived behavioral control, peer influence, and compatibility with work practices [10, 11]. Findings suggest that physicians tend to be relatively independent when making decisions about IT acceptance. Explanations for their independence include specialized training and autonomy, but Perceived Threat to Professional Autonomy has not been proposed as a new construct or
studied under the nomological network of other IT acceptance constructs. Although researchers have studied similar constructs such as behavioral control, they have not examined professional autonomy, considered a central characteristic of the medical professional [2]. The next section examines the construct of Perceived Threat to Professional Autonomy under the nomological network of IT acceptance.

We formally define the construct of Perceived Threat to Professional Autonomy as follows:

Perceived threat to professional autonomy is the degree to which a person believes that using a particular system would decrease his or her control over the conditions, processes, procedures, or content of his or her work.

4. Hypotheses

Physicians are particularly sensitive to changes in their work environment that may threaten their overall professional autonomy [18,27,28,30], as discussed previously. The effect of this perceived threat on adoption intention may be partly mediated by perceived usefulness, in that when physicians perceive certain IT as threatening to their professional autonomy, their perception of usefulness toward job performance of that IT may be colored. This is because physicians are usually uncomfortable, and rightly so, when someone (in this case a computer system) acts as if he knows more than they do about one of their patients [44]. Instructions given by a computer system such as a clinical decision system can be considered as telling physicians what to do and hence can be perceived as encroaching on their professional autonomy. Because physicians believe that they are in the best position to decide what to do with a patient, such instructions may be deemed as not useful [29]. We therefore have the following two hypotheses:

Hypothesis 1. For physician users, perceived threat of an IT to professional autonomy is negatively related to the intention to use that IT.

Hypothesis 2. For physician users, perceived threat of an IT to professional autonomy is negatively related to perceived usefulness of that IT.

Hypotheses 1 and 2 are the central propositions of this paper. To more clearly understand the relative impact of perceived threat to professional autonomy on physician IT acceptance, we put Perceived Threat to Professional Autonomy construct in the nomological network of TAM. We did not choose an extended model of TAM because our central hypotheses only involved perceived usefulness and intention to use, two of the three constructs in TAM. The following hypotheses specify the relationships among TAM constructs and are included for completeness.

Hypothesis 3. For physician users, perceived usefulness of an IT is positively related to the intention to use that IT.

Hypothesis 4. For physician users, perceived ease of use of an IT is positively related to the intention to use that IT.

Hypothesis 5. For physician users, perceived ease of use of an IT is positively related to perceived usefulness of that IT.

Empirical results reported in the literature are consistent with respect to the effect of perceived usefulness on intention (Hypothesis 3) and with respect to the effect of perceived ease of use on perceived usefulness (Hypothesis 5). The results concerning perceived ease of use on intention (Hypothesis 4), on the other hand, are somewhat mixed in the literature. Some studies have found that perceived ease of use has a direct effect on intention to use [64,65], whereas others have found that perceived ease of use is related to behavioral intentions only in the early phases of implementation [17]. Because the participants in our study will be inexperienced users (discussed later), we hereby consider that perceive ease of use has a positive effect on intention to use (Hypothesis 4).

5. Method

5.1. Procedure

Data were collected from a survey conducted by mail. Surveys were sent to 1000 randomly selected physicians found in the directory of physicians affiliated with either a major insurance company or a major medical information services management company in the US. Each respondent was asked two sets of parallel questions, one set containing questions with respect to Electronic Medical Records (EMR) systems and the second Clinical Decision Support (CDS) systems. A working definition of each of the two types of systems was given as follows in the survey itself.

Electronic Medical Records (EMR) systems are computer systems that allow you to create, store, edit, and retrieve patient charts on a computer. These systems facilitate the organization and rapid retrieval of information by serving as digital repositories for physicians’ notes and laboratory results as well as patients’ problem lists, medications, allergies, and essential socio-demographic and contact data.

Clinical Decision Support (CDS) systems are computer systems that allow you to obtain professional advice during consultations with patients. These systems, often referred to as expert or knowledge-based systems, use patient data and a series of symbolic and heuristic reasoning techniques to generate diagnostic and treatment options, prescription advice, and care planning.

Our main reason for using two types of systems was that codification of knowledge was theorized in this paper as the main cause of perceived threat to professional autonomy of an IT. EMR and CDS differed in their levels of knowledge codification because EMR’s main function is to improve organization and efficiency, whereas CDS’s main function is to improve clinical decision-making by formulating rules, procedures, and recommendations that guide or even restrict medical practice. Having data on both types of systems would allow us to investigate the hypothesized relationships in technological contexts of low and high knowledge codification.

Naming specific systems of EMR and CDS would have been more desirable than defining two generic types, but this was not possible because there were no dominant systems known to most physicians. However, the practice of using a
classification of a system can be found in IT adoption literature. For example, studies of telemedicine adoption conducted by Hu and colleagues involved physicians from different hospitals and different specialties where telemedicine technology could be used differently. In those studies, a general definition, instead of a specific use of telemedicine technology, was used in the questionnaires [10,11,32].

In addition to questions about EMR and CDS, data about respondents’ demographics and practice setting were also collected. Respondents were also asked to specify their past experience with each system. Two rounds of mailings were sent, with the second round sent to physicians who did not respond in the first round. Overall, 271 responses were received. Because attitudes of pre-adopters, initial-adopters, and post-adopters were known to be influenced by different variables [37,49] and a National Center for Health Statistics survey found that only 25% of office-based physicians reported using fully or partially EMR [47], we concluded that pre-adopters in our sample would reflect the general population more closely. To obtain a sample of pre-adopters, responses from physicians who had used EMR before (53 of responses) were excluded from analyses of EMR data. In addition, incomplete responses to EMR system questions were also excluded. The same exclusions were made separately for responses to CDS system (only 16 reported having used a CDS before).

In the end, 203 responses from the original sample were used for EMR data analyses and 129 responses were used for CDS data analyses. The effective response rate is comparable to published studies using this population or the population of top executives in business[9,34]. In order to assess whether non-response bias was present, t tests were conducted comparing first round responses to second round responses [37]. No significant differences were detected.

5.2. Measures

Survey items measuring perceived usefulness and perceived ease of use were adapted from the original 12-item instrument developed by Davis [15]. Six more items measuring intention to use a certain IT were adapted from Hu and others [32].

To develop a scale to measure perceived threat to professional autonomy, we reviewed literature on professional autonomy and collected all measures used in the literature. Lengermann [43], in measuring perceived professional autonomy of CPAs, used one item: “freedom to exercise one’s own professional judgment in carrying out one’s work.” However, in the health care environment, there are other professional or paraprofessional groups that are subordinate to the physicians. Being able to exercise professional judgment alone is not sufficient because it does not address physicians’ relationships with other professionals or paraprofessionals. We hence conducted interviews with local physicians to elicit the most salient features of professional autonomy. The result was a 6-item measurement for perceived threat to professional autonomy, listed below for EMR. The same 6 questions were used for CDS by replacing EMR with CDS.

1. Using EMR may decrease my control over clinical decisions.
2. Using EMR may decrease my professional discretion over patient care decisions.
3. Using EMR can decrease my control over each step of the patient care process.
4. Using EMR may increase monitoring of my diagnostic and therapeutic decisions by non-providers.
5. Using EMR may decrease my control over the allocation of scarce resources.
6. I would find EMR advantageous for the medical profession as a whole.

All survey items were measured using a 5-point Likert scale indicating the extent to which each respondent agreed or disagreed with statements describing their perception or intention to use a specific IT. The values of 1 (strongly disagree) to 5 (strongly agree) were used. The midpoint value, 3, indicated neither agree nor disagree.

6. Analyses and results

The data were analyzed using a partial least squares approach to structural equation modeling. Because of its component-based approach to estimation, this approach places minimum demands on sample size and residual distributions [12,13]. The software used was PLS-Graph 3.0, Beta Test Copy, developed by Wynne W. Chin. Each analysis was performed twice, one for each type of IT. An alpha level of .05 was used for all statistical tests.

Demographic data for the 203 EMR responses and the 129 CDS responses are summarized in Table 1. Chi-square tests showed no significant difference between EMR percentages and CDS percentages for the same demographic variable.

Characteristics of our sample of physicians are consistent with those found in the broader United States physician population. According to Scalise [55], in 2003, nearly 75% of all licensed physicians in the United States were male. Further, physician age distribution was listed as follows: less than...
Table 2
Mean, standard deviation, square root of average variance extracted, and correlations

<table>
<thead>
<tr>
<th></th>
<th>EMR</th>
<th></th>
<th>CDS</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>S.D.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1. PU</td>
<td>3.61</td>
<td>.82</td>
<td>.89</td>
<td>.90</td>
</tr>
<tr>
<td>2. EOU</td>
<td>3.32</td>
<td>.82</td>
<td>.58</td>
<td>.81</td>
</tr>
<tr>
<td>3. Intention</td>
<td>3.78</td>
<td>.94</td>
<td>.83</td>
<td>.60</td>
</tr>
<tr>
<td>4. PTA</td>
<td>3.30</td>
<td>.74</td>
<td>.73</td>
<td>.53</td>
</tr>
</tbody>
</table>

Note. Values in diagonal cells are square root of average variance extracted. EMR = electronic medical records; CDS = clinical decision support; PU = perceived usefulness; EOU = perceived ease of use; Intention = Intention to Use an IT; PTA = perceived threat to professional autonomy.

Discriminant validity was assessed by comparing the square root of average variance extracted of one construct with correlations between this construct and another construct. In Table 2, diagonal elements are square root of the variance shared between the constructs and their measurements. The off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements [22], which is the case as shown in Table 2. Table 2 also records descriptive statistics for all constructs.

Path coefficients for the structural model are presented in Table 3 for EMR and CDS data, respectively.

Hypothesis 1 predicted that perceived threat of an IT to professional autonomy is negatively related to the intention to use that IT by physicians. This main hypothesis was supported for both EMR and CDS, although the path coefficient for CDS was stronger than for EMR. A moderated multiple regression was run to see if type of system served as a moderating variable for the negative relationship between perceived threat to professional autonomy and intention. The result showed that respondents had higher intention to use EMR (p-value < .01). However, the interaction term (perceived threat to professional autonomy interacting with type of IT) was not significant (p-value = .57). An F test of R² difference between the models with and without the interaction term showed that there was no difference in the adjusted R². Hence, type of IT was a factor in physicians' intention to use IT but it does not moderate the relationship between perceived threat to professional autonomy and intention to use an IT.

Hypothesis 2 predicted that perceived threat of an IT to professional autonomy is negatively related to perceived usefulness of that IT. This hypothesis was supported for both EMR and CDS with the same path coefficients.

Hypotheses 3–5, corresponding to similar hypotheses derived from the original TAM model, were supported for both the EMR and CDS data. The support for Hypotheses 3 and 5 is consistent with the literature. Our relatively small path coefficients for Hypothesis 4 reflect the existing findings that pre-adopters rely mainly on perceived usefulness when forming their intentions [61].

To assess the explanatory power of Perceived Threat to Professional Autonomy construct, we calculated effect size of this construct on Intention to Use according to Chin’s formula [13]. According to Chin [13], effect size of .02, .15, and .35 could be viewed as a gauge for whether a new construct had a small, medium, or large effect at the structural level, respectively. The effect size of Perceived Threat to Professional Autonomy on Intention to Use was calculated to be 0.22 for EMR data and 0.30 for CDS data.

35 years, 16%; 35–44 years, 24.1%; 45–54 years, 24.9%; 55–64 years, 16.3%; and more than 65 years, 18.6%. This age distribution is consistent with the distribution of “number of years in practice” variable in our sample. With respect to practice setting, according to United States Department of Labor statistics for physicians and surgeons [63], 16% of physicians and surgeons work in private hospitals. The majority of them work in office-based medical practices. Among those who work in office-based medical practices, a National Center for Health Statistics survey found that about 33% work in a solo practice, 33% work in a practice of two to four physicians, 20% works in a practice of five to nine physicians, and the rest work in groups of 10 or more [47]. This distribution of physicians matches closely our sample distribution.

Construct validities were assessed with item loadings, internal consistency reliability, and discriminant validity. Item loadings greater than .7 were deemed acceptable [13]. Two of the items measuring perceived threat to professional autonomy, Items 2 and 4, had lower than .7 loadings for both EMR and CDS data and hence were dropped from further analyses. The measurement model was then re-run with four of the remaining items measuring perceived threat to professional autonomy and all items of the other constructs. In the new result, all t values were significant. One item measuring perceived ease of use, “I would find EMR INFLEXIBLE to interact with,” had an item loading of .67 for EMR data and .76 for CDS data. It was retained in further analyses. All other new item loadings were greater than .70 for both EMR and CDS data.

Internal consistency reliability was assessed using composite reliability scores reported in the software output. These scores ranged from .86 to .97, well above the recommended value of .7 [22].

Table 3
Path coefficients and t values for EMR and CDS data, respectively

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path</th>
<th>EMR data</th>
<th></th>
<th>CDS data</th>
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<tbody>
<tr>
<td></td>
<td>Independent variable</td>
<td>Dependent variable</td>
<td>Path coefficient</td>
<td>t-value</td>
<td>Path coefficient</td>
</tr>
<tr>
<td>1</td>
<td>PTA</td>
<td>Intention</td>
<td>−.37</td>
<td>−3.08**</td>
<td>−.42</td>
</tr>
<tr>
<td>2</td>
<td>PTA</td>
<td>PU</td>
<td>−.57</td>
<td>−1.93**</td>
<td>−.57</td>
</tr>
<tr>
<td>3</td>
<td>PU</td>
<td>Intention</td>
<td>.62</td>
<td>11.41**</td>
<td>.39</td>
</tr>
<tr>
<td>4</td>
<td>EOU</td>
<td>Intention</td>
<td>.15</td>
<td>2.93**</td>
<td>.13</td>
</tr>
<tr>
<td>5</td>
<td>EOU</td>
<td>PU</td>
<td>.29</td>
<td>5.43**</td>
<td>.32</td>
</tr>
</tbody>
</table>

Note. *: p-value < .05; **: p-value < .01. EMR = electronic medical records; CDS = clinical decision support; PU = perceived usefulness; EOU = perceived ease of use; Intention = Intention to Use an IT; PTA = perceived threat to professional autonomy.
0.18 for CDS data, both considered medium size effect. We therefore concluded that Perceived Threat to Professional Autonomy construct adds more explanatory power for explaining physicians’ intention to use information technology for both EMR and CDS.

7. Discussion

Our results show the importance of perceived threat to professional autonomy in IT acceptance by physicians. The construct measuring perceived threat to professional autonomy of an IT was found to have a significant, negative effect on perceived usefulness for both EMR data and CDS data, which suggests that perceived threat to professional autonomy is an important antecedent to perceived usefulness.

Our results confirm existing studies that have concluded that other factors beyond perceived usefulness and perceived ease of use are important to consider when examining user acceptance of IT among professionals [10,11]. Our results provide further support that members of professional groups such as physicians may approach user acceptance decisions differently from other users. Such findings provide further support that characteristics of distinct user populations should be considered in studying user attitude toward IT. Other studies have examined separate influences of a subset of professional characteristics such as subjective norms, peer influence, and compatibility of IT with work practices. However, our findings are the first in IT adoption research to document that physicians pay attention to whether or not an IT may threaten their professional autonomy.

Our results have important IT design implications: Perceived usefulness is not just a matter of functionality. For physician users, a sophisticated system would not be adopted if the system does not follow the natural flow of a physician’s work, or if it can be perceived by the physician user as threatening to her professional autonomy. Organizational decisions to adopt a new IT should be made with attention to physicians’ priorities about the nature of their work.

Our results also show that the negative effect of perceived threat to professional autonomy on intention to use an IT was larger for CDS data than for EMR. In addition, physicians had higher intention to use EMR. This can probably be explained by the fundamental differences in their functionalities between these two systems. EMR’s main function is to improve organization and efficiency. It does not (or in very limited way) codify the medical knowledge. Such a system may free health care professionals from the busy work of data gathering and organizing, and in turn allow them to create knowledge and to participate more in patient advising. This effect is indeed demonstrated in a study of OLAP tools used by health care planners [62]. On the other hand, CDS’s main function is to improve clinical decision-making by formulating rules, procedures, and recommendations that guide physician behaviors. This process codifies knowledge needed for clinical decision-making previously held exclusively by physicians. Since the potential effect of codification of knowledge is outside access of previously exclusive domain of a profession, which, in turn, threatens professional autonomy, IT that codifies more knowledge can be perceived as more threatening to professional autonomy. Therefore, physicians may be more resistant to CDS than to EMR. Another possible explanation is that EMR is more widely used in the health care field. Thus, such systems may be more familiar to medical professionals and so are better received. Physicians’ having differing attitudes toward the two types of systems supports the notion that level of knowledge codification is an important technological context in user acceptance. This alerts managers to the fact that different types of systems may require different policies and tactics to ensure that perceived threat to professional autonomy is minimized.

7.1. Limitations of the study

Although this study demonstrated the importance of perceived threat to professional autonomy in IT acceptance for physicians, there are limitations to the study. First, concerning the participants of the study, although the response rate is comparable to published studies of this population using mail survey methods [9,34], it is nevertheless low. Thus, self-selection biases might have been introduced into the study. Physicians who were interested in or familiar with health care IT such as EMR and CDS might have been more likely to respond. Even though only pre-adopters were used in analyses, there was a chance that the respondents were more weighted toward people with stronger feelings about IT than the general physician population. Further, some respondents might hold strong and negative feelings toward EMR or CDS and as a result would in fact be non-adopters. This chance was small, however, because our t tests did not show a statistically significant difference between the first batch of respondents and the second batch.

Our sample was heavily male: over 77%. This was not surprising considering that the physician population was similarly heavily male. We did not have enough data from female participants to do a comparison study between the two sexes. However, because the study population, the physicians, is heavily male ~ 75%, according to Scalise [55] – our sample distribution is consistent with the true demographic and hence we do not consider this demographic of our sample as impeding.

The participants of this study were pre-adopters who might not foresee all types of potential impact on their autonomy. Our results are therefore limited to only early stages of clinical IT implementation. However, since only 25% of office-based medical practice reported using EMR fully or partially [47], our results should still have wide applicability.

The respondents were heavily centered around office-based physicians. Since majority of physicians do work in office-based medical practices with physician distribution matching our sample [47], our results are valid. However, we do not recommend generalizing our results to a hospital setting, where circumstances and conditions surrounding professional autonomy seem to take on different dynamics. It will be interesting to see how physicians at different levels of professional authority, such as interns, residents, and attendings, show their intentions to accept IT in a hospital environment. Such a study would use only subjects working in hospital settings as a sample. In addition, often, in a hospital setting, the use of EMR and other systems is mandated. Pre-adopters in such organizations may not have much control over the decisions. Further, this population may also represent a relatively small portion of physicians. So in investigating the hospital setting, using post-adopters would be more appropriate.
The systems referred to in the survey were two categories of medical IT. Respondents were not given two specific software systems. This limitation was mostly due to the difficulty in obtaining a large enough sample who had used the same specific software systems. Although using a type of system as opposed to a specific system has been done in studies of telemedicine acceptance [10,11], caution needs to be exercised in interpreting the results. This is because the general definitions of EMR and CDS given in the survey might have invoked different perceptions of what they were. To deal with this situation, we used only pre-adopters in our analyses, which served to reduce the impact of varied preconceptions about the two types of systems.

7.2. Implications for future research

Our study identifies perceived threat to professional autonomy as an important antecedent to perceived usefulness in the context of physician acceptance of IT and it has significant, negative impact on intention to use IT for the physician population.

Future research can examine what other factors may moderate the negative relationship between perceived threat to autonomy and intention to use. For example, although physicians may be sensitive to an IT that greatly codifies knowledge when considering its use, such concerns may be moderated by the extent to which physicians are involved in the decisions related to and development of that IT or, alternatively, by the confidence that the IT will be used exclusively by physicians. In fact, a qualitative study found that physician were willing to change their practice patterns when they were involved in both the planning and the implementation of a web-based Physician Profiling System and that such willingness contributed to the success of this system [38]. Other moderating variables may include physician characteristics such as computer self-efficacy and familiarity with the system.

The existing professional autonomy of the medical profession is an outcome of hundreds of years of practice. Effect of IT on professional autonomy is theorized on the basis of knowledge codification of IT. Further studies are needed to identify how other features of clinical information system besides level of knowledge codification of IT may affect perceived threat to professional autonomy. For example, level of interactivity may enhance user perception of control and thus reduce perceived threat to professional autonomy.

Physicians are central elements of patient care, but there are other groups of people whose roles are important as well. Nurses, hospital administrators, medical technicians, and IT support play unique roles and will influence the outcome of IT adoption. Since an IT can greatly threaten knowledge claims and occupational boundaries [46], studying perceived threat to professional autonomy of clinical information systems in the context of multiple professional groups is a natural extension of the current research.

The empirical results of this paper are based on data collected from physicians. Although theoretical arguments about perceived threat of IT to professional autonomy made in this paper apply to any occupation granted professional autonomy, more empirical studies are needed to investigate the role of perceived threat of IT to professional autonomy in professions unrelated to the medical profession. This is because, even though physicians form a specific type of professionals and share many common characteristics with other professionals, different professional groups may differ across industry and organizations. For example, some may have greater control over other subordinate groups and may differ in the degree to which they benefit from privileges of resource control. Others may not have volitional control over existing organizational policies. Professional groups enjoying more privileges and having more volitional control (such as physicians) may be more sensitive to potential threats of IT to their professional autonomy than other professional groups. Professional groups enjoying less privileges may only be sensitive to whether or not an IT affects their work flow and work style as opposed to professional autonomy, as demonstrated in the case of software developers (Purao and Storey, 2008). Future research is needed to examine whether perceived threat of IT to professional autonomy affects the attitude toward IT for other types of professionals.

7.3. Conclusions

Medicine is one of the oldest and most well-established professions where professional autonomy is a central characteristic [2]. With health care constituting larger and larger shares of GDP, the health care industry increasingly is looking to IT to improve health care delivery [21]. Acceptance of IT by physicians is needed to bring IT to fruition. Our finding that perceived threat to professional autonomy has a negative impact on both perceived usefulness and intention to use an IT informs managers about physicians’ concerns and fears of IT’s perceived negative impact on their work environment. This finding offers an improved and deeper understanding of the complexity of user behavior concerning IT use. With this understanding, managers can be in a better position not only to identify sources of resistance but also to develop strategies to promote the benefits of IT so as to improve overall acceptance of IT. Only with greater acceptance by physicians and other health professionals alike, can IT play a central role in improving health care delivery.

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