Paper versus Electronic: Challenges Associated with Physicians' Usage of Electronic Medical Records.

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Abstract

This study builds on the theory of planned behavior, institutional and diffusion theories to investigate physicians' attitudes and usage behaviors of electronic medical records (EMR). Interviews with seventeen physician-residents enrolled in a Family Practice residency program and eight attending physicians in the same clinic showed that most physicians held rather negative attitudes regarding the EMR system. EMR was often times seen as an intrusion in the patient-physician interaction. Other findings relate to the impacts EMR had on physicians' time, expertise, physicians' learning, the length (and sometimes the accuracy) of the clinical notes. Challenges associated with behavioral control issues such as availability of computers and the physical positioning of computers are shown to be very important in the context of this case. Physician-residents have to use EMR because of its mandatory nature, however, if they had a choice or the power, the majority of physicians would use the paper chart.

1. Introduction

Adoption of emergent information technologies (IT) has occupied a central role in IS research since the inception of the field. There have been many studies investigating IT adoption in different settings at both individual and organizational levels of analysis and different theoretical models have been used [1,51]. However, with few significant exceptions [16,19,21,32,33], IS research is scarce regarding IT adoption in a healthcare environment.

Adoption of IT in healthcare *to support physicians' clinical decisions* [52] is considered to be a major problem [34,47]. While administrative IT systems have been in use for quite some time in hospital environments to deal with billing, data handling and other administrative issues [6], clinical information systems that require physicians to write orders, prescriptions, access lab results and support other aspects of their work are not yet very common.

A particular clinical IS that is the object of this study is the Electronic Medical Record (or EMR). While clinical IS hold much promise in reducing medical errors and cutting healthcare costs [48], physicians are reluctant and unwilling to accept these new healthcare applications in their practices [6,12,26,35,47]. Today, in many hospitals, physicians often write orders in the traditional manner, while nurses or other personnel enter them into an information system. However, this clerical input of physician data can be quite expensive overall. The annual cost of physician transcription for a subset of dictated notes was estimated at $325,000 [26]. Thus, understanding what drives physicians' acceptance of IT systems and how they use these systems is a major research problem.

2. The Healthcare Environment

Recently, it has been argued [18] that the healthcare industry received little attention in IS research and theory and concluded that the industry itself provides an important "contextual space" to extend and build new IS theory and also to evaluate the boundaries of existing IS theory.

IT has not been pervasive in healthcare other than at the administrative level (i.e. tracking health plan enrollment, processing claim transactions, risk adjustment and profiling physicians) [53]. Hospitals lag other industries in IT adoption by 10-15 years as regards to IT spending [13].

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Little is known about the adoption and use of healthcare IS among healthcare professionals. Several studies investigated physicians' perceptions of IT in different settings. For example, one study [16] looked at the adoption of telemedicine by healthcare professionals and found that attitudes, together with system usefulness are major determinants of physicians' acceptance of telemedicine.

Several other authors found similar results in investigating physicians' acceptance of telemedicine or Internet-based applications [19,29]. These results suggest that physicians are a special professional group and thus their evaluations of the technology may differ from those of other subjects previously examined in IS research. It is worth mentioning that most of these studies have used telemedicine as the technology of interest. Fewer studies have looked at consequences of EMR implementation in different settings. Some authors used a longitudinal approach to investigate physicians' resistance to EMR in three hospital settings [33]. They focused on the factors triggering physician group level resistance during different phases of EMR implementation. They found that in early stages of EMR implementation, the object of resistance was the system itself and its features while in the latter stages of implementation the object of resistance has become politicized.

In the present study we focus on a rather new technology, EMR. EMR systems seem to be quite different from other technologies looked at in past IS studies, primarily because of their complexity [17].

An Institute of Medicine report [30] defines EMR as "…an electronic patient record that resides in a system specifically designed to support users through availability of complete and accurate data, reminders and alerts, clinical DSS, links to bodies of medical knowledge and other aids." The emphasis thus is on the clinical functions with the final goal of achieving standardized care (data is available in a structured form) and interoperable health records. More specifically, an EMR can be used to prescribe medication (dosages), check allergy information, drug interactions, view X-rays, order and access lab results, support diagnosis, make referrals, see a patient's history (age, disease state, insurance plan) and document a clinical encounter. An EMR can also be used for communications (remote access, Internet access and email) and clinical decision-support.

3. Research Framework

This study aims at analyzing individual physician's acceptance and usage of EMR. The following research question is posed: "*What are factors that most contribute to physicians' attitudes and usage behavior regarding electronic medical records?*"

The research builds on the Theory of Planned Behavior (TPB) [3,4,44], diffusion theory [39,42] and institutional theories [8,14,22] to present a framework for studying physicians' adoption and usage of EMR in a healthcare environment.

Using a research framework has been recommended when existent theoretical models have not yet been specifically applied in a domain of interest such as healthcare [50]. TPB is the guiding framework as it is a general model that has the potential to explain any human behavior including adoption and usage of EMR [3,3,5,25]. TPB has been previously applied in IS research in a variety of domains [16,37,44].

TPB posits that a person's performance of a specified behavior (e.g. usage of EMR) is primarily determined by the person's attitudes, subjective norms and perceptions of behavioral control concerning the behavior in question. These constructs are presented in the following paragraphs.

3.1. Attitudinal Belief Structure

Attitudes capture an individual's positive or negative feelings about performing the target behavior such as using an information system [3]. Attitudes have been shown to influence both initial usage and long term usage [10,20,31]. Although Venkatesh et al (2003) present an argument for excluding attitudes from their proposed unified theory of user acceptance of IT, we believe that when using the original TPB-framework, [3,4,5] physicians' attitudes towards the EMR technology can provide valuable insights into why they may like or dislike EMR.

TPB posits that attitudes are primarily driven by the beliefs individuals form about a particular behavior [25]. This theory is general with regards to the types of beliefs that impact attitudes. We posit two main sets of beliefs that may be important in a healthcare context, namely beliefs about the EMR artifact and beliefs about the medical profession. This last construct allows us to deal with contextual issues present in healthcare considering the fact the medical profession has strong values on which it is based. In eliciting the proposed attitudinal belief structure, we complement TPB with diffusion theories and institutional theories.

3.1.1. Beliefs about the EMR artifact

It was recommended [25] that salient beliefs be elicited anew for each context. However, in the IS literature there is a wealth of research on technology adoption that provide a set of stable, well-established individual beliefs that drive technology acceptance and usage [31]. Innovation diffusion theory [42] offers a rich set of beliefs, called perceived innovation characteristics, that concern a potential adopter's beliefs regarding the characteristics of the innovation in question (in this case EMR). Based on a meta-analysis of existent research, [46] found that three innovation characteristics received consistent empirical support across studies, therefore these three main beliefs will be investigated in a healthcare context.

Perceived complexity refers to the degree to which an innovation is viewed as being difficult to use [42]. Some authors [39] view this construct as the conceptual opposite of perceived ease of use [20], which refers to the degree to which the prospective user expects the target system to be free of effort.

Perceived relative advantage is the degree to which adopting or using an IT innovation is perceived as being better than using the existent practice [31,42]. This construct is seen as similar to perceived usefulness [20], however, we see relative advantage as rather more comprehensive construct as it involves a comparison of a newly introduced system with the old existent system.

Perceived compatibility is the degree to which an innovation fits with a potential adopter's existing values, beliefs and experiences [42]. This construct has been shown to consistently influence innovation adoption [2,39,40,42,49].

3.1.2. Beliefs about the Medical Profession

In a professional setting, values and beliefs about the profession itself may play a major role in the formation of individuals' attitudes about an IT innovation.

We consider the current ways of practicing medicine as an institution. Institutional theorists such as [8] defined institutions as "prevalent habits of thought" with respect to the institutionalized behaviors of a group of people. The "habit of thought" feature of institutions is given a cognitive dimension reflecting culturally-based social norms, rules and embodiment of habituated behaviors, which gives institutions a stable and inert quality over time [14,28]. Habit is a central element that characterizes any institution as it provides the tendency for individuals or groups of individuals to "engage in a previously adopted or acquired form of action" [15].

The medical profession has long had an established tradition regarding its own identity as a profession [24,43] based upon main values such as professional autonomy, status role and expertise [11]. Such values in time become institutionalized and serve as a basis for individual behavior [41]. EMR thus, may be perceived as a direct attack to these values [26].

Furthermore, healthcare organizations are viewed as professional bureaucracies [7] characterized by a high degree of professionalism. Healthcare professionals may be accustomed to a certain way of practicing medicine, based on specialized training [16] that usually does not involve use of computers but rather practice, experience and intuition. EMR radically disrupts these institutionalized beliefs and practices, which may lead to negative attitude formation towards the EMR technology.

3.2. Normative Belief Structure

According to TPB, normative pressures are an important element influencing individuals' intentions to use a technology. Subjective norms are a form of social influence [27]. Three main sources of influence [22] may be part of the normative control structure.

Coercive pressures may arise from government regulators, hospital administrators or other dominant actors. As EMR are often times multi-million dollar systems, physicians may be coerced into using EMR as the bylaws are enforced towards supporting a culture of using EMR in the organization. Furthermore, key players in the industry, such as Medicare or Medicaid have recently demanded more control over healthcare spending and tightened their requirements regarding electronic billing.

Normative pressures arise from interactions of individuals in different professional settings. To the extent that healthcare professionals are part of different professional associations and interact in different forums, they may be subject to different normative influences that may lead them to act in a certain way (i.e. use or not use EMR).

Mimetic pressures arise from direct imitation of an individual's behavior. Individuals may mimic each other as they are faced with uncertainty, goal ambiguity or poorly understood technologies and look for answers to their uncertainty by imitating others' behaviors [22].

3.3. Control Belief Structure

TPB posits that the perceived presence of certain constraints on behavior can inhibit both intentions to perform a behavior and the behavior itself [4]. Perceived behavioral control reflects the presence of

factors that can interfere with or facilitate the performance of a specific behavior [25]. Facilitating conditions or the availability of resources needed to engage in a behavior such as time, money and other specialized resources [44] and availability of support have been identified as major factors constraining or facilitating performance of a behavior (e.g. using an EMR system).

4. Research Site and Methodology

We used a grounded theoretical case study in order to investigate the impacts of the proposed constructs on physicians' usage of EMR. A case study examines a phenomenon of interest in its natural setting employing multiple methods of data collection to gather information from one or a few entities [9]. This approach is well-accepted in studying complex and contemporary phenomena [9] with strong contextual dependencies [54]. Case studies can be used to accomplish different goals [23,54] such as description, testing theory or generating theory.

The case study under investigation revolves around a Family Practice Center (FPC) that operates within a large hospital facility (Alpha) which is part of a billion dollar health system in the southern US. The Family Practice clinic is an outpatient clinic that operates at one of the main Alpha sites where physician-residents are trained in an Osteopathic family medicine residency program. The residency program operates a fully functional electronic medical record that both residents and attending physicians use on a daily basis. As opposed to the main hospital, Alpha, the Family Practice clinic is entirely paperless.

The 3-year Osteopathic family medicine residency program trains twenty-eight Doctors of Osteopathy (DOs) or physician-residents to become board certified in Osteopathic family practice medicine. The program is structured in three modules or groups based on the admitting year. Family practice one group (FP1) consist of ten DO residents, family practice two (FP2) group includes eleven DO residents while family practice three (FP3) has seven DO residents enrolled.

Osteopathic medicine is founded on the philosophy of considering the "whole person" (according to the American Academy of Osteopathy). Its focus is on the interrelationships of structure and function in the human body and the appreciation of the body's ability to heal itself. Doctors of Osteopathic Medicine (DOs) look at the "total person" with a focus on preventative care (which means that DOs focus on maximizing the body's inherent anatomic and physiologic capabilities to restore and maintain health). Rather than just treating specific symptoms or illnesses (more like MDs do), DOs look at the whole body.

The Family Practice clinic is entirely paperless. Paper charts are not an option for either residents or attending physicians. The clinic operates a comprehensive EMR that was implemented in 1997. This EMR system started as a mandatory system and it remained mandatory for both residents and attending physicians. The EMR system is used for both patient data retrieval such as histories or test results and also data entry (i.e. computerized physician order entry). All residents are required to use the EMR to look up their patient schedule, pull up the patient's chart, access patient's previous medical history, vital signs and other clinical data, write progress notes, enter diagnoses and write medical orders. Some of the attending physicians only use the EMR to supervise residents' charts (check the electronic chart for accuracy or errors) and co-sign the charts, while others also see patients in the clinic, thus they use the system to both supervise residents but also access and enter patient data.

Semi-structured interviews were conducted with seventeen DO residents and eight attending physicians. The DO resident sample included eight residents enrolled in the first module (FP1), five residents from the second module (FP2) and four residents enrolled in FP3. All residents have had both training and hands-on experience with the EMR system in the clinic and they used it regularly. Five of the attending physicians were in the clinic since the EMR system was introduced, some of them in fact supported its implementation in the clinic.

Other data sources were used in addition to the semi-structured interviews with physicians such as direct observation in the hospital environment and discussions with hospital administrators. Direct observation is a powerful tool [54] that allows the researcher to study phenomena in the natural setting of interest, absorb and note details and actions that take place. Specifically, one of the researchers attended various hospital meetings and spent many hours in the physicians' lounge (i.e. a break room where physicians use throughout the day for dining and other breaks during the day) in order to observe physicians' interaction and informally discuss with different physicians issues related to EMR usage. This researcher has also been rounding with physicians in the hospital in order to observe how physicians perform their daily work.

5. Analysis and Results

In order to analyze the interview data, pattern-matching techniques [38] have been used. Each interview has been coded in a table-based format according to the initial theoretical framework [38]. At the same time, we documented other new issues that emerged from the interviews in a grounded fashion [23].

5.1. Attitudinal Belief Structure

Most physician-residents in this sample (twelve out of seventeen) and some attending physicians (three out of eight) had predominantly negative attitudes about the EMR system at FPC both for data retrieval and data entry. It is important to mention that five attending physicians that had shown positive attitudes towards FPC's EMR were either part if the administration of the clinic or heavily involved with the EMR initiative. The motives underlying these attitudes are detailed in the next sections.

5.1.1.Beliefs about the EMR Artifact

Fifteen out of seventeen physician-residents and six out of eight attending physicians pointed towards complexities in using EMR and identified system navigation and EMR search capabilities as major considerations underlying their perceptions of complexity of FPC's EMR.

System navigation and search were two emerging dimensions of EMR complexity in this case study. EMR "navigation" refers to a physician's perceived ability to access a desired page with a minimum number of clicks or a minimum number of windows to get to desired clinical results. Ease of navigation for FPC's EMR is an important consideration for most physicians in this sample. Difficulties in navigating through the EMR systems at FPC are directly related to physicians' perception of the time it takes to access clinical information, which in turn impacts physicians' perception of work inefficiency. EMR search capabilities refer to a physician's ability to easily sort through clinical results to get a desired, customized view of the reports. As some physician-residents mentioned:

"…You type in a diagnosis that you feel appropriate, but it's not on their list of diagnoses… then you have to go thorough the time of finding what they feel it's an equivalent diagnosis….I don't have time for that…" (Physician-Resident 1).

"…What I discovered is that you have to close a record by hitting "Accept" on three different screens before it saves the information….it's a pain" (Physician-Resident 4)

The relative advantage of an EMR system refers to whether using the system is perceived as being better than using the paper chart. Almost all residents (seventeen out of eighteen) and some attending physicians (four out of eight) found the EMR system to be more at a relative disadvantage as compared to the paper chart. Several reasons underlie physicians' perceptions of the disadvantages of the EMR system versus the traditional paper chart. One reason for this negative perception is the amount of time it takes a physician to document clinical information in the computer system. This fact was also recognized by some of the attending physicians that worked with the system.

"The biggest disadvantage is the time you spend putting stuff into the computer. It used to be that it took 60 seconds to check things on a sheet of paper…less than that…now in the computer the physician has to code the exact diagnosis, the physician has to code the exact lab. It may double or quadruple the time it takes" (Attending Physician 1)

Another contributor that emphasizes the time related disadvantages of EMR is the double charting. Most physician-residents write their notes on paper during the patient encounter then document it in the computer, which can add time to their already busy schedule.

"You often don't have time during the patient encounter to actually put too much in the system; you have to go back afterwards and input most of the narrative. The charts tend to stack up cause you see a patient, then you have another patient and another patient… so, charts stack up towards the end of the day" (Attending Physician 6).

The EMR system at FPC did not seem to be compatible with the way physicians practiced medicine. The EMR system was perceived as an intrusion in the physician-patient interaction by the majority of residents (eleven out of seventeen) and also recognized by some attending physicians (three out of eight).

"…now that we have a computerized record it's strange but I felt like I was there to produce documentation for the computer not to take care of my patient" (Attending Physician 4).

One other reason EMR may not be seen as compatible with physicians' workflow seems to also be due to the

specialty of these physicians as DOs. As previously mentioned, DOs are more patient-oriented; they value the entire interaction with the patient and having a computer in the room with the patient is perceived to be in the way of this interaction.

"I personally have a problem with typing in front of the patient, cause I just don't like turning my back to the patient, even if I can put the computer in front of me, I still have a problem with typing in front of somebody. I still think this is extremely rude, so I'm never gonna do it" (Physician-Resident 2).

5.1.2. Beliefs about the Medical Profession

In this section we explore physicians' beliefs about whether current EMR systems have caused any change in the way they perform their clinical work. Physicians were asked during the interviews how the EMR system impacted the profession of medicine and the way they like to work. Several impacts on the profession have been documented.

One impact EMR had brought as compared to the paper chart is lengthy notes. Most residents felt compelled to document much more than on paper. Often times, as noted by some attending physicians, lengthy notes do not necessarily mean better notes. In fact, because most residents use existent templates and document their notes in mass, errors may be put in the system. As several different attending physicians that supervise residents' charts noted:

"The quality of the documentation is not better, probably worse overall. The idea is to get your note down as fast as you can. So they [physician-residents] may pick the simplest template even if it's barely relevant and sometimes irrelevant. There were some residents who were very conscientious with their notes and then there were some who were extremely sloppy" (Attending Physician 3).

EMR has significantly impacted physicians' "time" resource at FPC. Almost all physicians in this sample identified "time" as a scarce resource and have indicated that EMR systems at FPC have affected this important resource in mostly a negative manner. Often times, physicians have to stay over time to finish entering data in the EMR and many physicians are lagging behind with entering data or use workarounds such as asking close relatives to enter the data.

"Typically you are supposed to close your chart within a day so I try to do that but sometimes they can get dragged out a little longer. Some people get a couple of weeks behind. I heard situations where physicians had their wives to come in because they

were so far behind in their logs and then they dictated to them to type into the EMR"(Physician-Resident 13)

"…One physician…I ran into him yesterday, he's 200 charts behind!" (Attending Physician 4)

Physicians' "*expertise*" is another important resource that seemed to have been somewhat impacted by the EMR system at FPC. Some residents saw the EMR system as a threat to their independent thinking. This is mainly because the EMR system does not easily accept any diagnosis unless it matches a diagnosis from an existent list. As other discussions with other attending physicians have unveiled, the diagnoses in the EMR are not entirely complete and accurate according to the international classification codes. Searching to find a close diagnosis in the EMR to the one a physician desires to enter is cumbersome and does not allow for flexibility.

"I did not go to school for five years to do this…I'm not gonna have a computer tell me what I can or cannot diagnose!" (Physician-Resident 5)

One emergent theme from the interviews related to the impact the paperless EMR may have on residents' learning, as most times, all residents are doing are "clicking on things" (Attending Physician 8).

…If nobody moonlights in this program [go to outside clinics where paper charts are used], you may forget how to write prescriptions, because the computer does it for you, you may forget how to refer, being able to do everything without computers is important…here, we are so dependent on the computer system" (Physician-Resident 3)

As some other attending physicians were mentioning, when reviewing the charts, they found many inaccuracies due to the residents' extensive use of templates.

"For example, in the chart, on one of the SmartText phrases it says "checked the cranial nerves…. did few other things"…one of these phrases has basically a truly detailed neural exam…. well I know the resident didn't do it because he didn't have enough time to do it. At the same time, there was no reason to do that extensive of a neural exam according to the diagnosis" (Attending Physician 10).

In sum, most physicians in this sample did not see much positive change on their profession associated with EMR implementation at FPC.

"The timing, the typing, not always agreeing with your diagnosis, all these things add frustration to your day …medicine is already hard enough without adding

something that was supposed to help you…but actually making things worse" (Physician-Resident 8)

5.2. Normative Belief Structure

Social influences refer to an individual physician's assessment of the extent to which important referent others (e.g. hospital administrators, other peer physicians in different forums) would desire the performance or nonperformance of a specific behavior such as using an EMR system [25,27]. Due to the mandatory usage of EMR, most residents at FPC tended to perceive EMR as "the way things are" in the clinic. Normative and mimetic influences did not seem to carry too much weight in this environment.

"We don't have a choice, a paper choice" (Physician-Resident 11).

"That's what we use here and this is what we have here. It's already engrained. Nobody is trying to push it one way or the other" (Physician-Resident 6)

Other sources of pressures such as Medicare were recognized by some residents however these pressures were perceived as future rather than a present threat.

"…within two years Medicare is gonna require everyone to use it. If you don't take Medicare, you have a choice to use paper….. Reimbursement is higher with an electronic system than with a paper system because you document better" (Physician-Resident 9)

5.3. Control Belief Structure

Perceived behavioral control factors such as availability of hardware resources and physicians' perceptions of the available support regarding their EMR usage [44] are investigated in this section. Physicians were asked whether they believed there were a sufficient number of computers available to support their usage of EMR and whether they could easily find a computer when they needed to access the EMR system while in the hospital. Physicians were also asked whether they perceived they had enough support in terms of physicians' advocates to support them in their EMR usage.

All eighteen residents acknowledged the lack of available computers in the clinic. FPC currently has a computer in each patient's room and three-four other computers throughout the clinic. Residents have to find an available computer to document their electronic notes at the end of each patient's encounter or at the end of the day. The rooms are used at all times for the

patient encounter and, as previously discussed, most physicians do not document while in the room with the patient. In addition to the number of computers, the physical location of computers (i.e. in the exam rooms as opposed to a computer lab) was another major contributor to the general perception that hardware is a barrier to physicians' usage of EMR at FPC. It is worth mentioning here that residents do not have a physical office where they can use EMR. Comments such as the following were very common among the physician-residents interviewed at FPC.

"You have a lot of patients, all rooms are full, it's hard to get a computer" (Physician-Resident 6)

"We could have more and also better quality computers; some are very slow particularly in the clinic. It would be nice to have a computer to use when we are between the rooms… having a computer outside of the rooms would be ideal" (Physician-Resident 17)

As opposed to residents, attending physicians do have a physical office with an available computer, thus their perceptions regarding hardware were not so negative. Attending physicians however, also acknowledged residents' concerns regarding availability of and physical location of hardware at FPC.

"The way the rooms are set up…the treatment tables are opposite the computers so you'd have to turn your back and type. You can't talk to the patient. So… it's just not really feasible unless you want to turn your back to the patient and do your whole encounter with your back to the patient. Because of that they [residents] don't really appreciate it" (Attending Physician 8)

As regards available support, there is not much support available to physicians in their usage of the EMR system. In fact, many physicians did not know whether support was available and which number to call for help. Discussions with the hospital administrators revealed that there was only one support person for the entire clinic that was familiar with the EMR system. This person is also the one offering the initial training to the residents on the EMR system. Generally, if a physician needs help, he or she would refer to a colleague or attending physician with questions regarding the EMR system.

"I basically ask somebody senior to me that's been using the system longer but I do not always get an answer…we have an IT guy that we can call but he's always on beeper…rather than be able to just talk to him. There is only one guy that knows the system in and out and its hard to get a hold of him, you can't get

a hold of him immediately, you can leave a message and he'll call you back but we just need to get more access than that…"(Physician-Resident 11)

As compared to the availability of physical computers and their location which were found to be major problems by all residents at FPC, availability of support was not perceived as a very strong barrier to EMR usage as *"there is always some other peer that we can go to."* (Physician-Resident 13). Only five out of seventeen physician-residents pointed out they would need more support.

It is often the case in the IS literature that hardware considerations are "taken for granted." Most organizations would provide their employees with an office and computers to use. As we showed in this case study, hardware issues emerged as a rather strong theme in this hospital setting. All physician-residents interviewed in this study complained about difficulties related to availability of physical computers and their location. This finding has implications for design and implementation of EMR systems as we will discuss in the next section.

6. Conclusions and Implications

This study employed a TPB-based theoretical framework to study physicians' acceptance of EMR in a family practice residency clinic. Results from the case study showed that most physicians held negative attitudes towards the EMR system the clinic had in place. The system's usability characteristics such as navigation difficulties (e.g. the number of clicks) and EMR's perceived relative disadvantage as compared to the traditional paper chart emerged as major themes throughout this case. At the same time, EMR did not seem very compatible with the way the family practitioners liked to practice. The EMR was often times seen as an intrusion in the examining room, in the patient-physician interaction. Because of this issue, most physicians used workarounds such as documenting diagnoses and medications on the paper during the patient encounter, and then entering them in the computer system.

As discussed by many physicians, EMR has had several impacts on physicians' time, expertise, physicians' learning, the length (and sometimes the accuracy) of the clinical notes. As regards social influences, normative and mimetic pressures did not play a role beyond the coercive pressures already in place due to the mandatory use of EMR. One rather interesting finding is related to perceived behavioral control. Issues related to behavioral control strongly emerged across almost all interviews. All physician-

residents and most attending physicians recognized the challenges associated with availability of computers and the physical positioning of computers in the examining room. These two dimensions of perceived behavioral control thus seem to have been given most importance by the participants in this study. This seems to be the case because finding an available computer takes time and many times, residents need to wait for the end of the day when exam rooms are empty such that to be able to document their clinical notes.

As regards usage of EMR at FPC, physician-residents have to use EMR to retrieve and enter clinical orders due to the mandatory environment in which they practice. However, most residents (eleven out of seventeen) confessed that if the EMR was not mandatory, they would not have made use of it. In fact, when asked that if they started their own practice after completion of the residency program and decided to acquire an EMR system, all physician-residents responded that they would not acquire the same EMR they use in the clinic presently. In fact, the majority of respondents (twelve out of seventeen) mentioned that they would use paper if that was an option, both in the clinic or in their future practice.

This research has significant contributions both theoretical and practical. Among theoretical contributions, we integrate various theories such as the theory of planned behavior, institutional and diffusion theories in order to get a more complete view of physicians' acceptance of EMR systems. Using a case study and a grounded approach [23] we uncovered the underlying dimensions of the EMR "complexity" in a hospital setting and we showed how EMR have impacted some of the physicians' main values such as "time" and "expertise." We also showed the importance of the behavioral control construct in TPB in a healthcare context where physicians do not have a physical office with a ready available computer. Another contribution of this research is using triangulation from multiple sources of evidence. This method helped strengthen the case findings. Interview data was augmented with direct observations in the hospital setting for a nine-month period. This research also has important managerial and practical contributions. Physicians' acceptance and usage of EMR systems is a key issue for any healthcare organization to gain the benefits from its IT investments. Understanding physicians' attitudes regarding EMR systems can guide future implementation efforts such that EMR does not meet with physicians' resistance. As previously mentioned, if physicians in this sample had a choice or the power to resist the system, they would not have made use of

EMR. Many barriers however, seem to be quite technical in nature. Having more computers available and strategically positioned between examining rooms or in a neutral area can help reduce the perceptions of time-related disadvantages in trying to use EMR. At the same time, designers should take into account navigability issues within the EMR such that physicians can easily move between screens and complete their notes in a timely manner. Furthermore, caution should be taken with design and excessive use of templates in EMR, as errors may be introduced in the medical record. This study is not without limitations. This case has been primarily focused around a small outpatient residency clinic. Readers should be careful generalizing these results to other settings. Future research in the area will better establish the external validity of these findings and applicability to other settings such as larger hospitals or smaller physicians' practices.

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